



Measuring the financial health using the Altman Z-score model: A case study on listed banks in Bangladesh

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Abstract

The study evaluates the financial performance of publicly listed banks in Bangladesh and forecasts potential financial distress using the Altman Z-score model. Based solely on secondary data from annual reports of the banks over the period 2018 to 2023, the analysis reveals alarming findings. Across the listed banks, 34 banks scored an average Z score of below the threshold level, placing them in the “Financial Distress Zone”, indicating a likelihood of financial difficulty or potential bankruptcy in the near future. Notably, 16 banks are not only scored below the threshold level and were placed in the financial distress zone but also recorded negative values, indicating a high risk of imminent financial collapsed. Only two banks namely Union Bank and Uttara Bank achieved average Z scores above the threshold level and were categorized in the “Grey Zone”, suggesting a reduced risk of financial distress in the short-term, though they should still remain conscious about their financial activities. The findings underscore the need for regulatory authorities to implement proactive measures to address financial instability within the banking sector. Additionally, the results offer valuable insights for bank managers, shareholders, investors, lenders, and customers to assess and mitigate financial risks, thereby contributing to informed decisions and promoting financial stability across the industry.

Keywords: Altman Z-Score, Bankruptcy, Banking industry, Financial health, Financial distress, Financial risk, Financial performance, Financial stability.

JEL Classification: C53; G33; G21; G32; G01.

Citation | Hasan, M. T., & Ara, R. (2025). Measuring the financial health using the Altman Z-score model: A case study on listed banks in Bangladesh. *Asian Journal of Economics and Empirical Research*, 12(1), 40–51. 10.20448/ajeer.v12i1.6825

History:

Received: 30 April 2025

Revised: 26 May 2025

Accepted: 12 June 2025

Published: 25 June 2025

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Publisher: Asian Online Journal Publishing Group

Funding: This study received no specific financial support.

Institutional Review Board Statement: Not applicable.

Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Competing Interests: The authors declare that they have no competing interests.

Authors’ Contributions: Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

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Contribution of this paper to the literature

This study uniquely applies Altman's Z-score model to all 36 listed Bangladeshi banks from 2018 to 2023, highlighting the sector's financial distress amid the July 2024 revolution. It offers timely insights into banking vulnerabilities during a period marked by political upheaval, economic disruption, and systematic corruption.

1. Introduction

Rapid financial integration, technological development, and demographic shifts over the past 20 years have produced both significant new difficulties and opportunities for national economies (Qamruzzaman, 2014). In such a quickly changing and competitive market, banks and other financial organizations serve as the foundation of the entire economy. They offer funding for economic growth, infrastructure improvements, employment growth, and modernization. Additionally, banks have a significant impact on society by influencing not only individual consumers' spending but also the expansion of entire financial sectors (Uddin & Kaium, 2015). Bangladeshi banking sector has recently grown in terms of the number of institutions, sophisticated financial tools, asset size, skilled human resources, etc. However, there are several reasons such as default loans, financial errors, money laundering, internal and external scams and many more, this sector of the economy has been facing enormous difficulties. As a result, the banking sector's total performance is significantly impacted (Khatun, 2018). Moreover, the central bank and financial professionals in the country are currently concerned about the stability of the financial system.

At present, the stability of Bangladeshi banking system and economy is of highest importance, as Bangladesh is going through a lot of political instability due to the ongoing student movement in Bangladesh. Reportedly, the prime minister was forced to resign. In that case, people have become anxious about their savings deposited in different commercial banks in Bangladesh. Besides, the performance of banking sector has been worsening gradually over the years. As a consequence, the study is conducted to examine and predict the financial health of 36 listed banks of Bangladesh over the period from 2018 to 2023. The study aims to evaluate the performance of the banks, forecast the banking industry's future financial distress, assess the risk of bankruptcy, validate the Altman Z-score model, and forecast future distress using the Altman's Z-score model.

Financial distress is a situation in which a business or individual is unable to generate revenue or income due to its inability to fulfill or pay its financial obligations. The final stage before bankruptcy is typically preceded by a period of financial strain. This is often caused by high fixed costs, illiquid assets, or revenue streams vulnerable to economic downturns (Nath, Biswas, Rashid, & Biswas, 2020).

Fisher (1936) often known as Sir Ronald Aylmer Fisher, created the linear discriminant analysis method in 1936. On the other hand, Altman (1968) developed the "Z-Score Model" for bankruptcy prediction in 1968. It is essentially a modified description of R.A. Fisher's discriminant analysis method. Whether a company will file for bankruptcy within two years or not can be predicted using the Z-score method. The Z-score algorithm makes use of an organization's income statement and balance sheet figures to assess its financial soundness (Nath et al., 2020).

This study uses Altman's z-score model to forecast the financial health of Bangladesh's banking sector. The main aim of this study is to use the Altman Z-score Model to forecast the financial health of 36 listed banks of Bangladesh over the period from 2018 to 2023. The secondary data is collected for this study. The rest of this paper is organized as follows. Part 2 describes the literature review of the study. Part 3 and 4 contain the research methodology, the discussions and analysis of the study. Part 5 describes the summary of the study.

2. Literature Review

The Altman Z-score, introduced by Altman (1968), is a widely recognized and utilized model for predicting corporate bankruptcy and assessing financial health. Originally developed for manufacturing firms, the Z-score model has undergone various adaptations to be applicable across different industries, including the banking sector. Altman's pioneering work built upon previous research by Beaver (1966) who used a univariate analysis to predict business failures. In contrast, Altman's model employs multivariate discriminant analysis, incorporating several financial ratios to improve prediction accuracy. Over time, the model has been refined to better suit the changing dynamics of global financial systems. Altman, Haldeman, & Narayanan (1977) introduced the ZETA model, which extended the original Z-score to predict financial distress up to five years before bankruptcy, making it highly relevant for long-term financial planning. Subsequent revisions, such as the Altman Z-score Plus, have further broadened its applicability to both public and private firms, manufacturing and non-manufacturing entities, and companies across different geographic regions (Altman, 2002).

In the context of banking, the Z-score has proven to be a valuable tool for regulators, investors, and managers to gauge financial stability and predict distress. For instance, Chieng (2013) confirmed the validity of the Z-score model in predicting the future distress of European banks, demonstrating its robustness even during the financial crisis. Similarly, studies on Bangladeshi banks have employed the Z-score to compare the financial health of conventional and Shariah-compliant banks, revealing that Islamic banks often exhibit higher financial stability (Saha & Navila, 2018). Despite its widespread use, the Altman Z-score model is not without limitations. Critics point out that the model's reliance on accounting data, which may be subject to manipulation, and its assumption of linearity in the relationships between variables, can sometimes result in inaccurate predictions (Li & Rahgozar, 2012). Nonetheless, the Z-score remains a crucial metric in financial analysis, particularly for its simplicity and effectiveness in providing early warnings of financial distress.

Altman, Hartzell, & Peck (1995) added a constant (+3.25) to the Z-score values to normalize them and make scores of zero or below "equivalent to the default situation". A confirmatory study using Eurozone banks was undertaken in 2013 to support this updated model. Chieng (2013) chose four distressed banks and used data from the previous five years to demonstrate that the Altman Z-score model can predict future bank distress. The study's findings supported Altman Z-score's ability to predict Eurozone banks' behavior. Additional research has been conducted by Siskos (2014) in this regard. He concluded that utilizing Altman Z-score and Beneish M-score, the Enron's scandal of 2001 could have been detected, which ultimately contributed to the largest business bankruptcy

in history (Ahmed, 2015). As a result, this study applies the Z-score model to evaluate the financial health of Bangladeshi listed banks.

Parvin, Rahman, and Nitu (2016) compared the Z-scores of state-owned commercial banks (SOCBs) and private commercial banks (PCBs) to predict the financial health of the banking sector using Altman’s Z-score model. The data shows that SOCBs were in better financial health than PCBs. In the empirical analysis of the liquidity, profitability, and solvency, Abdullah (2015) discovered that while 22 banks were insolvent during the financial years from 2009 to 2014, only 7 banks were in a sound financial position.

Additionally, Islamic or Sariah-compliant banks performed better than conventional banks. He also noted that state-owned banks have improved compared to previous performance. Mostofa, Rezina, and Hasan (2016) used the Z score model of Altman to predict the financial distress of Bangladesh’s private sector banking industry and found that the model was 72% accurate at predicting bankruptcy two years in advance. However, previous studies have not been conducted on all the listed banks of Bangladesh. Bangladesh is currently experiencing significant financial instability due to political turmoil, as mentioned earlier. Moreover, Bangladeshi financial institutions, including Bangladesh Bank, have been facing widespread loan scams.

Furthermore, the stability of the financial system has become a major concern for the central bank and professionals in our country. The current priority is ensuring the stability of Bangladesh’s banking system and economy, especially given the ongoing political unrest triggered by recent student movements. This situation even led to the resignation of the prime minister. In light of these circumstances, this study has been undertaken to assess and predict the financial health of 36 listed banks in Bangladesh over the period from 2018 to 2023. Considering all these issues, the study is conducted to predict the financial health of Bangladeshi listed banks. In conclusion, the Altman Z-score has established itself as an essential tool in assessing the financial health and stability of banks. Its continued relevance, despite evolving market conditions, underscores the model's robustness and adaptability, making it a cornerstone of financial risk assessment in the banking sector.

3. Materials and Methods

3.1. Sample Selection and Data Sources

This study focuses on 36 banks that were listed on the Dhaka Stock Exchange (DSE) as of December 2023, covering the period from 2018 to 2023. The financial health of these banks is assessed using ratios such as working capital to total assets, retained earnings to total assets, earnings before interest and tax to total assets, and shareholders’ equity to total liabilities. Most of the data was gathered from the annual reports of the banks.

3.2. Variables’ Definition and Measurements

This study adopts Altman’s Z-score model to assess the bankruptcy risk of the listed banks in Bangladesh. The model utilizes four financial ratios, each representing a distinct aspect of a firm’s financial health. Table 1 presents these independent variables, including their formulas and descriptions.

Financial evaluations, which primarily rely on financial statements, are among the oldest and most significant methods for assessing business performance (Qamruzzaman, 2014). The main purpose of this study is to forecast the financial stability of Bangladeshi banking sector. Particular attention has been paid to the 36 listed banks of Bangladesh. In addition, arguments presented by various authors regarding financial ratios and indicators used for bankruptcy prediction served as inspiration for this study (Beaver, 1966).

The four independent variables in the Altman Z-score model, each representing typical financial ratios, are weighted by coefficients. The following equation for insolvency or potential bankruptcy of non-manufacturing or service businesses has been examined using the Altman Z score model (Altman, 1968).

Formula: Z – Score bankruptcy model: $Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$

Where,

Table 1. Independent variables of Z-score.

Variable	Formula	Description
X1	(Current assets – Current liabilities) / Total assets	This ratio represents the firm's liquid assets.
X2	Retained earnings / Total assets.	It displays the age and earning capacity of the company.
X3	Earnings before interest and taxes / Total assets	In addition to tax and leverage variables, it analyzes operating efficiency. It displays operating income
X4	Market value of equity / Book value of total liabilities	This ratio shows how the fair market value of a company's share has performed in relation to the book value of the outstanding loan capital.

3.3. Zones of Discriminations

The Altman Z-score model categorizes banks into distinct zones based on their financial health, aiding in the assessment of bankruptcy risk. Table 2 presents these zones, portraying the threshold and corresponding interpretations.

Table 2. Indicator of Z-score.

SL	Score	Indicator	Description
1	$Z > 2.6$	“Safe”	The bank is financially stable, and there is little chance that it will experience financial trouble. The bank’s financial situation is sound, it can be argued.
2	$1.1 \leq Z \leq 2.6$	“Grey”	The bank is in the gray area, which suggests there is less chance that it may soon experience financial trouble.
3	$Z < 1.1$	“Distress”	The likelihood that the bank may experience financial difficulty or possibly bankruptcy in the near future is very high. One may say that the bank is in a precarious position.

Secondary data were collected from annual reports of the banks. The study particularly focuses on the six-year period between 2018 and 2023 using publicly available financial reports. The Z-score model was used to predict the financially distressed and non-distressed banks after various financial ratios were computed for the study’s analysis. The following equation has been examined for bankruptcy or potential insolvency of non-manufacturing or service industries using the Altman Z score model (Altman, 1968).

3.4. Tool Applied

$$Z - \text{Score bankruptcy model: } Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$$

- Where, X1= Working capital / Total asset.
A common metric for assessing a business’s liquidity, effectiveness, and general health is working capital. Total assets display all bank assets, including short- and long-term investments. A bank’s liquidity and capacity to fulfill short-term obligations to creditors are shown by the WC/TA ratio.
- X2= Retained earnings / Total assets.
The amount of net earnings carried over to the following years is known as retained earnings. The ratio used to determine a bank’s cumulative profitability is Accumulated Retained Earnings to Total Asset (TA).
- X3= Operating earnings / Total assets.
EBIT, or Earnings before Interest and Taxes, displays a bank’s operating profit. An organization’s operational efficiency is measured by EBIT to Total Asset. The value of this ratio reveals the firm’s ability to make enough money to cover fixed obligations like interest.
- X4= Market value of equity / Total liabilities.

This ratio represents the market value of shareholders’ equity relative to total liabilities. In relation to the total liabilities, this ratio showed how the fair market value of the bank’s stock performed. A higher ratio typically indicates a stronger market perception, often reflected in increasing share prices. The higher the values of each of the four ratios required to construct the Z-score, the better. It suggests that a bank’s financial health improves with higher ratios (Parvin et al., 2016).

Beaver was a pioneer in the empirical study of bankruptcy risk; yet, the univariate structure of the model that he created is chiefly responsible for his work’s limitations. It only permits the use of one ratio at once (Beaver, 1966). By adding four additional factors to the model in Altman (1968) improved on Beaver’s work and produced a prediction of manufacturing firm failure that was ultimately more accurate. Beaver’s model and Altman’s multi-discriminant analysis (MDA) model differed in the financial ratios selected for optimal prediction accuracy. Altman classified companies into two mutually exclusive categories: bankrupt and non-bankrupt. The Zeta Credit Risk model was created by Altman et al. (1977) as a second-generation discriminant model that “seemed to be quite accurate for up to five years prior to failure” (Altman, 2002). To account for various criteria and the shifting corporate landscape, the z-score model has been revised frequently (Altman, 2002).

4. Result and Discussion

Here, Table 3 shows the average calculation of Z score for AB Bank Limited and the calculation for the rest of the banks is shown in the Appendix 1. Table 4 shows the discriminant zones of the listed banks of Bangladesh using Z-score Model. According to this approach, any commercial bank that receives a score higher than 2.6 should be classified as safe. However, if it doesn’t get a score of at least 1.1, it will be placed in the distress zone and more likely to be declared bankrupt. If the Z score falls in the range between 1.1 and 2.6, it should be in the grey area.

Table 3. Data analysis of AB bank limited (See appendix for the rest of the listed banks).

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
AB bank	2023	0.015	0.036	0.041	0.022	0.110	0.146
	2022	0.008	0.041	0.046	0.023	0.120	
	2021	0.159	0.047	0.032	0.031	0.270	
	2020	0.006	0.056	0.023	0.028	0.110	
	2019	0.008	0.061	0.025	0.019	0.110	
	2018	0.036	0.070	0.015	0.032	0.150	

The present study showed had an average Z-score of less than 1.1 and are placed in the “Distress Zone” except 02 banks namely Union bank and Uttara bank. This indicates that there is a high probability of some banks becoming bankrupt in the near future. However, the average Z-scores of Union Bank and Uttara Bank are 1.30 and 1.56, respectively. Among 36 banks, Union bank and Uttara bank are placed under “Grey Zone”. This indicates that there is less probability of having financial trouble in near future but they also need to be cautious about their financial activities.

Table 4. Average Z- score table of 36 listed banks and their financial health.

SL no.	Bank name	Year-2023	Year-2022	Year-2021	Year-2020	Year-2019	Year-2018	Avg. Z score	Indicator	Std. dev.
1	AB Bank	0.114	0.119	0.268	0.113	0.113	0.152	0.146	Distress	0.061
2	Al-Arafah Bank	-2.906	0.191	1.320	-1.269	0.506	0.404	-0.293	Distress	1.532
3	Bank Asia	0.221	0.414	0.453	0.382	0.355	0.418	0.374	Distress	0.082
4	BRAC Bank	1.108	0.853	1.236	0.623	0.796	0.919	0.922	Distress	0.220
5	City Bank	-0.311	-0.218	-0.048	-0.216	-0.348	0.121	-0.170	Distress	0.176
6	Dhaka Bank	-1.255	-1.176	-1.101	-1.098	-0.754	-0.619	-1.000	Distress	0.253
7	Dutch-Bangla Bank	0.439	0.787	0.580	0.425	0.637	0.574	0.574	Distress	0.134
8	Eastern Bank	0.949	0.935	1.185	0.965	0.978	0.946	0.993	Distress	0.095
9	Exim Bank	-0.669	-0.667	-0.609	-0.512	-0.447	-0.488	-0.565	Distress	0.096
10	FSIBL	0.272	0.316	0.307	0.254	0.333	0.174	0.276	Distress	0.058
11	Global Islami Bank	0.559	0.533	0.327	0.406	0.330	0.339	0.416	Distress	0.105

SL no.	Bank name	Year-2023	Year-2022	Year-2021	Year-2020	Year-2019	Year-2018	Avg. Z score	Indicator	Std. dev.
12	ICB Islamic Bank	-6.739	-9.214	-4.684	-8.537	-5.759	-5.222	-6.692	Distress	1.835
13	IFIC Bank	-0.528	-0.449	-0.068	0.062	0.080	-0.030	-0.156	Distress	0.265
14	Islami Bank	-0.358	0.365	0.294	0.428	0.450	0.493	0.279	Distress	0.319
15	Jamuna Bank	-0.797	-0.250	-0.509	-0.195	-0.019	0.522	-0.208	Distress	0.449
16	Mercantile Bank	0.363	0.363	0.303	0.409	0.367	0.440	0.374	Distress	0.047
17	Midland Bank	-0.540	0.873	0.248	0.062	1.359	0.518	0.420	Distress	0.660
18	Mutual Trust Bank	0.283	0.398	0.336	0.317	0.199	0.246	0.296	Distress	0.070
19	National Bank	-5.931	-1.176	0.077	0.061	0.011	-0.585	-1.257	Distress	2.342
20	NCC Bank	0.166	0.367	0.317	0.576	0.310	0.271	0.335	Distress	0.136
21	NRB Bank	-1.198	-1.181	-0.789	-0.503	-0.948	-1.027	-0.941	Distress	0.263
22	NRBC Bank	-1.708	-1.512	-1.245	-0.955	-0.282	0.387	-0.886	Distress	0.798
23	One Bank	-1.527	-1.230	-1.065	-0.972	0.155	0.168	-0.745	Distress	0.727
24	The Premier Bank	-0.754	-0.934	-1.023	-0.930	-1.348	-1.534	-1.087	Distress	0.294
25	Prime Bank	0.361	0.066	0.579	1.025	0.744	0.292	0.511	Distress	0.344
26	Pubali Bank	0.600	0.549	-12.031	0.426	0.397	0.439	-1.603	Distress	5.109
27	Rupali Bank	-1.507	-1.450	-1.548	-1.389	-1.102	-0.920	-1.319	Distress	0.251
28	SBAC Bank	0.439	0.423	0.600	0.734	0.685	0.814	0.616	Distress	0.159
29	Shahjalal Islami Bank	0.408	0.406	0.463	0.363	0.396	0.318	0.392	Distress	0.049
30	Social Islami Bank	0.178	0.208	0.181	0.188	0.210	0.243	0.201	Distress	0.025
31	Southeast Bank	-0.111	-0.404	-0.073	0.372	-0.015	-0.177	-0.068	Distress	0.254
32	Standard Bank	0.294	0.442	0.501	0.582	0.266	0.584	0.445	Distress	0.138
33	Trust Bank	-2.038	-1.826	-1.581	-1.948	-1.494	-1.312	-1.700	Distress	0.283
34	UCB	0.366	0.192	0.287	0.530	0.552	0.629	0.426	Distress	0.171
35	Union Bank	1.293	1.363	1.149	1.374	1.644	0.997	1.303	Grey	0.220
36	Uttara Bank	1.856	1.525	1.469	1.806	1.241	1.489	1.564	Grey	0.230

Note: 2.6>Safe, Between 1.1 to 2.6= Grey, and 1.1<=Distress

However, the most alarming issue is that 16 banks including Al-Arafah Bank, City Bank, Dhaka Bank, Exim Bank, ICB Islami Bank, IFIC Bank, Jamuna Bank, National Bank, NRB, NRBC, One Bank, The Premier Bank, Pubali Bank, Rupali Bank, Southeast Bank and Trust Bank scored negative point while measuring the financial health. According to the zone of criteria of Altman Z-score, these 16 banks are not only scored below 1.1 and were placed in the financial distress zone but also received negative scores; indicating that these banks might be financially collapsed in the near future as their liquidity, overall working capital, total asset, total liabilities, market value of equity, operating earnings and retained earnings are in a precarious condition.

It is surprisingly found that ICB Islami Bank scored a z-score of -6.69 during the study period from 2018 to 2023. Hence, there is a high likelihood that ICB Islami Bank may soon become bankrupt. In that condition, immediate action should be taken by the authority of the ICB Islami Bank to improve their financial condition.

All banks were performing poorly during the study period from 2018 to 2023 in terms of financial stability as all of them scored less than 1.1 except two banks. The likelihood that all the banks may experience financial difficulty or possibly bankruptcy in the near future is very high. One may assume that all the banks are in a precarious position. The authoritative body of all the listed banks in Bangladesh must be concerned about their performance. They should take necessary steps for improving their banks’ performance. Otherwise, all of them might face huge financial instability in the near future.

A graphical presentation of average Z score and their financial health is attached below.

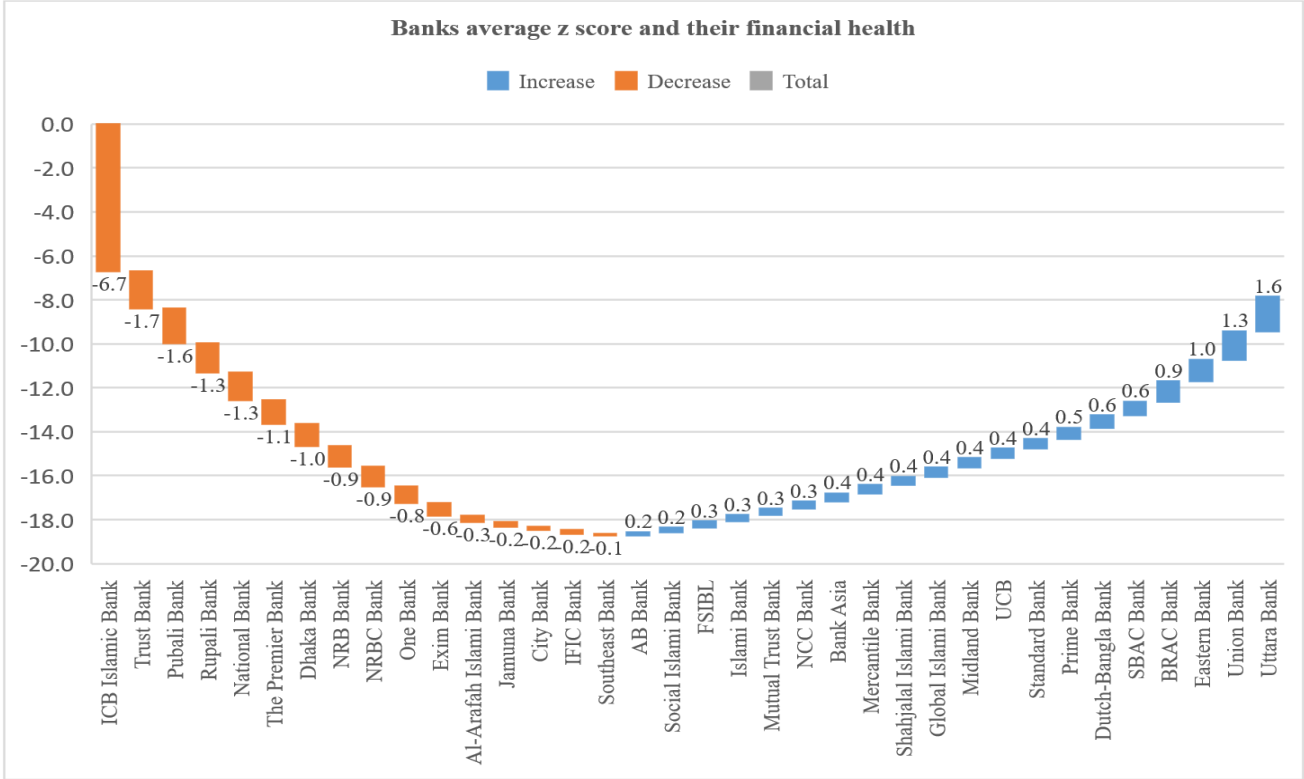


Figure 1. Financial health score of 36 listed banks.

This Figure 1 presents the negative discriminant zone in rust and positive zone in navy blue color. Rust colors banks are in very precarious position in terms of financial stability. In this case, every bank should be cautious

regarding their financial stability. They need to find out how to perform well and take necessary steps to fix their financial health.

5. Conclusion

The foundation of the economy is the banking system. As the public's trust and confidence are essential to the banking industry, the entire financial sector would crumble if the public lacked trust and confidence in the banking sector. Hence, the primary duty of banking industry is to uphold and preserve public confidence (Nath et al., 2020). However, it is found that all the listed banks of Bangladesh are not performing well. The result showed that there is high likelihood that the mentioned banks may fail. The overall Z-scores of 34 banks are below the standard which is an indication of a strong potential for failure within a short time. All the banks should act immediately to allay concerns about their ability to continue operating. This study provides a detailed picture of the financial performance of Bangladeshi listed banks.

The findings show that operating effectiveness is gradually declining as a result of an excessive amount of non-performing loans. According to Mostofa et al. (2016) loans are a bank's asset, but when they are written off as bad loans, it negatively impacts the bank's financial performance. Both financial trouble and insolvency could result from these actions. As a result, the management of these institutions needs to demonstrate managerial effectiveness while being more cautious with loan issuance. The study predicts only the financial health and bankruptcy of the listed banks in Dhaka stock exchange. However, the study does not provide any indication of how banks that are placed in the financial distress zone, would be able to overcome the financial instability. Hence, further research could be conducted on why these banks will keep on suffering from financial instability and which factors could help them overcome bankruptcy in the future.

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Appendix

Appendix 1. Data analysis of 36 listed banks of Bangladesh using Z score indicator and value.

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
AB bank	2023	0.015	0.036	0.041	0.022	0.110	0.146
	2022	0.008	0.041	0.046	0.023	0.120	
	2021	0.159	0.047	0.032	0.031	0.270	
	2020	0.005	0.056	0.023	0.028	0.110	
	2019	0.008	0.061	0.025	0.018	0.110	
	2018	0.036	0.070	0.015	0.032	0.150	
Data analysis of AB bank limited							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Al-Arafah Islami bank	2023	-3.701	0.102	0.643	0.050	-2.910	-0.293
	2022	0.061	0.011	0.066	0.052	0.190	
	2021	1.169	0.013	0.070	0.068	1.320	
	2020	-1.423	0.013	0.077	0.063	-1.270	
	2019	0.300	0.013	0.139	0.054	0.510	
	2018	0.189	0.018	0.125	0.071	0.400	
Data analysis of Al-Arafah Islami bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Bank Asia	2023	0.074	0.023	0.068	0.055	0.220	0.374
	2022	0.242	0.020	0.095	0.057	0.410	
	2021	0.300	0.020	0.069	0.064	0.450	
	2020	0.244	0.015	0.065	0.058	0.380	
	2019	0.196	0.016	0.075	0.067	0.350	
	2018	0.227	0.018	0.101	0.072	0.420	
Data analysis of bank Asia							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
BRAC bank	2023	0.795	0.129	0.103	0.081	1.110	0.922
	2022	0.508	0.145	0.095	0.105	0.850	
	2021	0.806	0.163	0.088	0.179	1.240	
	2020	0.260	0.117	0.093	0.153	0.620	
	2019	0.354	0.120	0.121	0.201	0.800	
	2018	0.376	0.121	0.162	0.259	0.920	
Data analysis of BRAC bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
City bank	2023	-0.567	0.071	0.132	0.052	-0.310	-0.170
	2022	-0.449	0.052	0.122	0.057	-0.220	
	2021	-0.340	0.063	0.151	0.078	-0.050	
	2020	-0.459	0.049	0.121	0.074	-0.220	
	2019	-0.605	0.027	0.162	0.068	-0.350	
	2018	-0.145	0.021	0.144	0.102	0.120	
Data analysis of City bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Dhaka bank	2023	-1.383	0.019	0.072	0.037	-1.250	-1.000
	2022	-1.315	0.023	0.076	0.040	-1.180	
	2021	-1.252	0.022	0.085	0.044	-1.100	
	2020	-1.231	0.023	0.070	0.040	-1.100	
	2019	-0.957	0.018	0.145	0.040	-0.750	
	2018	-0.846	0.017	0.163	0.047	-0.620	
Data analysis of Dhaka bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Dutch-Bangla bank	2023	0.067	0.158	0.130	0.085	0.440	0.574

	2022	0.458	0.132	0.107	0.089	0.790	
	2021	0.236	0.118	0.106	0.120	0.580	
	2020	0.100	0.102	0.137	0.085	0.430	
	2019	0.307	0.088	0.128	0.113	0.640	
	2018	0.262	0.087	0.131	0.094	0.570	

Data analysis of Dutch-Bangla bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Eastern bank	2023	0.657	0.083	0.129	0.079	0.950	0.993
	2022	0.651	0.078	0.121	0.084	0.930	
	2021	0.853	0.079	0.146	0.107	1.190	
	2020	0.646	0.086	0.133	0.099	0.960	
	2019	0.704	0.058	0.126	0.091	0.980	
	2018	0.671	0.057	0.111	0.106	0.950	

Data analysis of Eastern bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Exim bank	2023	-0.772	0.012	0.062	0.029	-0.670	-0.565
	2022	-0.789	0.012	0.079	0.031	-0.670	
	2021	-0.708	0.011	0.051	0.038	-0.610	
	2020	-0.640	0.016	0.074	0.039	-0.510	
	2019	-0.577	0.017	0.076	0.037	-0.450	
	2018	-0.633	0.020	0.077	0.049	-0.490	

Data analysis of Exim bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
First security Islami bank	2023	0.188	0.005	0.062	0.017	0.270	0.276
	2022	0.232	0.005	0.060	0.018	0.320	
	2021	0.203	0.005	0.073	0.026	0.310	
	2020	0.164	0.006	0.065	0.019	0.250	
	2019	0.057	0.007	0.061	0.208	0.330	
	2018	0.085	0.008	0.056	0.025	0.170	

Data analysis of first security Islami bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Global Islami bank	2023	0.396	0.027	0.080	0.056	0.560	0.416
	2022	0.349	0.033	0.088	0.063	0.530	
	2021	0.250	0.024	0.013	0.039	0.330	
	2020	0.249	0.018	0.100	0.039	0.410	
	2019	0.222	0.007	0.055	0.045	0.330	
	2018	0.205	0.017	0.071	0.046	0.340	

Data analysis of global Islami bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
ICB Islamic bank limited	2023	-0.428	-6.118	-0.353	0.160	-6.740	-6.692
	2022	-3.113	-6.106	-0.161	0.166	-9.210	
	2021	0.804	-5.414	-0.228	0.154	-4.680	
	2020	-3.103	-5.455	-0.109	0.131	-8.540	
	2019	-0.192	-5.410	-0.249	0.093	-5.760	
	2018	0.112	-5.200	-0.284	0.150	-5.220	

Data analysis of ICB Islamic bank limited

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
IFIC bank	2023	-0.676	0.050	0.054	0.044	-0.530	-0.156
	2022	-0.616	0.046	0.071	0.049	-0.450	
	2021	-0.272	0.040	0.085	0.079	-0.070	
	2020	-0.096	0.038	0.042	0.078	0.060	
	2019	-0.118	0.050	0.096	0.052	0.080	

	2018	-0.206	0.049	0.069	0.058	-0.030	
Data analysis of IFIC bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Islami bank Bangladesh	2023	-0.447	0.005	0.056	0.028	-0.360	0.279
	2022	0.273	0.005	0.055	0.032	0.360	
	2021	0.204	0.005	0.048	0.037	0.290	
	2020	0.333	0.006	0.053	0.036	0.430	
	2019	0.315	0.007	0.085	0.044	0.450	
	2018	0.324	0.007	0.095	0.067	0.490	
Data analysis of Islami bank Bangladesh							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Jamuna bank	2023	-0.980	0.026	0.094	0.062	-0.800	-0.208
	2022	-0.428	0.036	0.078	0.064	-0.250	
	2021	-0.728	0.040	0.103	0.076	-0.510	
	2020	-0.415	0.031	0.121	0.068	-0.200	
	2019	-0.235	0.022	0.130	0.064	-0.020	
	2018	0.325	0.022	0.107	0.067	0.520	
Data analysis of Jamuna bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Mercantile bank	2023	0.264	0.012	0.046	0.041	0.360	0.374
	2022	0.250	0.014	0.056	0.043	0.360	
	2021	0.148	0.018	0.082	0.055	0.300	
	2020	0.295	0.015	0.057	0.042	0.410	
	2019	0.232	0.015	0.075	0.044	0.370	
	2018	0.264	0.013	0.098	0.065	0.440	
Data analysis of mercantile bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Midland bank	2023	-0.807	0.034	0.103	0.130	-0.540	0.420
	2022	0.661	0.013	0.092	0.107	0.870	
	2021	0.005	0.014	0.110	0.119	0.250	
	2020	-0.204	0.024	0.102	0.140	0.060	
	2019	1.038	0.021	0.134	0.166	1.360	
	2018	0.138	0.030	0.162	0.188	0.520	
Data analysis of midland bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Mutual trust bank	2023	0.130	0.041	0.065	0.046	0.280	0.296
	2022	0.254	0.035	0.061	0.047	0.400	
	2021	0.163	0.037	0.078	0.058	0.340	
	2020	0.171	0.026	0.046	0.074	0.320	
	2019	0.013	0.029	0.081	0.076	0.200	
	2018	0.036	0.032	0.077	0.101	0.250	
Data analysis of mutual trust bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
National bank	2023	-5.579	-0.152	-0.252	0.052	-5.930	-1.257
	2022	-0.732	-0.052	-0.450	0.058	-1.180	
	2021	-0.022	0.044	0.011	0.045	0.080	
	2020	-0.079	0.013	0.083	0.045	0.060	
	2019	-0.167	0.019	0.105	0.054	0.010	
	2018	-0.786	0.021	0.115	0.065	-0.580	
Data analysis of national bank							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
NCC bank	2023	-0.004	0.017	0.102	0.052	0.170	0.335

	2022	0.180	0.016	0.116	0.055	0.370	
	2021	0.129	0.021	0.104	0.064	0.320	
	2020	0.393	0.020	0.105	0.059	0.580	
	2019	0.136	0.022	0.104	0.049	0.310	
	2018	0.091	0.017	0.097	0.066	0.270	

Data analysis of NCC bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
NRB bank	2023	-1.442	0.039	0.109	0.096	-1.200	-0.941
	2022	-1.385	0.042	0.063	0.099	-1.180	
	2021	-0.985	0.016	0.069	0.111	-0.790	
	2020	-0.747	0.028	0.116	0.100	-0.500	
	2019	-1.029	-0.001	-0.015	0.097	-0.950	
	2018	-1.254	0.034	0.089	0.104	-1.030	

Data analysis of NRB bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
NRBC bank	2023	-1.902	0.039	0.083	0.071	-1.710	-0.886
	2022	-1.735	0.036	0.110	0.078	-1.510	
	2021	-1.575	0.043	0.143	0.143	-1.250	
	2020	-1.279	0.037	0.121	0.167	-0.950	
	2019	-0.652	0.037	0.153	0.179	-0.280	
	2018	-0.038	0.041	0.157	0.227	0.390	

Data analysis of NRBC bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
One bank	2023	-1.613	0.017	0.034	0.034	-1.530	-0.745
	2022	-1.326	0.016	0.048	0.032	-1.230	
	2021	-1.142	0.013	0.035	0.030	-1.060	
	2020	-1.059	0.019	0.041	0.027	-0.970	
	2019	0.057	0.018	0.057	0.024	0.150	
	2018	0.066	0.016	0.060	0.026	0.170	

Data analysis of one bank

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
The premier bank PLC	2023	-0.918	0.037	0.082	0.044	-0.750	-1.087
	2022	-1.120	0.035	0.106	0.044	-0.930	
	2021	-1.213	0.037	0.103	0.049	-1.020	
	2020	-1.086	0.040	0.078	0.038	-0.930	
	2019	-1.561	0.047	0.116	0.050	-1.350	
	2018	-1.745	0.038	0.118	0.054	-1.530	

Data analysis of the premier bank PLC

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Prime bank PLC	2023	0.139	0.070	0.095	0.057	0.360	0.511
	2022	-0.143	0.056	0.096	0.057	0.070	
	2021	0.366	0.043	0.099	0.071	0.580	
	2020	0.853	0.034	0.075	0.064	1.020	
	2019	0.562	0.020	0.090	0.073	0.740	
	2018	0.101	0.020	0.092	0.079	0.290	

Data analysis of prime bank PLC

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Pubali bank PLC	2023	0.368	0.095	0.100	0.037	0.600	-1.603
	2022	0.337	0.085	0.084	0.042	0.550	
	2021	-12.218	0.076	0.061	0.049	-12.030	
	2020	0.242	0.065	0.070	0.049	0.430	
	2019	0.206	0.058	0.074	0.058	0.400	

	2018	0.236	0.034	0.098	0.071	0.440	
Data analysis of Pubali bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Rupali bank PLC	2023	-1.542	0.003	0.012	0.020	-1.510	-1.319
	2022	-1.478	0.003	0.007	0.018	-1.450	
	2021	-1.583	0.003	0.009	0.023	-1.550	
	2020	-1.418	0.004	0.005	0.020	-1.390	
	2019	-1.152	0.004	0.013	0.032	-1.100	
	2018	-0.967	0.004	0.011	0.032	-0.920	
Data analysis of Rupali bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
SBAC bank PLC	2023	0.261	0.010	0.082	0.086	0.440	0.616
	2022	0.233	0.012	0.084	0.095	0.420	
	2021	0.376	0.023	0.067	0.133	0.600	
	2020	0.460	0.025	0.104	0.145	0.730	
	2019	0.381	0.024	0.140	0.139	0.680	
	2018	0.477	0.027	0.156	0.154	0.810	
Data Analysis of SBAC bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Shahjalal Islami bank PLC	2023	0.191	0.017	0.135	0.065	0.410	0.392
	2022	0.179	0.017	0.144	0.067	0.410	
	2021	0.263	0.017	0.105	0.079	0.460	
	2020	0.181	0.013	0.083	0.085	0.360	
	2019	0.197	0.012	0.097	0.091	0.400	
	2018	0.119	0.012	0.081	0.106	0.320	
Data analysis of Shahjalal Islami bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Social Islami Bank PLC	2023	0.082	0.011	0.056	0.029	0.180	0.201
	2022	0.104	0.012	0.060	0.032	0.210	
	2021	0.081	0.011	0.049	0.039	0.180	
	2020	0.091	0.009	0.054	0.035	0.190	
	2019	0.100	0.010	0.061	0.039	0.210	
	2018	0.104	0.010	0.085	0.045	0.240	
Data analysis of social Islami bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Southeast bank PLC	2023	-0.205	0.011	0.046	0.038	-0.110	-0.068
	2022	-0.504	0.009	0.052	0.039	-0.400	
	2021	-0.169	0.011	0.044	0.042	-0.070	
	2020	0.281	0.009	0.046	0.036	0.370	
	2019	-0.153	0.027	0.070	0.042	-0.010	
	2018	-0.333	0.025	0.082	0.049	-0.180	
Data analysis of Southeast bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Standard bank PLC	2023	0.188	0.007	0.057	0.042	0.290	0.445
	2022	0.345	0.007	0.044	0.045	0.440	
	2021	0.396	0.010	0.041	0.055	0.500	
	2020	0.462	0.010	0.066	0.043	0.580	
	2019	0.121	0.015	0.086	0.044	0.270	
	2018	0.417	0.015	0.073	0.078	0.580	
Data analysis of standard bank PLC							
Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Trust bank limited	2023	-2.228	0.033	0.092	0.066	-2.040	-1.700

	2022	-2.033	0.027	0.109	0.071	-1.830	
	2021	-1.776	0.032	0.092	0.071	-1.580	
	2020	-2.128	0.030	0.083	0.067	-1.950	
	2019	-1.692	0.028	0.107	0.063	-1.490	
	2018	-1.519	0.025	0.106	0.077	-1.310	

Data analysis of trust bank limited

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
United commercial bank PLC	2023	0.257	0.030	0.049	0.029	0.370	0.426
	2022	0.069	0.031	0.059	0.032	0.190	
	2021	0.153	0.034	0.062	0.039	0.290	
	2020	0.382	0.038	0.071	0.039	0.530	
	2019	0.399	0.037	0.077	0.039	0.550	
	2018	0.457	0.034	0.085	0.052	0.630	

Data analysis of united commercial bank PLC

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Union bank PLC	2023	1.161	0.024	0.074	0.034	1.290	1.303
	2022	1.225	0.027	0.076	0.037	1.360	
	2021	1.037	0.025	0.062	0.025	1.150	
	2020	1.250	0.023	0.071	0.030	1.370	
	2019	1.527	0.027	0.055	0.035	1.640	
	2018	0.846	0.027	0.079	0.044	1.000	

Data analysis of union bank PLC

Bank name	Year	6.56 X1	3.26 X2	6.72 X3	1.05 X4	Z	Avg.
Uttara bank PLC	2023	1.596	0.035	0.153	0.071	1.860	1.564
	2022	1.284	0.032	0.140	0.070	1.520	
	2021	1.266	0.027	0.108	0.068	1.470	
	2020	1.608	0.023	0.113	0.062	1.810	
	2019	1.021	0.025	0.130	0.066	1.240	
	2018	1.287	0.030	0.104	0.068	1.490	

Data analysis of Uttara Bank PLC