

A Comparative Study on Analyzing the Solvency of The Indian Public, Private and Foreign Sector Commercial Banks Using Modified Altman Z-Score

OPJU BUSINESS REVIEW
1-10, (2022)
Published online in OPJU
University
(<http://www.opju.ac.in/opjubr/>)

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Abstract

The financial solvency of the banks is the backbone of the economic stability of a country. Evaluating and predicting the vulnerability of banks is crucial not only for the banks' management but also considered important by the creditors, investors, depositors, government, and policymakers. This study is trying to accomplish the objective of evaluating the financial solvency of Indian commercial banks. Modified Altman Z-score developed by Edward I. Altman in 1995 calculated for the Indian commercial banks for a period from F. Y. 2016-2020. The Study comprised 77 banks covering 21 public sector, 19 private sector and 37 foreign sector banks. This study further examined the statistical independence of all the three groups taken. The findings claim that private sector banks are more solvent than public sector banks. While comparing with the foreign sector banks, both public and private sector banks having less Z-Score. However, the results supporting the previous shreds of evidence that Indian commercial banks are in the safe zone. This independent test shows that there are significant differences among all the three groups taken in the study. Further, the regression analysis outcome claims the statistically significance of each component of Altman Z-score. The originality of the study is that it covers all the Indian commercial banks. Previous studies do not find any evidence of the foreign sector banks in the Indian commercial banking system. The findings have a larger application for the managers and policymakers to prevent the adversity of bankruptcy in Indian commercial banks. Researcher can further extend this study by including the impact of the Covid-19 period, which may be compared with the prior period to check and predict the solvency of the Indian banks.

Keywords: *Solvency, Commercial Bank, Altman Z-Score*

Introduction

There is not any particular definition of financial stability of an economic system as different measures have been adopted for that in previous research. One definition given by Padoa-Schioppa (2003) is that financial stability is the ability of the financial system to absorb the adverse effect of uncertainty and external shocks. Banks, among other financial intermediaries, solve the problem of uncertainty and external shocks by agglomerating and allocating the capital to the best investment opportunities and monitors the effective use of that capital (Stiglitz, 1998).

Banking institutions are one of the important constituents of the financial system of any economy. Thus, solvency of banking firms matters for the economic development of the nation. Solvency of banking institutions depends on its compliance with the regulations and meeting its expansions and growth plans (Ebiringa, 2011). Also, the bank's management obliged to give a better rate of return and growth to the investment of the shareholders (Ongore and Kusa, 2013). In India, RBI has also undertaken significant regulatory actions for maintenance of integrity and resilience of banking institutions. Financial risk imposed by the 2008 Global

Financial Crisis results in failure and distress of many enormous giants globally. Thus, Banks distress measurement is one of the debatable areas. Altman Z score is one of the financial distress measures introduced by the Edward I. Altman (1968) who is a pioneer in failure prediction model using financial indicators of a company. This score is revised in 2000 and 2002 in order to make its use in different economic condition. A high accuracy makes its large applicability in research areas focusing on the companies' failures prediction (Bolat, 2017). Particularly, the use is limited to only large-sized companies listed on the stock exchange. This study is using a specified Altman Z-Score model applied in non-production companies in emerging markets as the use is also recommended in earlier studies also such as Ghosn, (2019) and Bolat (2017). The revised Altman Z-Score is used to predicting the solvency of Indian commercial banks taking five years.

In India, however, many studies had used this measure to analyse the distress in banking firms (Joshi, 2020; Motwani *et al.*, 2021; Pradhan, 2014; Sharma, 2013). These all studies were surrounded through either the public sector banks or public and private sector both, there is paucity of literature in the Indian banking that gives evidence for the overall banking sector including foreign banks also. This study has analysed the Indian public, private and foreign sector commercial banks comparatively to check the solvency in all the three categories of the banks. First objective of the study aims to check the efficiency of the Indian public, private and foreign sector commercial banks using Altman Z-Score. Further, the statistical difference of the Altman Z-Score value across all the three groups of the Indian commercial banks have been analysed. Also, it aims to analyse the statistical significance of each element of Altman Z-score in the Indian commercial banks.

Thus, this study has provided an overall view of the Indian banking sector regarding the distress position and thereby helps the various stakeholders in their decision-making process. Through the comparative analysis of the distress position of the banks the results claims that the private sector banks are in better position than public and foreign sector banks in terms of solvency. The findings would be used by the Indian financial regulators while policy-making decisions and during regulatory checking. The structure of the study firstly gives a comprehensive review of the relevant literature. Then the research methodology has been given to provide the design and analytical process of the study. The next section has provided the results and discussion which has been followed by the conclusion.

Review of Literature

Evaluating the financial position of banks is inevitable to make sure the growth and development of an economy. Various financial measures have been adopted in previous literature for this purpose. Capital Adequacy Ratio, liquidity, efficiency and hybrid model, like CAMELS, has been used widely in previous studies. Yet, the extensive research on evaluation of distress position needs to be explored. In this section, firstly an attempt is made to show the incentives of widely use of Altman Z-score Model in distress prediction. Then, the review of the relevant studies have been given.

While analysing the Z-Score model for a period from 2002 to 2008, it was found that the model predicting the banks failures effectively in Greece (Gerantonis *et al.*, 2009). They had claimed that this model can predict 54% of banks failure before one year of bankruptcy and the same is found by the other researchers in Greece (Christopoulos *et. al.*, 2008; Vergos *et al.*, 2006).

Manaseer and Al-Oshaibat (2018) also found the high predictive power of Altman Z-Score in their study of insurance companies listed in Amman Stock Exchange during a period of 2011-2016.

Further, Altman *et al.* (2017) claims that the use of the general Altman Z-score model performs very well in most of the countries. They found the prediction accuracy 0.75 approximately while classification accuracy which was above 0.90 approximately can be further improved by adding some country specific variables. Thus the widely used Altman Z-score is an efficient distress measurement tools has incentivise its adoption to provide further evidences.

Previous studies evaluating the solvency position of banks have come out with different findings. A study of 23 banks in Kazakhstan (Bolat, 2017) which analysed the stability using Altman Z-score and Bankometer model for a period of five years found that banks insolvency risk is between the range of 4.3% to 8.7%. While the Bankometer model does not show any distress in those banks. Empirical study made by the Idree (2021) found that among the Mangolian banks, 12 banks are in 'healthy condition during first three years of the study. For the next two years, the 11 banks are in 'Safe Zone' while the average score for all the banks was found 3.71 in the last year. Study suggest that lower scoring banks need to improve their managerial efficiency.

Using the annual financial statement of 29 Indonesian banks that had gone public, Khaddafi *et al.* (2017), had found that 14 banks out of all the banks taken were in a state of bankruptcy for the 3 years of study period. In another study of Ouma and Kirori (2019) found the opposite results. They claimed that in Kenyan commercial banks system, both small and medium sized banks are financially stable throughout the study period. Qamruzzaman (2014) had found the dissimilarities in the finding of Bankometer-S score and Altman Z-score results in Bangladesh private commercial banks during 2008-2012.

Further, there are many Indian studies which have studied the financial status of the Indian private and public sector commercial banks found the mixed evidences of financial position. Nandi and Chaudhary (2011) had developed an equation to predict the future bankruptcy of Indian banks using Altman Z-score. In another study by Chotalia (2012), found that the financial health of the Indian private sector banks during the period of 2007-2012 is solvent as they fall in 'Safe Zone'. Also, reported the possibility of financial distress among some of those banks. The findings of Sharma (2013) had concluded that only two banks were close to distress position among the Indian public and private sector banks. Tandon *et al.* (2015), had found the same results in 5 public and 5 private sector commercial banks in India.

Thus, the scenario of Indian banks is stable as other studies also showed in their research (Pardhan, 2014; Joshi, 2020; Motwani *et al.*, 2021). However, there is gap in this area regarding the inclusion of foreign sector banks also need to be explored. This study is trying to bridge this gap by examining the Alman Z-score in the public, private and the foreign sector commercial banks in Indian banking system.

Research Methodology

Data and Sample

The study has based on the secondary data of the Indian commercial banks and used the Prowess Database of CMIE and RBI Database of Indian Economy as source of data. The five-

year study period has been taken from the financial year 2016 to 2020. Study has comprised the data of a total no. of 77 banks that includes the 21 public sector banks, 19 private sector banks and 37 foreign sector banks.

Model and Tools used in the study

Modified Altman Z-score model developed in 1995 applies to the emerging market has been used to examine the solvency of the Indian commercial banks. The study is descriptive as well as empirical in nature. The statistical tools used for the evaluation of the data is Kruskal-Wallis Test which has been performed after checking the normality and similar variance assumptions. To examine the significance of each element of Altman Z-score, Multiple Linear Regression has been performed using the Stata 14 analytical software.

Data Description

Modified Altman Z-score comprising the following formula:

$$Z\text{-score} = 3.25 + 6.56(X_1) + 3.26(X_2) + 6.72(X_3) + 1.05(X_4)$$

This score comprising the four financial elements, the description of these is given in the Table 1.

Table 1: Description and Interpretation of Elements used in Modified Altman Z-score

Elements	Description	Interpretation
X ₁	Ratio of Working Capital to Total Assets	Showing the ability of a firm to meet its short-term liabilities
X ₂	Ratio of Retained Earnings to Total Assets	A higher ratio depicts the lower dependence on debt capital
X ₃	Return (EBIT) to Total Assets	Indicating the operating efficiency of the firm
X ₄	Market value of Equity or book value of Equity/Total Liabilities	Indicating the long-term solvency of company

Expected or cut-off value of Z-score

If, Z-score < 1.1 (Distress zone, high probability of banks' bankruptcy);

1.1 < Z-score < 2.6 (Grey zone, probability of distress is not high);

Z-score > 2.6 (Green zone, probability of distress is very less)

Results and Evaluations

Descriptive Outcomes and observations

Descriptive results have been presented in the Table II, showing the value of Z-score for three groups of the Banks corresponding to the year. From the table it could be clearly visible except the public sector banks, all other groups were in safe zone for all the five years taken in the study. Further, in public sector banks, year of 2016 and 2017 are safer in terms of solvency than 2018-2020. The negative values in these three years have shown the instability and close to insolvency position in public sector banks. The financial situation of foreign sector banks is

solvent across the study period, although in the year of 2018, the value of Z score is less in comparison to other years. While the private banks are in safe position throughout the study as per the value of Z-score.

In Table III and Table IV value of Altman Z-score has been shown for individual banks. As the table has shown that the value of Z-score are less in public sector banks in comparison of private sector and foreign sector banks. While calculating the value it has been observed that the Return on Assets (ROA) is the main reason for the low Z-score value or indicating the high chances of distress among most of the public sector banks. The results also states that Panjab and Sind Bank, Bank of India and Canara Bank are in grey area while only 5 banks are in healthy position.

Table II: Altman Z-score among banks across the study period

Banks/Years	2016	2017	2018	2019	2020	Average
All Banks	7.920	7.484	2.476	3.031	7.262	5.634
Private Sector	10.151	11.001	8.871	7.046	7.429	8.899
Public Sector	2.288	2.934	-3.961	-6.500	-0.750	-1.198
Foreign Sector	11.334	8.535	2.537	8.567	15.114	9.217

For private sector Banks, the results are in favour of the healthy position and the value of Z-score is above the cut-off score limit of 2.6. Where HDFC Bank has the highest score with a value of 15.77 which is followed by IndusInd Bank LTD, Kotak Mahindra Bank LTD, DCB Bank Ltd, Nainital Bank LTD and RBL Bank LTD.

Table III: Z-score Values of the Indian Public, Private Sector Commercial Bank

Public Sector Banks	Z Z-score	Private Sector Banks	Z-score
Allahabad Bank	-7.257	Axis Bank Ltd.	8.888
Andhra Bank	-0.032	City Union Bank Ltd.	2.673
Bank Of Baroda	3.230	DCB Bank Ltd.	10.533
Bank Of India	2.291	The Dhanalakshmi Bank Ltd.	3.949
Bank Of Maharashtra	-1.897	Federal Bank Ltd.	9.754
Canara Bank	2.107	HDFC Bank Ltd.	15.774
Central Bank of India	-2.419	ICICI Bank Ltd.	9.527
Corporation Bank	-4.354	IDFC Bank Ltd.	3.357
Dena Bank	-8.163	IndusInd Bank Ltd.	14.877
IDBI Bank Limited	-8.648	Karnataka Bank Ltd.	9.349
Indian Bank	6.343	Karur Vysya Bank Ltd.	8.998
Indian Overseas Bank	-7.825	Kotak Mahindra Bank Ltd.	13.623
Oriental Bank of Commerce	-0.965	Lakshmi Vilas Bank Ltd.	2.713
Punjab And Sind Bank	1.855	Nainital Bank Ltd.	11.326
Punjab National Bank	-0.393	RBL Bank Ltd.	11.758

State Bank of India	5.886	South Indian Bank Ltd.	8.534
Syndicate Bank	-1.164	Tamilnad Mercantile Bank Ltd.	9.846
UCO Bank	-5.058	Yes Bank Ltd.	4.707
Union Bank of India	3.089		

Table IV: Z-score Values of Indian Foreign Sector Commercial Bank

Foreign Sector Banks	Z score	Foreign Sector Banks	Z score
A B Bank Ltd.	29.049	Industrial & Commercial Bank of China Ltd.	19.003
Abu Dhabi Commercial Bank Ltd.	-2.490	Industrial Bank of Korea	24.706
American Express Banking Corpn.	3.669	J.P. Morgan Chase Bank, National Association	-40.908
Australia & New Zealand Banking Group Ltd.	8.646	J S C Ltb Bank	18.511
Bank Of America N A	19.214	Krung Thai Bank Public Co. Ltd.	18.186
Bank Of Bahrain & Kuwait Bsc	6.947	Mizuho Bank Ltd.	13.067
Bank Of Ceylon	24.501	National Australia Bank Ltd.	4.615
Bank Of Nova Scotia	0.000	Pt Bank Maybank Indonesia T B K	-4.074
Barclays Bank Plc	12.162	S B E R Bank	30.676
Citibank N A	20.188	S B M Bank (India) Ltd.	-22.360
Cooperative Rabobank U A	-6.554	Shinhan Bank	10.916
Credit Agricole Corporate & Invst. Bank	1.591	Societe Generale	6.397
Credit Suisse AG (Mumbai)	10.736	Sonali Bank	15.940
D B S Bank India Ltd. (Take any one)	2.814	Standard Chartered Bank - India Branches	13.381
D B S Bank Ltd.	12.657	Sumitomo Mitsui Banking Corpn.	13.525
Deutsche Bank A G	6.342	United Overseas Bank - Mumbai Branch	11.339
Doha Bank Q S C	-2.090	Westpac Banking Corpn.	13.623
Firststrand Bank Ltd.	13.770	Woori Bank	12.443
Hongkong & Shanghai Banking Corpn. Ltd.	12.437		

Table V has depicted the results for the summary of Z-score among Indian Commercial banks. The mean Z-score in public sector banks i.e., -1.198 is less than the private (8.884) and foreign sector banks (8.989). The value of standard deviation is higher among foreign sector banks gives a second place to public sector and private sector banks having the least.

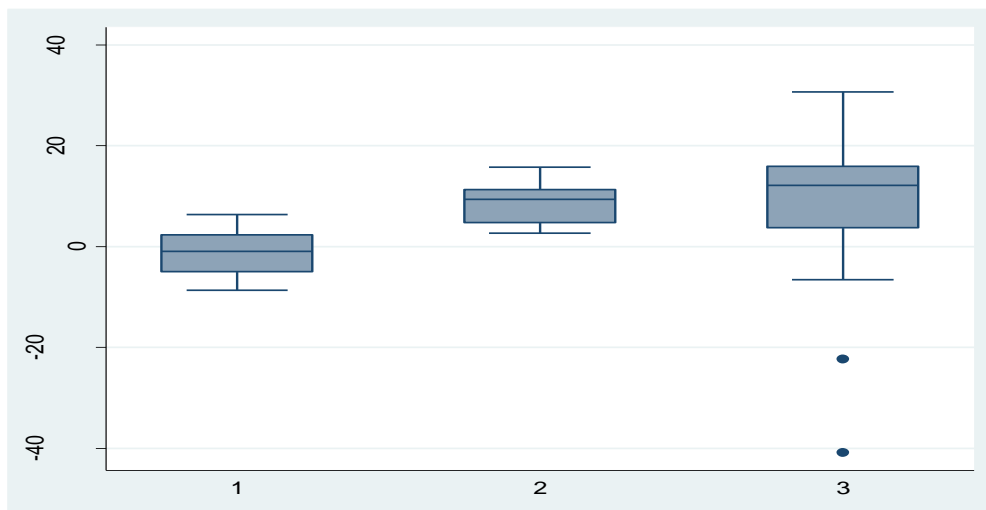
Table V: Summary of Z-score among Indian commercial banks

Banks	Mean	Std. Dev.
Public	-1.198	4.640
Private	8.884	3.903
Foreign	8.989	13.388

Results for Statistical difference of Z-score among Indian Commercial banks

Further, to check the statistical difference among the three groups of the banks taken in the study, assumption of normality of the data is checked. Levene's test is one of the tests to check the homogeneity of variance of the groups. The results of the Levene's Test has claimed that variance of the groups are not equal and have a degree of freedom of value 2. And value of F-statistics is 0.001 showing the unequal variance distribution among the banks. Also, the condition of equality of means when checked by the Kolmogorov-Smirnov test using a pair at one time, has also violated. Thus, the data has not followed in the category of parametric and need has arises to check the distribution using a non-parametric test.

For checking the statistical distribution, Kruskal-Wallis test, a non-parametric test has performed. Before performing the Kruskal-Wallis test, a three box-plots graph (1) has been presented that showing the distribution of Z-score among three groups of the Indian commercial banks.

**Graph 1: Box-plot Distribution among Indian Commercial Banks**

From the Graph 1, it has concluded that Z-score of foreign sector banks (3) is higher than the private (2) and public (1) sector banks. Whereas variance distribution between public sector group and private sector group is similar in comparison to third group.

Table VI: Kruskal-Wallis equality-of- population Rank test

Banks	Observation	Rank Sum
Public Sector	21	374.00
Private Sector	19	866.00
Foreign Sector	37	1763.00
Chi-squared=26.013; p-value= 0.0001		

The results of non-parametric test have been shown in Table VI and claimed that there is significant statistical distribution among the three categories of Indian commercial banks. Having a value of chi-square of 26.013 the null hypothesis of the test that aims to check whether the groups have equal statistical distribution was neglected.

These results are similar to the earlier finding of the Indian studies such as Joshi (2020) and Motwani *et al.* (2021). Also, the ranks provided by the results are more in foreign sector banks than the rest of the groups. While comparing the private and public sector banks, the rank score is more in case of the private banks.

Regression results

Further, to check the significance of each element of Altman Z-score, Multiple Linear Regression analysis has performed for which the output has shown below in the Table VII. After deleting 32 observations, results have depicted a 0.988 value of R-sq. with a significant chi-square. From this results, it has concluded that each independent variable has a statistically significant effect of the financial position of the banks i.e., Altman Z-score. The coefficient value is highest in case of the capital to total assets with a positive and significant value of 7.267. While the coefficient value i.e., 2.587 is the lowest in case of retained earnings to total assets. However, the coefficient values for NCW/TA and ROA are found similar in both cases. These results are different to the earlier studies as the value of ROA coefficient is more and RE/TA is less in comparison to other studies in this area in the Indian banking sector (Joshi, 2020).

Table VII: Output of the Multiple Linear Regression Analysis

Z-score	Coefficient	Std. Error	P-value
NWC/TA	6.958	0.146	0.000***
RE/TA	2.587	0.9666	0.000***
ROA	6.722	0.005	0.000***
CAP/TA	7.267	0.249	0.000***
Cons.	3.444	0.0285	0.000***

Thus, the first part of the paper has examined the Altman Z-score in three groups of Indian banking sector. Then, the second objective of the study has fulfilled by checking the statistical distribution of Altman Z-score in the Indian commercial banks. From the above observations and statistical test, it has been cleared that among all the categories the private sector banks are in safe zone than other categories. And the results gives a slightly different findings what has been earlier shown by (Marulkar and Faniband, 2017) In this scenario it is very likely to be given more preferences to safer banks by customer while transacting with the banks.

Concluding remarks

Evaluating the financial position and checking the ability of facing the financial risk of the banks is an utmost requirement for the solvency of any market and development of the economy. This paper has contributed toward this motive by examining the Altman Z-score among Indian Public, private and foreign sector banks in the Indian commercial banking system. Taking a data of total 77 Indian commercial banks this study has found interesting outcomes and concluded that private sector banks were more financially solvent in comparison to foreign and public sector banks. The statistical difference among these three groups has also shown by the results. Study has further checked the significance of each component and concluded that the results are statistically significant for each components of Altman Z-score. Study has the implications for regulatory bodies and investors to making decisions regarding the policies and investments. As study has claimed that public sector banks were followed in risk category than other groups the government and regulatory bodies are required to frame policies to improve the position of these banks. Study can be further extended by taking a larger period of the study and other measures of solvency could also be examined to provide more evidences in this area.

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