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Evaluating Bangladesh Bank's Zoning Framework using Altman's Z-Score: Evidence from Commercial Banks

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Abstract

Bangladesh's banking sector is currently undergoing a challenging period. The Bangladesh Bank's recent categorization of banks into red, yellow, and green zones has drawn the attention of stakeholders in the banking industry and raised questions about its evaluation criteria. This study aims to evaluate the financial performance and position of commercial banks in Bangladesh using the Altman Z-score Model and to verify its validity against the recently established red, yellow, and green zone banks. 44 Commercial Bank's four years of data, from 2019 to 2022, were analyzed for this purpose. Using the Altman Z-score model to assess the validity of Bangladesh bank zoning, only one bank was identified as safe, three as in the grey zone, and the remaining 38 as in the distress zone. However, the Altman Z-score opposes all Zoning by the Bangladesh Bank, except for 7 banks from the red zone out of 44 banks. The study argues that the Altman Z-score Model doesn't support the division of banks in most cases. The study confirms that the majority of Bangladesh's commercial banks are experiencing financial difficulties, and their performance between 2019 and 2022 was quite concerning. This study demands an in-depth investigation of the Bangladesh Bank Zoning criteria and an explanation of why this Zoning differs from other alternatives, which can be addressed in future research.

Keywords: *Commercial banks, Altman's Z-score, Bank Zoning, Financial distress*

1. Introduction

Bangladesh's financial system is bank-based, and the economy is largely dependent on the banking system's proper functioning. However, the success of the banking industry largely depends on harmonization among savers, investors, and borrowers to orchestrate economic development. The banking industry's ability to grow sustainably is a prerequisite for economic growth. At present, 33 conventional private commercial banks, 10 Islamic Shariah-based commercial banks, 9 foreign banks, 3 specialized banks serving agriculture and industry, and 6 state-owned commercial banks are on the list of scheduled institutions. Financial institutions controlled by BB and subject to regulations under the Financial Institutions Act of 1993 are referred to as non-bank financial institutions, or NBFI. There are now 35 FIs active in the market. The banking and finance industry has a vast infrastructure; however, a lack of discipline in Bangladesh's banking sector.

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In recent years, this symphony has cast a shadow, demanding an urgent plea for order. Over a long period, Bangladesh's banking industry has faced numerous difficulties. High loan default rates and poor performance across the board have been constant markers of its weaknesses. Bangladesh's banking industry has consistently demonstrated signs of vulnerability, primarily due to poor governance and a lack of reforms. There are significant risks to the economy as a whole due to this inherent fragility. Unfortunately, the government has not lived up to its promises to protect the banking industry. The government's actions have not been sufficient in light of the repeated instances of irregularities and fraudulent activities. The growing rate of Nonperforming Loans (NPLs) has drawn the attention of regulators and policymakers, who are tightening regulatory compliance requirements and monitoring to ensure banking industry stability. Failure of a bank not only endangers the position of the bank's depositors but also threatens the trust of all depositors in the banking industry.

Commercial banking is both important for the economy and inherently fragile. The fragility can be mitigated through appropriate bank management practices and good regulation and oversight. While it is too soon to understand all that contributed to the recent crisis, some themes are already apparent. Rules and regulations intended to address this fragility include capital requirements, government oversight, and deposit insurance. Nonetheless, banks can fail, as recent events have demonstrated. These failures underscore the importance of banks' risk management and the role of oversight and regulation, and threaten the economy. Banking experts' perspectives from across the banking industry help evaluate banks and build customers' trust in them. This system also helps customers understand the risks involved in choosing a bank. Bangladesh Bank, as a regulator, observes the regulatory and other risk compliance of listed banks. However, inappropriate evaluation of bank performance may hinder bank growth and affect the business and trust of those banks. The recent Zoning of the Bangladesh Bank raises several research questions. These are: Does the central banks' support align with Altman's Z-score? Does the Zoning of central banks parallel the Z-score, or does it contradict it entirely, or is it about to match? This study investigates the validity of Central bank zoning by evaluating bank financial stability using the Altman Z-score.

1.1. Background and objective of the study

This study opted for Altman's Z-score because it provides a quantitative, objective, statistically validated method for evaluating distress and bankruptcy risk. Unlike CAMELS, which relies on regulatory judgment and qualitative evaluations, the Z-score stability measure is based on financial ratios derived from publicly available data, making it more transparent and replicable. Moreover, Z-score considers leverage, solvency, profitability, and activity metrics in a single predictive model that is widely used and considered acceptable compared to other models [1]. This study operationalized the validation of Bangladesh Bank's Zoning through a comparative analysis of Bangladesh Bank's official zone classification and Z-score models from 44 commercial banks from 2019 to 2022.

Only a small number of banks are stable enough to be in the "Green Zone" in good condition, with the majority of the nation's banking institutions falling into the weak to inferior category and circling about the "Red Zone" or the "Yellow Zone," according to the most recent report by Bangladesh Bank. The Financial Stability Department of the BB has prepared this analysis using data from 54 banks covering the last six semi-annual periods, from December 2020 to June 2023. The Financial Stability Department meticulously prepared

the Bank Health Index and HEAT Map using six ratios based on the CAMELS rating, excluding market risk sensitivity but including the Basel III leverage ratio, to estimate Z-scores.

Twelve of the 54 banks examined are in critical condition, and nine have already entered the red zone. Furthermore, three banks in the yellow zone are on the verge of entering the red zone. On the other hand, only 16 banks—eight of them local—have secured a spot in the green zone. This classification is made at a crucial time, since the central bank plans to consolidate ten banks by the beginning of 2025.

The yellow zone contained three commercial banks (Bangladesh Development Bank, Sonali Bank, and First Security Islami Bank) that were close to entering the red zone.

Bengal Commercial Bank, Citizens Bank, Community Bank Bangladesh, and Probashi Kallyan Bank have not been considered due to insufficient historical data. At the same time, Bangladesh Krishi Bank, Rajshahi Krishi Unnayan Bank, and ICB Islamic Bank have been excluded from the analysis because their data points differ significantly from those of the other sample banks.

According to Bangladesh Bank Governor Abdur Rouf Talukder, approximately ten banks in the nation are expected to merge by January 2025, as announced during a meeting with bank owners. According to him, in that scenario, the weaker banks can work with the bank they wish to combine with. This study delves into the Z-score validation of the Zoning.

The associated Objectives of this research are as follows:

1. To investigate the effectiveness of Altman's Z-score in comparing the financial performance of Bangladeshi banks.

2. To evaluate the accuracy and consistency of the Z-score by contrasting it with the Recently Divided Bank Zones of Bangladesh, as stated in the Financial Stability Reports by Bangladesh Bank.

2. Literature review

The Altman Z-score model, developed by Altman [2], is a cornerstone of financial analysis, particularly renowned for its predictive power in assessing the likelihood of corporate bankruptcy. This Model, developed by Professor Edward I. Altman in the late 1960s, provides a systematic framework for assessing a company's stability and financial health across industries. The Altman Z-score has become a vital tool for analysts, creditors, and investors seeking to assess a company's credit risk over time.

Fundamentally, the Altman Z-score model provides a thorough overview of a company's financial situation by combining several financial measurements into a composite index. By integrating factors such as liquidity, profitability, solvency, leverage, and activity ratios, the Model generates a numerical score that assesses the probability of insolvency over a specified period. Furthermore, the Altman Z-score model has undergone iterative refinements and adaptations since its inception, reflecting advancements in financial theory and empirical research. Subsequent studies have validated and improved the Model's predictive accuracy, often by tailoring its parameters to specific contexts or by incorporating additional variables to enhance robustness. This ongoing evolution attests to the dynamic nature of financial analysis and the enduring quest for more reliable predictive tools. According to Altman et al. [3], the Altman Z-score has greater predictive power for bank bankruptcy than other market-based models. The authors applied Z-score models across different European and non-European countries and validated them against other models for predicting financial distress. The study of Asia also supports the use of Z-scores to predict banks' financial positions.

Khaddafi et al. [4], based on a survey of 29 Indonesian banks, opine that the Z-score measures a bank's economic condition and indicates the areas that need to be addressed to reduce the likelihood of bank distress.

Comparative studies between Z-scores and other models for predicting distress support the use of Z-scores for better identification and precision. To identify distress, Altman's Z-score shows greater discriminant power than Spingate's Model in Sri Lankan data [5]. The study by Gunathilaka (2014) found that models for predicting bankruptcy may yield results similar to those of Altman's Model; however, the Z-score Model provides better inputs for decision-making.

In a seminal study on financial ratios, discriminant analysis, and the forecasting of corporate bankruptcy, Altman et al. [6] proposed combining several financial ratios in a discriminant analysis method to forecast corporate insolvency. An unsound financial situation can have severe and lasting consequences, limiting capital flows, investment activity, and business performance. As a result, businesses must recognize the factors that could lead to corporate failure and take appropriate action to prevent it.

By treating MCDM for ASEAN banks as a proxy for the CAMELS rating, [7] demonstrates the cumbersome process of predicting financial soundness. Although comprehensive MCDM adequately addresses economic hardship, there is ambiguity regarding the acceptability of CAMELS and other approaches [7]. In determining the banking industry's financial soundness, Chakraborty [8] posits that the Z-score is an accurate predictor of corporate distress.

In a study on the Analysis of Bank Health Levels Using Camel, RGEC, and Altman Z-Score Method [9], the authors employed the CMAELS, RGEC, and Z-score models to assess the financial conditions of three banks. Every qualitative and quantitative element, including risk, governance, capital, assets, liquidity, solvency, and bankruptcy tendency, was taken into account. The three banks all have Very Good Financial Conditions according to the CAMELS and RGEC methods. However, Altman's Z-Score Model [10] indicated that all three banks are in the Grey Zone, suggesting they are at risk of failure or solvency problems. Therefore, the study presented a diverse range of results, including the proposed Z-score and other methods such as CAMELS and GREC.

In a study of the Lebanese Alpha Banks [11] the Altman Z-score model was employed to gauge financial distress. They discovered that the Z-score Model was a valuable tool for both internal and external bank users. The primary issue they encountered was the lack of clarity regarding the banks' current assets and liabilities as reported in the financial statements, and there were also doubts regarding the veracity of the published report. Furthermore, they suggested that future studies focus on the macroeconomic conditions of Lebanon's financial sector.

A study in Bangladesh to estimate the risk of financial hardship for Z-category companies listed on the Dhaka Stock Exchange, using the Z-score methodology [12], found that 41 of 53 enterprises were operating at a high distress risk, while 7 were in the grey region. Five of the 53 companies were found to be out of danger. The research findings indicate that although the Model may not be entirely suitable for companies operating in Bangladesh, it exhibits high accuracy in forecasting the distressed condition of Z-category companies[13]. Based on the survey of related literature, there is an ongoing debate among different groups over the predictors of financial soundness. However, a good number of the literature advocate the Z-score over other methods [5, 8, 13]. Reviewing the literature, this study opted for the Z-score to validate Central bank zoning in Bangladesh to confine the existing debate on predicting financial distress.

3. Methodology of the study

This section presents the methodology, focusing on research design, target population, sampling technique, sample size, and data collection instrument and procedure.

There are 61 scheduled banks in Bangladesh, comprising 6 State Owned Commercial Banks (SOCBs), 3 Specialized Banks, 43 Private Commercial Banks (of which 10 are Islamic Shariah-based PCBs and 33 are conventional PCBs), and 9 Foreign Commercial Banks (FCBs). After excluding banks with missing data from the dataset, we are left with 44 commercial banks with consecutive data from 2019 to 2022.

The inclusion and exclusion criteria of the sample data are given in the following flow chart

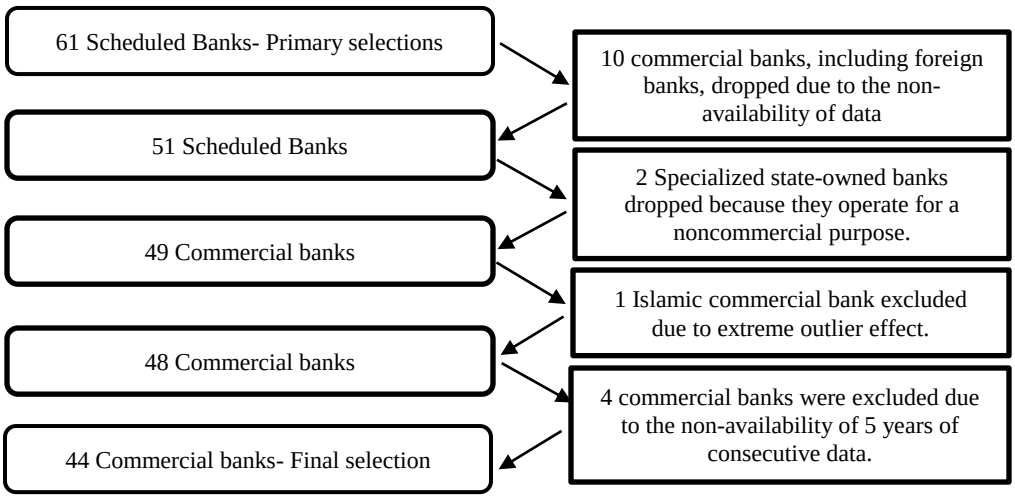

Figure 1. Flow chart of Sample banks selection

3.1. Model specification

This study employed the revised Altman Z-Score model for non-manufacturing firms in emerging markets [10], as previously discussed in the literature review, to assess the financial performance and standing of 44 commercial banks with respect to financial hardship and bankruptcy risk. The used equation is –

$Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4 + 3.25$

Here,

X1 = Net Working Capital/ Total Assets

X2 = Retained Earnings/ Total Assets

X3 = EBIT/ Total Assets

X4 = Book or Market Value of Equity/ Book Value of Total Liabilities

According to Richard D. [14], the ratio's value varies across different circumstances. High ratios increase the Z score and reduce the likelihood of failure; conversely, low ratios increase the likelihood of failure. The Z-score intercept was used to calculate the values. According to Altman [10], the Z values were 2.66 and 1.1. Companies that are in bankruptcy have scores less than 1.1, and those in solvency have scores greater than 2.6. Scores corresponding to the two values are located in the "grey zone," as described by Altman [10], where profiling is

more challenging. The analyst advocated a 2.6 cut-off because that zone contained, if desired, a crucial score rather than the "grey zone."

Table 1. Z-Value, declared zone, and implications

Z value	Declared Zone	Implication
$Z > 2.6$	Safe zone	Indicates a Safe zone and states the good position of the firm with no financial problems.
$1.1 < Z < 2.6$	Gray zone	Indicates the alarming situation. That is, there is a likelihood of being distressed in the near future. Therefore, the firm should take the necessary steps to prevent this situation.
$Z < 1.1$	Distress zone	It sends a bad signal to the firm, and it is most likely on the verge of bankruptcy. Therefore, urgent actions are needed to avoid financial crises.

4. Findings and analysis

The Financial Stability Department meticulously prepared the Bank Health Index and HEAT Map using six ratios based on the CAMELS rating, excluding market risk sensitivity but including the Basel III leverage ratio, to estimate Z-scores.

The Zone-wise Banks are as follows:

Table 2. Zone of commercial banks by Bangladesh Bank

Red Zone	Yellow Zone	Green Zone
Bangladesh Commerce Bank Ltd	Bangladesh Development Bank Ltd	Prime Bank Ltd
Padma Bank Ltd	Sonali Bank PLC	Eastern Bank PLC
BASIC Bank Ltd	First Security Islami Bank PLC	HABIB Bank Ltd
National Bank of Pakistan	IFIC Bank PLC	NCC Bank Ltd
National Bank Ltd	Meghna Bank Ltd	Midland Bank Ltd
Janata Bank PLC	Social Islam Bank Ltd	Bank Alfalah Ltd
Agrani Bank PLC	Islami Bank Bangladesh Ltd	Bank Asia Ltd
Rupali Bank Ltd	ONE Bank PLC	Shimanto Bank Ltd
AB Bank Ltd	United Commercial Bank PLC	Jamuna Bank PLC
	NRB Bank Ltd	Shahajalal Islami Bank PLC
	Al-Arafah Islami Bank Ltd	Woori Bank
	Standard Bank Ltd	The HSBC Ltd
	Union Bank Ltd	Commercial Bank of Ceylon
	NRB Commercial Bank Ltd	Citibank N.A.
	Mercantile Bank PLC	Standard Chartered Bank
	Mutual Trust Bank Ltd	State Bank of India
	EXIM Bank Ltd	
	Dutch Bangla Bank Ltd	
	Global Islami Bank PLC	
	Premier Bank PLC	
	BRAC Bank PLC	
	Southeast Bank PLC	
	The City Bank Ltd	
	Trust Bank Ltd	
	South Bangla Agri. and Com. Bank Ltd	
	Modhumati Bank Ltd	
	Dhaka Bank Ltd	
	Uttara Bank PLC	
	Pubali Bank PLC	

To examine the consistency between the Z-score and Bangladesh Bank's Zoning, we calculate various ratios for commercial banks. We measure Z-scores from 2019 to 2022 to establish a trend.

Different ratios of Z-score in 2019 to 2019 are given as follows:

Table 3. Ratios and Z-score of commercial banks in 2019 and 2020

		2019					2020				
SL	Bank Name	X1	X2	X3	X4	Z Score	X1	X2	X3	X4	Z Score
1	Global Islami Bank	-0.716	0.002	0.008	0.000	-1.390	-0.708	0.005	0.015	0.000	-1.270
2	South Bangla Agriculture and Commerce Bank	-0.546	0.007	0.021	0.000	-0.170	-0.532	0.008	0.015	0.000	-0.110
3	Union Bank	-0.773	0.008	0.008	0.000	-1.740	-0.769	0.007	0.011	0.000	-1.700
4	Sonali Bank	-0.302	0.001	0.003	0.000	1.290	-0.299	0.001	0.003	0.000	1.320
5	Janata Bank	-0.497	0.009	0.001	0.032	0.060	-0.460	0.004	0.002	0.000	0.260
6	Agrani Bank	-0.443	-0.004	0.011	0.000	0.400	-0.378	-0.003	0.007	0.000	0.810
7	Rupali Bank	-0.549	0.001	0.002	0.026	-0.310	-0.484	0.001	0.001	0.019	0.100
8	National Bank	-0.615	0.006	0.016	0.057	-0.600	-0.642	0.004	0.012	0.039	-0.820
9	Basic Bank	-0.554	-0.171	-0.017	0.000	-1.050	-0.546	-0.188	-0.019	0.000	-1.070
10	Social Islami Bank	-0.659	0.003	0.009	0.038	-0.960	-0.673	0.002	0.008	0.033	-1.070
11	Standard Bank	-0.660	0.005	0.013	0.041	-0.940	-0.662	0.003	0.010	0.041	-0.970
12	Al-Arafah Islami Bank	-0.667	0.004	0.013	0.051	-0.970	-0.636	0.004	0.011	0.060	-0.770
13	Southeast Bank	-0.571	0.008	0.010	0.039	-0.360	-0.573	0.003	0.007	0.034	-0.420
14	AB Bank	-0.551	0.019	0.004	0.017	-0.260	-0.562	0.017	0.003	0.026	-0.330
15	IFIC Bank	-0.551	0.019	0.004	0.017	-0.260	-0.562	0.017	0.003	0.026	-0.330
16	Uttara Bank	-0.532	0.008	0.019	0.063	-0.020	-0.356	0.007	0.017	0.059	1.110
17	EXIM Bank	-0.678	0.005	0.011	0.035	-1.070	-0.704	0.005	0.011	0.036	-1.240
18	Bank Asia	-0.508	0.005	0.011	0.641	0.680	-0.474	0.005	0.010	0.553	0.800
19	BRAC Bank	-0.503	0.039	0.019	0.007	0.210	-0.415	0.036	0.014	0.146	0.890
20	City Bank	-0.556	0.006	0.017	0.061	-0.200	-0.548	0.015	0.018	0.070	-0.100
21	Dutch Bangla Bank	-0.547	0.027	0.019	0.072	-0.050	-0.469	0.031	0.020	0.081	0.500
22	Eastern Bank	-0.609	0.018	0.019	0.086	-0.470	-0.567	0.026	0.020	0.094	-0.150
23	Mercantile Bank	-0.626	0.005	0.011	0.042	-0.720	-0.640	0.005	0.008	0.040	-0.840
24	Dhaka Bank	-0.561	0.003	0.011	0.041	-0.300	-0.538	0.005	0.010	0.038	-0.150
25	NCC Bank	-0.581	0.007	0.015	0.047	-0.390	-0.569	0.006	0.016	0.052	-0.310
26	Prime Bank	-0.539	0.006	0.013	0.069	-0.100	-0.540	0.010	0.011	0.061	-0.120

27	Pubali Bank	-0.482	0.010	0.011	0.055	0.250	-0.437	0.020	0.010	0.047	0.570
28	Trust Bank	-0.620	0.009	0.016	0.060	-0.620	-0.528	0.009	0.012	0.063	-0.030
29	Shahjalal Islami Bank	-0.635	0.004	0.014	0.087	-0.720	-0.547	0.004	0.012	0.081	-0.160
30	Islami Bank Bangladesh	-0.660	0.002	0.013	0.035	-0.950	-0.613	0.002	0.008	0.032	-0.680
31	First Security Islami Bank	-0.747	0.002	0.009	0.020	-1.560	-0.745	0.002	0.010	0.018	-1.550
32	Jamuna Bank	-0.623	0.006	0.019	0.061	-0.620	-0.526	0.007	0.018	0.065	0.010
33	United Commercial Bank	-0.607	0.011	0.011	0.037	-0.580	-0.599	0.012	0.011	0.037	-0.530
34	Mutual Trust Bank	-0.624	0.009	0.012	0.077	-0.650	-0.618	0.008	0.007	0.070	-0.660
35	ONE Bank	-0.630	0.005	0.008	0.031	-0.770	-0.598	0.006	0.006	0.033	-0.580
36	Premier Bank	-0.631	0.014	0.017	0.047	-0.680	-0.601	0.012	0.012	0.036	-0.540
37	Shimanto Bank	-0.212	0.011	0.020	0.000	2.020	-0.199	0.008	0.018	0.000	2.090
38	Meghna Bank	-0.543	0.001	0.010	0.000	-0.240	-0.525	0.008	0.012	0.000	-0.090
39	Bangladesh Development Bank	-0.014	0.010	0.004	0.000	3.220	-0.037	0.012	0.003	0.000	3.070
40	Bangladesh Commerce Bank	-0.488	-0.085	-0.031	0.053	-0.390	-0.523	-0.130	-0.047	0.046	-0.870
41	Midland Bank	-0.457	0.007	0.020	0.000	0.410	-0.490	0.007	0.015	0.000	0.160
42	Modhumati Bank	-0.721	0.007	0.022	0.000	-1.310	-0.387	0.016	0.033	0.000	0.990
43	NRB Bank	-0.580	0.000	-0.002	0.000	-0.570	-0.559	0.009	0.017	0.000	-0.280
44	Global Islami Bank	-0.716	0.002	0.008	0.000	-1.390	-0.708	0.005	0.015	0.000	-1.270

Also, different ratios and Z-scores of commercial banks in 2021 and 2022 are given as:

Table 4. Ratios and Z-score of commercial banks in 2019 and 2020

		2021					2022				
SL	Bank Name	X1	X2	X3	X4	Z Score	X1	X2	X3	X4	Z Score
1	Global Islami Bank	-0.746	0.007	0.018	0.000	-1.500	-0.701	0.010	0.013	0.151	-1.070
2	South Bangla Agriculture and Commerce Bank	-0.537	0.007	0.010	0.136	-0.040	-0.594	0.004	0.012	0.090	-0.450
3	Union Bank	-0.759	0.008	0.009	0.000	-1.640	-0.761	0.008	0.011	0.036	-1.600
4	Sonali Bank	-0.316	-0.004	0.003	0.000	1.190	-0.376	-0.003	0.004	0.000	0.800
5	Janata Bank	-0.451	0.000	0.002	0.000	0.310	-0.549	0.001	0.002	0.000	-0.340
6	Agrani Bank	-0.419	-0.001	0.002	0.000	0.510	-0.535	-0.001	0.001	0.000	-0.260
7	Rupali Bank	-0.505	0.001	0.001	0.023	-0.030	-0.566	0.001	0.001	0.022	-0.430

8	National Bank	-0.652	0.001	0.002	0.040	-0.970	-0.733	-0.016	-0.067	0.038	-2.020
9	Basic Bank	-0.565	-0.210	-0.021	0.000	-1.280	-0.621	-0.234	-0.007	0.000	-1.630
10	Social Islami Bank	-0.657	0.003	0.007	0.040	-0.960	-0.696	0.004	0.009	0.039	-1.210
11	Standard Bank	-0.680	0.003	0.006	0.053	-1.100	-0.692	0.002	0.007	0.034	-1.200
12	Al-Arafah Islami Bank	-0.640	0.004	0.010	0.059	-0.800	-0.676	0.003	0.010	0.059	-1.040
13	Southeast Bank	-0.578	0.003	0.007	0.040	-0.440	-0.597	0.003	0.008	0.040	-0.560
14	AB Bank	-0.552	0.014	0.005	0.029	-0.260	-0.600	0.013	0.007	0.029	-0.570
15	IFIC Bank	-0.552	0.014	0.005	0.029	-0.260	-0.600	0.013	0.007	0.029	-0.570
16	Uttara Bank	-0.547	0.008	0.016	0.065	-0.140	0.259	0.010	0.021	0.070	5.190
17	EXIM Bank	-0.675	0.003	0.008	0.036	-1.080	-0.718	0.003	0.012	0.041	-1.330
18	Bank Asia	-0.470	0.006	0.010	0.614	0.900	-0.458	0.006	0.014	0.540	0.930
19	BRAC Bank	-0.404	0.050	0.013	0.171	1.030	-0.423	0.044	0.014	0.201	0.920
20	City Bank	-0.528	0.019	0.022	0.074	0.080	-0.552	0.016	0.018	0.054	-0.140
21	Dutch Bangla Bank	-0.515	0.036	0.016	0.103	0.210	-0.552	0.041	0.016	0.123	0.000
22	Eastern Bank	-0.578	0.024	0.022	0.102	-0.210	-0.569	0.024	0.018	0.096	-0.180
23	Mercantile Bank	-0.619	0.005	0.012	0.052	-0.650	-0.602	0.003	0.008	0.054	-0.580
24	Dhaka Bank	-0.518	0.005	0.013	0.042	0.000	-0.556	0.007	0.011	0.043	-0.250
25	NCC Bank	-0.524	0.006	0.016	0.061	0.000	-0.530	0.005	0.017	0.063	-0.030
26	Prime Bank	-0.549	0.014	0.015	0.067	-0.140	-0.569	0.018	0.014	0.060	-0.270
27	Pubali Bank	-0.464	0.023	0.009	0.047	0.390	-0.551	0.026	0.013	0.041	-0.150
28	Trust Bank	-0.598	0.010	0.014	0.067	-0.480	-0.620	0.000	0.016	0.000	-0.710
29	Shahjalal Islami Bank	-0.554	0.005	0.016	0.076	-0.190	-0.561	0.005	0.021	0.063	-0.210
30	Islami Bank Bangladesh	-0.608	0.002	0.007	0.033	-0.650	-0.689	0.002	0.008	0.030	-1.180
31	First Security Islami Bank	-0.747	0.002	0.011	0.024	-1.550	-0.722	0.002	0.009	0.000	-1.420
32	Jamuna Bank	-0.522	0.009	0.015	0.072	0.030	-0.514	0.004	0.012	0.061	0.030
33	United Commercial Bank	-0.603	0.011	0.009	0.037	-0.570	-0.638	0.011	0.009	0.000	-0.840
34	Mutual Trust Bank	-0.589	0.011	0.012	0.056	-0.440	-0.561	0.011	0.009	0.000	-0.330
35	ONE Bank	-0.576	0.004	0.005	0.044	-0.430	-0.551	0.004	0.007	0.000	-0.300
36	Premier Bank	-0.627	0.011	0.015	0.046	-0.680	-0.600	0.011	0.016	0.042	-0.500
37	Shimanto Bank	-0.337	0.005	0.015	0.000	1.160	-0.339	0.007	0.017	0.000	1.160
38	Meghna Bank	-0.502	0.005	0.009	0.000	0.040	-0.434	0.002	0.008	0.000	0.460
39	Bangladesh Development Bank	-0.057	0.013	0.007	0.000	2.970	-0.075	0.015	0.005	0.000	2.840

40	Bangladesh Commerce Bank	-0.492	-0.147	-0.033	0.039	-0.640	-0.558	-0.195	-0.043	0.039	-1.290
41	Midland Bank	-0.527	0.004	0.016	0.000	-0.090	-0.537	0.004	0.014	0.000	-0.170
42	Modhumati Bank	-0.400	0.010	0.020	0.000	0.790	-0.736	0.008	0.019	0.000	-1.420
43	NRB Bank	-0.512	0.013	0.010	0.000	0.000	-0.527	0.013	0.009	0.000	-0.110
44	Global Islami Bank	-0.746	0.007	0.018	0.000	-1.500	-0.701	0.010	0.013	0.151	-1.070

Now, a summarized table of Z-score can be given as:

Table 5. Z-score of commercial banks from 2019 to 2022

SL	Bank Name	Z-Score				Average
		2019	2020	2021	2022	
1	NRB Commercial banks	-0.110	0.150	0.290	0.000	0.240
2	South Bangla Agriculture and Commerce Bank	-0.170	-0.110	-0.040	-0.450	-0.190
3	Union Bank	-1.740	-1.700	-1.640	-1.600	-1.670
4	Sonali Bank	1.290	1.320	1.190	0.800	1.150
5	Janata Bank	0.060	0.260	0.310	-0.340	0.070
6	Agrani Bank	0.400	0.810	0.510	-0.260	0.370
7	Rupali Bank	-0.310	0.100	-0.030	-0.430	-0.170
8	National Bank	-0.600	-0.820	-0.970	-2.020	-1.100
9	Basic Bank	-1.050	-1.070	-1.280	-1.630	-1.260
10	Social Islami Bank	-0.960	-1.070	-0.960	-1.210	-1.050
11	Standard Bank	-0.940	-0.970	-1.100	-1.200	-1.050
12	Al-Arafah Islami Bank	-0.970	-0.770	-0.800	-1.040	-0.900
13	Southeast Bank	-0.360	-0.420	-0.440	-0.560	-0.440
14	AB Bank	-0.260	-0.330	-0.260	-0.570	-0.350
15	IFIC Bank	-0.260	-0.330	-0.260	-0.570	-0.710
16	Uttara Bank	-0.020	1.110	-0.140	5.190	1.530
17	EXIM Bank	-1.070	-1.240	-1.080	-1.330	-1.180
18	Bank Asia	0.680	0.800	0.900	0.930	0.830
19	BRAC Bank	0.210	0.890	1.030	0.920	0.760
20	City Bank	-0.200	-0.100	0.080	-0.140	-0.090
21	Dutch Bangla Bank	-0.050	0.500	0.210	0.000	0.160
22	Eastern Bank	-0.470	-0.150	-0.210	-0.180	-1.020
23	Mercantile Bank	-0.720	-0.840	-0.650	-0.580	-0.700
24	Dhaka Bank	-0.300	-0.150	0.000	-0.250	-0.180
25	NCC Bank	-0.390	-0.310	0.000	-0.030	-0.180
26	Prime Bank	-0.100	-0.120	-0.140	-0.270	-0.160
27	Pubali Bank	0.250	0.570	0.390	-0.150	0.270
28	Trust Bank	-0.620	-0.030	-0.480	-0.710	-0.460
29	Shahjalal Islami Bank	-0.720	-0.160	-0.190	-0.210	-0.320
30	Islami Bank Bangladesh	-0.950	-0.680	-0.650	-1.180	-0.860
31	First Security Islami Bank	-1.560	-1.550	-1.550	-1.420	-1.520
32	Jamuna Bank	-0.620	0.010	0.030	0.030	-0.140
33	United Commercial Bank	-0.580	-0.530	-0.570	-0.840	-0.630
34	Mutual Trust Bank	-0.650	-0.660	-0.440	-0.330	-0.520
35	ONE Bank	-0.770	-0.580	-0.430	-0.300	-0.520
36	Premier Bank	-0.680	-0.540	-0.680	-0.500	-0.600

37	Shimanto Bank	2.020	2.090	1.160	1.160	1.610
38	Meghna Bank	-0.240	-0.090	0.040	0.460	0.040
39	Bangladesh Development Bank	3.220	3.070	2.970	2.840	3.020
40	Bangladesh Commerce Bank	-0.390	-0.870	-0.640	-1.290	-0.800
41	Midland Bank	0.410	0.160	-0.090	-0.170	0.080
42	Modhumati Bank	-1.310	0.990	0.790	-1.420	-0.240
43	NRB Bank	-0.570	-0.280	0.000	-0.110	-0.240
44	Global Islami Bank	-1.390	-1.270	-1.500	-1.070	-1.310

From the Z-scores, it is apparent that the banks' Z-scores do not align with the Bangladesh Bank's zoning classification. The comparison between these zones is depicted below.

Table 6: Validation of Zoning by Altman Z-score

SL	Bank Name	Bangladesh Bank Zoning	Z-score		Z-score Zoning	Validation by Z-score
			2022	Average of 4 years		
1	NRB Commercial banks	Yellow Zone	0	0.24	Red/Distress zone	Heterogeneous Zoning
2	South Bangla Agriculture and Commerce Bank	Yellow Zone	-0.45	-0.19	Red/Distress zone	Heterogeneous Zoning
3	Union Bank	Yellow Zone	-1.6	-1.67	Red/Distress zone	Heterogeneous Zoning
4	Sonali Bank	Yellow Zone	0.8	1.15	Red/Distress zone	Heterogeneous Zoning
5	Janata Bank	Red Zone	-0.34	0.07	Red/Distress zone	Homogeneous Zoning
6	Agrani Bank	Red Zone	-0.26	0.37	Red/Distress zone	Homogeneous Zoning
7	Rupali Bank	Red Zone	-0.43	-0.17	Red/Distress zone	Homogeneous Zoning
8	National Bank	Red Zone	-2.02	-1.1	Red/Distress zone	Homogeneous Zoning
9	Basic Bank	Red Zone	-1.63	-1.26	Red/Distress zone	Homogeneous Zoning
10	Social Islami Bank	Yellow Zone	-1.21	-1.05	Red/Distress zone	Heterogeneous Zoning
11	Standard Bank	Yellow Zone	-1.2	-1.05	Red/Distress zone	Heterogeneous Zoning
12	Al-Arafah Islami Bank	Yellow Zone	-1.04	-0.9	Red/Distress zone	Heterogeneous Zoning
13	Southeast Bank	Yellow Zone	-0.56	-0.44	Red/Distress zone	Heterogeneous Zoning
14	AB Bank	Red Zone	-0.57	-0.35	Red/Distress zone	Homogeneous Zoning
15	IFIC Bank	Yellow Zone	-0.57	-0.71	Red/Distress zone	Heterogeneous Zoning
16	Uttara Bank	Yellow Zone	5.19	1.53	Safe/Green zone	Heterogeneous Zoning
17	EXIM Bank	Yellow Zone	-1.33	-1.18	Red/Distress zone	Heterogeneous Zoning
18	Bank Asia	Green Zone	0.93	0.83	Red/Distress zone	Heterogeneous Zoning
19	BRAC Bank	Yellow Zone	0.92	0.76	Red/Distress zone	Heterogeneous Zoning
20	City Bank	Yellow Zone	-0.14	-0.09	Red/Distress zone	Heterogeneous Zoning
21	Dutch Bangla Bank	Yellow Zone	0	0.16	Red/Distress zone	Heterogeneous Zoning
22	Eastern Bank	Green Zone	-0.18	-1.02	Red/Distress zone	Heterogeneous Zoning
23	Mercantile Bank	Yellow Zone	-0.58	-0.7	Red/Distress zone	Heterogeneous Zoning
24	Dhaka Bank	Yellow Zone	-0.25	-0.18	Red/Distress zone	Heterogeneous Zoning
25	NCC Bank	Green Zone	-0.03	-0.18	Red/Distress zone	Heterogeneous Zoning
26	Prime Bank	Green Zone	-0.27	-0.16	Red/Distress zone	Heterogeneous Zoning
27	Pubali Bank	Yellow Zone	-0.15	0.27	Red/Distress zone	Heterogeneous Zoning
28	Trust Bank	Yellow Zone	-0.71	-0.46	Red/Distress zone	Heterogeneous Zoning

29	Shahjalal Islami Bank	Green Zone	-0.21	-0.32	Red/Distress zone	Heterogeneous Zoning
30	Islami Bank Bangladesh	Yellow Zone	-1.18	-0.86	Red/Distress zone	Heterogeneous Zoning
31	First Security Islami Bank	Yellow Zone	-1.42	-1.52	Red/Distress zone	Heterogeneous Zoning
32	Jamuna Bank	Green Zone	0.03	-0.14	Red/Distress zone	Heterogeneous Zoning
33	United Commercial Bank	Yellow Zone	-0.84	-0.63	Red/Distress zone	Heterogeneous Zoning
34	Mutual Trust Bank	Yellow Zone	-0.33	-0.52	Red/Distress zone	Heterogeneous Zoning
35	ONE Bank	Yellow Zone	-0.3	-0.52	Red/Distress zone	Heterogeneous Zoning
36	Premier Bank	Yellow Zone	-0.5	-0.6	Red/Distress zone	Heterogeneous Zoning
37	Shimanto Bank	Green Zone	1.16	1.61	Gray zone	Heterogeneous Zoning
38	Meghna Bank	Yellow Zone	0.46	0.04	Red/Distress zone	Heterogeneous Zoning
39	Bangladesh Development Bank	Yellow Zone	2.84	3.02	Safe/Green zone	Heterogeneous Zoning
40	Bangladesh Commerce Bank	Red Zone	-1.29	-0.8	Red/Distress zone	Homogeneous Zoning
41	Midland Bank	Green Zone	-0.17	0.08	Red/Distress zone	Heterogeneous Zoning
42	Modhumati Bank	Yellow Zone	-1.42	-0.24	Red/Distress zone	Heterogeneous Zoning
43	NRB Bank	Yellow Zone	-0.11	-0.24	Red/Distress zone	Heterogeneous Zoning
44	NRB Global Bank	Yellow Zone	-1.07	-1.31	Red/Distress zone	Heterogeneous Zoning

From Table 6, it is apparent that the Zoning of Bangladesh Bank and the Z-score are not consistent in most cases. Of the 44 banks, only 7 (Janata, Agrani, Rupali, National, Basic, AB, and Bangladesh Commerce Bank) show the same outcomes. The results of the remaining 37 banks contradict each other. Surprisingly, all banks in homogeneous Zoning are in Red/Distress. Bangladesh Bank placed eight banks in the Green Zone, while the Z-score classifies them as Red Zone banks, which is entirely contradictory. Again, two banks, Uttara and Bangladesh Development Bank, are in the Green Zone according to the Z-score rating, but fall into the Yellow zone according to the BB rating.

Therefore, Bangladesh Bank's Zoning and Z-Score prescriptions are inconsistent with each other. As a regulator, Bangladesh Bank should consider the Z-score alongside other factors, as it is a widely accepted measure of financial distress. Again, more transparent, widely disclosed measurement tools by Bangladesh Bank's Zoning may address the actual reason for the heterogeneous results.

5. Conclusion

Bangladesh's banking sector is primarily in its infancy. Lack of market discipline, excessive government interference, bureaucratic influence, corruption at various political and economic levels, inept leadership at managerial levels across banks, and poor decision-making are the primary obstacles facing this industry. Furthermore, the global economy has been affected by the recent COVID-19 outbreak, including Bangladesh. Between 2019 and 2022, the banking industry faced a challenging period due to this inevitable circumstance. The analysis presents a very dismal and concerning picture of the banks' performance from 2019 to 2022. Banks with negative Z-scores should devise a plan of action immediately to extricate themselves from this perilous situation.

Furthermore, the Altman Z-score model does not support Bangladesh Bank's zone categorization. There needs to be a different plan of action to reconsider, reassess, and decide

how to divide the banks into zones. Since the Z-score is widely used to measure financial distress, any contradictory measurement warrants greater transparency and explanation. Regulators and policymakers should take this matter seriously and reinvestigate the Zoning to identify the errors (if any). This research is anchored in the Altman Z-score model for non-manufacturing and emerging markets. Future studies may explore different models, such as those by Springate, Fulmer, Taffler, Grover, Ohlson, and Zmijewski, which may provide insights into banks' performance from various viewpoints.

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