

Comprehensive Analysis of Altman's Z Score, Zmijewski X Score, Springate S-Score and Grover G-Score Model for Predicting Financial Health of Listed Non-Bank Financial Institutions (NBFIs) of Bangladesh

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Abstract

This study is conducted to evaluate the financial health of Non-Bank Financial Institutions (NBFIs) in Bangladesh and to point out financially distressed companies through the use of different models. The study also determined whether there is any distinction in the result of different models for anticipating the insolvency of 21 NBFIs listed in Dhaka Stock Exchange (DSE) before 2012. Panel data (a mixture of time series and cross-section data) have been utilized. According to Altman's Z score 48% (10 companies) of the total operating NBFIs of Bangladesh are facing the threat of insolvency, Zmijewski X score shows that 62% or 13 firms are in threat, Springate S score identifies 52% or 11 firms and Grover G score pinpoints 48% as financially distressed organizations. There are seven companies to face probable bankruptcy. Models which have been utilized here have correctly identified the 2 organizations such as ILFSL and PLFSL as prone to bankruptcy. Zmijewski x score model indicates financial distress better than other models for the NBFIs listed on DSE. Scholars can depend on the outcome and further research through the addition of other insolvency prediction models. Authorities, shareholders and decision-makers can utilize this study for taking preventive measures along with making future investment decisions.

Keywords

Financial Distress, Bankruptcy Prediction Model, Non-Bank Financial Institution, Solvency, Dhaka Stock Exchange (DSE)

1. Introduction

Recent financial stability has become a significant issue in our country. The stability of the economy, including financial institutions is the greatest concern of Bangladesh. Banks are an integral part of an economy and grant long-term credit from its collection of short-term deposits. However, it is quite challenging to handle long-term loans from short-term deposits on a practical level. Because of this, there might be a discrepancy between lending and borrowing. Non-Banking Financial Institutions (NBFIs) can fill that gap as they carry out long-term financial activity. NBFIs supplementing the banking institutions are a swiftly growing and fundamental part of a financial market as they play a noteworthy role in economic advancement (Hamid et al., 2016).

NBFI is a financial institution having authorization and control by the Financial Institution Act, 1993 and unable to engage in foreign exchange funding because of a risk-based management system, unable to issue cheques, pay orders, and demand drafts (The Financial Institution Act, 1993). NBFI mitigates the gap present in the financial management system through the rotation and distribution of income, assets and other resources and also takes part actively in economic advancement (Ahmed & Chowdhury, 2007).

NBFIs are essential to Bangladesh's corporate and Small and Medium Enterprise (SME) sectors as well as its capital market. The majority of NBFIs undertake merchant banking operations through distinct subsidiaries (Bangladesh Bank, 2021). An earlier study by Mizan and Hossain (2014) uncovered a direct connection between NBFI success and capital market expansion.

Osuala & Odunze (2014) found a notable positive correlation between the performance of NBFI and economic advancement. But regrettably, the present condition of NBFIs in Bangladesh is alarming. 10 out of 34 were in the red or weak zone, which is prone to insolvency in case of major shock, 19 were in the yellow zone or at risk and 04 were in the green zone or impressive condition is the outcome of stress test on all NBFIs of Bangladesh arranged by central bank (Bangladesh Bank, 2021). Due to the rise in non-performing loans, violation of rules and regulations, loan scams, weak compliance and accountability, and financial statement manipulation the sector is experiencing vulnerabilities, liquidity crunch and overall insolvency leading to a financially distressed position in the past few years (Hasan, 2020).

Along with these contributions, this pandemic has impacted much on the profitability, capital adequacy ratio, asset quality, and caused a massive decline in the equity position of this sector. 95% of 20 NBFIs were in distress position during the period 2014-2018 (Rahman et al., 2020).

The ability to meet long-term liabilities is called solvency. When cash flow from operation is not enough to meet current obligations or the current asset is less than the current liability, the firm is called insolvent. Anticipating insolvency of a firm has become paramount for both stakeholders and stockholders to

obstruct complexities in advance, and guide the decision-making process. Financial distress must be detected at the earliest time as financial distress is the primary indicator of insolvency and the outcome of insolvency and its effects on stakeholders are vast (Ohlson, 1980).

Recent bankruptcies of firms irrespective of size in both developed and developing countries have emerged a need to invent tools and procedures to analyze the financial health of companies in advance before the emergence of adverse situations. Different approaches have been proposed by researchers such as the Z score model, financial statement analysis, and ratio analysis but doubt still exists in choosing the best approach and model (Ross et al., 2007). To analyze the financial health and to anticipate the situation leading to the path of insolvency researchers have developed several models predicting corporate failure and various studies have been conducted in different countries of the world. They are not the same in terms of nature and implication. Based on superiority, drawback and purpose some are better compared to others (Shirata, 1998).

This study is different from others in two ways. Firstly, the four bankruptcy indication model is used in this study. Secondly, comparison among the models and predict the appropriate one.

There is no comprehensive study to analyze the financial health and dictating financial distress of NBFIs of Bangladesh using Altman, Zmijewski, Springate and Grover model together for the period 2012-2021. This study aims to identify not only financially distressed organizations of NBFIs sector of Bangladesh but also examine the contrast among bankruptcy prediction models mentioned above. So, this paper will provide a guideline for researchers, authorities and other stakeholders regarding using the bankruptcy prediction models.

2. Theoretical Framework and Hypotheses

2.1. Corporate Failure and Its Reasons

Financial distress and bankruptcy are different concepts though people consider and interpret these as the same. Financial distress is an early alarm indicating bankruptcy and it leads to the path of bankruptcy if distress does not get better (Husein & Pambekti, 2015). When a company encounters financial and economic distress, bankruptcy occurs. Again, if a firm's cost exceeds its revenue, then it is in economic distress. As the business is unable to meet its debt commitment, it is facing financial distress. Organizations experience negative operating profit and lay off or close operations temporarily in case of financial distress.

Adverse economic conditions, excess leverage, managerial incompetence, moderate profitability and liquidity play a dominant role in leading a firm to the path of bankruptcy (Musmar, 2016). According to Ohlson (1980) size of the corporation, estimation of financial performance, financial structure and liquidity position contribute towards corporate failure. Financial distress should be detected in time and preventive measures must be taken to stop likely bank-

ruptcy. The cost of insolvency is numerous and all the stakeholders of the organization are affected (Adnan Aziz & Dar, 2006).

2.2. Models and Previous Studies Predicting Corporate Failure

Numerous studies and models have been initiated for predicting corporate failure (Beaver, 1966; Altman, 1968; Deakin, 1972; Kida, 1980; Ohlson, 1980; Taffler, 1983). They are not the same in terms of nature, industry, country, time frame and implication.

Altman's Z score: Altman's z-score is a model for forecasting the chance of a firm going bankrupt that was invented by Edward I. Altman in 1968. Altman's Z score is a combination of weighted ratios as a Multiple Discriminant Analysis (MDA), which is a leading method for predicting failures. Altman evaluated 66 manufacturing organizations using MDA. 33 of the 66 enterprises went bankrupt between 1946 and 1965, while the other half were still operating in 1966. The original z-score algorithm focuses on five financial metrics and applies to manufacturing listed businesses.

The study found that 94 percent of bankrupt businesses were successfully identified, and 95 percent of bankrupt and nonbankrupt businesses were allocated properly (Altman, 1968) Altman changed the z-score for private corporations in 2000, termed the z'-score, by altering X_4 from the market value of equity to book value of equity. Altman altered the model for non-manufacturers two years later, omitting the fifth variable and named the z'-score. (Altman, 2002).

Previous researches (Al-Manaseer & Al Oshaibat, 2018; Hamid et al., 2016; Zainuddin et al., 2018; Ahmed & Govind, 2018; Samaraweera, 2018) represent high predicting capability of Z score model for corporate failure. To know the relevance of Altman's Z score model. Al-Manaseer and Al-Oshaibat (2018) wrote a paper by selecting 21 insurance companies in Jordan for six years and found positive results for determining distress. Z score model predicted 94% bankruptcy level precisely is the outcome of research on 17 selected companies in the retail industry of the USA (Hilston Keener, 2013).

Chowdhury and Barua (2009) wrote a paper using Z score model to anticipate bankruptcy on 53 Z category companies listed on DSE and found that 5 were safe and others were in danger. To pinpoint the financially distressed organizations among the top pharmaceutical corporations of Bangladesh research was initiated on the listed A category companies on DSE for 2000-2009. Using Z score it was evident that only 2 companies were safe having no probability of financial distress and others had a possibility of being bankrupt in the next two years (Islam & Mili, 2012).

Zmijewski X-score: Zmijewski model is an augmented model of Altman's model where Zmijewski (1984) utilized financial analysis to calculate the performance of debt and liquidity of an organization. In his research, Zmijewski applied probit analysis on 40 bankrupt and 400 non-bankrupt companies and initiated a model by employing liquidity ratio, ROA and leverage.

An analysis to predict insolvency was conducted on 14 retail corporations listed on the Indonesian Stock Exchange (ISE) from 2014 to 2018. This research employed Zmijewski X-score and Altman Z-score model and showed that X-score is the appropriate model in indicating bankruptcy having an accuracy rate of 90% (Viciwati, 2020).

Springate Z score: Springate (1978) initiated the Springate model which is a modified version of Altman's model built by Multiple Discriminant Analysis. Among the initial 19 financial ratios, the final four are used to dictate the financial health of a business. Springate test represents 92.5% accuracy rate by using 40 companies as a sample (Husein & Pumbekti, 2015). A study on 20 NBFIs listed on DSE for the period (2013-2017) using Springate and Fulmer model expressed that Fulmer and Springate can predict the solvency status of the firms. (Fahad Noor & Mustofa, 2020)

Grover G score: The remake of Altman's model is Grover model where Jevri (2016) added 13 new financial ratios to the sample of Altman's model in 1968. The sample size is 70 firms of which 35 are facing insolvency and others are in good condition during 1982-1996. The outcome of a study based on the coal industry for analyzing financial distress with Springate and the method of Grover in 2012-2016 expressed that Grover method is the most accurate in anticipating financial adverse conditions. (Hungan & Sawitri, 2018)

According to research by Huda et al. (2019) on the retail companies incorporated on the ISE, financial health has been analyzed through Altman, Zmijewski and Springate according to which Zmijewski X score is the most precise one having the highest accuracy rate. Gerantonis et al. (2009) inspected the capability of Z score model in anticipating financial failure in organizations listed on the Athens Stock Exchange where they found out that the model can effectively identify financially unsound organizations and it can anticipate 54% of the failures before their occurrence. To know the applicability of Z score, Jaisheela (2015) studied 27 leasing companies in India and found out that 27% were facing the risk of probable bankruptcy and 22% were in the grey zone.

Vaziri et al. (2012) undertook a study on 100 financial institutions taken from Asia and Europe by using Altman Z score, Zmijewski X score and Springate S score. According to his study, all the models can anticipate bankruptcy while Zmijewski model can predict bankruptcy more precisely compared to other models.

To examine the financial distress through Altman, Grover, Springate and Zmijewski score on 24 consumer goods establishments listed on ISE, Hantono (2019) initiated research and showed that all the insolvency prediction models mentioned above can predict the financial distress of firms. To discover if there are any dissimilarities among bankruptcy models Sutra Tanjung (2020) made a comparative analysis of bankruptcy indication models in identifying financial disasters based on pharmaceutical companies incorporated on ISE. This work

conveyed that a significant distinction exists among Altman, Springate, Zmijewski, Ohlson and Grover models; Altman's model is the most appropriate one for anticipating adverse financial conditions.

Mizan & Hossain (2014) conducted to predict the possibility of insolvency of the cement industry of Bangladesh and by using 5 top cement companies as a sample size, the result of z score model was two companies were in a financially good position with no probability of failure and the other three were in an undesired situation having a possibility of financial distress in the coming days.

Arminian, Mousazade and Khoshkho examined the capability of bankruptcy indication models and re-researched 35 ceramic and textile companies incorporated in Tehran Stock Exchange and discovered that Altman, Springate, Grover, and Zmijewski can predict financial disaster accurately (Aminian et al., 2016).

3. Rational of the Study

Broad objective of this study is to determine whether there is any distinction in the probable bankruptcy anticipation result of Altman Z-score, Zmijewski X-score, Springate S-score and Grover G-score of non-bank financial institutions listed on Dhaka Stock Exchange (DSE) for the period 2012-2021.

3.1. Research Framework

Based on the scholar's previous research (Husein & Pumbekti, 2015), a subsequent model has been developed for this study is dispatched below **Figure 1**.

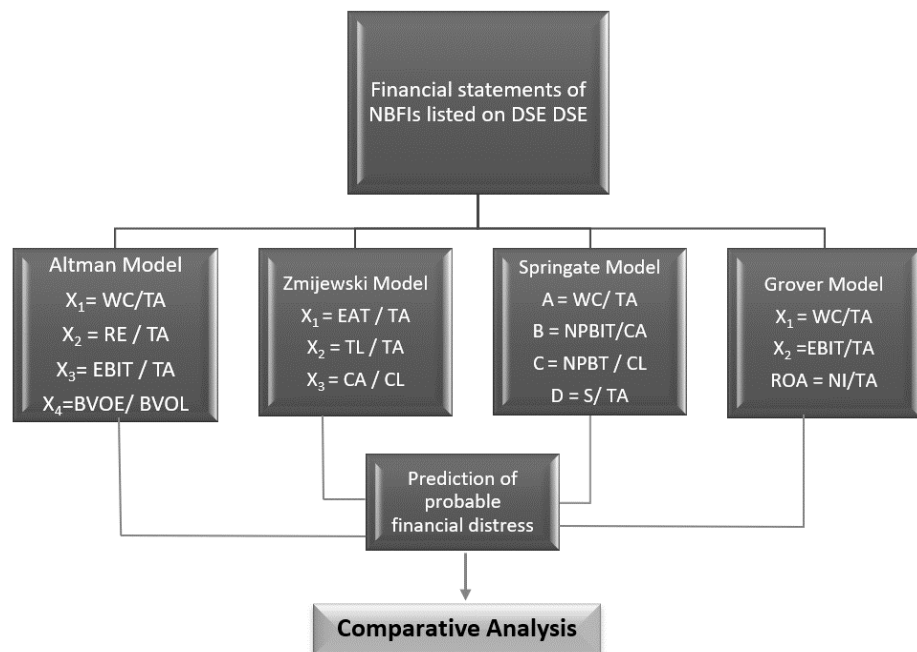


Figure 1. Research framework.

3.2. Research Hypothesis

HYPOTHESIS	LITERATURE
H ₁ = There is a dissimilarity between Altman Z score and Zmijewski X score in anticipating potential financial distress of the NBFIs of Bangladesh.	Putri (2018) Ditasari et al. (2019) Noor Salim & Ismudjoko (2021)
H ₂ = There is a dissimilarity between Altman Z score and Springate S score in anticipating potential financial distress of the NBFIs of Bangladesh.	Putri (2018) Ditasari et al. (2019) Noor Salim & Ismudjoko (2021)
H ₃ = There is a dissimilarity between Altman Z score and Grover G score in anticipating potential financial distress of the NBFIs of Bangladesh.	Putri (2018) Noor Salim & Ismudjoko (2021)
H ₄ = There is a dissimilarity between Zmijewski X score and Springate S score in anticipating potential financial distress of the NBFIs of Bangladesh.	Putri (2018) Ditasari et al. (2019) Noor Salim & Ismudjoko (2021)
H ₅ = There is a dissimilarity between Zmijewski X score and Grover G score in anticipating potential financial distress of the NBFIs of Bangladesh.	Ditasari et al. (2019) Noor Salim & Ismudjoko (2021)
H ₆ = There is a dissimilarity between Springate S score and Grover G score in anticipating potential financial distress of the NBFIs of Bangladesh.	Ditasari et al. (2019) Noor Salim & Ismudjoko (2021)
H ₇ = Altman model can better anticipate financial distress than Zmijewski, Springate, Grover model for the NBFIs of Bangladesh.	Aminian et al. (2016) Noor Salim & Ismudjoko (2021)
H ₈ = Zmijewski model can better anticipate financial distress than Altman, Springate, Grover model for the NBFIs of Bangladesh.	Aminian et al. (2016) Noor Salim & Ismudjoko (2021)
H ₉ = Springate model can better anticipate financial distress than Altman, Zmijewski, Grover model for the NBFIs of Bangladesh.	Aminian et al. (2016) Noor Salim & Ismudjoko (2021)
H ₁₀ = Grover model can better anticipate financial distress than Altman, Zmijewski, Springate model for the NBFIs of Bangladesh.	Aminian et al. (2016) Noor Salim & Ismudjoko (2021)

4. Research Method

This research compares the outcome of financial distress analysis through Altman, Zmijewski, Springate and Grover model, which is comparative descriptive research. As data from the financial statements of 2012 to 2021 are included, this research can also be considered historical research based on the features of the situation. All the 34 NBFIs operating in Bangladesh are the population size for this study among which 21 NBFIs which has been listed on the Dhaka Stock Exchange before 2012 and have required data for the study during the study period is the number of samples and the total sample size is 84 (Dhaka Stock Exchange, 2023).

Panel data (mixture of time series and cross-section data) have been utilized for this study where data of 21 NBFIs listed on the DSE between 2012 and 2021 are included. The nature of data is secondary which has been acquired from the annual reports containing profit-loss statements, cash flow statements and balance sheets from Dhaka Stock Exchange (DSE) and company websites. Financial distress prediction is the dependent variable. On the other hand, the score of all bankruptcy models named Altman, Zmijewski, Springate and Grover is the in-

dependent variable.

4.1. Data Analysis:

Descriptive statistics, normality tests and hypothesis testing are utilized to satisfy the motive of this study. To inspect the significance of the four prediction models and from H_1 - H_6 testing will be done through paired sample T-test for normal distribution or Kruskal Wallis Test for abnormal distribution. To determine the most accurate model for predicting financial distress, H_7 - H_{10} testing will be done through logistic regression with a dummy variable.

4.2. Operating Variables

Table 1 shows the variables taken into consideration for this study. It also describes the variables' descriptions and the contexts in which they were used in earlier studies.

Table 1. Variable definition.

Variables	Ratio	Description	Used in Models	Literature
WCTA	Working Capital/ Total Assets	Counts organization's liquidity. The excessive WCTA (current asset—current liability) ratio designates considerable working capital from total assets and increases the company's profits.	Altman Springate Grover model.	Al-Manaseer & Al-Oshaibat (2018); Sutra Tanjung (2020); Fahad Noor & Mustofa (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
RETA	Retained Earnings/ Total Assets	Displays the quantity of the total asset funded by retained earnings and it indicates the company's progressive profitability. This ratio shows that management has chosen to reinvest the accumulated profit over paying dividends or taking a payout.	Altman model	Al-Manaseer & Al-Oshaibat (2018); Sutra Tanjung (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
EBITTA	Earnings Before Interest and Taxes/Total Assets	Dictates the company's profitability and indicates the effectiveness of assets to produce profit.	Altman, Springate Grover Model.	Al-Manaseer & Al-Oshaibat (2018); Sutra Tanjung (2020); Fahad Noor & Mustofa (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
BVETL	Book Value of Equity/ Total Liabilities	Demonstrates the corporation's value in the capital market.	Altman Model	Al-Manaseer & Al-Oshaibat (2018); Sutra Tanjung (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
SATA	Sales/Total Assets	Counts the company's potential to create sales by existing assets.	Springate Model	Sutra Tanjung (2020); Fahad Noor & Mustofa (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
EBTCL	Earnings Before Taxes/Current Liabilities	Calculates the company's profitability	Springate Model.	Sutra Tanjung (2020); Fahad Noor & Mustofa (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)

Continued

TLTA	Total Liabilities/ Total Assets	A leverage ratio estimates the total amount of debt respective to the total asset	Zmijewski Model	Sutra Tanjung (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
NITA	Net Income/ Total Assets	Known as Return on Asset (ROA) which defines the relationship between profit and total resources and indicates the company's profitability	Zmijewski Grover Model.	Sutra Tanjung (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)
CACL	Current Assets/ Current Liabilities	Indicates the ability to pay current liability through current asset	Zmijewski Model	Sutra Tanjung (2020); Fauzi et al. (2021); Noor Salim & Ismudjoko (2021)

Table 2. The List of non-banking financial institutions.

Name of the Company	Abbreviation
Bay Leasing & Investment Limited	BAYLEASING
Bangladesh Finance Limited	BDFINANCE
DBH Finance PLC.	DBH
United Finance Limited	UNITEDFIN
GSP Finance Company (Bangladesh) Limited	GSPFINANCE
Investment Corporation of Bangladesh	ICB
IDLC Finance Ltd.	IDLC
IPDC Finance Limited	IPDC
Islamic Finance & Investment Ltd.	ISLAMICFIN
LankaBangla Finance PLC	LANKABAFIN
National Housing Fin. and Inv. Ltd.	NHFIL
Phoenix Finance and Investments Ltd.	PHOENIXFIN
Uttara Finance and Investments Limited	UTTARAFIN
Premier Leasing & Finance Limited	PREMIERLEA
Prime Finance & Investment Ltd.	PRIMEFIN
Union Capital Limited	UNIONCAP
FAS Finance & Investment Limited	FASFIN
International Leasing & Financial Services Ltd.	ILFSL
MIDAS Financing Ltd.	MIDASFIN
First Finance Limited	FIRSTFIN
Peoples Leasing and Fin. Services Ltd.	PLFSL

Source: Dhaka Stock Exchange.

Table 2 shows the number of companies and their abbreviations which as taken as samples for the study.

4.3. Model Specification

$$\text{Revised Altman's Z score: } Z = 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4 \quad (1)$$

Here, X_1 = Working Capital/Total Asset, X_2 = Retained Earnings/Total Asset, X_3 = Earning Before Interests and Tax/Total Asset, X_4 = Book Value of Equity/Book value of Liability, Z = Altman's Z-Score.

If the cutoff value is less than 1.1 then the organization is predicted as bankrupt. A value between 1.1 and 2.6 indicates a grey area and a value more than 2.6 indicates the good condition of a company which means having no possibility of being bankrupt (Altman, 2002).

$$\text{Zmijewski X-score: } X = -4.3 - 4.5X_1 + 5.7X_2 + 0.004X_3 \quad (2)$$

Here, X_1 = Net income/Total Asset, X_2 = Leverage (Total Liabilities/Total Asset), X_3 = Liquidity (Current Asset/Current Liabilities), X = Zmijewski X-Score.

X score greater than 0 indicates that the organization is having the possibility of being bankrupt otherwise value less than 0 indicates a positive condition (Zmijewski, 1984).

$$\text{Springate S-score: } S = 1.03A + 3.07B + 0.66C + 0.4D \quad (3)$$

Here, A = Working Capital/Total Asset, B = Net Profit Before Interest and Tax/Total Assets, C = Net Profit Before Tax/Current Liability, D = Sales/Total Assets, S = Springate S-Score.

S score higher than 0.862 forecasts the good health of a company on the contrary score less than 0.862 indicates probable financial distress of an organization (Springate, 1978).

$$\text{Grover G-score: } G = 1.650X_1 + 3.404X_2 - 0.016ROA + 0.057 \quad (4)$$

Here, X_1 = Working Capital/Total Asset, X_2 = Earnings Before Interest and Taxes/Total Asset, ROA = Return on Asset, G = Grover G-Score.

$G \leq -0.02$ predicts bankruptcy of an organization and $G \geq 0.01$ indicates that the company is not bankrupt (Jevri, 2016).

$$\text{Binary Logistic Regression: } Y = a + b_i X_i + \ell \quad (5)$$

where a , b = constants, ℓ = error term, X = score of models mentioned above, Y = dummy variable 1-distress, 0 otherwise).

To see the accuracy of each model and to make a comparison among them this formula is applied to all the prediction models.

5. Data Analysis and Discussion

Analysis of the Bankruptcy Model's Score:

According to **Table 3**, we have seen the Altman's Z score results. According to the benchmark of Z score model on average, four organizations are facing the threat of bankruptcy, ten are in the grey zone and seven companies are in the safe zone. The outcome of is in line with the result of the study conducted by Rahman et al. (2020) where the researchers utilized Altman Z score and tried to estimate the financial distress of NBFIs of Bangladesh.

Table 3. Calculated Altman's Z scores of selected NBFIS.

List of Selected Financial Institutions	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVERAGE
BAYLEASING	0.87	0.89	1.03	1.69	2.01	2.05	2.68	2.99	2.04	3.05	1.930
BDFINANCE	0.45	0.38	0.29	0.98	1.06	1.11	1.20	1.64	1.84	2.69	1.164
DBH	1.38	1.47	1.88	2.67	3.82	3.97	3.69	3.90	3.87	3.93	3.058
UNITEDFIN	1.67	1.71	2.09	2.31	2.78	2.85	3.96	4.03	4.08	4.78	3.026
GSPFINANCE	1.82	1.97	2.02	2.45	2.85	3.51	3.59	3.99	4.11	3.93	3.024
ICB	1.10	1.03	1.06	1.58	1.85	1.89	2.59	2.56	2.57	2.89	1.912
IDLC	2.97	1.95	2.55	2.67	2.94	3.67	3.02	3.14	3.61	4.28	3.080
IPDC	1.78	1.94	1.82	2.91	3.83	3.92	3.15	3.19	3.94	3.99	3.047
ISLAMICFIN	1.23	2.33	2.54	2.89	3.21	3.09	3.67	4.03	3.16	3.81	2.996
LANKABAFIN	1.48	1.83	2.89	3.09	3.75	3.54	3.08	2.78	3.56	3.94	2.994
NHFIL	0.58	0.97	0.84	1.06	1.02	1.93	2.02	2.06	1.57	1.85	1.390
PHOENIXFIN	0.82	0.84	1.92	1.28	1.37	1.39	1.41	1.98	1.04	1.88	1.393
UTTARAFIN	0.57	0.37	0.49	0.78	0.34	1.68	1.05	1.34	1.08	0.93	0.86
PREMIERLEA	1.28	1.48	1.19	1.47	2.29	2.35	2.47	1.92	2.29	2.78	1.952
PRIMEFIN	1.29	1.91	2.45	2.99	1.25	1.64	1.98	2.47	1.05	2.98	2.001
UNIONCAP	0.88	0.81	0.91	1.93	1.75	1.07	1.98	2.06	1.35	1.67	1.441
FASFIN	0.94	0.57	0.53	1.68	1.43	1.01	1.04	1.51	1.20	1.38	1.129
ILFSL	0.32	0.48	0.53	0.62	0.95	0.98	1.04	1.01	1.03	1.09	0.805
MIDASFIN	0.75	0.58	1.09	1.05	2.10	1.94	1.65	1.98	1.38	1.96	1.448
FIRSTFIN	1.24	0.81	0.71	0.35	0.44	1.03	0.98	1.89	0.67	1.02	0.914
PLFSL	-0.22	-0.49	0.27	0.43	0.92	0.72	0.47	-0.28	-0.15	0.89	0.256

Source: Author's Calculation.

Based on the testing benchmark of Zmijewski's X score in 2012 eleven organizations, in 2013 two organizations, in 2014 four organizations, in 2015, twelve organizations, in 2016 five organizations, in 2017, twelve organizations, in 2018 fourteen organizations, in 2019, eighteen organizations, in 2020 sixteen organizations and finally in 2021 fifteen organizations are facing the threat of bankruptcy shown in **Table 4**.

In **Table 5**, depending on the testing score of Springate S score ten out of twenty one organisations are safe and the other eleven are facing the threat of probable bankruptcy. This outcome is in line with the result of a study by **Fahad Noor & Mustofa (2020)** where they employed Springate and Fulmer model to investigate the solvency of NBFIs in Bangladesh.

Based on the testing benchmark of Grover G score in 2012 three organizations, in 2013 seven organizations, in 2014 nine organizations, in 2015, seven

Table 4. Calculated Zmijewski X scores of selected NBFIS.

List of Selected Financial Institutions	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVERAGE
BAYLEASING	-0.421	-0.110	-0.450	1.110	0.250	0.980	-0.570	0.540	0.220	0.190	0.174
BDFINANCE	-0.013	-0.741	-0.963	0.005	-0.458	0.111	0.211	0.324	0.556	0.842	-0.013
DBH	-0.685	-0.233	-0.486	-0.662	-0.559	-0.773	0.446	0.997	0.994	0.126	-0.084
UNITEDFIN	0.326	-0.784	-0.965	-0.852	-0.046	-0.357	-0.951	0.864	0.243	0.033	-0.249
GSPFINANCE	-0.325	-0.258	-0.667	0.987	-0.429	0.552	0.776	0.227	0.348	0.624	0.184
ICB	0.121	-0.123	-0.325	-0.321	-0.231	-0.693	-0.428	0.674	0.349	0.987	0.001
IDLC	0.120	-0.240	-0.350	-0.640	-0.720	-0.310	-0.140	0.560	-0.630	-0.850	-0.320
IPDC	0.640	-0.820	-0.370	-0.690	-0.730	-0.200	-0.360	-0.100	-0.690	-0.456	-0.378
ISLAMICFIN	-0.682	-0.348	-0.683	-0.321	-0.123	-0.256	0.985	0.678	0.752	-0.634	-0.063
LANKABAFIN	-0.657	-0.963	-0.852	-0.147	-0.847	-0.562	-0.342	-0.522	-0.344	-0.779	-0.602
NHFIL	0.110	-0.885	-0.752	0.125	-0.479	0.334	0.884	0.445	0.453	0.771	0.101
PHOENIXFIN	0.320	-0.624	-0.899	0.324	-0.451	0.661	0.664	0.661	0.347	0.625	0.163
UTTARAFIN	0.780	-0.812	-0.776	0.625	-0.624	0.428	0.227	0.883	0.761	0.339	0.183
PREMIERLEA	0.551	-0.423	-0.334	0.782	-0.347	0.987	0.331	0.995	0.354	0.224	0.312
PRIMEFIN	0.325	-0.562	-0.782	-0.921	-0.394	-0.783	-0.624	-0.851	-0.459	-0.754	-0.581
UNIONCAP	0.123	0.456	-0.679	-0.583	-0.589	-0.460	0.420	0.115	0.659	0.887	0.035
FASFIN	-0.331	-0.552	0.334	0.780	0.420	0.467	0.420	0.240	0.180	0.770	0.273
ILFSL	-0.210	-0.580	0.470	0.440	0.330	2.090	1.030	1.080	0.980	0.450	0.608
MIDASFIN	-0.315	-0.015	-0.013	0.042	-0.062	0.420	0.440	0.650	-0.210	-0.110	0.083
FIRSTFIN	0.100	-0.260	0.330	0.540	0.610	0.670	0.470	0.580	0.310	0.240	0.359
PLFSL	-0.230	0.480	0.540	0.560	0.780	0.250	0.980	0.850	0.820	0.890	0.592

Source: Author's Calculation.

Table 5. Calculated Springgate S scores of selected NBFIS.

List of Selected Financial Institutions	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVERAGE
BAYLEASING	1.030	0.930	0.740	1.860	1.610	0.850	0.950	0.680	0.890	0.420	1.027
BDFINANCE	1.010	1.160	0.430	0.580	0.640	0.780	0.960	0.890	1.250	0.070	0.677
DBH	0.990	0.210	0.260	1.480	0.830	1.080	1.310	0.690	0.850	0.010	0.800
UNITEDFIN	0.480	1.750	1.510	1.390	1.540	1.960	0.870	0.930	1.720	1.870	1.402
GSPFINANCE	0.610	1.370	0.580	0.490	1.040	1.270	2.080	0.780	0.990	1.200	0.941
ICB	0.580	0.310	0.870	0.640	1.200	1.340	1.870	1.850	0.590	1.090	1.034

Continued

IDLC	1.560	1.210	1.090	1.230	1.480	1.510	1.150	1.390	1.010	1.380	1.301
IPDC	1.460	0.190	0.770	1.240	1.620	1.070	0.890	1.120	1.130	0.490	0.998
ISLAMICFIN	0.880	0.790	1.160	0.890	1.320	1.010	1.230	0.350	0.270	0.970	0.877
LANKABAFIN	0.290	0.340	0.330	0.870	1.650	1.870	0.832	1.290	0.980	0.880	0.958
NHFIL	0.900	0.210	0.430	0.740	0.950	1.330	1.270	0.710	0.890	1.040	0.847
PHOENIXFIN	0.460	0.490	0.690	0.710	0.870	1.270	1.410	0.630	0.800	1.310	0.864
UTTARAFIN	0.180	1.320	0.610	0.860	1.060	1.380	1.470	0.840	-0.790	1.270	0.720
PREMIERLEA	1.060	0.240	0.370	0.480	0.750	1.620	1.820	0.620	0.670	0.060	0.766
PRIMEFIN	0.590	0.470	0.340	0.510	0.890	1.580	1.490	0.730	0.880	0.910	0.839
UNIONCAP	0.410	0.990	0.560	0.890	1.260	0.800	1.080	0.810	1.960	0.980	0.925
FASFIN	0.320	0.610	0.870	1.050	1.280	1.310	1.020	-0.830	0.890	1.010	0.753
ILFSL	0.550	0.770	0.880	0.730	0.640	0.870	0.310	0.950	0.790	0.640	0.713
MIDASFIN	0.250	0.340	0.470	0.490	0.800	0.890	0.870	0.970	1.340	1.080	0.750
FIRSTFIN	0.240	0.270	0.360	0.540	0.840	0.820	-0.470	-0.370	0.540	0.670	0.344
PLFSL	0.360	0.430	0.730	0.960	0.680	0.610	0.400	-0.370	-0.870	0.410	0.384

Source: Author's Calculation.

organizations, in 2016 three organizations, in 2017, ten organizations, in 2018 eleven organizations, in 2019, twelve organizations, in 2020 sixteen organizations and finally in 2021 nine organizations are facing the threat of insolvency based on the result of **Table 6**.

Table 7 and **Figure 2** show a comparison of Z score, X score, S score and G score for anticipating the financial status of an organization. An organization having Z score of less than 1.1 is predicted as bankrupt, having a value between 1.1 and 2.6 indicates a grey area and a value of more than 2.6 indicates a good condition which means having no possibility of being bankrupt (Altman, 2002). Based on this criterion 7 organizations namely IDLC, IPDC, Lanka Bangla Finance, Islamic Finance, United Finance, GSP Finance and Delta Brac Housing Finance are in the safe zone, while 4 organizations namely Bay Leasing, ICB, Premier Leasing, Prime Finance are in Grey zone and 10 organizations namely Bangladesh Finance, National Housing Finance, Phoenix Finance, Uttara Finance, Union Capital, FAS Finance, ILFSL, MIDAS Financing, First Finance, PLFSL are in risk of bankruptcy.

In **Figure 3**, 48% is in the bankrupt zone, 19% is in the grey zone and 33% is in the safe zone according to Z score. Organizations having X score greater than 0 indicate the possibility of being bankrupt otherwise value less than 0 indicates a positive condition (Zmijewski, 1984). Based on this criteria, 62% which means 13 organizations namely National Housing Finance, Phoenix Finance, Uttara Finance, GSP, Premier Leasing, ICB, Union Capital, FAS Finance, ILFSL, Midas

Table 6. Calculated Grover G scores of selected NBFIS.

List of Selected Financial Institutions	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVERAGE
BAYLEASING	0.10	0.21	-0.50	0.24	0.37	0.22	0.29	-0.14	-0.35	-0.30	0.02
BDFINANCE	0.01	0.00	-0.50	0.17	0.48	-0.10	-0.38	0.16	-0.10	-0.30	-0.05
DBH	0.02	0.03	0.05	0.51	-0.40	0.61	0.70	-0.40	-0.21	-0.30	0.06
UNITEDFIN	0.42	0.05	0.06	0.30	0.08	0.05	0.22	-0.31	0.67	0.12	0.16
GSPFINANCE	-0.80	0.07	-0.10	0.04	0.56	0.52	0.00	0.00	-0.61	-0.30	-0.06
ICB	0.31	0.08	0.12	0.01	0.42	0.74	0.23	-0.75	-0.24	-0.60	0.04
IDLC	0.65	0.63	0.51	0.59	0.81	1.04	1.02	0.81	0.73	0.58	0.74
IPDC	0.20	0.99	-1.70	0.41	0.31	-0.40	0.65	0.38	0.98	0.15	0.20
ISLAMICFIN	0.30	-0.60	1.12	0.54	0.61	0.31	0.33	-1.05	-0.23	0.48	0.18
LANKABAFIN	0.73	0.61	-0.30	0.85	0.19	0.33	0.11	-0.08	0.27	0.42	0.31
NHFIL	0.12	0.27	-0.30	0.25	0.37	-0.60	-0.42	-0.63	-0.46	-0.90	-0.22
PHOENIXFIN	0.02	-0.50	0.30	-0.50	0.32	0.79	-1.05	0.14	-0.70	0.11	-0.10
UTTARAFIN	0.31	-0.10	0.40	-0.60	0.13	-0.90	-0.36	-0.24	-0.37	0.21	-0.16
PREMIERLEA	0.16	0.11	0.14	-0.50	0.18	0.74	-0.49	-0.04	-0.28	0.32	0.03
PRIMEFIN	0.13	0.53	-0.70	0.09	0.04	-0.60	0.08	0.74	0.52	0.42	0.13
UNIONCAP	0.23	0.31	0.46	-0.40	0.49	-0.40	-0.43	0.15	-0.39	0.10	0.01
FASFIN	0.14	-0.60	0.26	-0.50	0.65	-0.90	-0.68	-0.39	-0.45	0.65	-0.18
ILFSL	-0.60	-0.30	0.12	0.11	-0.30	-0.60	-0.67	-0.08	-0.42	-0.60	-0.35
MIDASFIN	0.01	0.14	-0.20	-0.30	0.02	0.09	-0.19	0.02	-0.15	0.26	-0.03
FIRSTFIN	0.03	-0.50	0.11	-0.30	-0.40	-0.40	-0.76	0.62	-1.10	-1.30	-0.39
PLFSL	-0.20	-0.30	-0.60	0.01	0.02	-0.20	-0.47	-0.78	-0.79	-1.20	-0.45

Source: Author's Calculation.

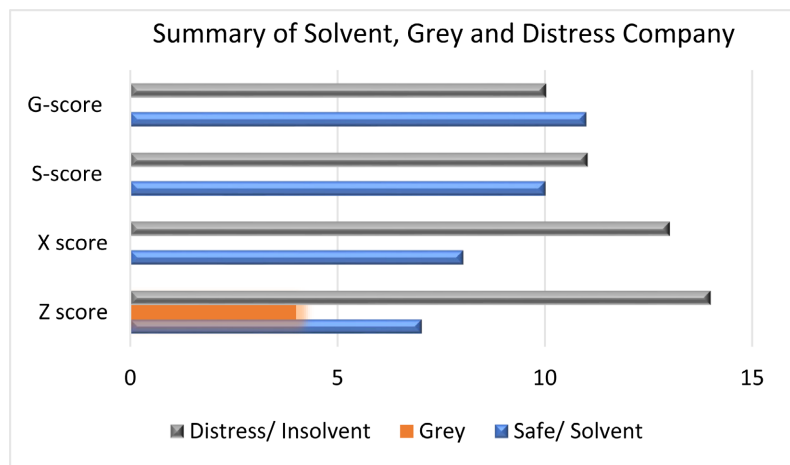
Table 7. Comparison of bankruptcy models score.

List of Selected Financial Institutions	Z_Score	status	X_score	status	S_score	status	G_score	status
BAYLEASING	1.93	Grey	0.1739	Bankrupt	1.027	Safe	0.015	Safe
BDFINANCE	1.164	Bankrupt	-0.01255	Safe	0.677	Bankrupt	-0.0539	Bankrupt
DBH	3.058	Safe	-0.0835	Safe	0.8	Bankrupt	0.0638	Safe
UNITEDFIN	3.026	Safe	-0.24888	Safe	1.402	Safe	0.1648	Safe
GSPFINANCE	3.024	Safe	0.1835	Bankrupt	0.941	Safe	-0.0583	Bankrupt
ICB	1.912	Grey	0.001	Bankrupt	1.034	Safe	0.0354	Safe
IDLC	3.08	Safe	-0.32	Safe	1.301	Safe	0.737	Safe

Continued

IPDC	3.047	Safe	-0.3776	Safe	0.998	Safe	0.195	Safe
ISLAMICFIN	2.996	Safe	-0.0632	Safe	0.877	Safe	0.18	Safe
LANKABAFIN	2.994	Safe	-0.6015	Safe	0.958	Safe	0.312	Safe
NHFIL	1.39	Bankrupt	0.1006	Bankrupt	0.847	Bankrupt	-0.222	Bankrupt
PHOENIXFIN	1.393	Bankrupt	0.1628	Bankrupt	0.864	Safe	-0.097	Bankrupt
UTTARAFIN	0.863	Bankrupt	0.1831	Bankrupt	0.72	Bankrupt	-0.158	Bankrupt
PREMIERLEA	1.952	Grey	0.312	Bankrupt	0.766	Bankrupt	0.032	Safe
PRIMEFIN	2.001	Grey	-0.5805	Safe	0.839	Bankrupt	0.132	Safe
UNIONCAP	1.441	Bankrupt	0.0349	Bankrupt	0.925	Safe	0.012	Safe
FASFIN	1.129	Bankrupt	0.2728	Bankrupt	0.753	Bankrupt	-0.178	Bankrupt
ILFSL	0.805	Bankrupt	0.608	Bankrupt	0.713	Bankrupt	-0.346	Bankrupt
MIDASFIN	1.448	Bankrupt	0.0827	Bankrupt	0.75	Bankrupt	-0.0327	Bankrupt
FIRSTFIN	0.914	Bankrupt	0.359	Bankrupt	0.344	Bankrupt	-0.3908	Bankrupt
PLFSL	0.256	Bankrupt	0.592	Bankrupt	0.384	Bankrupt	-0.4464	Bankrupt

Source: Author's Calculation

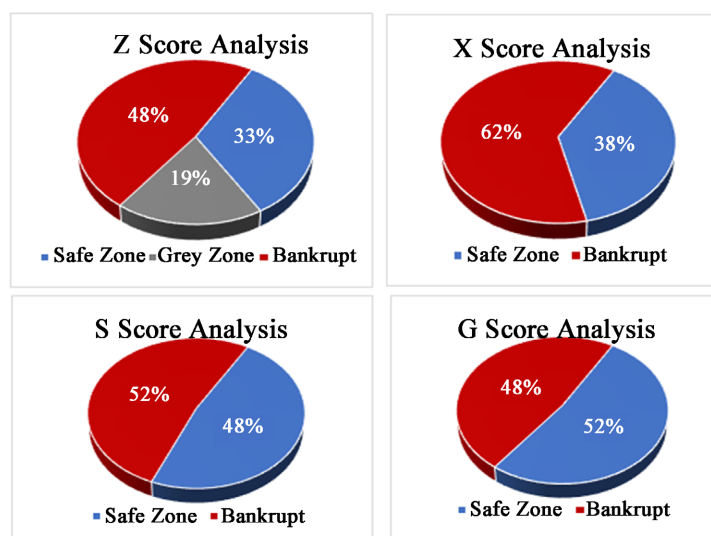


Source: Author's Calculation.

Figure 2. Summary of solvent, grey and distress company.

Financing, First Financing, PLFSL have the risk of probable bankruptcy while 38% which means 8 organizations namely Prime Finance, BD Finance, DBH, United Finance, IDLC, IPDC, Islamic Finance and Lanka Bangla are in the safe zone.

S score higher than 0.862 forecasts the good health of a company otherwise indicates probable financial distress of an organization (Springate, 1978). Based on this, 52% which means 11 organizations namely BD Finance, DBH, National Housing Finance, Uttara Finance, Premier Leasing, Prime Finance, FAS Finance, ILFSL, Midas Financing, First Finance, PLFSL are having risk of probable



Source: Author's Calculation.

Figure 3. Financial Soundness of the NBFIs Sector in Bangladesh.

bankruptcy while 48% which means 10 organizations namely, GSP, ICB, Union Capital, United Finance, IDLC, IPDC, Islamic Finance, Bay Leasing, Phoenix Finance and Lanka Bangla are in safe zone. $G \leq -0.02$ predicts bankruptcy of an organization and $G \geq 0.01$ indicates that the company is not bankrupt (Jevri, 2016). Based on this, 52% which means 11 organizations namely, ICB, Union Capital, United Finance, IDLC, IPDC, Islamic Finance, Bay Leasing, Premier Leasing, DBH, Prime Finance and Lanka Bangla are in the safe zone while 48% which means 10 organizations namely, BD Finance, GSP, National Housing Finance, Phoenix Finance, Uttara Finance, FAS Finance, ILFSL, Midas financing, First Financing, PLFSL are facing the threat of probable bankruptcy.

Table 8. Descriptive statistics.

Descriptive Statistics							
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Z_SCORE	210	-0.490	4.780	1.19633	1.12117	0.044	3.653
X_SCORE	210	-0.965	2.090	0.03707	0.59892	0.075	2.751
S_SCORE	210	-0.870	2.080	0.87333	0.50063	-0.027	2.129
G_SCORE	210	-1.720	1.120	-0.005	0.49075	-0.093	2.094
Valid N (listwise)	210						

Source: Author's Calculation.

To gain an overview of the essence and attributes of the data, descriptive statistics have been applied. In **Table 8** it is shown that Altman Z score has a total of 210 data with a minimum value of -0.490 and maximum value of 4.780 , av-

average value of 1.19633 and standard deviation of 1.12. Zmijewski X score has a total of 210 data with a minimum value of -0.965 and maximum value of 2.090 , an average value of 0.03707 and a standard deviation of 0.59892 . Springate S score and Grover G score also have a total of 210 data with a minimum value of -0.870 & -1.720 , a maximum value of 2.080 & 1.120 and the average value of 0.873 & -0.00496 and standard deviation of 0.500 & 0.490 .

The mean values of all the variables indicate that the industry is facing financial distress and may face probable bankruptcy in the future in case of a major shock. The values of the skewness and kurtosis columns show the shape of the distribution. The skewness shows the highest point of data distribution. Data distribution having skewness equal to 0 is referred to as perfect data or normal data distribution. The larger the skewness value is the more skewed the data distribution which specifies the concentration of data on one side.

The skewness values for Z score, X score, S score and G score are -0.044 , 0.075 , -0.027 , -0.093 respectively. Positive values of skewness indicate a longer right tail of the curve and negative values indicate a longer left tail of the curve. Kurtosis designates the fitness of the data distribution. It shows whether the distribution is tapered (kurtosis < 3), blunt (kurtosis $= 3$) and very blunt (kurtosis > 3).

The fine data distribution specifies that data are homogenous or concentrated in one point and blunter means heterogenous or widespread data distribution. Kurtosis values for the Altman, Zmijewski, Springate and Grover are respectively 3.653 , 2.751 , 2.129 , 2.094 . Based on the kurtosis value, it can be said that the shape of the distribution is tapered-blunt.

Table 9. Normality test.

	Tests of Normality					
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Z_SCORE	0.094	210	0.997	0.959	210	0.985
X_SCORE	0.095	210	0.667	0.957	210	0.525
S_SCORE	0.052	210	0.200	0.977	210	0.325
G_SCORE	0.091	210	0.155	0.989	210	0.113

Source: Author's Calculation.

Table 9 shows that the significance values of Z score, X score, S score, G score for Kolmogorov-Smirnov test are 0.997 , 0.667 , 0.200 , 0.155 and Shapiro-Wilk normality test are 0.985 , 0.525 , 0.325 , 0.113 . The values are greater than 0.05 , which indicates the normal data distribution.

According to the output shown in **Table 10**, there is a significance (2-tailed) of $.001$ in pair 1 between the Altman Z score and Zmijewski X score, 0.000 in pair 2 between Altman Z score and Springate S score, 0.001 in pair 3 between Altman

Table 10. Paired sample T test.

		Paired Samples Test					
		Std. Deviation	95% Confidence Interval of the Difference			20	Significance Two-Sided p
			Lower	Upper			
Pair 1	Altman_Z_score - Zmijewski_X_score	1.178745	1.3227	2.395817	7.228	20	0.001
Pair 2	Altman_Z_score - Springate_S_score	0.763175	0.695607	1.390393	6.263	20	0.000
Pair 3	Altman_Z_score - Grover_G_score	0.730137	1.568936	2.233645	11.93	20	0.001
Pair 4	Zmijewski_X_score - Springate_S_score	0.513568	-1.050032	-0.582485	-7.283	20	0.001
Pair 5	Zmijewski_X_score - Grover_G_score	0.557795	-0.211873	0.295937	0.345	20	0.002
Pair 6	Springate_S_score - Grover_G_score	0.167724	0.781943	0.934638	23.45	20	0.000

Source: Author's Calculation

Table 11. Summary of regression results.

	Z_Score	X_Score	S_Score	G_Score
Sig F/P value	0.003	0.0075	0.026	0.044
Determinant Co-efficient	0.4425	0.6839	0.5132	0.4422
P value of Const	0.2002	0.002	0.031	0.024
Constant	0.2101	0.3367	0.088	0.712
B	0.305	-0.252	0.586	0.378
OR	2.79	3.27	1.2	1.97

Source: Author's Calculation

Z score and Grover G score, 0.001 in pair 4 between Zmijewski X score and Springate S score, 0.002 in pair 5 between Zmijewski X score and Grover G score, 0.000 in pair 6 between Springate S score and Grover G score. These significance scores indicate a probability < 0.05, which denotes that there are significant differences between the two sample groups.

Table 11 represents the regression results of Z score, X score, S score and G score. The significance F or P value of Z score is 0.0030, the significance value specifies the error model rate, which is to be given attention by the researcher. Based on the testing criteria significance value of less than 1% is strongly significant. The coefficient of determination or R square is 0.4425 or 44.25%, which dictates the ability to predict financial distress of Altman model and 56.75% is

explained by other variables which may not be involved indeed the model. The significance of the constant value is 0.2002 greater than 1% which means the value is moderately significant and it specifies a missing variable carried by Altman model. The value of the odd ratio 2.79 indicates that organizations having Z scores lower than the benchmark are three times more likely to face financial distress than other organizations having higher Z scores.

The significance of Zmijewski model is statistically significant as its value of 0.0075 is less than 1%. The R square value which indicates the ability to predict financial distress of X score model is 0.6839 or 68.39% while 32.61% is explained by other variables excluded in the model. The significance of the constant value is 0.0020 which is strongly significant which means that the X score model is missing a high variable. The value of the odd ratio is 3.77 which indicates that organizations having X score greater than the benchmark are four times more likely to face financial distress than organizations having a lower X score.

The significance value of Springate model 0.026 shows moderate significance. The value of coefficient determination is 0.5132 which means 51.32% of financial distress can be explained by Springate model while 49.68% is explained by other variables excluded from the model. The significance of the constant value is 0.001 which also shows high significance and indicates the missing variable carried by Springate model. The odd ratio of 1.20 indicates that an organization having S score greater than the benchmark is likely to face one times financial distress compared to other organizations having a lower S score.

The significance value of Grover model is 0.044 and it is moderately significant based on the testing criteria. The value of R square is 0.4422 which indicates that 44.22 percentage financial distress can be predicted by Grover model while 66.88 % may be explained by other variables excluded in the model. The significance of the constant value is 0.024 and it indicates the missing variable carried by Grover model. The value of the odds ratio is 1.97 which indicates that an organization has a lower G score is likely to face two times financial distress compared to other organizations.

According to the result shown in **Table 11**, Zmijewski is the most accurate one compared to others by having a higher significance value of 0.0075. The determinant of the coefficient value of this model is 68.39% which is higher than other models. The accuracy of any model is shown by two elements, one is the significance level and the other is the determination of coefficient. Based on the values of these two elements H_7 , H_9 and H_{10} is rejected and H_8 is accepted which means Zmijewski model indicates financial distress better than Altman, Springate and Grover model. Zmijewski model emphasizes the amount of debt rather than profitability measures like other models do. For predicting bankruptcy concentration should be given on the amount of debt than profitability measures as debt is a crucial factor pushing the organization towards bankruptcy though profitability is also a major concern and object of inspection. The results

of this study are in line with the result of a study conducted by Mila [Fatmawati \(2012\)](#) according to which Zmijewski model is more precise in identifying financially distressed companies.

6. Conclusion and Implication

By opening up a different channel for the supply of credit and expanding the choice of larger investment products available to individuals, non-bank financial institutions offer several advantages. These advantages, though, have been paid for by a rise in transaction risks and financial instability. While the risks associated with the various non-bank financing options vary, some of them carry excessive risk and have few transparent and prudential controls. NBFIs have made it possible for lending to risky borrowers, large liquidity and maturity mismatches, more leverage and a web of links that feed back into the financial system of Bangladesh.

According to Altman's Z score 48% of the total operating NBFIs of Bangladesh or 10 organizations are facing the threat of insolvency, Zmijewski X score shows that 62% or 13 firms are in threat, Springate S score identifies 52% or 11 firms and Grover G score pinpoints 48% or 10 organizations as financially distressed organizations.

There are seven companies to face probable bankruptcy in case of major shock namely, National Housing Finance, Uttara Finance, FAS Finance, ILFSL, MIDAS Financing, First Finance and PLFSL are facing the threat of probable bankruptcy in case of major shock while 5 organizations namely, IPDC, IDLC, LANKABANGLA, United Finance and Islamic Finance are in safe zone according to the analysis of Altman, Zmijewski, Springate and Grover score. Moreover, 33% are in the red zone and the NBFIs sector is undergoing financially distressed and challenging conditions.

The significance value of the Paired Sample T-test indicates a probability < 0.05 which denotes that there are significant distinctions between the two sample groups, in other words, the significant dissimilarity between the Altman, Zmijewski, Springate and Grover model. Besides, based on the result of Binary Logistic Regression it can be said that Zmijewski is the most significant one compared to the other three models in indicating financial distress of the NBFIs by having higher significance value, co-efficient determination value and odd ratio for the NBFIs listed on DSE for the period 2012-2021. Zmijewski model places a strong emphasis on debt size when predicting a company's financial problems.

Since NBFIs handle people's money and many of them are even publicly listed, they must use ethical business methods, and their management must work to boost the wealth of the stakeholders. The regulatory authorities and the government's proper oversight can help to ameliorate the company's finances and liquidity ratios.

Policymakers should initiate a revolutionary strategy to address its failing

NBFIs. To address the hazards while mitigating them, regulations must be created that are difficult to bypass. This study is effective and applicable the models which have been used here have correctly identified the 2 organizations such as ILFSL and PLFSL as prone to bankruptcy and are already on the verge of insolvency. So future researchers, authorities, shareholders and decision-makers can utilize this study for further use and for making future investments or for making any other decisions.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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