

REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

ASSESSMENT OF THE RESILIENCE OF THE BANKING SECTOR TO CREDIT RISKS IN THE REPUBLIC OF AZERBAIJAN

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Applicant: Hasan Vugar Ganbarov

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The dissertation was conducted at the Institute of Economics under the Ministry of Science and Education of the Republic of Azerbaijan.

Scientific Supervisor: Doctor of Economics Sciences, Professor
Mubariz Mammadhuseyn Baghirov

Official Opponents: Doctor of Economics Sciences, Professor
Zahid Farrukh Mammadov

Doctor of Economics Sciences, Associate Professor
Elshan Ali Ibrahimov

PhD in Economics
Abdulrahim Abdulrahman Dadashov

Dissertation Council ED 2.10 operating under the Azerbaijan State University of Economics, under the Higher Attestation Commission under the President of the Republic of Azerbaijan

Chairman of the
Dissertation council:  Doctor of Economic Sciences, Professor
Yashar Atakishi Kalbiyev



signature

Scientific secretary of the
Dissertation council: 

PhD in Economics, Associate professor
Suqra Ingilab Humbatova

signature

Chairman of the
scientific seminar: 
signature

Doctor of Economics Sciences, Professor
Nizami Najafgulu Khudiyev

GENERAL CHARACTERISTICS OF THE DISSERTATION

Relevance of the Topic and Degree of Elaboration.

The modern era is marked by a number of adverse developments such as the intensification of global conflicts and their impact on economic processes, the strengthening of competitive environments, instability in national economies, and the persistence of global economic shocks. Under such conditions, it is practically impossible to establish risk-free and efficiently functioning business processes or to ensure their effective management. In other words, it is no longer conceivable to imagine macro- and microeconomic systems operating without risk in the contemporary period.

It is well known that lending to various sectors of the economy is one of the key areas of banking activity. By extending credit to different branches of the economy, banks fulfill their historical functions and generate income in the form of interest. In meeting the economy's demand for financial resources, banks simultaneously act as an important source of investment. All of this indicates that banks also play a role in ensuring the continuity of the reproduction process and in accelerating economic processes.

It is evident that banks are regarded as one of the most important sectors of the economy across the globe. The banking sector is considered one of the most sensitive sectors to constant changes, both at the macro and microeconomic levels. The internationalization of banking legislation in most countries, the use of modern technologies, and the increase in competition levels have also contributed to a higher degree of risk. Therefore, the primary task of banking is not to avoid risk, but to assess its level, draw accurate conclusions, and develop the capacity to manage it effectively. Consequently, all these factors indicate that the success of any business depends not only on entrepreneurial activity and the correctness of the chosen strategy but also on the consideration of crisis situations and the ability to manage them properly.

Summarizing the above, it can be concluded that a comprehensive study of the resilience of the banking sector in the Republic of Azerbaijan to credit risks constitutes one of the most pressing issues. In this regard,

the examination of these matters and the outcomes achieved in this field are of significant scientific and practical importance. Determining the complexity level of the credit risk management and control system, ensuring the reliability of the control system, evaluating the impact of risks on the profitability and efficiency of the banking system, as well as its stability and trustworthiness, are among the key problems requiring attention. In this context, the research and results obtained in this area possess substantial scientific and practical relevance.

In Azerbaijan, a number of scholars, including A.A. Babayev, M.M. Baghirov, R.A. Bashirov, J.N. Ismayilov, A.A. Alakbarov, Z.F. Mammadov, S.M. Mammadov, I.N. Mammadov, M.Kh. Hasanli, E.M. Sadiqov, and others, have contributed valuable academic work on the assessment of resilience indicators of the banking sector against credit risks, the identification, analysis, and evaluation of influencing factors, the classification of banking risks, and the specific features of the development of the financial-banking system and economic risks.

At various stages of economic science, different aspects of banking risks have been the subject of research by many economists. For example, Turkish economists such as Tughba Ildash, Serdar Ozgur, Okshan Artar, Aksoy Tamer, Alpaydin Ethem, Jangurel Ozan, and Gungor Serkan; Western scholars such as Hall M.Mikes, A.Millo, Y.Aasen, M.R.Altman, E.I.Manganelli, S.Engle, R.F.Holton, D.Aristei, and M.Gallo; and Russian economists including E.P.Zharkovskaya, A.A.Perfiliyev, A.A.Labanov, A.V.Chugunov, L.I.Yuzvovich, Y.E.Klepykhinoy, T.G.Gurnovich, A.I.Ukalov, E.A.Ostepenko, and S.A.Molchanenko have all conducted extensive research on risk management and assessment in banking, obtaining results of considerable theoretical and practical significance.

While acknowledging the scientific significance of the research conducted by Azerbaijani economists in this field, it should be noted that the unequivocal assessment of the role of risk management in the banking system remains highly challenging. Moreover, the necessity of conducting research that addresses the demands of the modern era has made the selection and relevance of this dissertation topic essential. This has also contributed to the identification of the scientific novelty of the study and the formulation of its goals and objectives.

The object and subject of the research. The object of the research is the banking sector of the Republic of Azerbaijan.

The subject of the research is the identification of trends related to credit risks encountered by commercial banks in the context of the development of a new system of economic relations in the modern environment.

The purpose and objectives of the research. The main purpose of the dissertation is to identify the directions for strengthening the resilience of the banking sector in Azerbaijan against credit risks by generalizing theoretical and practical perspectives, and to develop scientifically grounded proposals and recommendations in these directions.

In accordance with the aim of the dissertation, the following research tasks have been set forth for resolution:

- To clarify the nature, types, and theoretical foundations of the risk process in the banking sector;
- To determine the methodological foundations for assessing credit risks in the banking sector;
- To study international experience in risk management and implement appropriate systematizations in this area;
- To evaluate the resilience characteristics of the banking sector in Azerbaijan;
- To analyze credit risks within the Azerbaijani banking system;
- To determine the probability of bank insolvency based on credit risks;
- To calculate the exposure of banks to risk based on credit risks;
- To identify the factors influencing the formation of interest rates on loans in the banking system;
- To outline directions for improving the credit risk management mechanism in Azerbaijani banks.

Research methods. The research methods are primarily based on theoretical provisions regarding the assessment of credit risks in banks, approaches related to the Central Bank's monetary policy, credit risk standards, and similar frameworks. During the study, comparative analysis, regression analysis, systematization and generalization,

statistical and econometric methods, as well as analysis and synthesis, among other research techniques, were employed.

Main provisions submitted for defense:

1. Among banks operating in Azerbaijan, 13% are classified as large banks, while 87% are small banks. Since 2020, medium-sized banks in the country have transitioned into small banks.
2. There is a concentration of loans issued by banks across different sectors of the economy. Specifically, bank lending is predominantly concentrated in the household sector.
3. The fragility index of the banking sector (BSFI) in Azerbaijan has been calculated, indicating that the banking sector exhibits a moderate level of fragility.
4. Based on the Altman model, the assessment of bankruptcy probability regarding credit risks suggests that only four banks in Azerbaijan have risk exposure within their credit portfolios.
5. The evaluation of bankruptcy probability using the Merton model revealed that some banks in Azerbaijan have a low probability of bankruptcy, while others exhibit a higher level.
6. Determining the target reserve amount for banks based on their bankruptcy probability is important for mitigating credit risks in Azerbaijan.

Scientific novelty of the research:

- The structure and status of the Azerbaijani banking system have been determined, and a new classification of banks into "large," "medium," and "small" categories has been introduced;
- For the period 2012–2023, the deposit ratio of the banking sector, as well as the bank, deposit, money, and credit multipliers, have been calculated. A high deposit ratio indicates increased public confidence in the banking system, whereas low deposit and credit multipliers suggest low economic efficiency of these factors;
- Credit risks for the period 2020–2023 have been calculated using the Altman model, and a corresponding rating system for banks operating in the country has been developed. The calculations revealed that two banks hold a "B" rating, while the others are rated as "C," "CC," and "CCC";

- A Value at Risk (VaR) model based on credit risks has been constructed, and credit risks have been assessed for individual banks;
- An evaluation of the probability of bankruptcy of banks has been carried out based on the Merton model;
- An analysis of factors affecting interest rates on loans in the country's banking sector has been provided;
- Proposals for improving the credit risk management mechanism in Azerbaijani banks have been developed.

Theoretical and practical significance of the research. The conceptual generalizations, systematizations, and evaluations conducted within the framework of this research are significant for measuring the resilience of the banking sector to credit risks in the Republic of Azerbaijan. They also hold importance for the financial inclusion of the country's banking system and its strategic development.

At the same time, the practical significance of the dissertation lies in the fact that the analytical assessments, results, and recommendations made in this study will assist in establishing a systematic risk management framework addressing various aspects of credit risks in the banking sector. Moreover, they will facilitate the accurate assessment of credit risks, determination of banks' probabilities of bankruptcy, and the assignment of bank ratings.

Approval and application of the research results. The main provisions and practical proposals of the dissertation have been presented at local and international conferences, and six articles outlining the key findings of the research have been published in scientific journals. The results of the study may be utilized by the Central Bank of the Republic of Azerbaijan, the Banking Training Center, the Association of Banks, as well as the Ministries of Economy and Finance of the Republic of Azerbaijan.

Institution where the dissertation was conducted. The dissertation was carried out at the Department of "Monetary and Fiscal Regulation Problems" of the Institute of Economics under the Ministry of Science and Education of the Republic of Azerbaijan.

Structure and volume of the dissertation. The dissertation consists of an introduction, three chapters, 10 paragraphs, a conclusion, and a list of references. The introduction is 17,718 characters long,

Chapter I is 82,842 characters long, Chapter II is 88,942 characters long, Chapter III is 64,597 characters long, and the conclusion and suggestions are 7,795 characters long. The volume of the dissertation, excluding tables, graphs, and a list of references, is 261,894 characters long.

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MAIN CONTENT OF THE RESEARCH

The first chapter of the dissertation, titled "**The Theoretical and Methodological Foundations of Credit Risk Management**," investigates the nature, types, and theoretical foundations of risks in the banking sector, methodological approaches to the assessment of credit risks, as well as the existing international experience in risk management.

Risk, as a broad economic category, exists in most areas of human activity. It is no coincidence that the concept of risk is encountered not only in economics but also in probability theory, geology, construction, sociology, and several other sciences. Risks do not arise solely from human activities. In many cases, risks also result from processes independent of human actions. Natural disasters such as earthquakes, landslides, tsunamis, and similar events belong to this category.

When examining the views of researchers and experts on risks, two factors stand out prominently. Some scholars define risk as a loss factor. More specifically, according to the general economic consensus of many economists analyzing bank risk, risk is considered the probability of an event that will negatively affect the bank's profit or capital. Others, however, perceive risk as an opportunity. Therefore, it is necessary to pay special attention to these differing approaches. When determining the risk factor, it is possible to encounter experts who emphasize it more as a threat or loss. The ideas of those who present risk as a loss are based on the understanding of risk as the probability of an event occurring. Probability, in turn, is related to "uncertainty."

At the same time, decisions made under conditions of uncertainty inevitably give rise to risks. Those who perceive risk as harm or loss emphasize that it is not only a material loss but also includes losses such as time and reputation. It is no coincidence that a lack of public confidence in the banking system can sometimes escalate to the point of a bank's insolvency.

On the other hand, those who view risk as an opportunity argue that when the subject of risk is known, there exists a chance of achieving a certain success.

Thus, based on these two perspectives, risk can be illustrated in the following schematic form:

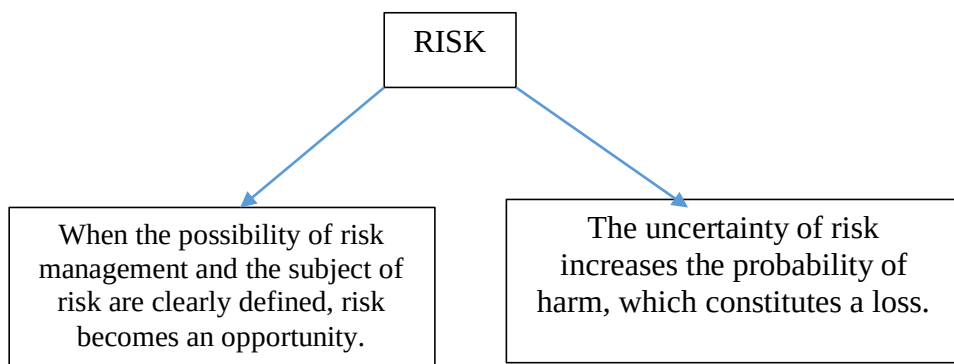


Figure 1. Main Elements of Risk

Source: Prepared by the author

In the course of their operations, banking systems encounter various types of risks, among which liquidity, market, operational, reputational, credit, and strategic risks are particularly notable. Among these, credit risks are the most significant due to the fact that loans constitute the largest share of banks' income-generating assets. As early as 2021, the Central Bank of Russia announced that credit risks accounted for approximately 91% of the total risks in the Russian banking system. In my opinion, this level is applicable—with a deviation of 5% to 10%—to most countries except for developed ones.

As evidence supporting this view, an examination of recent financial reports of most banks reveals that a significant portion of their income is derived from interest revenues generated through lending activities. Indeed, credit provision and meeting the demand for credit are essential functions of the banking system. On the other hand, the increased demand for credit in the national economies of many countries reflects the result of economic development within those economies.

However, the expansion of lending inevitably leads to an increase in credit risks. Credit risk, as a threat, can adversely affect various processes within a bank, ranging from potential insolvency to impacts on attracted deposits, granted loans, the bank's securities, and so forth. From this

perspective, the occurrence of credit risks depends on the following factors¹:

- Negative changes in economic and political processes globally, regionally, and within the country;
- Adverse changes in the microeconomic and macroeconomic environment;
- The degree of concentration of loans;
- Borrower insolvency and a high number of problematic clients;
- Lack of diversification in the credit portfolio, etc.

Over the past 30 years, Western economists and banks have developed various methods using different types of statistical models to assess the potential quality of borrowers. The well-known American scholar Edward Altman, in 1968, attempted to calculate the probability of bankruptcy for 66 companies listed on stock exchanges. In the same year, his widely disseminated work titled *“Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy”* was published. Since then, this model has been modified and updated in 1983, 1993, 2003, and 2007. Today, this model is well-known in the economic literature as the Altman formula, the Altman equation, or the Z-score model.

In terms of assessing credit risks, the original Z-score model introduced by Altman holds particular significance. Thus, the Z-score default model is as follows:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.64X_4 + 0.999X_5$$

Here:

X_1 = Working Capital / Total Assets

X_2 = Retained Earnings / Total Assets

X_3 = Earnings Before Interest and Taxes (EBIT) / Total Assets

X_4 = Market Value of Assets / Total Liabilities

X_5 = Sales / Total Assets

¹ Serdar Özgür *Bankacılık sektöründe kredi riski ve kredi türevleri: ampirik bir uygulama.* Ankara, -2019, - s. 17

The discrimination zones according to this model are as follows:²

Table 1. Discrimination Zones

Z - Quantitative	Probability of a Bank
$Z < 1,81$	80 – 100%
$1,81 \leq Z < 2,77$	35 - 50%
$2,77 < Z < 2,99$	15 – 20 %
$2,99 \leq Z$	Approaching zero (0)

Source: Prepared by the author

One of the conclusions drawn by E. Altman is that a value below 1.81 indicates a high probability of bankruptcy for the enterprise.

From a methodological perspective, the Merton model holds particular significance in the assessment of credit risks in banks. With this in mind, let us consider this model:³

$$DD = \frac{\ln\left(\frac{V}{D}\right) + (\mu_a - 0,5\sigma^2) \times T}{\sigma_a \sqrt{T}}$$

$$PD = 1 - N(DD)$$

In the Merton model, the probability of default is determined by comparing the market value of a bank's assets with its liabilities. The bank's liabilities typically represent its debts. Here: DD — Distance to Default (probability of default), V — Total assets of the bank, D — Total liabilities of the bank, μ — Expected return (mathematical expectation), T — Time, σ — Volatility, PD — Probability of default.

When assessing risk within the banking system, evaluating the concentration risk of loans across different sectors of the economy is one of the essential conditions for ensuring competition within the banking system. For this purpose, the market share of banks in the banking system and the level of loan concentration are measured using the Herfindahl-

² Peteron Ayusa Makini, "Validity of Atman's Z-Score Model in predicting Financial Distress of Listed Companies at the nairobi security exchange.- 2015.- p.25

³ Zhiguo He. Credit Risk: Intro and Merton Model Booth School of Business.- July 2018.- SAIF p.11

Hirschman Index (HHI). The Herfindahl-Hirschman Index is defined as the sum of the squares of the market shares of each bank⁴:

$$HHI = \sum_k^m D_k^2,$$

Here, D_k represents the market share of a bank in the market, and m denotes the number of banks.

Table 2. Evaluation Criteria for the HHI

HHI Criteria	Level of Concentration
HHI ≤ 1500	Competitive market
1500 < HHI ≤ 2500	Moderate competition
HHI > 2500	High concentration

Source: Prepared by the author

Determining the market share of each bank within the banking sector holds significant scientific and practical importance. The classification of banks as "large," "medium," or "small" is typically based on the following approach:

- Banks with a market share of more than 10% are classified as “large” banks;
- Banks with a market share between 5% and 10% are classified as “medium” banks;
- Banks with a market share of less than 5% are classified as “small” banks.

For this purpose, the following formula is used:⁵

$$P_i = \frac{X_i}{\sum_{i=1}^n X_i}$$

Here, P_i represents the market share of the i -th bank, and n denotes the number of banks. For the specified i -th bank, the following values are initially calculated as the arithmetic mean:

$$X_i = \frac{P_A^2 + P_{kr}^2 + P_d^2 + P_{oh}^2}{4}$$

⁴ Stephen A. Rhoades, of the Board's Division of Research and Statistics, prepared this technical note. The Herfindahl-Hirschman Index 1993-march 188-190

⁵ Морозов, А.В. Управление рисками АЛМ и ликвидности банка. Учебное пособие / под ред. А.В. Морозова, А.Ю. Лякина, И.В. Малаховой, М.В. Воробьева. – М.: АНО ДПО «Корпоративный университет Сбербанка». Эксмо, 2017. – 336 с.

Here P_a^2 represents the square of the shares of the i -th bank's assets, loans, deposits, and liabilities. One of the main approaches when assessing banks based on credit risks is determining the size of the bank, i.e., whether it is classified as a large, medium, or small bank. This classification helps to obtain more comprehensive results during the evaluation of banks.

$$A = \frac{B_i}{\sum_{i=1}^n B_i} \quad K = \frac{B_i}{\sum_{i=1}^n B_i} \quad D = \frac{B_i}{\sum_{i=1}^n B_i}$$

$$O = \frac{B_i}{\sum_{i=1}^n B_i} \quad B = \frac{A^2 + K^2 + D^2 + O^2}{4}$$

Here, A - represents the assets of any bank, K - its loans, D - its deposits, O - its liabilities, and B denotes any i -th bank. By dividing the sum of the squares of the shares of these indicators by four, it is possible to determine the size category to which a given bank belongs.

To determine the sensitivity of the banking sector, the banking sector vulnerability index (BSVI) is used in international practice. The calculation of the BSVI involves the use of the following indicators:

- Total amount of deposits in banks;
- Total amount of loans issued by banks;
- Total amount of banks' external liabilities.

In fact, the amount of deposits reflects the liquidity problems or risks of the bank for which the vulnerability index is calculated; the amount of loans reflects the status related to credit risk; and the amount of liabilities indicates the condition of the bank's debts, especially its external debts, or expresses exchange rate risk.

Thus, the banking sector vulnerability index (BSVI) can be mathematically expressed as follows:

$$BSVI_3 = \frac{\left(\frac{KR_t - \mu}{\sigma} \right) + \left(\frac{OH_t - \mu}{\sigma} \right) + \left(\frac{DEP_t - \mu}{\sigma} \right)}{3}$$

This index serves as a composite indicator, and the subcomponents included in its calculation are as follows:

$$KR_t = \left(\frac{VKR_t - VKR_{t-12}}{VKR_{t-12}} \right), OH_t = \left(\frac{AOH_t - AOH_{t-12}}{AOH_{t-12}} \right)$$

$$DEP_t = \left(\frac{ADEP_t - ADEP_{t-12}}{ADEP_{t-12}} \right)$$

The letters used in the presented model represent the following meanings: BSVI3 denotes the banking sector vulnerability index, KR represents the amount of loans issued, OH stands for the amount of liabilities, DEP indicates the amount of deposits, μ is the mathematical expectation (mean), and σ is the standard deviation.

It should be noted that the numerical values used can be expressed both in absolute terms and as average annual changes. The BSVI is used to compare periods of growth and decline within the banking sector.

The BSVI can vary within four intervals, which can be described as follows:

- If the BSVI coefficients are 0.5 or above, it indicates a high growth rate in the banking system;
- If within the range (0; 0.5), it signifies stability in the banking system;
- If within the range (-0.5; 0), it indicates moderate vulnerability in the system;
- Finally, if the BSVI is -0.5 or below, it suggests an increased likelihood of risk realization.

The BSVI is usually calculated on a monthly basis because economic processes within the banking system can change over a short period. Therefore, the BSVI is used to characterize changes over a twelve-month period.

In this study, based on the aforementioned methods, credit risks in banks operating in the Republic of Azerbaijan have been assessed.

In the second chapter of the dissertation, titled "**Analysis and Evaluation of the Resilience of Azerbaijan's Banking Sector to Credit Risks**" the resilience characteristics of the banking sector in Azerbaijan, the analysis of credit risks within the Azerbaijani banking system, and the assessment of banks' probability of default based on credit risks have been conducted.

When analyzing the resilience characteristics of Azerbaijan's banking sector, it is essential to evaluate the sector's stability based on

the financial indicators of commercial banks. The resilience of the banking sector is usually determined based on its financial indicators. For this purpose, let us consider the following table:

Table 3. Indicators of the Banking System's Resilience

Years	2017	2018	2019	2020	2021	2022	2023
Share of Non-Performing Loans in the Credit Portfolio, %	13.7	12.2	8.3	6.1	4,2	2.9	2.7
Share of Net Profit in Assets, %	3.2	0.9	1.6	1.8	1,6	1.8	1.9
Share of Net Profit in Total Capital, %	23.8	6.9	11.7	12.1	12,3	14.2	15.4
Interest Margin to Net Profit Ratio	104.6	168.6	156.7	170.2	163,1	148.8	154

Source: Table prepared by the author based on data from the Azerbaijan Banks Association. <https://aba.az/>

As seen from the table data, a decrease in the share of non-performing loans has been observed. At the same time, the interest margin has been developing with an increasing trend. When analyzing the resilience of the banking sector in Azerbaijan, it is important to examine factors characterizing its efficiency. Additionally, it should be noted that the resilience of the banking system affects several development indicators of the banking sector. In this regard, let us consider these indicators.

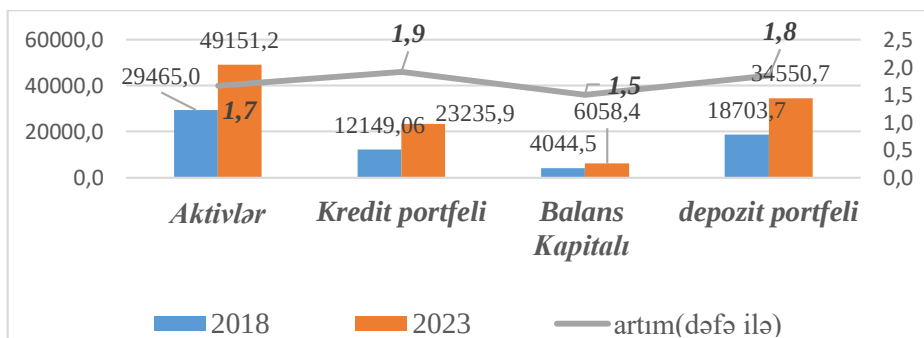


Figure 2. Development Indicators of the Banking System (in million AZN, growth multiples).

Source: Table prepared by the author based on data from the Azerbaijan Banks Association. <https://aba.az/>

The data in Figure 2 indicate that compared to 2018, by 2023 the total assets of the banking system increased by 1.7 times, the loan portfolio by 1.9 times, the equity capital by 1.5 times, and the deposit portfolio by 1.8 times.

When analyzing the resilience of the banking system in the country, one of the key considerations is the efficiency indicators of the banking system. The primary indicators of banking system efficiency in the country are evaluated based on the banks' return on equity (ROE) and return on assets (ROA). For this purpose, let us refer to Figure 3.

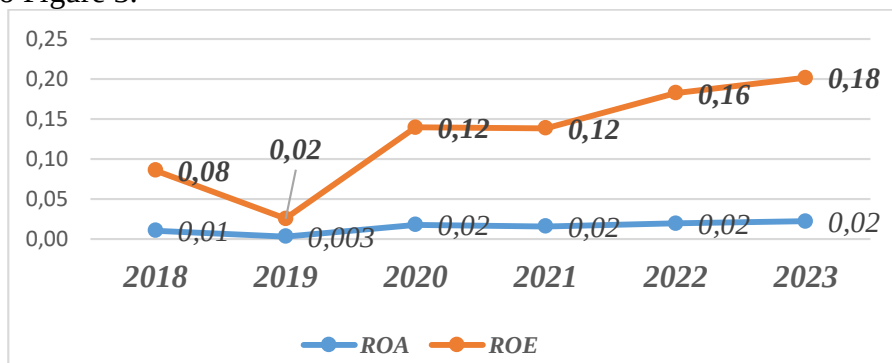


Figure 3. Dynamics of ROE and ROA

Source: Table prepared by the author based on data from the Azerbaijan Banks Association. <https://aba.az/>

Figure 3 shows that the return on equity (ROE) in banks is characterized by a higher level compared to the return on assets (ROA).

The classification of banks as large, medium, or small is important for the Central Bank's monetary policy and for measuring the potential extent of losses in the event of a bank's insolvency. A bank's market share is generally determined based on its share in total assets, the share of its credit portfolio in the total credit portfolio of all banks, its deposits' share in the total deposits of all banks, and its liabilities' share in the aggregate liabilities of all banks operating in the country. These calculated ratios are then squared and divided by four. Based on the relevant criteria for categorizing banks as "large," "medium," or "small," the following results were obtained for the period 2018–2023:

Table 4.
The Structure and Status of the Banking System in Azerbaijan

Market Share	Classification	2018	2019	2020	2021	2022	2023
10% >	Large Banks	13.0	13.0	13.0	13.0	13.0	13.0
5%-10%	Medium Banks	4.3	4.3	4.3	0.0	0.0	0.0
5% <	Small Banks	82.6	82.6	82.6	87.0	87.0	87.0

Note: The table is based on the author's calculations.

The results indicate that out of 23 banks operating in Azerbaijan, only 13% are classified as large banks. During the period of 2018–2020, medium-sized banks accounted for merely 4.3%, while small banks constituted 82.6%. In the years 2021–2023, the number of medium-sized banks declined significantly, virtually disappearing, whereas the number of small banks increased.

According to the analysis, Azerbaijan International Bank, Kapital Bank, and PASHA Bank are identified as large banks. Based on statistical data from 2021–2023, other banks fall under the category of small banks. Furthermore, between 2018 and 2023, approximately 90.1% of the total market share in terms of assets, loans, liabilities, and deposits belongs to these three large banks, with the remaining banks accounting for only 9.9%.

It should also be noted that during 2018–2020, Xalq Bank was classified as a medium-sized bank; however, due to a decrease in market share in 2021–2023, it was reclassified as a small bank.

When assessing credit risks in the country's banks, it is appropriate to begin by examining the level of concentration in assets, loans, and deposits. This is because bank assets represent the overall financial strength of the bank, deposits reflect the banks' ability to attract financial resources, and loans indicate the extent of banks' real sector engagement.

Analyses show that between 2016 and 2023, there has been an increase in concentration across assets, deposits, and loans within the banking system. Specifically, during this period, there was a rising tendency towards concentration in assets and deposits within the

banking sector. According to calculations, the concentration coefficient for deposits increased from 1282.8 to 1589.2, while for assets it rose from 1501.4 to 1563.7 between 2018 and 2023. Considering that a Herfindahl-Hirschman Index (HHI) above 1500 indicates the presence of concentration, it can be concluded that the Azerbaijani banking sector has experienced a tendency toward concentration in both deposits and assets during these years. It should be noted that a high level of concentration in the banking system is a risk-enhancing factor.

To examine the level of concentration of loans by sectors of the economy, let us refer to the data in Table 5. Statistical data show that credit allocation within the banking system is primarily concentrated in household sectors. This suggests that the population approaches banks mainly to satisfy their social needs, which occasionally leads to an increase in overdue loans.

On the other hand, consumer loans issued to individuals are generally considered less risky than loans extended to the corporate sector. This is primarily because, first, the amount of credit given to individuals is significantly lower compared to that provided to corporations. Second, banks usually have greater leverage to recover loans from individuals than from corporate clients. Under market economy conditions, the corporate sector is often evaluated based on assigned credit ratings. However, subjective biases in rating assessments may result in discrepancies between an organization's actual financial condition and its true loan repayment capacity. Moreover, loans extended to the corporate sector are typically larger in amount and longer in maturity. Consequently, potential losses for the bank in this segment are considerably greater. This issue is particularly relevant for countries where the real sector is underdeveloped.

Table 5. Concentration Level of Loans by Economic Sectors

Indicators	2015	2016	2017	2018	2019	2020	2021	2022	2023
Trade and Services Sector	211.2	225.1	309.7	334.0	265.2	321.9	305.5	267.8	217.8
Mining, Electricity, Gas, Steam, and Water Supply Sector	2.1	13.1	7.2	10.4	16.4	13.0	19.1	10.4	9.9
Agriculture, Forestry, and Fisheries Sector	5.5	7.2	13.3	13.0	12.6	15.2	11.9	9.7	4.9
Construction and Building Sector	198.7	134.7	21.6	8.9	9.7	11.5	27.8	29.6	22.4
Industry and Manufacturing Sector	80.4	59.2	27.9	29.5	32.5	74.0	32.2	27.6	25.5
Transport and Communication	45.5	59.7	91.8	110.8	62.0	34.1	18.5	15.4	35.4
Household Sector	1488.4	1269.3	1534.9	1669.2	2081.0	2132.0	2527.7	3119.4	3411.8
Real Estate Activities	50.4	107.3	218.3	201.4	160.7	207.6	210.4	222.8	229.3

Source: *Table is based on the author's calculations using data from the Central Bank of Azerbaijan.* <https://www.cbar.az>

In our research, this process related to the LCR (Liquidity Coverage Ratio) was calculated by summarizing the quarterly data on banks' loans, deposits, and liabilities for the final quarters of 2022 and 2023. To this end, let us examine the LCR results obtained for individual banks operating in Azerbaijan's banking sector.

Table 6. Fragility Index of the Banking System

Bank Name	2022	2023	Ədədi orta	Median
AccessBank	-0.40	-0.18	-0.3	-0.3
AFB Bank	-0.04	-0.18	-0.1	-0.1
Azer Turk Bank	-0.29	-0.29	-0.3	-0.3
International Bank of Azerbaijan (ABB)	-0.04	-0.5	-0.3	-0.3
Azerbaijan Industry Bank	-0.28	-0.01	-0.1	-0.1
Bank Eurasia	-0.23	0.00	-0.1	-0.1
Bank BTB	0.50	-0.22	0.1	0.1
Bank Melli Iran Baku Branch	-0.67	0.04	-0.3	-0.3
Bank of Baku	-0.12	-0.37	-0.2	-0.2
Bank Respublika	-0.21	-0.24	-0.2	-0.2
VTB Bank (Azerbaijan)	0.27	-0.29	0.0	0.0
Expressbank	0.64	-0.29	0.2	0.2
Kapital Bank	-0.50	-1.15	-0.8	-0.8
Yelo Bank	-0.15	-0.34	-0.2	-0.2
Pasha Bank	0.06	-0.11	0.0	0.0
Rabitabank	-0.41	-0.22	-0.3	-0.3
Premium Bank	-0.14	0.34	0.1	0.1
TuranBank	-0.45	-0.08	-0.3	-0.3
Unibank KB	-0.55	0.09	-0.2	-0.2
Khalq Bank	0.35	-0.35	0.0	0.0
Yapi Kredi	0.00	-0.26	-0.1	-0.1
Ziraat Bank Azerbaijan	-0.10	-0.20	-0.2	-0.2
Average LCR (Liquidity Coverage Ratio)	-0.12	-0.22	-0.17	-0.17

Source: The table was compiled by the author based on data from the Azerbaijan Banks Association. <https://aba.az>

As can be seen from the table data, the financial condition of several banks was more favorable in 2022 compared to 2023. The deterioration of the Liquidity Coverage Ratio (LCR) in 2023 naturally led to the exit of several banks—particularly Günay Bank, Mugan Bank in the second half of 2023, and Nakhchivanbank in the second quarter of the same year—from the banking system.

In general, the banking system of the country was characterized by a moderate level of fragility during 2022–2023. It should be noted that both the arithmetic mean and the median of the LCR calculated for 2022–2023 were equal to 0.17, indicating a symmetric distribution of the LCR over the analyzed period. Moreover, analysis of the fragility index of Azerbaijan’s banking sector shows that in 2023, compared to 2022, the fragility index increased in Yapı Kredi Bank Azerbaijan, Xalq Bank, and Bank BTB.

The estimation of the probability of bankruptcy based on credit risks using the Altman model suggests that only four banks in Azerbaijan have risk present in their credit portfolios.

The results of the analysis based on the E. Altman model are presented in Table 7. The outcomes of the calculations indicate that AccessBank, Bank BTB, the Baku Branch of Bank Melli Iran, and VTB Bank are experiencing certain financial or credit-related difficulties.

It should also be noted that in international practice, bank ratings are typically determined based on credit risk assessments or other financial parameters.

Table 7.

**Estimation of Bankruptcy Probability Based on Credit Risks
Using the Altman Model for the Period 2020-2023**

Banks	2020	2021	2022	2023	Arithmetic Mean	Median
International Bank of Azerbaijan (ABB)	2,91	2,91	2,90	3,17	2,91	2,91
Pasha Bank	2,94	2,89	2,85	3,07	2,89	2,89
Kapital Bank	2,59	3,00	2,38	2,95	2,65	2,59
Bank Eurasia	2,33	2,31	2,15	2,92	2,26	2,31
Khalq Bank	2,84	2,79	2,19	2,44	2,61	2,79
Premium Bank	1,90	1,89	1,95	2,36	1,92	1,90
Yapı Kredi Bank Azerbaijan	2,08	2,03	1,95	2,34	2,02	2,03
Bank of Baku	2,00	2,15	1,90	2,32	2,02	2,00
Expressbank	1,89	2,05	2,00	2,31	1,98	2,00
Azerbaijan Industry Bank	1,87	1,81	1,92	2,29	1,87	1,87
Yelo Bank	1,47	2,63	2,22	2,27	2,11	2,22
AFB Bank	2,02	2,10	2,06	2,27	2,06	2,06
Ziraat Bank Azerbaijan	1,81	1,98	1,82	2,25	1,87	1,82
Unibank	1,67	1,98	1,97	2,24	1,88	1,97
Bank Republic	2,24	1,73	1,74	2,21	1,91	1,74
Turanbank	1,84	1,93	1,93	2,11	1,90	1,93
Rabitabank	1,98	1,75	1,69	2,09	1,81	1,75
Azer-Turk Bank	1,91	1,93	2,81	2,05	2,22	1,93
AccessBank	1,88	1,89	1,95	2,04	1,91	1,89
Bank "BTB"	1,89	1,59	1,89	1,89	1,79	1,89
Bank Melli Iran Baku Branch	1,80	1,72	1,78	1,84	1,77	1,78
VTB Bank (Azerbaijan)	1,78	1,82	1,70	1,74	1,76	1,78

Source: The table was compiled by the author based on data from the Azerbaijan Banks Association. <https://aba.az>

The estimation of the probability of bank bankruptcy in Azerbaijan based on the Merton model was conducted using the relevant statistical indicators from 2021 to 2023. Let us review the results obtained according to the Merton model.

Table 8.

**Estimation of Banks' Probability of Bankruptcy
Based on the Merton Model (in Percentage)**

Banks	2021	2022	2023	Arithmetic Mean	Median
Turan Bank	20	37	55	37,3	37,0
Bank BTB	25	28	54	35,7	28,0
Premium Bank	31	35	40	35,3	35,0
Gunay Bank	32	38		35,0	35,0
Ziraat Bank Azerbaijan	27	33	44	34,7	33,0
Arithmetic Mean	51	15	36	34,0	36,0
Bank Eurasia	21	6	70	32,3	21,0
Rabitabank	21	42	28	30,3	28,0
Yapi Kredi Bank Azerbaijan	13	36	42	30,3	36,0
Azerbaijan Industry Bank	27	24	31	27,3	27,0
Mughan Bank	25	28		26,5	26,5
VTB Bank (Azerbaijan)	20	21	34	25,0	21,0
AFB Bank	30	30	15	25,0	30,0
Accessbank Open Joint-Stock Company	29	19	23	23,7	23,0
Azer-Turk Bank	15	8	43	22,0	15,0
Bank Republic	33	16	13	20,7	16,0
Kapital Bank	24	20	12	18,7	20,0
ABB	22	18	15	18,3	18,0
Paşa Bank	10	20	21	17,0	20,0
Yelo Bank	1	11	38	16,7	11,0
Expressbank	12	19	12	14,3	12,0
Unibank	0	7	33	13,3	7,0
Khalq Bank	19	6	1	8,7	6,0
Bank of Baku	17	1	7	8,3	7,0

Source: The table was compiled by the author based on data from the Azerbaijan Banks Association. <https://aba.az>

First of all, it should be noted that the probability of bankruptcy increased for both Günay Bank and Mugan Bank, which were declared bankrupt in 2023, during the first two years analyzed, i.e., 2021 and

2022. More specifically, the probability of bankruptcy for Günay Bank was 32% in 2021, which rose by 6 percentage points to 38% in 2022. The arithmetic mean and median for these two years were both approximately 35%. For Mugan Bank, this indicator increased from 25% to 28% over the respective analysis period, resulting in an arithmetic mean and median of 26.5%.

Accordingly, the probability of bankruptcy for other banks based on the Merton model changed as follows: the probability of bankruptcy for Bank of Baku was 8.3%, for Xalq Bank 8.7%, and for Pasha Bank, ABB, and Kapital Bank it ranged between 17% and 18%. In other words, these banks have an 82–83% probability of not becoming bankrupt.

The third chapter of the dissertation, titled “*Directions for Improving the Resilience of Azerbaijan’s Banking Sector to Credit Risks*,” discusses the formation of interest rates on loans within the banking system. It also presents recommendations aimed at enhancing the competitiveness of the banking sector and improving the credit risk management mechanisms in Azerbaijani banks.

International experience in risk management demonstrates that the significance and role of credit risk management in any country’s banking system are increasing year by year. This is due to factors such as periodic changes in the economic structure, intensified competition among banks, the multifunctional responsibilities undertaken by individual banks, expansion of branch networks, growth in the customer base, frequent changes in the Central Bank’s monetary and interest rate policies, rising banking costs, diversification of banking services, and other factors. Given the growing importance of bank risk management, its modernization in accordance with the requirements of the contemporary period becomes imperative.

The internal mechanisms used to mitigate bank risks are as follows:

Internal Mechanisms Used to Mitigate Bank Risks Are as Follows:

1. **Risk Avoidance or Rejection.** This method is the most radical form of risk neutralization. It involves internal measures that completely exclude certain bank risks. Examples of such measures include refusal to conduct banking operations with excessively high

risk levels, refraining from using large amounts of charter capital, and avoiding overutilization of attracted funds, among others. Such forms of risk avoidance deprive the bank of additional profit sources by rejecting certain types of risks, which in turn affects the pace of the bank's economic development and the efficiency of its capital use.

2. **Risk Limitation or Setting Limits.** The mechanism of limiting or capping risks is generally applied to types of risks exceeding permissible levels. During ongoing operations, banks should establish individual limits for their counterparties (both for asset and liability transactions), as well as overall limits on all types of bank positions aimed at restricting market risks and specific operational limits. Limiting risks is an important method to reduce the overall risk level.
3. **Diversification.** This mechanism is primarily used to neutralize the adverse effects of unsystematic internal risks. Its principle lies in spreading risks so as to prevent their accumulation (concentration). However, diversification cannot reduce risks to zero.
4. **Risk Distribution.** This mechanism entails relatively small individual losses being distributed among partners in separate bank transactions.
5. **Self-Insurance.** This approach is based on reserving a portion of bank resources to offset negative outcomes of certain banking operations. The main forms of this mechanism include the creation of reserves, insurance, and other funds. The primary purpose of self-insurance is to quickly eliminate temporary difficulties in banking operations. While this mechanism allows rapid coverage of financial losses, it ultimately reduces the efficiency of using the bank's charter capital and increases dependence on external financing sources.

Efficient organization of credit risk management in banks operating in the country also requires timely identification of not only credit risk-related problems but also other issues within individual banks. Currently, early problem detection has become a serious subject of discussion both theoretically and practically in

developed countries. It has become one of the key responsibilities of bank management and risk departments.

To improve credit risk management mechanisms and enable early detection of problems in Azerbaijani banks, it is advisable to implement the following measures:

1. **Financial Statement Analysis.** It is important to develop a set of financial ratios based on banks' financial data to assess their financial condition.
2. **Early Warning Systems.** The essence of this system is to estimate future probabilities of bankruptcy or financial instability and assess banks' future solvency and potential bankruptcy losses by applying various statistical models. The principles of early detection include indicators such as:
 - Asset quality deterioration;
 - Lack of profit and income;
 - Capital losses;
 - Reputation problems;
 - Liquidity issues;
 - Increase in non-performing loans, etc.

If problems arise in any bank, timely intervention measures should be taken. The main principles of such interventions may include:

- Achieving cost efficiency;
- Implementing measures to increase capital;
- Applying limits on deposit attraction and lending;

Improving management, internal control, and risk management practices in the bank, etc.

Conclusion

1. The conducted analyses indicate that between 2012 and 2023, every manat increase in the credit portfolio in Azerbaijan's banking system has led to an expansion of the money supply by approximately 0.60 to 0.63 manat. In 2023, the deposit multiplier was 0.67, indicating that 67% of the cash in circulation is held within banks, while the remainder exists outside the banking system.
2. Banks in Azerbaijan are categorized as "large," "medium," or "small" based on their market shares. Market share is typically determined by a bank's share in total sector assets, credit portfolio share within the aggregate credit portfolio of all banks, share of deposits in total sector deposits, and each bank's liabilities as a portion of total banking liabilities. Banks with a market share exceeding 10% are classified as "large," those with market shares between 5% and 10% as "medium," and those with less than 5% as "small." Analyses from 2018 to 2023 identify Kapital Bank, ABB, and Pasha Bank as large banks, while others fall into the small bank category.
3. Between 2016 and 2023, although concentration existed in assets and deposits within the banking system, such concentration was absent for loans. However, a high concentration of loans was observed across different economic sectors. Notably, the majority of loans were directed towards households.
4. The analysis shows that in developed countries, both deposits and loans constitute a significant share of GDP. For example, the deposit-to-GDP ratio ranges between 80-90% in Germany, 70-80% in the Czech Republic, and 50-60% in Denmark. Correspondingly, the loan-to-GDP ratios are 90.1% in Spain, 83.4% in Germany, 70.2% in Israel, 63.6% in Georgia, 54.5% in Turkey, and 54.4% in Russia. In Azerbaijan, from 2014 to 2023, the loan-to-GDP ratio ranged between 19.5% and 34.1%, while the deposit-to-GDP ratio fluctuated between 26.1% and 30.1%, which is significantly lower compared to other countries.

5. According to the calculations, Azerbaijan's banking system exhibited a moderate level of fragility in 2022–2023. It is noteworthy that both the arithmetic mean and the median of the banking system fragility index (BSFI) for these years equaled 0.17, indicating a symmetric distribution of the index during the period analyzed. The BSFI was better in 2022 compared to 2023.
6. Using the Altman model, the bankruptcy probability of banks operating in Azerbaijan was assessed based on financial data from 2020 to 2023. The findings revealed that AccessBank, Bank BTB, the Baku branch of Bank Melli Iran, and VTB Bank faced certain financial or credit risks.
7. The estimation of bankruptcy probabilities of banks based on the Merton model for 2021–2023 showed that the bankruptcy risk of Günay Bank and Mugan Bank increased in 2022 compared to 2021. Specifically, the probability of bankruptcy for Günay Bank rose from 32% in 2021 to 38% in 2022, while for Mugan Bank it increased from 25% to 28%.
8. In Azerbaijan's economy, the demand for credit—particularly consumer credit—exceeds the credit supply offered by banks, which contributes to high interest rates on loans. In recent years, stricter lending regulations have further reduced credit supply, necessitating higher interest rates on loans.

**The main content of the research is reflected in the author's
following published scientific works:**

1. Qənbərov H.V. “Azərbaycanda bank sektorunun rəqabətqabiliyyətliliyinin qiymətləndirilməsi”. AMEA İqtisadiyyat İnstitutu, AMEA-nın Xəbərləri İqtisadiyyat seriyası” jurnalının 2022-6 sayı, səh. 119-126
2. Qənbərov H.V. “Azərbaycanda bank sektorunun inkişaf göstəriciləri” Azərbaycan Kooperasiya Universiteti, “Kooperasiya elmi-praktiki” jurnalının №3-2023 sayı, səh. 83-88

3. Qənbərov H. V. "Azərbaycanda bank sisteminin struktur və təmərküzləşmə səviyyəsinin qiymətləndirilməsi" Bakı Biznes Universiteti, "Audit" jurnalının №2-2024 sayı, səh. 39-48
4. Ганбаров Х.В. "Расчет кредитного риска в банках Азербайджана с использованием метода VaR (Value at risk-VAR)". Журнал "Финансовая экономика", №2-2024, С. 123-128
5. Qənbərov H.V. "Azərbaycanda bank sisteminin kövrəklik indeksinin hesablanması" Azərbaycan Respublikası Elm və Təhsil Nazirliyi, İqtisadiyyat İnstitutunun "İqtisadi artım və İctimai Rifah" jurnalının №3-2024 sayı, səh. 150-155
6. Qənbərov H.V. "Azərbaycanda bank sektorunun inkişaf mərhələləri" VII International Ankara Multidisciplinary studies congress, səh 1370-1372, March 5-6 2024, Ankara Türkiyə
7. Qənbərov H.V. "Azərbaycanda pul-kredit siyasətinin qiymətləndirilməsi" "Mütarəqqi texnologiyalar və innovasiyalar" mövzusunda IX Respublika elmi-texniki konfransı, Azərbaycan Texniki Universiteti səh 739-742, May 1-2 2024, Bakı Azərbaycan
8. Qənbərov H.V "Azərbaycan Respublikasında pul-kredit siyasətinin təkmilləşdirilməsi istiqamətləri" "Yaşıl Dünya: sosial-iqtisadi transformasiya" mövzusunda beynəlxalq elmi konfrans, Azərbaycan Əmək və Sosial Münasibətlər Akademiyası, səh 170-174, 7 May 2024, Bakı Azərbaycan
9. Qənbərov H.V. "Azərbaycanda Altman və Merton modelləri əsasında bankların müflisləşmə ehtimalının qiymətləndirilməsi" Azərbaycan Dövlət İqtisad Universitetinin "Elmi Xəbərlər" jurnalının №1-2025 sayı, səh.71-81



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*“AA – Poliqraf” istehsalat-kommersiya birliyində
hazır diopozitivlərdən istifadə olunmaqla çap edilmişdir.
Əlaqə üçün: capevi@internet.ru / (+99455) 201-2809*