

Review Paper

# An Empirical Study of Indian Commercial Banks through Financial Distress Models

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## ABSTRACT

This study has predicted commercial banks' financial distress in India using the Altman Z-score model and the Emerging market model. All the Public sector banks listed in the National stock exchange were considered in this research from 2010 to 2019. The Altman Z-score formula is  $Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$ . The criteria for assessing a Z-score are  $> 2.99$  is categorized as a safe zone; healthy banks will fall under this category.  $1.80 < Z\text{-score} < 2.99$  is the gray zone, banks falling under this category have a chance of being safe as well as going bankrupt.  $Z\text{-score} < 1.80$  is a distress zone; banks' falling under this category are at high risk of bankruptcy and may go bankrupt within two years. Emerging market model is  $Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$ . The criteria for assessing emerging market Z-score are  $> 2.60$  is categorized as a safe zone;  $1.10 < Z\text{-score} < 2.60$  is the gray zone and  $Z\text{-score} < 1.10$  is a distress zone. Independent t-test was used to test the hypothesis of the study. The results of both models (Altman Z-score model and Emerging market Z-score model) separately provided outcomes that were two extremes in the opposite direction. The findings of the emerging market Z-score model were more relatable to real-life observed (during the period selected for study) scenarios in the banks, i.e., both public sector as well private sector banks are in the safe zone.

## HIGHLIGHTS

- ① This study predicted the financial distress of Indian Commercial banks using Altman Z-score model and Emerging Z-score market model.
- ② Five ratio based Altman Z-score model developed in 1968 was unable to predict the financial distress of public and private sector bank of India and showed all banks are in distress zone.
- ③ Emerging market Z-score model predicted that Indian commercial banks are in safe zone indicating that the model fitted well for the emerging market like India.

**Keywords:** Altman Z-score model, commercial banks, emerging market Z-score model, financial distress, t-test

Distress is a form of business failure that can manifest itself in many ways. One is an economic breakdown that occurs when a company cannot produce the revenue, which would be enough to meet operational costs and creditors' obligations. Second, financial distress causes the failure of the business. (Beaver, 1966) defined financial distress as the lack of ability of a firm to pay its financial debts as they mature. Financial distress occurs when the company experiences a negative net

operating income for several years and cannot pay any dividends for several years. This distress can lead to insolvency or bankruptcy eventually. As a result, bankruptcy can be defined as a circumstance in which a company's liabilities finally outweigh its

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assets due to financial difficulty (Kittur, 2019). In our economic system, business failures are a natural occurrence, with enterprises entering and exiting as a consequence of overall commercial activity. The assurance in ratio analysis as a capable predictor of financial difficulty has been regularly refreshed in financial and accounting literature. However, more attention should be paid to predicting bank collapses (Chieng, 2013). Because the banking sector is a service sector organization that plays a crucial role in developing the economy, both on the national and international level, it is always demanding and vital to measure banks' financial health. The objective of the study is to observe the financial distress of Indian Commercial Banks using the Altman Z-score model and the Emerging market Z-score model developed by Edward I. Altman.

### MATERIALS AND METHODS

Edward I. Altman built on Beaver's work in 1968 by adding four more variables to the model to forecast the bankruptcy of a manufacturing company (Chieng J, 2013). Altman used a sample of 33 pairs of bankrupt and non-bankrupt enterprises to develop the exact formulation of the model, which can predict 90 percent of bankruptcy cases a year before they happen. Altman employed a statistical technique known as multiple discriminant analysis (MDA), in which he used five accounting ratios to try to anticipate defaults (Hayes *et al.* 2010). A linear combination of five ratios with five weighted coefficients is used to estimate the Altman's z-score model. They are liquidity ratios, cumulative profitability ratios, asset productivity ratios, market-based financial leverage ratios, and capital turnover ratios.

The Altman Z-score formulas (original) are as follows:

$$\text{Model 1: } Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5 \dots(1)$$

Where;

- $X_1$  = Working capital/ Total assets
- $X_2$  = Retained earnings/ Total assets
- $X_3$  = Earnings before interest and taxes/ Total assets
- $X_4$  = Book value of equity/ Total Liabilities
- $X_5$  = Sales/ Total assets

The table below presented a classification of Z-score cut-offs. Classification between healthy and distressed companies is done using the following scores. When the Z-score is below 1.80, it means that the firm probably faces a high risk of going bankrupt, while a score above 2.99 implies the firm is unlikely to go bankrupt. That is, a lower score indicates a higher likelihood of bankruptcy and vice versa.

**Table 1:** Classification of Z-score cut-off

Model Zone	Safe	Gray	Distress
Z (original model)	>2.99	2.99-1.80	<1.80

In 1993, Altman revised his model to incorporate a "four variable Z-Score" prediction model (Altman, 1993). Altman felt this revised model significantly improved his model's predictive ability and made it simpler to incorporate (Meeampol, 2014).

The Emerging Market Score Model (EM Z- Score Model) is as follows:

$$\text{Model 2: } Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 \dots(2)$$

Whereas;

- $X_1$  = Current Assets - Current Liabilities / Total Assets;
- $X_2$  = Retained Earnings / Total Assets;
- $X_3$  = Earnings before Interest and Taxes / Total Assets;
- $X_4$  = Book Value of Equity / Total Liabilities

The table 2 presented a classification of Z-score cut-offs proposed by Altman for his emerging market Z-score model. When the Z-score is below 1.10, the firm probably faces a high risk of going bankrupt, while a score above 2.60 implies the firm is unlikely to go bankrupt. That is, a lower score indicates a higher likelihood of bankruptcy and vice versa.

**Table 2:** Classification of Z-score cut-off

Model Zone	Safe	Gray	Distress
Z (emerging market model)	>2.60	2.60-1.10	<1.10

### Hypothesis of the study

$H_{01}$ : There is no significant difference in the Z-score of public and private sector banks of India.

**Research design:** Research design is a framework or a blueprint for conducting research. It provides

a clear plan on how the investigation will be completed and helps the researcher stick to the plan. A descriptive research design was used in this study.

**Data required:** For doing, the research Secondary data was collected. Secondary data related to banks were collected from the financial report, such as balance sheet and profit and loss.

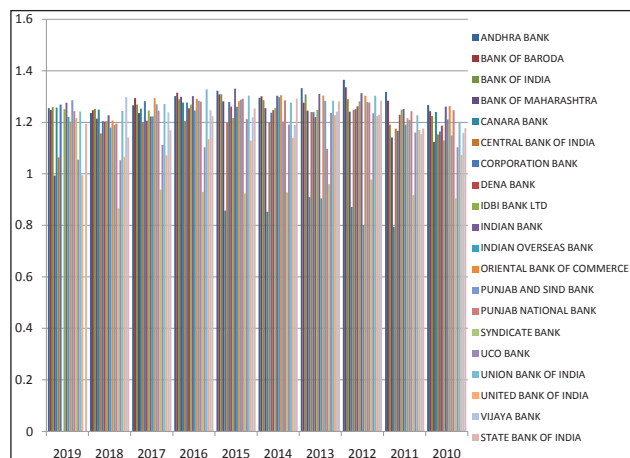
**Area of study:** All the public and private sector banks listed in NSE were the study area, which is the largest Indian stock exchange in volume traded.

**Sample size:** All the public and private sector banks listed on the National Stock Exchange in 2019 was the sample taken for study purposes. Therefore, the sample consists of 21 public sector banks and 19 private sector banks.

## RESULTS AND DISCUSSION

### Analyzing financial distress of Indian commercial banks using Original Z-score model

Altman Z-score calculation of Public sector banks listed in the National Stock Exchange is given in Fig. 1.

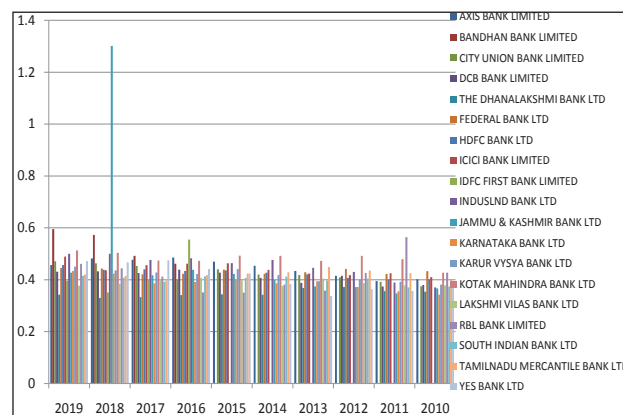


**Fig. 1:** Z-scores of Public sector banks using Original Altman model

Under the original Altman Z-score model, it is found that Z-scores of all the Public sector banks were in the distress zone, which means Z-score was less than 1.80. A Z-score below 1.80 indicates the company is probably headed for bankruptcy. Banks falling under the distress zone have enormous financial difficulties and may go bankrupt in the next two years. But against this rule Fig. 1 showed that from 2010 to 2019, all the banks were in

distress; then also all the banks were active and working except two banks, i.e., Dena Bank and Vijaya bank merged in 2019. As the original Altman Z-score model was built to predict publicly traded manufacturing industries' distress, its applicability to the banking sector was questionable. This study showed that the original Altman Z-score model is unable to predict the financial distress of Indian banks.

Altman Z-score calculation of Private sector banks listed in the National Stock Exchange is given in Fig. 2. Under the original Altman Z-score model, it was found that Z-scores of all the Public sector banks were in the distress zone, which means Z-score was less than 1.80. The Z-score of Jammu & Kashmir Bank Ltd in 2018 was 1.30 less than the cut-off score, whereas all the other private sector banks had Z-score between 0.2 - 0.6 range.



**Fig. 2:** Z-scores of Private sector banks using Original Altman model

### Analyzing financial distress of Indian commercial banks using Emerging market Z-score model

Emerging market Z-score calculation of Public sector banks and Private sector banks listed in the National Stock Exchange is given in Fig. 3 and 4, respectively. Under the emerging market Z-score model, it was found that the Z-scores of all the Public sector banks were found to be unexpectedly well above the highest respective cut-off limit of 2.60, indicating that all the banks are in the 'Safe' zone and that there is no impending danger of bankruptcy. The intercept value of +3.25 pushed the Z scores to more than eight scores. The Z-score of Private sector banks was around 4.0 – 5.0 way above the cut-off range of 2.60, showing that all the banks

are in the safe zone. The result indicated that there is a need to revise the cut-off limits of the model.

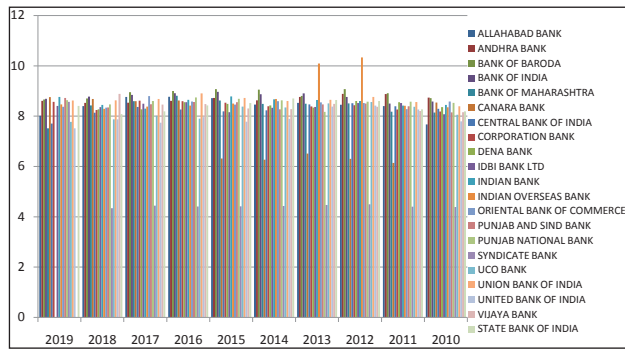


Fig. 3: Z-scores of Public sector banks using Emerging market Z-score model



Fig. 4: Z-scores of Private sector banks using Emerging market Z-score model

Earlier studies conducted to check the accuracy of the Altman model had the following results. The accuracy of the Z-score model is questionable for predicting the financial distress of European banks regarding the emerging market (Manousaridis, 2017). Kittur (2019) investigated the financial distress of Indian Commercial banks using Altman Z-score model and Emerging market Z-score model using Non-performing assets (NPA) as a benchmark stability indicator. The result showed that due to the distinctiveness of the Indian banking sector both model does not generate any better

results. Barbullushi and Dragusha found that the Altman Z-score model has the highest accuracy in predicting the financial distress of commercial firms (big entities) of North Albania. Chiaramonte *et al.* (2015) indicated that the Z-score model has the highest accuracy in predicting financial distress samples of European banks from 12 countries from 2001 to 2011. Al-Manaseer and Al-Oshaibat (2018) investigated the validity of the Z-score model, and their study found that Altman Z-score has high predictive power. Meeampol (2014) examined the listed company’s financial distress on Thailand’s stock exchange (SET) using the Z-score model and emerging market score. His study concluded that Altman Z-score fitted well in comparison to Emerging market Z-score model with the Thailand Stock Market even though Thailand is an emerging economy.

### Comparison of Z-score of Public and Private sector banks

An independent sample t-test was conducted to compare the Z-score of Public and Private sectors banks of India. There is significant difference in the z-scores of Public sector banks ( $M = 1.07, SD = 0.36$ ) and Private sector banks, ( $M = 0.45, SD = 0.05$ );  $t(20.95) = 0.79, p = .00$  (two tailed). The p value is less than .05 indicating that there was a significant difference in the z-scores of Public and private sector banks (Table 3 and 4).

Table 3: Group Statistics

	Banks	N	Mean	Std. Deviation	Std. Error Mean
Z-score	Public sector banks	21	1.0772	.36984	.08071
	Private sector banks	19	.4501	.05445	.01249

Table 4: Independent Samples Test

		Levene’s Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2 tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower		Upper
Z score	Equal variances assumed	7.703	0.009	7.311	38	0.000	0.62709	0.08578	0.45344	0.80073
	Equal variances not assumed			7.679	20.95	0.000	0.62709	0.08167	0.45723	0.79694



## CONCLUSION

The results of both models (Altman Z-score model and Emerging market Z-score model) separately provided outcomes that were two extremes in the opposite direction. The findings of the emerging market Z-score model were more relatable to real-life observed (during the period selected for study) scenarios in the banks, i.e., both public sector as well private sector banks are in the safe zone. The emerging market Z-score model fits better than the Altman Z-score model when applied to the Indian commercial banks listed on National Stock Exchange (NSE). The findings of the study suggested that the emerging market Z-score is a robust tool and is useful in the prediction of potential financial distress of banks.

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