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FINANCIAL PERFORMANCE ANALYSIS OF SELECT INDIAN PUBLIC SECTOR BANKS USING ALTMAN'S Z-SCORE MODEL

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Abstract

This study aims to assess the financial performance of select public sector banks, having the highest level of gross non-performing assets, using the Altman's Z-Score model. It was found that all the select banks were in the safe zone, with the average Altman's Z-Score value being higher than the prescribed safe zone cut-off limit of 2.9. The Altman's Z-Score values differed significantly between the banks, possibly due to their varying asset sizes. However, when considered individually for each bank, the Altman's Z-Score did not exhibit statistically significant variation between the years, in the ten year study period. The Altman's Z-Score value, for the first five year period, was found to be statistically different from the last five year period when all the banks were pooled together. This may be on account of the increase in the non-performing assets in the last five year period. The results of linear regression analysis indicated that for every 1% increase in the gross non-performing assets, the Altman's Z-Score decreased by about 3.1%. However, for every 1% increase in the net profits, the Altman's Z-Score increased by about 15.31%. Hence the public sector banks not only have to keep their non-performing assets under control but also devise innovative ways to increase their profits.

Keywords: *Public Sector Banks, Altman's Z-Score Model, Multiple Regression, Correlation, ANOVA and One-Sample Kolmogorov-Smirnov Test*

JEL Code : *G17, G21, G28 and G33*

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1. Introduction

Banking industry is the catalyst, that propels the economic growth, in a formal manner. This is because finance is the life blood for any industry and it is provided mainly by the banking institutions, operating in the country. For any banking institution, lending is a predominant activity since it is the backbone of its survival and the reason for its existence. In the globalised world, business organizations periodically face downturn. This downturn, in turn, affects the banking sector, resulting in the increase of Non-Performing Assets (NPAs).

The economic growth in India is supported by a wide variety of banking institutions consisting of public and private sector banks, (both domestic and foreign), along with cooperative banks and regional rural banks. In addition, various kinds of Non-Banking Financial Companies (NBFCs) also provide credit facilities to individuals and industries. Along with a major role being assigned to the financial sector of the country, the banking institutions also assume additional responsibility for ensuring socio-economic development **(Brown, 2003; Safiullah, 2010; Olson** and **Zoubi, 2011)**. The problem of NPAs, in the Indian banking sector, has become acute in the last five years. The Reserve Bank of India (RBI) and the Government of India (GoI) counter it through a slew of policy measures. Rising level of NPAs constrain the ability of the public sector banks to lend fresh loans, thereby aggravating the slowdown in the economy. Another serious consequence is that the NPAs have the potential to threaten the very existence of banks. Hence periodically, the GoI comes to the rescue of the banks through recapitalization packages. The effect of subprime financial crisis (2007-2010), that plunged the world into recession, was contagious, affecting the movement of funds in the global financial system (**Sharma, 2013)**. Researchers opine that the activities of the banking industry should be regularly monitored, to ensure unhindered international financial flow **(Rashid** and **Nishat, 2009)**.

2. Review of Literature

The mathematical model of Z-Score, developed by **Altman (1968),** became a well-known tool of financial analysis. Altman used Multi Discriminant Analysis (MDA), for carrying out the analysis. The original model was again revised by Altman in 2000 and in 2002, so that it can be used for improving the prediction accuracy under different economic scenarios. **Ebiringa (2011)** applied the Altman's Z-Score model to three Nigerian banks for predicting distress. Considering the data, four years prior to the banks declaring their distress, the author found that the model could predict financial distress at 1% level of significance. **Cole** and **Gunther (1998),** in their research study, have compared the application of CAMEL rating and econometric forecasts for predicting bank failures. The authors observed that the accuracy of econometric analysis is more compared to CAMEL analysis because there will be a progressive loss of information provided by CAMEL rating, from the second or third quarter. **Zhang** and **Zhang (2016)** studied a sample of 629 bank holding companies in the U.S., to determine the impact of factors on the financial distress, with regard to the recent financial crisis. The authors found that housing price index and regulatory capital requirements were positively related to the Z-Score measure. In addition, non-performing loans are significant in predicting financial distress. **Sahut** and **Mili (2009)** predicted the financial distress, in banks of MENA countries, by means of bank specific and macro variables. The authors found that while indicators of monetary policy did not affect bank distress, bank capitalization and regulatory supervision need to be given due consideration

for preventing distress. **Niresh** and **Pratheepan (2015),** in their research study, considered the firms operating in the trading sector of Sri Lanka from 2010 to 2014. The authors applied Altman's original model for bankruptcy prediction. They found that all the firms were in distress or in the grey zone, with none being in the safe zone. **Chandra** and **Selvaraj (2013)** analyzed the financial health of select Indian steel companies using the Altman's Z-Score. The authors found that small companies, were in the 'grey zone' while the medium and large companies were in the 'distress zone'. None of the select companies was in the safe zone because their profits were not enough to cover their non-operating activities.

Balachandran and **Sriram (2005)** analyzed the financial solvency position of LMW company, (a manufacturer of textile machinery), using the Altman's Z-Score model. The authors did not find any significant difference between the actual and the projected Z-Scores. They concluded that the company's financial position was sound even though the industry was facing difficulties. **Bandyopadhyay (2006)** developed a model, to predict bankruptcy for Indian corporate bond sector, based on MDA and the logistic regression model. The ratios considered were leverage, turnover, liquidity and such other financial variables. The results of the study indicated that the default risk can be predicted more accurately by including the financial and non-financial parameters, in the logistic regression analysis. **Bhunia** and **Sarkar (2011)** analyzed 64 private companies in the pharmaceutical sector, using sixteen financial ratios and MDA. The ratios pertained to solvency, liquidity, profitability and efficiency of the firms. The authors concluded that MDA can act as a reliable statistical tool even though many advanced statistical tools are available. **Jan** and **Marimuthu (2015)** analyzed the bankruptcy aspect of 25 select Islamic banks, using the Altman's model. The Altman's Z-Score indicated that liquidity, insolvency and profitability (considered as performance indicators) recorded significant relationship while productivity does not have significant relationship with bankruptcy. **Ongore** and **Kusa (2013)** analyzed the financial performance of commercial banks in Kenya, using the multiple regression and Generalized Least Square models. The research findings revealed that the performance of the banks was significantly influenced by the bank specific variables (except the liquidity variable), along with the decisions of the management. However, macroeconomic factors did not have any significant influence.

3. Statement of the Problem

RBI advises Indian banks not to depend heavily on the government for funding. Instead their financial health should be judged on the basis of their ability to garner funds from the capital markets **(Reserve Bank of India, 2019).**The public sector banks received a capital of Rs. 90,000 crore and Rs. 1.06 crores in the financial years 2018 and 2019 respectively, from the government **(Ghosh, 2019)** since they were overwhelmed with the problem of impaired assets. In contrast, private and foreign banks reported capital adequacy well above the minimum level of 10.875 % (as per the regulatory norms), in March, 2019. Based on these facts, this research study aims to find out whether the select Indian public sector banks are financially sustainable, as measured by the Altman's Z-Score model.

4. Need of the Study

Table-1 compares the credit and deposit growth of public, private and foreign banks, along with the actual and projected Gross NPA (GNPA) ratios. It can be observed that banks in the private sector were far more aggressive, in both credit and deposit growth, compared to

the public sector banks. The credit growth of private sector banks was more than twice that of the public sector banks. This may be due to the rising problem of NPAs, which might have slowed down the credit growth in public sector banks. The growth of deposits was also less for the public sector banks. It was just 6.5% for public sector banks (March, 2019) while for both private and foreign banks, it was more than 17%. The GNPA ratio was calculated by dividing the total GNPA by total advances (loans) of the bank. It can be observed that the actual GNPA ratio for the public sector banks was about four times that of private and foreign bank counterparts. Moreover, the GNPA ratio of public sector banks was projected to marginally decrease from 12.6% to 12.2% (severe stress scenario), as of March, 2020. However, for private and foreign banks, it was projected to rise marginally from around 3.0% - 3.7% to 4.1% - 4.4%. The RBI wants the financial position of the public sector banks to be healthy so that they can follow the international Basel norms and thereby, compete globally. The problem of NPAs is a major roadblock in this regard. The study proposes to explore the relationship between GNPAs, net profits and the Altman's Z-Score. The results of the study may guide the public sector banks, to take suitable measures, to strengthen their balance sheet.

5. Objectives of the Study

- To evaluate the financial soundness of select Indian public sector banks based on the Altman's Z-Score model.
- To estimate the differences in the Altman's Z-score values of the select public sector banks individually as well as jointly.
- To determine the relationship between Altman's Z-Score, GNPAs and Net Profits
- To analyze the impact of the components of Altman's Z-Score on the Altman's Z-Score

6. Hypotheses of the Study

Following hypotheses were formulated, to be tested.

NH-1: There is no significant difference between the Altman's Z-Score values of the select banks.

NH-2: Individually, for each of the select ten banks, the Altman's Z-Score values do not exhibit any significant difference between the years in the ten year study period.

NH-3: There is no significant difference between the values of the Altman's Z-Score for the first five years and the next five years of the study period for all the ten banks taken together.

NH-4: Components of the Altman's Z-Score have no significant effect on it.

NH-5: GNPAs is not a significant predictor of the Altman's Z-Score.

NH-6: Net Profits is not a significant predictor of the Altman's Z-Score.

7. Research Methodology

7.1 Sample Selection

The Ministry of Finance, GoI, published a list of twenty public sector banks, along with their Gross NPAs (GNPAs), as on 31 March, 2019 **(Ministry of Finance, Government of India, 2019)**. In this study, only the first ten banks, having the largest amount of GNPAs, were chosen for the analysis and they are depicted in **Table-2.** The Table also shows the average values of GNPAs, net profits and the total assets for the first half (i.e., 2009-2010 to 2013-2014) and the second half (i.e., 2014-2015 to 2018-2019) of the study period. It can be observed that the average values of GNPAs for all the banks, had increased considerably, in the second half of the study period, compared to

the first half. The result was that the average values of net profits for all the banks (except State Bank of India), had turned negative in the second half of the study period.

7.2 Sources of Data

The secondary data were obtained from the annual reports of the ten public sector banks. Additional data for analysis and verification, were sourced from www.moneycontrol.com. The data were subjected to certain fundamental mathematical operations such as computing the ratios, before being used for the analysis.

7.3 Period of the Study

The period of study was ten years from 2009-2010 to 2018-2019.

7.4 Tools used in the Study

Altman's Z-Score model was primarily used, to determine the financial health of the select banks. The analysis of the financial data was carried out, by means of various statistical tools and techniques such as mean, correlation, ANOVA (single factor), paired sample t-Test, One-Sample Kolmogorov-Smirnov Test and regression analysis. E-Views version 10, SPSS 23 and MS-Excel were used for numerical data analysis. The five variable, Z-Score model (used for companies in the manufacturing sector) was modified, to develop a four-variable model, for the firms operating in the non-manufacturing sectors (**Altman, 1977; Altman** and **Hotchkiss, 2010**). It is expressed as:

$$Z = 6.56\,X1 + 3.26\,X2 + 6.72\,X3 + 1.05\,X4 \quad \textbf{...(1)}$$

Where,

- Z = Altman's Z-Score
- X1 = Working Capital /Total Assets
- X2 = Retained Earnings /Total Assets
- X3 = Earnings before Interest and Taxes/ Total Assets
- X4 = Book Value of Equity/Book Value of Total Liabilities

Table-3 presents the cut-off limits for the Altman's Z-score. It has three zones – Safe, Grey and Distress. A company will not face the risk of bankruptcy in the coming years if its Z-Score value was higher than the safe zone cut-off value of 2.9. Another version of the model, given by Altman, adds a constant +3.25 to equation (1), so as to accommodate the needs of the emerging economies **(Altman, 2013)**. This modified second version is expressed as:

$$Z = 3.25 + 6.56\,X1 + 3.26\,X2 + 6.72\,X3 + 1.05\,X_4 \quad \textbf{...(2)}$$

However, the cut-off limits for equation (2) would remain the same as given for equation (1). In this research study, Altman's Z-Score values, based on both the first and the second versions (i.e., equations (1) and (2) respectively) were computed.

The description of each of the components of equation (1) is given below:

(i) Z = Altman's Z-Score

(ii) X1 = Working capital /Total assets

Working capital is measured as the difference between the current assets and current liabilities. It measures the ability of the bank to meet its short-term obligations.

(iii) X2 = Retained earnings/Total assets

A high value of this ratio indicates that the bank has used more of its retained profits to finance its assets rather than being dependent upon the debt capital.

(iv) X3= Earnings Before Interest and Taxes (EBIT)/Total assets

This ratio indicates not only the operating efficiency of the bank but also its ability to generate enough earnings to pay for its expenses.

(v) X4 = Book value of equity/Total liabilities

Book value of equity refers to the capital contributed by the ordinary shareholders and the preference capital. This ratio is an indication of the long-term financial soundness of a commercial entity, without being dependent upon excessive debt capital.

8. Data Analysis

Table-4 presents the average values (for the period 2009–2010 to 2018–2019) of the two versions of Altman's Z-Score model and that of its components, for the ten select banks. It can be observed that the average values of Altman's Z-Score, for all the ten banks, were almost double that of the "Safe" zone, cut-off standard. Considering both the versions of the Altman's Z-Score model, the Bank of Baroda recorded the highest average values of 5.4683 and 8.7183 and Central Bank of India reported the lowest average values of 4.8285 and 8.0785. ANOVA (Single Factor) Test was conducted, by taking the Altman's Z-Score values of the select ten banks. The results are presented in **Table-5**. It can be observed that the value of F-statistic was 10.945814, which was greater than the F-critical value of 1.985595. Thus, **NH-1:** There is no significant difference between the Altman's Z-Score values of the select banks, was rejected. One-Sample Kolmogorov-Smirnov Test was conducted, by stating the Null Hypothesis (H_0) as: The Altman's Z-Score values for each of the select banks, follow a normal distribution. The results of this test are shown in **Tables-6(a) and 6(b).** It can be observed that the probability value or the p-value (i.e., Asymp. Sig. (2-tailed), for each of the ten banks was greater than 0.05. Hence the null hypothesis was accepted (i.e., the distribution is normal). Hence, **NH-2:** Individually, for each of the select ten banks, the Altman's Z-Score values do not exhibit any significant difference between the years in the ten year study period, was also accepted. Paired sample t-Test was carried out, to determine whether the mean difference between the first set (i.e., 2009-2010 to 2013-2014) and the second set (i.e., 2014-2015 to 2018-2019) of Altman's Z-Scores, was zero. The results are shown in **Table-7**. The p-value, for the two-tailed test was 0.006883, which was less than 0.05 or 5% level of significance. Thus, **NH-3:** There is no significant difference between the values of the Altman's Z-Score for the first five years and the next five years of the study period, for all the ten banks taken together, was rejected. Multiple linear regression analysis was performed, with Altman's Z-Score as the dependent variable and its four components as the independent variables. It is specified as:

$$\text{Altman's Z-Score}_{it} = \beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + \beta_3 X3_{it} + \beta_4 X4_{it} + \varepsilon_{it} \quad \ldots\textbf{(3)}$$

Where, β_0 is the constant term; β_1, β_2, β_3 and β_4 are the coefficients of the independent terms, $X1_{it}$, $X2_{it}$, $X3_{it}$ and $X4_{it}$ respectively; ε_{it} is the error term; i is the i^{th} term and 't' denotes the time period. The result of multiple linear regression analysis is shown in **Table-8**.

The p-value of each of the independent variables was 0.0, indicating that they were all individually significant, at 1% level of significance. The p-value of F-statistic was 0.00, indicating that all the independent variables were jointly significant, in explaining the variance in the dependent variable. Based on the above results, "**NH-4: Components of the Altman's Z-Score have no significant effect on it",** was rejected. Linear regression analysis was performed with Altman's Z-Score as the dependent variable and GNPA/Total assets as the independent variable. The yearly GNPA and the net profit values of all the banks were divided by their respective total assets so as to normalize

the effect of bank size. The results are presented in **Table-9**. The p-value of GNPA/Total Assets was 0.00001974, indicating that it was statistically significant predictor of Altman's Z-Score, at 1% level of significance. Thus, **NH-5: GNPAs is not a significant predictor of the Altman's Z-Score**, was rejected. Linear regression analysis was performed, with Altman's Z-Score as the dependent variable and Net Profit/Total assets as the independent variable. The results are presented in **Table-10**. The p-value of Net Profit/Total Assets was 0.00000105, indicating that it was statistically significant, at 1% level of significance. Hence, **NH-6: Net Profits is not a significant predictor of the Altman's Z-Score**, was rejected.

9. Findings of the Study

All the select ten banks reported Altman's Z-Score value (both the versions), well above the safe zone cut-off standard of 2.9. However, there was statistically significant difference between the ten banks, with regard to the Z-Score values. There was statistically significant difference between the Altman's Z-Score values, for the first five years and the last five years of the study period, when all the banks were pooled together. The component variable, X3 recorded the maximum contribution to the Altman's Z-score, such that a 1% increase in X3 increased the Altman's Z-score by nearly 6.72%.The coefficient of GNPA/total assets (based on the linear regression analysis), was – 3.10, indicating that a 1% increase in GNPA/ Total Assets decreased the Altman's Z-Score by about 3.1%. The coefficient of Net Profit/ Total Assets(based on the linear regression analysis), was 15.31, indicating that a 1% increase in Net Profits/Total Assets increased the Altman's Z-Score by about 15.31%.

10. Suggestions

Based on the results of this study, it becomes imperative for the public sector banks, to take proactive measures for reducing the incidences of GNPAs and also increase their profits. Instead of depending upon the generous capital infusion from the government, public sector banks, in consultation with the RBI, should devise innovative market oriented strategies to become operationally and financially self-sufficient. Thus they will be able to compete vigorously with the private and foreign banks. Moreover, government, through mergers, should create not more than 10 public sector banks of world standards, for catering to the needs of the specialized economic sectors. Then it would become easy for the RBI, to monitor and regulate the banking operations, in that sector.

11. Conclusion

This study analyzed the financial performance of the ten select public sector banks, based on the Altman's Z-Score model. The results indicated that all the banks were in the safe zone since their average Altman's Z-Score values were double that of the safe zone cut-off of 2.9. This may have been possible due to the recapitalization measures of the government, to tide over the acute problem of GNPAs. The difference in the Altman's Z-Score values between the banks, may be due to the differing size of their assets. It is observed that there was significant difference in the Altman's Z-Score value between the first half and second half of the study period (when all the banks were pooled together). This may be due to the increase in the volume of GNPAs in the second half. This fact was corroborated by the results of regression analysis, which revealed that any increase in GNPAs would reduce the value of Altman's Z-Score while an increase in net profits would increase the Altman's Z-Score.

12. Limitations of the Study

This study was limited to only ten select public sector banks of India, reporting the highest level of gross NPAs, as on March, 2019. Not all the scheduled commercial banks were taken into consideration. There may be variation in the results of the study, if different kinds of banks such as private banks, foreign banks, cooperative banks and small finance payments banks were also considered for the analysis. Secondary data sources, such as the annual reports of the select banks and data from www.moneycontrol.com were used for the analysis and there might be have some discrepancies in the data sources.

13. Scope for Further Research

This study analyzed the financial health of public sector banks, using the Altman's Z-Score model and the impact of Gross NPAs and Net profits, on the Altman's Z-Score. There are many other techniques and models, for undertaking the financial analysis. These are the CAMEL model, the Bankometer: S-score model, analysis through neural networks and other techniques such as the stress test. The studies, based on other models, can be undertaken and the results of various models can be compared. In addition, a comparative financial analysis, involving the private sector and foreign banks, with the public sector banks, can be undertaken.

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Table-1: Results of Credit & Deposit Growth and Actual & Projected GNPA Ratios

Type of Banks	Credit Growth (%)		Deposit Growth (%)		Actual GNPA Ratios (%)	Projected GNPA Ratios (%) March, 2020		
	March, 2017	March, 2019	March, 2017	March, 2019	March, 2019	Baseline	Medium Stress	Severe Stress
Public Sector Banks	0.8	9.6	9	6.5	12.6	12.0	12.1	12.2
Private Sector Banks	17.5	21	20	17.5	3.7	3.2	3.8	4.4
Foreign Banks	–8.6	12	1.4	17.6	3.0	2.9	3.5	4.1
All Scheduled commercial Banks	4.0	13.2	11.0	10.2	9.3	9.0	9.2	9.6

Source: Financial Stability Report Issue No. 19, Reserve Bank of India, 27th December, 2019

Table-2: Results of GNPAs, Net Profit and Total Assets

Name of the Bank	GNPAs (Rs. In crore) (as on 31/03/ 2019)	Average Gross NPAs (Rs. In crore)		Average Net Profits (Rs. In crore)		Average Total Assets (Rs. In crore)	
		2009-2010 to 2013-2014	2014-2015 to 2018 - 2019	2009-2010 to 2013-2014	2014-2015 to 2018 - 2019	2009-2010 to 2013-2014	2014-2015 to 2018 -2019
State Bank of India	1,70,813	39,466.48	132,683.79	10,826.8	5,570.22	1,394,335.7	2,849,465.98
Punjab Nationa l Bank	76,724	9,731.85	60,395.28	4,262.66	–4,369.26	432,191.40	706,366.83
Bank of India	51,167	7,244.47	49,421.29	2,477.18	–3,505.85	407,007.76	617,943.73
Union Bank of India	47,554	5,524.25	33,802.62	1,959.64	–901.27	271,476.70	444,092.22
Bank of Baroda	40,388	5,975.28	40,842.87	4,265.75	–522.46	458,135.07	716,445.52
Canara Bank	36,165	4,708.33	33,114.48	3,128.07	–572.70	375,395.58	599,226.71
Indian Overse as Bank	32,416	5,249.84	30,329.52	799.72	–3361.15	209,580.62	261,043.37
Central Bank of India	32,356	6,416.44	26,466.40	519.16	–2,799.45	235,578.49	321,550.30
UCO Bank	29,233	4,530.89	22,830.40	1,031.22	–2,453.92	183,708.68	233,735.88
Andhra Bank	28,974	2,570.72	18,617.70	1,076.46	–969.208	127,485.68	219,748.21

Source: Annual Reports of respective banks

Table-3: Results of Altman's Z-Score Model – Cut-Off Limits

Z-Score	Zone	Result
$Z > 2.9$	Safe	Safe
$1.23 < Z < 2.9$	Grey	Stable
$Z < 1.21$	Distress	Likely to be bankrupt

Source: Altman (2000)

Table-4: Results of Two Versions of Altman's Z-Score Model (2009-2010 to 2018-2019)

Name of the Bank	Average value of X1	Average value of X2	Average value of X3	Average value of X4	Average value of Altman's Z-Score model (First Version)	Average value of Altman's Z-Score model (Second Version)
State Bank of India	0.678847	0.004937	0.058174	0.062462	4.9258	8.1758
Punjab National Bank	0.707522	0.002363	0.066993	0.059768	5.16201	8.4120
Bank of India	0.745706	–0.004529	0.060474	0.053137	5.3392	8.5892
Union Bank of India	0.71757	0.001963	0.069417	0.05283	5.2356	8.4856
Bank of Baroda	0.763456	0.0045	0.057212	0.05801	5.4683	8.7183
Canara Bank	0.705513	0.003515	0.070276	0.057139	5.1718	8.4218
Indian Overseas Bank	0.692176	–0.00868	0.071339	0.055558	5.0500	8.3000
Central Bank of India	0.663911	–0.00885	0.066631	0.051773	4.8285	8.0785
UCO Bank	0.660831	0.001709	0.067534	0.046023	4.8428	8.0928
Andhra Bank	0.718392	0.002156	0.075463	0.053638	5.2831	8.5331

Source: Author's own computations using Eviews 10

Table-5: Results of ANOVA Single Factor – Altman's Z-Score

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4.17051	9	0.46339	10.945814	2.45E–11	1.985595
Within Groups	3.81014	90	0.04233			
Total	7.98066	99				

Source: Author's own computations using Eviews 10

Table-6 (a): Results of One-Sample Kolmogorov-Smirnov Test (First Set of Five Banks)

Names of the Banks		State Bank of India	Punjab National Bank	Bank of India	Union Bank of India	Bank of Baroda
N		10	10	10	10	10
Normal Parameters[a,b]	Mean	8.1758209	8.4120117	8.5892915	8.4856107	8.7183117
	Std. Deviation	0.27895426	0.07697809	0.16703463	0.12888313	0.16935113
Most Extreme Differences	Absolute	0.136	0.244	0.172	0.148	0.201
	Positive	0.121	0.190	0.153	0.118	0.131
	Negative	–0.136	–0.244	–0.172	–0.148	–0.201
Kolmogorov-Smirnov Z		0.429	0.772	0.544	0.467	0.636
Asymp. Sig. (2-tailed)		0.993	0.590	0.928	0.981	0.813

a. Test distribution is Normal.

b. Calculated from data.

Source: Author's Own Computations from SPSS 17

Table-6(b): Results of One-Sample Kolmogorov-Smirnov Test (Second Set of Five Banks)

Names of the Banks		Canara Bank	Indian Overseas Bank	Central Bank of India	UCO Bank	Andhra Bank
N		10	10	10	10	10
Normal Parameters[a,b]	Mean	5.1718725	5.0500892	4.8285540	4.8428090	5.2831153
	Std. Deviation	0.0811867	0.1654421	0.2833694	0.3621286	0.1449805
Most Extreme Differences	Absolute	0.183	0.191	0.225	0.217	0.156
	Positive	0.183	0.186	0.153	0.108	0.156
	Negative	–0.174	–0.191	–0.225	–0.217	–0.127
Kolmogorov-Smirnov Z		0.578	0.604	0.712	0.685	0.493
Asymp. Sig. (2-tailed)		0.892	0.859	0.691	0.736	0.969

a. Test distribution is Normal.

b. Calculated from data.

Source: Author's Own Computations using SPSS 17

Table-7: Results of Paired Sample t-Test

	Altman's Z-Score (2009-2010 to 2013-2014)	**Altman's Z-Score** (2014-2015 to 2018-2019)
Mean	5.194938	5.066559495
Variance	0.049274	0.105187476
Observations	50	50
Pearson Correlation	0.353907	
Hypothesized Mean Difference	0	
df	49	
t Stat	2.821615	
P(T<=t) one-tail	0.003441	
t Critical one-tail	1.676551	
P(T<=t) two-tail	0.006883	
t Critical two-tail	2.009575	

Source: Author's own computations using Eviews 10

Table-8: Results of Multiple Linear Regression Analysis – Altman's Z-Score and its Components

Dependent Variable: Altman's Z-Score				
Method: Least Squares				
Sample (adjusted): 1 100				
Included observations: 100 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.68E–05	0.000116	0.575420	0.5664
X1	6.560035	0.000147	44619.59	0.0000
X2	3.259109	0.000433	7530.707	0.0000
X3	6.719781	0.000573	11724.41	0.0000
X4	1.048723	0.000858	1222.556	0.0000
R-squared	1.000000	Mean dependent var		5.130749
Adjusted R-squared	1.000000	S.D. dependent var		0.283924
S.E. of regression	5.42E–05	Akaike info criterion		–16.75808
Sum squared resid	2.79E–07	Schwarz criterion		–16.62782
Log likelihood	842.9040	Hannan-Quinn criter.		–16.70536
F-statistic	6.78E+08	Durbin-Watson stat		2.077107
Prob(F-statistic)	0.000000			

Source: Author's own computations using Eviews 10

Table-9: Results of Linear Regression Analysis – Altman's Z-Score and GNPA/Total Assets

Regression Statistics					
Multiple R	0.41277691				
R Square	0.170384777				
Adjusted R Square	0.161919316				
Standard Error	0.259922961				
Observations	100				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.359782491	1.359782491	20.1270513	1.97418E–05
Residual	98	6.620874669	0.067559946		
Total	99	7.98065716			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	
Intercept	5.281608902	0.04250126	124.2694656	1.2425E–109	
Gross NPA / Total Assets	–3.103014752	0.691661757	–4.486318234	1.97418E–05	

Source: Author's own computations using Eviews 10

Table 10: Results of Regression Analysis – Altman's Z-Score and Net Profit/Total Assets

Regression Statistics					
Multiple R	0.465614023				
R Square	0.216796418				
Adjusted R Square	0.208804545				
Standard Error	0.252547819				
Observations	100				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.730177887	1.730177887	27.12710906	1.0533E–06
Residual	98	6.250479273	0.063780401		
Total	99	7.98065716			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	
Intercept	5.112300046	0.025501971	200.4668597	6.6652E–130	
Net Profit / Total Assets	15.30842991	2.939198337	5.208369137	1.0533E–06	

Source: Author's own computations using Eviews 10