

Altman Z-Score Model Effects of Non-Performing Assets (NPAs) in Public and Private Bank In India

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Abstract- The study aims to measure the effectiveness of Altman's Z-score model using Non-Performing Assets (NPA) as a level fixture index. Paper examines if Altman's Z-score model captures the decline in the financial health of the banks caused by the NPAs. The sample size is taken in selected two public (CBI & PNB) & two private sector banks (ICICI & HDFC). The study is based on secondary data & data will be collected for the last five years 2014 to 2018. The findings of this paper suggest that, due to the uniqueness of the Indian banking sector during the NPA crisis, the 'Emerging Market Model' does not produce any significantly better results. Therefore, there is a future scope to develop a tailor-made model suitable to the Indian Banking sector.

Keyword:- NON-PERFORMING ASSETS (NPA), ALTMAN MODEL, Z-SCORES, BANKS.

Introduction- Banking industry in India is a large cluster of varied banking institutions which consists id public sector bank and private sector bank. The banking activities span around many significant small and large industry which is competing against the odds of global contain risks and domestic policy failures. One major consequence of this has been a significant increase in the non-performing assets (NPAs), which is spiraled out of control and the policymakers are grappling hard to have a hold on it. This adversity has mainly affected the public sector banks and private sector banks in India, who are two major competitive frontrunners and driving forces of the Indian Banking sector. This would lead to the unavailability of reliable data which could discourage the investors and consumers form counting a fair analysis of the solvency situation of the banks. So, one solution to this could be using a bankruptcy prediction model that could help do a logical using the financial statements published by the banks. To assess this, this paper considers the distress to be in the form of the ongoing NPA crisis in India and thus moves forward holding this as a stability benchmark indicator of distress with a focus 2 public sector and 2 private sector banks that are impacted by the NPA crisis. The bankruptcy prediction models used in this study is a model developed by Edward Altman, known as the Altman's Z-score model.

Literature Review-

Altman (1968), analyzed the Z-score formula intending to provide a more effective financial assessment tool to help lenders and risk analysts in their estimations. He used instead, multi discriminant analysis since this allowed the use of a model which could treat binary variables as a dependent to explain the behavior of two different groups. By that time multi-discriminant analysis as used merely by behavioral and biological sciences.

Altman (2000, 2002), repeatedly analyzed this revised his models to make it available to different economic life conditions and to advance its prediction accuracy figures.

Jaslene, Vinay & Mitra (2019), investigate panel data 46 Indian banks with 31 bank-specific financial ratios over the years 2007 to 2014. These ratios mirror capableness, liquidity, solvency, profitability, capital adequacy and business development capacity aspects across Indian banks that affect non-performing assets. Banks followed an aggressive growth strategy they would witness higher NPAs. These authors used the GMM(2SLS) method using the cross-section weights that had an r-square of 86%. These authors found that a significant intermediation cost ratio helps banks agents spend more time and effort.

Dudhe (2017), analysis the policies followed by the banks to tackle the NPAs and suggests a multi-pronged strategy for the speedy recovery of NPAs, in the banking sector. The researcher is applying the panel regression. Improvement in the recovery of loan banks should develop new recovery programs for over dues, monitoring accounts, keeping regular contact with borrowers.

Mittal & Suneja (2017), the study also compares the performance of the public sector banks with private sector banks. The study shows that the magnitude of NPAs is increasing publicly sector banks as compared to the non-public sector banks. Therefore banks need to effectively control their NPAs to increase their profitability and efficiency.

Majid & Seema (2019), examined the Indian banking sector (the J&K Bank Ltd.) is facing a serious problem of rising NPA. A high level of NPAs suggests a high probability of a large number of credit defaults that affect the overall probability and net worth of banks and jointly erodes the worth of the assets. To improve the efficiency and profitability of banks (the J&K Bank Ltd.) the NPA needs to be reduced and controlled at the lowest possible level.

Tripathi, Kushwaha, Mewada (2016), analyzed in this study are embracing global best practices with a dream to fortify the keeping money area. A few prudential and provisioning standards have been presented, and these are pressurizing banks to enhance productivity and trim down NPAs to enhance the monetary well being in the keeping money framework. The study watched that people in general area banks have accomplished a more noteworthy entrance contrasted with the private segment banks versus the weaker areas.

Altman-Z score model and Methodology:

In 1968, Edward I Altman (1968) developed and presented a multi-discriminant model which computed a Z-score, as an assessment tool to assist risk analysts. He considered that univariate prediction models served in most cases as indicators and not as predictors of bankruptcy. The formula uses a statistical technique known as multiple discriminant analysis (MDA), by which Altman attempted to predict defaults by use of the following five accounting ratios (Hayes et al., 2010).

The final discriminant function estimated by Altman in 1968, is as follows (Altman et al., 2014)

$$= 1.2 X_1 + 1.4 X_2 + 3.3 X_3 + 0.6 X_4 + 1.0 X_5 \dots \dots \dots \text{Equation 1}$$

Where, X_1 = Working capital/Total assets

X_2 = Retained Earnings/Total assets

X_3 = Earnings before interest and taxes/Total assets

X_4 = Market value of equity/Book value of total liabilities

X_5 = Sales/Total assets

Z = Overall Index

Cut off-limits:

$Z > 2.99$ - "Safe" Zone

$1.8 < Z < 2.99$ - "Grey" Zone

$1.9 < Z < 1.80$ - "Distress" Zone

However, the above original Z-Score Model was based on the market value of the firm and was thus applicable only to publicly traded companies. In 1983, Altman emphasized that the Z-Score Model is a publicly-traded firm model and ad hoc adjustments are not scientifically valid. Therefore, Altman (1983) re-estimated the model substituting the book value of equity for the market value in X_4 . Using the same data, Altman extracted the following revised Z-Score Private Firm Model:

$$= 0.717 X_1 + 0.847 X_2 + 3.107 X_3 + 0.420 X_4 + 0.998 X_5 \dots \text{Equation 2}$$

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

Cut off-limits: $Z > 2.90$ - "Safe" Zone

$1.23 < Z < 2.90$ - "Grey" Zone

$Z < 1.23$ - "Distress" Zone

Altman, improving upon the work done by himself (1977), developed a four-variable Z-Score model in collaboration with Hotchkiss (2006) for non-manufacturing firms. He excluded the Sales/Total assets ratio X_5 from this revised model, because of a potential industry effect. The industry effect is more likely to take place when this kind of industry-sensitive variable (asset turnover) is included in the model. (Altman 1983).

$$= 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4 \dots \text{Equation 3}$$

Cut off limits: $Z > 2.6$ - "Safe" Zone

$1.1 < Z < 2.6$ - "Grey" Zone

$Z < 1.1$ - "Distress" Zone

However, this model did not cater to the needs of emerging markets. Recognizing this need, Altman tweaked the model equation by additionally adding a constant of 3.25 to its existing equation. Heine & Altman (2011) explains that the constant term of +3.25 was added, to standardize the scores with a score of zero (0) equated to a D (default) rated bond. However, the set of cut off limits remain the same as above, to categorize the firms into solvency zones.

$$= 3.25 + 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4 \dots \text{Equation 4}$$

Cut off limits: $Z > 2.6$ - "Safe" Zone

$1.1 < Z < 2.6$ - "Grey" Zone

$Z < 1.1$ - "Distress" Zone

As regards the emerging markets, there is one more model developed by Altman (2017) and it is called Z" Score Model for Manufacturers, Non-Manufacturer Industrials; Developed and Emerging Market Credits. Here, the model equation remains the same as above in the emerging market model, but the cut off-limits are different. Altman, Hatzell, and Peck (1995) have applied this enhanced Z" Score model to emerging market corporates, specifically Mexican firms that had issued Eurobonds denominated in U.S. dollars.

$$Z'' = 3.25 + 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4 \dots \text{Equation 5}$$

Cut off-limits:

$Z'' > 5.85$ - "Safe" Zone

$4.35 < Z'' < 5.85$ - “Grey” Zone

$Z'' < 4.35$ - “Distress” Zone

Ratios applicable to both the models:

Z = the score and X = the independent variables (ratios of)

X1: Working Capital/Total Assets

X2: Retained Earnings/Total Assets

X3: EBIT/Total Assets

X4: Book Value Equity/Total liabilities

X5 Sales/Total Assets ratio

- X1 Working capital / Total asset- Working capital could be a common live of a company's liquidity, efficiency, and overall health. Total assets show the general assets of banks together with each short and long-run. The WC/TA ratio is a sign of a bank's liquidity and ability to meet the creditor's short-term obligations.
- X2 Retained earnings / Total assets- Retained earnings are the amount carried out to the coming years from net earnings. Accumulated maintained Earnings to Total quality (TA) is that the quantitative relation that measures the accumulated profitability of the banks.
- X3 Operating earnings / Total assets- Earnings before Interest and Taxes (EBIT) shows the operating profit of banks. EBIT to Total Asset measures the operating efficiency of an organization. The value of this ratio indicates the capacity of the firm to generate satisfactory earnings to pay off its fixed obligation like interest.
- X4 Book value of equity / total liabilities- This is the ratio of the Book value of shareholder's Equity to total liabilities. This ratio indicates the long-term financial soundness of the banks. Having a 1:1 equity debt mix is considered as quite good, whereas excessive debt represents the danger of insolvency.
- X5 Sales/Total Assets ratio- This is the standard capital-turnover ratio illustrating the sales-generating the ability of the assets of a firm. It refers to the aptitude of management in coping with competitive conditions. This ratio was dropped in the Z'' -Score model.

In this paper, the author uses the Altman model equation 3 developed for the non-manufacturing firms and Altman model equation 4 developed for the emerging markets to calculate and compare the Z-Scores. This is done to analyze if one model suits the Indian banking sector better than the other.

Methodology : This study use for analysis in Altman Z-score model. and study period in last five year 2014 to 2018.

Hypothesis : H0: There is no significant different in analysis Altman Z-score model.

Analysis :

Table: Summary of Non-Performing Assets of Public and Private sector bank

Bank's & Year	2014	2015	2016	2017	2018
Punjab National Bank	25695	55818	55370	86620	86620
Central Bank of India	11500	11873	22721	27251	32874
ICICI	10506	15095	26221	42159	53240
HDFC	2989	3438	4393	30848	42754

Table: Summary of Z score of Public and Private sector bank using Original Altman Model

Bank & Year	2014	2015	2016	2017	2018
Punjab National Bank	4.7386	5.0035	5.0906	5.1509	5.0815
Central Bank of India	4.4308	4.7316	4.6199	4.6673	4.6694
ICICI	5.1787	5.3469	5.2484	4.9432	4.8114
HDFC	5.3441	5.0896	5.3230	4.9541	4.9861

Table: Summary of financial figures of Public and Private sector bank

Punjab National Bank:-

Year	2018	2017	2016	2015	2014
Total Assets	766840	720823	667793	603334	550748
Total Liabilities	729450	682727	632328	564254	516261
Working Capital	533812	507565	485203	431295	386713
Retained Earning	0	1325	0	2249	2975
EBIT	13498	34294	26375	33717	31768
Book Value of Equity	37390	38096	35465	39080	34487

Central Bank of India :-

Year	2018	2017	2016	2015	2014
Total Assets	326860	333983	306018	312472	290266
Total Liabilities	312013	319920	291631	296829	276278
Working Capital	208425	223631	196552	198882	187158
Retained Earning	0	0	0	522	0
EBIT	9623	14558	16153	20052	16938
Book Value of Equity	14855	14063	14387	15643	12331

HDFC:-

Year	2018	2017	2016	2015	2014
Total Assets	1063990	863962	708939	590576	491658
Total Liabilities	957693	774499	636262	528567	448179
Working Capital	772363	589041	504892	388437	326364
Retained Earning	14164	11203	9837	8173	6867
EBIT	66844	58306	51268	41403	35425
Book Value of Equity	106295	89462	72678	62010	43479

ICICI:-

Year	2018	2017	2016	2015	2014
Total Assets	882659	775159	723856	648784	596882
Total Liabilities	780508	678256	636945	568362	523676
Working Capital	635086	565186	515156	423096	378180
Retained Earning	5828	8331	6808	8270	7162
EBIT	39374	43698	43711	45866	41666
Book Value of Equity	102150	96903	86911	80422	73207

Conclusion:-

In this paper, the financial health of the Indian Public & Private Sector Banks was studied with data spreading across 5 years from 2014 to 2018 using Altman's Z-score models. This paper finds that, as regards the solvency categorization of the banks, both the Altman's model that was used resulted in similar findings despite having a different cut off-limits, because the Z-scores classified all the banks as safe for bankruptcy. Also, the prevalent distress due to the NPAs in the Indian banking sector, especially of the public sector banks is found to be marginally reflected in the ratios chosen by the Altman model. As regards the Z-scores of the Pre-NPA crisis period. This paper contributes to the literature, towards the research on the effects of deterioration of stability indicators such as NPAs, which are unique to financial firms. Perhaps, Altman's models could explicitly incorporate NPAs as a direct variable in their equations applicable to the banking industry.

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