

SOLVENCY ANALYSIS OF PUBLIC SECTOR BANKS IN INDIA USING MODIFIED ALTMAN Z-SCORE

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ABSTRACT

At present Indian banking system is growing at rapid pace. For stability in economy of the country, the solvency of banks is primary necessity. To check whether a company is financially healthy or in crisis, Altman Z-score is very useful tool. That's why this study used modified Altman Z-score i.e. Altman Z''-score to analyze solvency of selected top five public sector banks for period of five years i.e. 2017-18 to 2021-22. Testing of hypothesis done using descriptive statistics. The research findings shows that during the period of study on an average Bank of India, Canara Bank and Punjab National Bank are in grey zone which shows not high probability of bank's bankruptcy while Bank of Baroda and State Bank are in distress zone indicating more chances of bankruptcy in future.

Keywords: Indian Banking System, Public Sector Banks, Altman Z-score, Economy.

Introduction

At present India is fastest growing economy in the world. For a development and growth of the nation, banking industry plays a vital role. Bankruptcy prediction is one of the very important issue for financial stability in economy. The Z-score model for prediction of bankruptcy was introduced by Edward I. Altman, an assistant professor of finance at New York University at that time in 1968. (Altman, 1968) has developed a model by using a statistical tool, having five financial ratios to assess potential failure of companies. This model was named as Altman Z-score model and this Z-score model is applicable to publicly held manufacturing companies. Altman Z score model has been updated by Altman (Altman, 1983) and it was called as Z' model developed for privately held manufacturing companies. Another revision is made over original Z score model and a new model called Z'' which is developed for both manufacturing and non-manufacturing companies and private and public firms (Altman, 1983).

Review of Literature

While evaluating financial solvency of Indian commercial banks using Modified Altman Z-Score model for a period from 2015-16 to 2019-20, (Rani, 2022) was found that private sector banks were more solvent as compared to public sector banks and foreign banks. Further, (Renuka & Chodisetty, 2022) also evaluate financial soundness using Altman Z-score had concluded that Punjab National Bank shows higher credit risk. In another study of (Agarwal, 2018) to predict possible future failures five public sector banks selected for a period of five years starting from 2012-13 to 2016-17 concluded that State Bank of India, Punjab National Bank, Bank of Baroda, Central Bank of India have low Z-score which shows distress zone while IDBI Bank has high Z-score which shows safe zone. A study of total 29 banks consisting of private commercial banks and state owned banks in Bangladesh (M, 2015) to measure performance of banking sector using Altman Z-score for a period of five years concluded that Z-score of Islamic banks were better as compared to standard which shows that they were performing well than other banks.

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Objective of the Study

The objectives of the study are as follows:

- To examine the solvency of selected sample banks using modified Altman z-score model for the period of study.
- To predict possible future failure of sample banks using modified Altman z-score model during period of study.

Research Methodology

Sources of Data

The study is purely based on secondary data collected through published annual reports of banks, websites, journals etc.

Period of the Study

To examine solvency and predict possible future failure, sample of banks have been selected for a period of five years starting from 2017-18 to 2021-22.

Sample of the Study

Out of twelve public sector banks in India as on 31st March, 2022 top five banks are selected for the purpose of the study on the basis of advances as on this date. The list of selected sampled public sector banks are as follows:

Sr. No.	Selected Public Sector Banks
1	Bank of Baroda (BOB)
2	Bank of India (BOI)
3	Canara Bank (CB)
4	Punjab National Bank (PNB)
5	State Bank of India (SBI)

Source: Published Annual Reports of Public Sector Banks

Hypothesis of the Study

H₀: There is no significant difference in Z"-score of selected public sector banks.

H₁: There is a significant difference in Z"-score of selected public sector banks.

Analysis & Interpretation

The calculation of modified Altman z-score was done using below mentioned equation:

$$Z''\text{-score} = 6.56(X1) + 3.26(X2) + 6.72(X3) + 1.05(X4)$$

Where

X1 = Working capital to total assets ratio

X2 = Retained earning to total assets ratio

X3 = Earning before interest and taxes to total assets ratio

X4 = Book value of equity to total liabilities ratio

Element X1 shows a company's ability to meet its short term liabilities while X4 shows long-term solvency of company. X2 measures company's profitability while X3 shows operating efficiency of the company.

Cut-off value of Z"-score

Value of Z"-score	Interpretation
Z"-score < 1.1	Distress zone (High probability of bank's bankruptcy)
1.1 < Z"-score < 2.6	Grey zone (Not high probability of bank's bankruptcy)
Z"-score > 2.6	Green zone (Very less probability of bank's bankruptcy)

Source: (Altman, 1983)

Below mentioned tables and graphs showing solvency through credit risk by considering its components like working capital, retained earning, earning before interest and taxes i.e. operating profit and total assets under Altman Z"-score model.

Table 1: (Amount in Crores)

Bank of Baroda	2021-22	2020-21	2019-20	2018-19	2017-18
Cash & balance with RBI	55184.41	38841.04	32645.85	26661.73	22699.64
Balance with bank & money at call and short notice	67470.59	81571.78	89255.27	62567.89	70197.74
Total assets	1277999.83	1155364.77	1157915.52	780987.40	719999.77
Net profit of current year	7272.28	828.96	546.19	433.52	-2431.81
Dividend paid	0.00	0.00	0.00	0.00	332.79
Operating profit	9988.00	10273.00	11519.00	8092.00	12005.60
Book value of equity	61523.70	55188.78	49758.85	71582.00	62201.14
Total liabilities	1277999.83	1155364.77	1157915.52	780987.40	719999.77
Bank of India	2021-22	2020-21	2019-20	2018-19	2017-18
Cash & balance with RBI	40280.58	60697.57	29239.25	29236.56	31347.84
Balance with bank & money at call and short notice	51277.06	65883.10	57217.05	65574.92	64534.66
Total assets	734614.01	725856.45	656995.48	625222.84	609574.83
Net profit of current year	3404.70	2160.30	-2956.89	-5546.90	-6043.71
Dividend paid	0.00	0.00	0.00	0.00	0.00
Operating profit	9988.00	10273.00	11519.00	8092.00	7139.00
Book value of equity	36932.09	34568.44	26923.50	38881.29	44691.94
Total liabilities	734614.01	725856.45	656995.48	625222.84	609574.83
Canara Bank	2021-22	2020-21	2019-20	2018-19	2017-18
Cash & balance with RBI	51602.91	43111.62	22570.14	29919.02	22100.04
Balance with bank & money at call and short notice	130451.39	135296.41	45701.33	36233.67	27812.29
Total assets	1226979.67	1153675.03	723874.75	694766.69	616886.10
Net profit of current year	5678.41	5678.41	-2235.72	347.02	-4222.24
Dividend paid	0.00	0.00	0.00	0.00	0.00
Operating profit	23089.00	19689.00	9360.00	10591.00	9548.00
Book value of equity	48693.07	43862.04	50977.06	63131.73	57145.10
Total liabilities	1226979.67	1153675.03	723874.75	694766.69	616886.10
Punjab National Bank	2021-22	2020-21	2019-20	2018-19	2017-18
Cash & balance with RBI	56636.12	43958.83	38397.85	32129.13	28789.03
Balance with bank & money at call and short notice	76010.66	67390.88	37595.18	43158.91	66672.97
Total assets	1314805.02	1260632.62	830665.91	774949.46	765830.10
Net profit of current year	3456.96	2021.62	336.19	-9975.49	-12282.82
Dividend paid	0.00	0.00	0.00	0.00	0.00
Operating profit	20762.00	22159.00	14739.00	12995.00	10294.00
Book value of equity	60307.33	58435.46	59932.96	985485.89	149133.19
Total liabilities	1314805.02	1260632.62	830665.91	774949.46	765830.10
State Bank of India	2021-22	2020-21	2019-20	2018-19	2017-18
Cash & balance with RBI	257859.21	213201.54	166735.78	176932.42	150397.18
Balance with bank & money at call and short notice	136693.11	129837.17	84361.23	45557.69	41501.46
Total assets	4987597.41	4534429.63	3951393.92	3680914.25	3454752.00
Net profit of current year	31675.98	20410.47	14488.11	862.23	-6547.45
Dividend paid	3569.84	0.00	0.00	0.00	2416.27
Operating profit	75292.00	71554.00	68133.00	55436.00	59511.00
Book value of equity	240500.43	214663.68	375156.30	178554.70	177599.77
Total liabilities	4987597.41	4534429.63	3951393.92	3680914.25	3454752.00

Source: Published annual reports

X1: Working capital to total assets ratio

Working capital is important tool to measure a company's liquidity. Working capital is having direct relationship with liquidity as well as profitability and solvency. Positive working capital shows that company will be able to pay-off all short term liabilities as and when required and vice-versa. Working capital to total assets ratio is calculated by using following formula:

$$\text{Working capital to total assets} = \frac{\text{Working capital}}{\text{Total assets}}$$

Working capital is the difference between current assets and current liabilities. Total assets refers to total amount of assets owned by a company. For the purpose of study gross working capital is taken into consideration. As exhibited in table no. 2 value of X1 for all sample banks is positive which shows banks are able to pay their short term liabilities during period of the study. Value of X1 of Bank of Baroda is gradually decreasing which shows the risk of inability to meet their short-term obligations.

Table 2: Value of X1

Year	2017-18	2018-19	2019-20	2020-21	2021-22
BOB	0.129024	0.114252	0.105276	0.104221	0.095974
BOI	0.157294	0.151644	0.131593	0.174388	0.124634
CB	0.080910	0.095216	0.094314	0.154643	0.148376
PNB	0.124650	0.097152	0.091484	0.088328	0.100887
SBI	0.055546	0.060444	0.063546	0.075652	0.079107

Source: Table 1

X2: Retained earning to total assets ratio

Retained earning to total assets ratio is a good indicator of measuring company's profitability. Retained earning refers to amount of profit available after the payment of taxes and dividend to its shareholders. Generally company did not pay dividend or pay smaller amount so that it may use it for investment or re-investment and expansion of the business operations. It calculated as follows:

$$\text{Retained earning to total assets ratio} = \frac{\text{Retained earning}}{\text{Total assets}}$$

Retained earning refers to net profit after tax minus any dividend paid. Total assets refers to total amount of assets owned by a company. Negative or lower value of X2 indicates increases the risk of bankruptcy as company unable to meet its debt obligations. Table no. 3 shows that value of X2 increasing gradually for all sample banks during period of the study which indicate lesser chance of bankruptcy and bank is able to meet its obligations. All sample banks registered negative earnings i.e. profit over a period of study and afterwards its start increasing.

Table 3: Value of X2

Year	2017-18	2018-19	2019-20	2020-21	2021-22
BOB	-0.003378	0.000555	0.000472	0.000717	0.005690
BOI	-0.009915	-0.008872	-0.004501	0.002976	0.004635
CB	-0.006844	0.000499	-0.003089	0.004924	0.004628
PNB	-0.016039	-0.012872	0.000405	0.001604	0.002629
SBI	-0.002595	0.000234	0.003667	0.004501	0.005635

Source: Table 1

X3: Earning before interest and taxes to total assets ratio

Earning before interest and taxes to total assets ratio gives information regarding company's profitability. A company which is having high profit and low assets indicates chances of bankruptcy are very less because assets are able to generate larger amount of operating profit and vice-versa. Earning before interest and taxes refers to operating profits. Total assets refers to total amount of assets owned by a company. This ratio is calculated as follow:

$$\text{Earning before interest and taxes to total assets ratio} = \frac{\text{Operating profits}}{\text{Total assets}}$$

Table 4: Value of X3

Year	2017-18	2018-19	2019-20	2020-21	2021-22
BOB	0.016674	0.017269	0.017006	0.018349	0.017519
BOI	0.001171	0.012943	0.017533	0.141530	0.013596
CB	0.015780	0.015244	0.129300	0.017066	0.018818
PNB	0.013442	0.016769	0.017744	0.017578	0.015791
SBI	0.017226	0.015060	0.017243	0.015780	0.015096

Source: Table 1

X4: Book value of equity to total liabilities ratio

Book value of equity to total liabilities ratio measures financial leverage of a company. It calculated as follows:

$$\text{Book value of equity to total liabilities ratio} = \frac{\text{Book value of equity}}{\text{Total liabilities}}$$

Book value of equity refers to book value per share multiply with number of shares. High ratio shows company is aggressive in financing its growth with debt. Generally, financial institutions and banks have higher ratio because they are having high capital structure. As exhibited in table no. 4, in 2018-19 PNB having very high value of X4 which shows that bank have borrowed higher money to lend the money. Value of X4 for all sample banks is positive which shows banks are able to pay their long term liabilities during period of the study.

Table 5: Value of X4

Year	2017-18	2018-19	2019-20	2020-21	2021-22
BOB	0.086391	0.091656	0.042973	0.047767	0.048141
BOI	0.073317	0.062188	0.040980	0.047624	0.050274
CB	0.092635	0.090868	0.070422	0.038019	0.039685
PNB	0.194734	1.271678	0.072150	0.046354	0.045868
SBI	0.051407	0.048508	0.094943	0.047341	0.048220

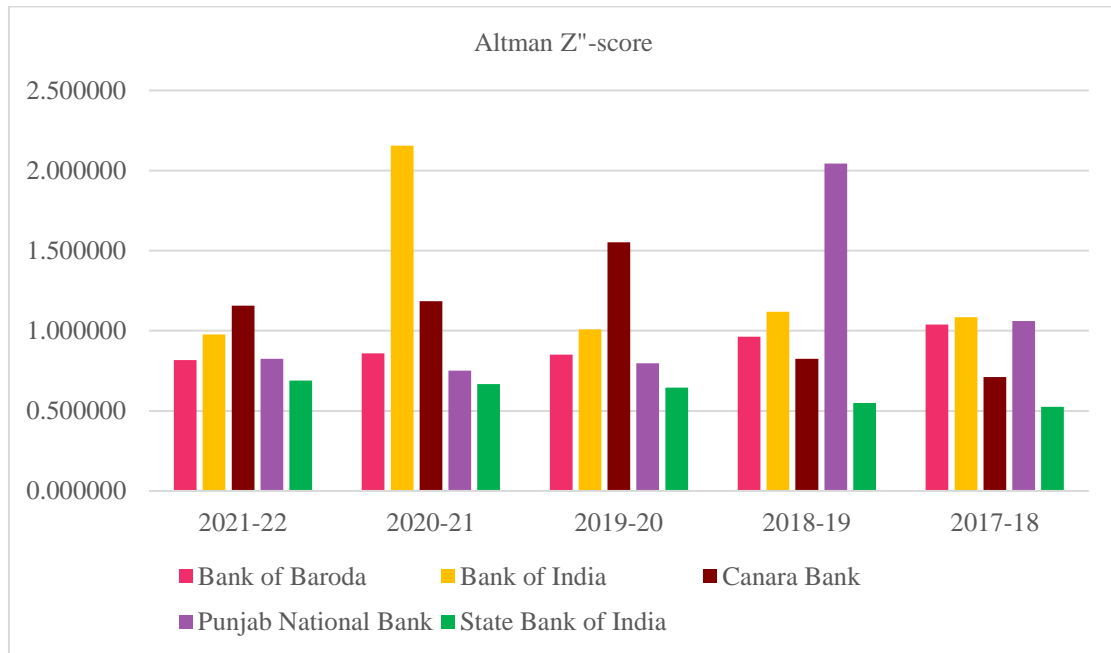
Source: Table 1

As exhibited in table no. 7, Bank of Baroda was performing very poorly as its score is less than 1.1 and over the year it's gradually decreasing. Distress zone shows high probability of bankruptcy and overall financial position of bank is insolvent during period of study. Except 2021-22, performance of Bank of India was satisfactory because it's Z"-score almost equal to 1.1 or more which shows lesser chances of insolvency in future period. During the 2017-18 and 2018-19 Canara Bank was performing poorly with less than 1.1 Z"-score which shows distress zone but overall performance shows that banks financial position is satisfactory and healthy. In the year 2017-18 and 2018-19, Z"-score of Punjab National Bank shows grey zone which shows that bank was performing well and its financial position was healthy but rest of the period of study bank was performing poor as its Z"-score below 1.1 which shows distress zone. From year 2017-18 to 2021-22, State Bank of India performing very poorly as Z"-score is below 1.1 constantly. Continuous declining trend in performance leads to higher chances of insolvency and bankruptcy.

Table 7: Z"-score analysis of sample banks

Year	2017-18	2018-19	2019-20	2020-21	2021-22	Average
BOB	1.038145	0.963589	0.851551	0.859488	0.816415	0.905838
BOI	1.084378	1.118136	1.009428	2.154774	0.976862	1.268716
CB	0.711767	0.824095	1.551469	1.185107	1.156560	1.085799
PNB	1.060231	2.043304	0.796453	0.751457	0.824666	1.095222
SBI	0.525658	0.549412	0.644379	0.666700	0.689388	0.615108

Source: Table 2,3,4,5,6

G1: Graph showing Altman Z"-score of sample banks

Source: Table 7

Table 8: Descriptive Statistics

Particulars	BOB	BOI	CB	PNB	SBI
Mean	0.905838	1.268716	1.085799	1.095222	0.615108
Median	0.859488	1.084378	1.156560	0.824666	0.644379
Standard deviation	0.092103	0.498539	0.331703	0.543305	0.073064
Min	0.816415	0.976862	0.711767	0.751457	0.525658
Max	1.038145	2.154774	1.551469	2.043304	0.689388
Confidence level (95%)	0.114362	0.619017	0.411863	0.674602	0.090721

Source: Table 7

From the table no. 8 of descriptive results, mean value of Z"-score of sample banks clearly shows that Bank of Baroda and State Bank of India are in distress zone while Bank of India, Canara Bank and Punjab National Bank are in grey zone showing satisfactory safety in terms of solvency. On an average Bank of India is having less chances of bankruptcy as compared to all other sample banks. With 95% confidence level, p value of all sample bank is more than 0.05 which shows that it failed to reject null hypothesis.

Conclusion

In India the banking sector is one of the developing and fastest growing sectors. After analysing the five public sector banking companies selected on their advances, it could be concluded that their overall financial performance is satisfactory as Z"-score of all sample banks is gradually improving year by year. Those banks which have lower Z"-score can probably lead to future failure. Constant lower Z"-score of State Bank of India indicating the high chances of distress and insolvency as compared all other sample banks during period of the study while Bank of India is having less chances of bankruptcy with average Z"-score value of 1.1 showing grey zone. For better performance banks needs to manage working capital and credit risk in future. In this highly competitive global environment it is imperative for the public sector bank to show outstanding performance in various parameters.

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