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Research Article

Financial Distress Prediction through Altman Z-Score Model: A Case Study of State Owned Commercial Banks of Bangladesh

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Abstract

Purpose: Banks are the backbone of the economy. The bank collects money temporarily from the public and lends to other people as per need. Banks should concern about the soundness of their financial health. The purpose of this study is to predict the financial health of the State Owned Commercial Banks (SOCBs) of Bangladesh using Altman Z-score Model. **Methodology:** The Z-score uses working capital to total assets, retained earnings to total assets, earnings before interest and tax to total assets, shareholders equity to total liabilities to measure the financial health of the banks. The study is analytical in nature and is carried out based on only secondary data. The published Annual Reports of the six SOCBs for the period of 2010-2018 collected for secondary data and financially analyzed through Altman Z-score Model for prediction of financial distress. **Findings:** The study found that with only one exception, the financial health of the SOCBs is unsatisfactory. One exception is only Bangladesh Development Bank which fell into grey zone among the six SOCBs as it secured on an average 1.52 score. However, the remaining others are found in Distress zone as they secured on an average < 1.10 score. Hence, it is said that the financial health of the Basic Bank Limited is the worst and BDBL is the best among the six banks. **Implications:** The implication of the study is that respective authority of the SOCBs of Bangladesh can use the findings of the study to take necessary actions for financial distress.

Key words: Altman Z-score, financial distress, prediction, state owned commercial banks

INTRODUCTION

R. P. Kent defined Bank as- "a financial institution which collects unused money for the time being from the public and lends to other people according to their need". "Financial institutions or banks are the backbone of the overall economy. It provides capital for modernization, infrastructural developments, new job creation, and overall affluence of the economy. Banks also play an integral role in society, by affecting not only individual consumers spending, but also the entire industries growth" (Uddin and Masud, 2015).

Now, the number of scheduled banks in Bangladesh is 59. These banks are run under direct control and administration

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of central bank (Bangladesh bank). According to Bangladesh Bank Order, 1972 and Bank Company Act, 1991, Bangladesh Bank is empowered to do so. Scheduled banks are classified into: State Owned Commercial Banks-6; Specialized Banks-3; Private Commercial Banks-41; and Foreign Commercial Banks-9 (BB website).

Recently, the banking industry of Bangladesh has extended in terms of number of institutions, advanced financial instruments, assets size, experienced human resources, etc. However, this industry is facing the tremendous challenges due to malpractices, internal, external scams, etc. As a result, the overall performance of the banking industry is greatly affected (Khatun, 2018).

Financial distress is usually the last step before bankruptcy. Financial distress is a circumstance in which a firm or individual cannot make revenue or income because it is unable to meet or cannot pay its financial obligations. This is generally due to high fixed costs, illiquid assets, or revenues sensitive to economic downturns. (Kenton, 2019)

ALTMAN Z-SCORE

In 1936, sir Ronald Aylmer Fisher (who is also known as R.A. Fisher) developed Linear Discriminant Analysis technique. On the other hand, in 1968, E. I. Altman published "Z-Score Model" for predicting bankruptcy. It is basically a modified description of the discriminant analysis technique of R.A. Fisher. The Z-score formula may be used as a probability predictor whether a firm will go into bankruptcy within 2 years or not. To measure the financial soundness of a company or firm, Z-score formula uses income statement and balance sheet values of that organization (Source: Wikipedia).

The original Z-Score formula was as follows:

$$Z = \{1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5\}.$$ Where

X_1 = Working capital/Total assets. This ratio indicates liquid assets of the firm or company.
X_2 = Retained earnings/Total assets. It indicates company's earnings ability and age.
X_3 = Earnings before interest and taxes/Total assets. It measures operating efficiency apart from tax and leveraging factors. It shows operating profit.
X_4 = Market value of equity/Book value of total liabilities.
X_5 = Sales/Total assets. It is the typical measure of total assets. It may vary significantly from business to business (Source: Wikipedia).

Zones of Discriminations:

Scenario	Score	Zone or indicator	Description
1	**Z=>2.6**	**"Safe"**	The bank is financially sound and there is a least possibility that the bank will face financial distress. It can be said that the bank is financially healthy.
2	**1.1 ≤ Z ≤ 2.6**	"Grey"	The bank falls in the gray area that means there is less possibility that the bank will face financial distress in the near future.
3	**Z< 1.1**	**"Distress"**	There is a possibility that the bank will face financial distress even bankruptcy in the near future. It can be said that the bank is in vulnerable position.

(Parvin et al., 2016)

Adaptation for Private Firm's Application

$$Z = \{0.717(X_1) + 0.847(X_2) + 3.107(X_3) + 0.420(X_4) + 0.998(X_5)\}.$$

The equation now looks different than the earlier model; note, for instance, the coefficient for X_1 went from 1.2 to 0.70. However, the model looks quite similar to the one using market values. The actual variable that was modified, X_4, showed a coefficient change to o.42 from 0.6001; that is, it now has less impact on the Z-score. X_3 and X_5 are virtually unchanged (Altman, 2000).

Particularly in 1995, Altman, Hatzell and Peck have applied this enhanced Z-score model to emerging markets corporate, especially Mexican firms that had issued Euro Bonds denominated in U.S. dollars. The new Z-score model is: $Z = \{6.56(X_1) + 3.26(X_2) + 6.72(X_3) + 1.05(X_4)\}$.

All of the coefficients for variable X_1- X_4 are changed as are the group means and cutoff scores. In the emerging market model, we added a constant term of +3.25, so as to standardize the scores with a score of zero (0) equated to a D (default) rated bond (Altman, 2000).

RESEARCH QUESTION

The following research questions have been derived for the study:

RQ_1: How is the financial health of SOCBs?

RQ_2: Is there any significant difference among Z-scores of SOCBs?

OBJECTIVES OF THE STUDY

The objectives are as follows

- Observing the financial health and forecasting the distress position of the SOCBs.
- Making comparison among Z-Scores of the State Owned Commercial Banks.

METHODOLOSY

Population and Sample Size

According to Schedule banks Statistics of Bangladesh Bank, there are 59 scheduled banks in Bangladesh. These 59 banks are considered as population of the study. Among this population, we have purposively selected all the six SOCBs as sample. The sample banks are Sonali Bank Limited, Agrani Bank Limited, Janata Bank Limited, Rupali Bank Limited, Basic Bank Limited and Bangladesh Development Bank Limited. In this article, we analyzed 9 years (2010-2018) data; like current assets, current liabilities, retained earnings, total assets, total equity, and total liabilities of the SOCBs of Bangladesh.

Data Source and Nature

The study applied explanatory research design and carried out based on secondary data only. The main source of data is annual reports (Audited Financial Statements) of the respective banks. For literature review purposes, relevant article has also been consulted.

Tools Applied

Various tools, such as Altman Z-score; Statistical tools (mean, one way ANOVA); and MS Excel version13 have been used in this study for data analysis.

Z-score bankruptcy model: $Z = \{6.560 (X_1) + 3.260 (X_2) + 6.720 (X3) + 1.050 (X_4)\}$.

Research Period

The research has been carried out for the period of 9 consecutive years starting from December 31, 2010 to December 31, 2018.

Research Hypothesis

To test one way ANOVA following hypotheses has been developed:

H_0: Z-score is alike in the sample units.

H_1: Z-score is not alike in the sample units.

Limitations of the Research Study

- The study is limited to the six SOCBs only, so it may not represent the whole banking industry of Bangladesh.
- The secondary data have been used for the study so, secondary data may limit the accuracy and authenticity of the conclusion.

LITERATURE REVIEW

Worldwide a number of researchers have worked out on prediction of financial distress of commercial banks using Altman Z-score model. In this section, we will amalgamate all these prediction of financial distress of commercial banks through Altman Z-score.

In Kenya, (Mwawughanga and Ochiri, 2017) have examined the financial health of both listed and non-listed banks under Nairobi Stock Exchange applying the Altman Z-score model of 2005 for the period of 2010 - 2015. They used survey descriptive research methodology for their study and their target population was the commercial banks in Kenya. Their study results indicated that throughout the study period high percentage of Kenyan banks were on Grey Zone. They concluded that the Altman Z-score model is an average tool which can only be relied alongside other measures. On the other hand, (Khaddafi et al. 2017) have also made a study to test the prediction of bankruptcy in banking companies listed in the Indonesian Stock Exchange during the period of 2011-2013 through the Altman Z-score model. The research found that in 2011, among the sample 29 banks, there were thirteen banks that are in a healthy condition and fourteen banks are in a state of bankruptcy and two banks are in Grey area. Whereas, in 2012, there were ten banks in good health; fourteen banks are in a state of bankruptcy; and five banks in condition

of Grey area. Moreover, in 2013, the number of healthy banks slightly increased that are 11 banks, in condition of Grey area 4 banks and in a state of bankruptcy remains the same in each year, that is, fourteen banks. However, (Al-Manaseer and Al-Oshaibat, 2018) have investigated the validity of Altman Z-score model to predict financial failure in insurance companies listed on Amman Stock Exchange over the period of 2011-2016. They found a high predictive power for the Altman Z-score model. Moreover, they concluded that the Altman Z-score model could be a valuable instrumental indicator for many uses of financial statement.

On the other hand, in India, (Apoorva et al. 2019) employed the Altman Z-score model to check the efficiency of this model in predicting bankruptcy of Indian companies 3 years before the occurring of the event. The findings of the study pointed out that bankruptcy of the sample companies could be predicted 3 years before the occurring of the event in India and concluded that the Altman Z-score model can be applied for Indian companies; however, the same is not 100% accurate. Moreover, (Sajjan, 2016) evaluated Altman's Z-score model to understand the likelihood of bankruptcy of selected firms listed in BSE and NSE in India and NSE for past 5 years from 2011-2015. The study found that Most of the sample firms fall under distress zone. However, (Turk, 2017) has conducted a study on Financial Failure Estimate in BIST companies in Turkey with Altman (Z-score) and Springate (S-score) Models for the period of 2014-2016. He found that both the models demonstrate different levels of financial failure. However, same results are found when analyses are done by years. Moreover, (Sanjaya et al. 2015) conducted a research in Indonesia to provide empirical evidence about the bankruptcy prediction model used by Altman. Their study results showed that the Altman Z-score model was appropriate for use in predicting bankruptcy of the Indonesian banking company on the observation period 2001-2012. They concluded that this model can be utilized as a bankruptcy prediction tool in Indonesia. In addition, (Al-Rawi, 2008) operated Altman Z-scores and Ratio Analysis approaches to conclude his views, why the firm under study went bankrupt. He also concluded that this model can be used as an indicator of bankruptcy in the future.

However, (Afrin, 2017) performed a study on "Analyzing the potential of Altman's Z-score for prediction of market performance and share returns – A case study of the cement industry in Bangladesh'' and she found extremely week correlation and regression model between these two variables. She opined that the Altman Z-score model cannot play any meaningful role for assessment and prediction of market performance of cement industry in Bangladesh. On the other hand, (Chowdhury and Barua, 2009) worked the Altman Z-score model to predict the risk of financial distress of Z–category companies listed in Dhaka Stock Exchange. They found that about 90% of companies are suffering from financial distress risk. However, model may not be fully applicable for Bangladeshi companies. In addition, (Jahan, 2018) investigated the determinants of financial distress in SOCBs of Bangladesh. He used the Altman's Z-score model as a measure of financial distress and Pooled OLS and Panel Corrected Standard Errors methods to find out the significant determinants of financial distress. The study found that the SOCBs in Bangladesh are financially distressed. However, (Parvin et al., 2016) have tried to predict the financial health of banking industry in Bangladesh using the Altman's Z-score model and made a comparison of Z-score between the SOCBs and the PCBs in Bangladesh. The analysis reveals that the SOCBs possess better financial health than that of PCBs in Bangladesh. On the other hand, (Qamruzzaman, 2014) carried out a study on Predicting Bankruptcy: Evidence from private commercial banks in Bangladesh applying with widely accepted bankruptcy predicting "S-score" and "Z-score" model over the period from 2008 to 2012. In his study, the S-score shows that the whole banking industry belongs to safe zone whereas the Z-score indicates likely bankruptcy status.

RESEARCH GAP

A lot of studies have done on financial distress using the Altman Z-score bankruptcy model: $Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$ in the global context as well as in Bangladesh. Moreover, in Bangladesh, most of the researches about financial distress are done based on PCBs and a few researches on the SOCBs. From literature review, it is observed that one researcher found that the SOCBs in Bangladesh are financially distressed and are characterized by low capital adequacy ratio, high loan loss provision, liquidity problem, poor earning quality, and management inefficiency (Jahan, 2018). However, another researcher has tried to predict the financial health of banking industry in Bangladesh applying the Altman's Z-score model and made a comparison of Z-score between the SOCBs and PCBs. The analysis reveals that the SOCBs possess better financial health than their counter parts (Parvin, et al., 2016). Hence, there is a scope of further research. Prediction of the financial distress of SOCBs is really necessary as

Table 1: Z- Score of state owned commercial banks

Year	Basic	BDBL	Rupali	Janata	Sonali	Agrani
2010	(0.99)	1.88	0.60	0.29	0.86	1.76
2011	(1.49)	1.60	0.38	0.42	1.13	1.37
2012	(0.91)	1.18	0.46	(0.03)	0.18	0.40
2013	(1.41)	1.15	0.44	0.25	1.18	1.18
2014	(2.06)	0.95	0.25	0.22	1.07	0.55
2015	(2.14)	0.72	(0.03)	0.27	1.12	0.62
2016	(2.83)	1.82	(1.54)	0.27	0.72	0.23
2017	(2.84)	2.25	(1.24)	0.28	0.99	0.43
2018	(2.84)	2.17	(0.91)	(0.65)	(1.85)	0.17
Mean	(1.95)	1.52	(0.18)	0.15	0.60	0.75
STD	0.78	0.55	0.83	0.32	0.97	0.56
F. Position	Distress	Grey	Distress	Distress	Distress	Distress

Table 2: Ranking of state owned commercial banks

Name of Bank	Rank based on		
	Liquidity	Profitability	Z –score
Agrani	1	4	2
BDBL	2	1	1
Sonali	3	5	3
Janata	4	2	4
Rupali	5	3	5
Basic	6	6	6

performance of the SOCBs in Bangladesh is deteriorating day by day. Therefore, the outcomes of this study will keep a significant contribution in literature and help the regulators to formulate policy and its implementation.

RESULTS AND DISCUSSION

Figure 1 (a-d) represents the various financial ratios of the six SOCBs of Bangladesh. The average liquidity ratio (working capital to total assets) of the Agrani Bank Limited was the highest at 0.102 and the lowest for the Basic Bank Limited at -0.277 [Figure: 1a]. The average retained earnings ratio was negative for the Sonali, Agrani and Basic Bank Limited and positive for the remaining others. Moreover, the retained earnings ratio was the lowest for the Basic Bank Limited at -4.80% and the highest for the Rupali Bank Limited at 0.90% [Figure: 1b]. On the other hand, the average profitability ratio (EBIT to total assets) was maximum in case of Rupali Bank Limited at 2.40% and minimum for the Basic Bank Limited at -0.80% [Figure: 1c]. In addition, equity to liabilities ratio was the highest for the BDBL at 0.695 and the lowest for the Sonali Bank Limited at 0.062 [Figure: 1d]. Table 1 provides the short description of Z-score's of the SOCBs.

Table 1 depicts that the Z-score of the BDBL and Agrani Bank Limited was positive during 2010-2018.The Basic Bank Limited showed negative Z-score during the study period. However, in case of Sonali, Janata and Rupali Bank Limited, the Z-score showed ups and downs throughout the period. As a result, the Altman Z-score model provides the best rank to the BDBL among the six SOCBs and put it in grey zone as it secured on an average 1.52 score. However, remaining others are found in the distress zone as they secured an average score < 1.10. Table 2 shows brief description of the ranking of the six SOCBs on the basis of the liquidity, profitability and Z-score.

Poor working capital to total assets ratio (liquidity ratio), EBIT to total assets ratio (profitability ratio) and Z-score of the Basic Bank Limited put it on the last (6^{th}) position. However, profitability and Z-score of the BDBL placed it the first position (Table 2). Details are shown in Appendix 1.

As the calculated value of F is greater than tabulated value of 2.408514 at 5% level of significance, statistically significance difference is found (Table 3). We should reject null hypothesis. Hence, it is said that the Altman Z score is not equal in the sample units.

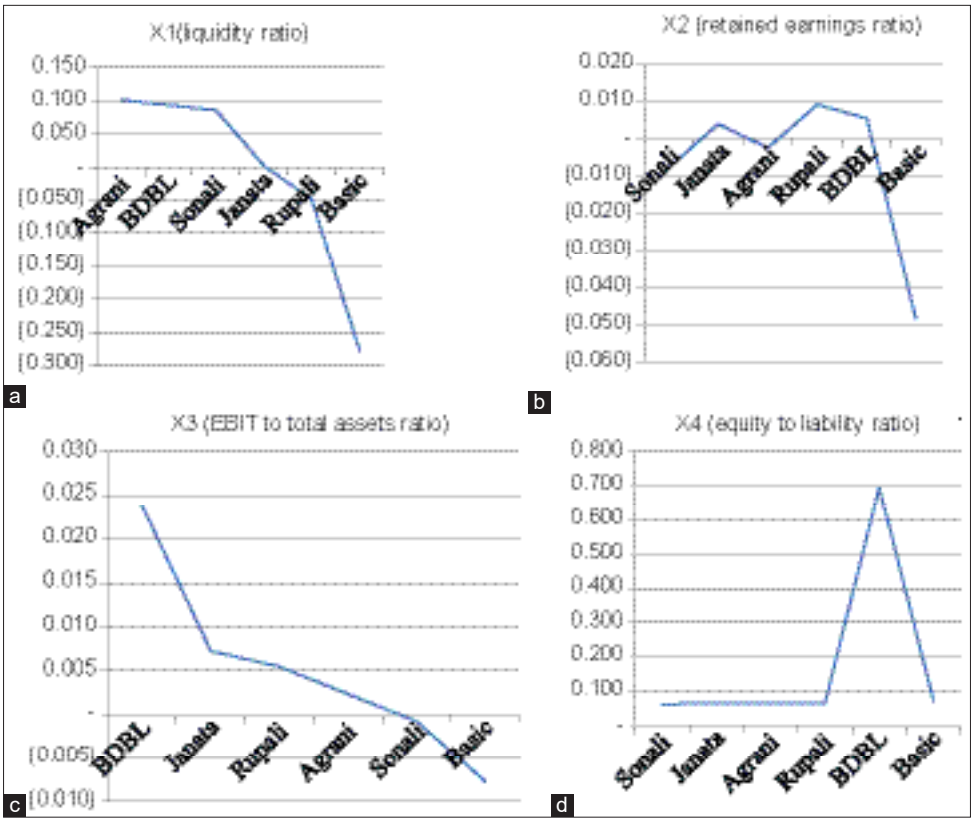

Figure 1: (a-d)The various financial ratios of the six SOCBs of Bangladesh

Table 3: ANOVA for the State Owned Commercial Banks

ANOVA: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance		
Basic	9	-17.516	-1.94628	0.61374		
BDBL	9	13.7173	1.524145	0.29940		
Rupali	9	-1.5933	-0.17704	0.68118		
Janata	9	1.32939	0.14771	0.10411		
Sonali	9	5.3937	0.5993	0.93873		
Agrani	9	6.72695	0.747439	0.30990		
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Between Groups	62.53565	5	12.50713	25.46341	1.9E-12	2.40851
Within Groups	23.57667	48	0.491181			
Total	86.11232	53				

CONCLUSION

The banks are the back bone of the economy. Banking business totally depends on public trust and confidence. In terms of deposit, advance, foreign remittance, about one-third market share of Bangladeshi banking industry is occupied by the SOCBs. They worked as a market leader in Bangladesh due to that public trust and confidence. But, if

public do not have any trust and confidence on the SOCBs then overall banking industry collapsed in Bangladesh. It is the prime responsibility of the SOCBs to keep and maintain public trust and confidence. Now, question comes how? Each and every SOCB's should properly analyze and disclose its financial soundness to the public. However, the financial health of the banking sector is weakening due to rising non-performing loans, a lack of corporate governance, and increasing capital shortfall (The Daily Star). That is why; the purpose of the study is set to predict the financial health of the SOCBs of Bangladesh through the Altman Z-score model and this study expressed the financial health of the SOCBs of Bangladesh. Moreover, it is tried to show, whether there are any difference among the Z-scores of the SOCBs or not. For this ANOVA (one-way) test has been done. The findings reveal that there is a difference among the Z-scores of the SOCBs. Moreover, study shows that all of the SOCBs except Bangladesh Development Bank Limited fall distress zone as they secured Z-score < 1.10. That means, there is a possibility that the SOCBs will face financial distress even bankruptcy in the near future. In addition, they are in vulnerable position. However, Only BDBL place Grey zone area as it obtains average Z-score 1.52.

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APPENDICES

Appendix 1: Ranking based on Financial Ratios

Bank	X1	Rank	Bank	X2	Rank	Bank	X3	Rank	Bank	X4	Rank
Agrani	0.102	1	Rupali	0.009	1	BDBL	0.024	1	BDBL	0.695	1
BDBL	0.094	2	BDBL	0.005	2	Janata	0.007	2	Basic	0.074	2
Sonali	0.086	3	Janata	0.004	3	Rupali	0.005	3	Agrani	0.067	3
Janata	0.003	4	Agrani	(.003)	4	Agrani	0.002	4	Rupali	0.067	4
Rupali	(.048)	5	Sonali	(.008)	5	Sonali	(0.001)	5	Janata	0.066	5
Basic	(.277)	6	Basic	(.048)	6	Basic	(0.008)	6	Sonali	0.062	6