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# Impact of ALTMAN Z SCORE MODEL for Checking financial health and detection of financial Fraud of public sector banks.

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## Abstract:

Many industry practitioners and Academicians used various risk management/reduction techniques for finding fraudulent reporting in financial statements. This study wants to determine the effectiveness of the Altman Z-score models for the detection of material misstatements/ manipulations in the financial statement of public sector banks in India. In this study, we took the top 10 public sector banks and periods of study is last five years i.e., from 2018 to 2022 and analyzed with the main objective of Checking financial health and fraud detection by using the Altman Z-score. Outcomes of The study's indicate that From 2018 to 2022, mostly all the given banks scored between 1.1 and 2.99, which Indicates that the Zone of ignorance or gray area due to the predisposition of errors. Which states that all the top 10 public sector banks was in good condition (financial health) and there was no chance of bankruptcy and financial frauds. This study concludes that the selection of forensic tool as a Altman Z-score models greatly influences fraud detection output. This study suggest that the crucial need for stricter governing measures.

## 1. Introduction

Day by day, we seen or witnessed that banking industry was collapse or making losses due to Increase in frauds in banking sectors. Most of the fraud happen in banking industry was related with Loan funds which were misappropriated and diverted to be invested through

foreign subsidiaries with the intent to make money illegally off the loan funds. Fraud defines as any of the following acts committed by a business / firm, which is made or make for gain or profit-making purpose with intent to deceive or against the law/ moral practice.

Financial frauds occurred through manipulation in the financial statements to reach the good market value of share or improved performance reporting. It is generally showed in the form of understatement of liabilities, expenses, or losses or overstatement of assets, sales, and profits. Fraudulent Financial Reporting leads to financial losses to the various shareholders. i.e., Nirav Modi-PNB Scam, Vijay Mallya-Kingfisher Airlines Debacle, Rotomac Pens Fraud, Punjab and Maharashtra Co-operative Bank (PMC Bank) Scandal, Satyam Computer Services Fraud, Bank of Baroda Forex Scam, Saradha Chit Fund Scam, Pearls Agrotech Corporation Limited (PACL) Scam, Winsome Diamonds and Forever Precious Diamonds Scam and IL&FS Financial Services Debacle.

**Altman's z-scores**

Altman's z-score was developed by Edward I. Altman in 1968, it is helpful in finding insolvency and bankruptcy of a company. He analyzed 66 manufacturing companies with the help of a multiple discriminant analysis (MDA). Out of these 66 companies, 33 became bankrupt within the years 1946-1965 and the other 33 were existing companies in 1966. The z-score formula applies to manufacturing companies listed on stock exchanges which is based on five financial ratios. Companies with a z-score < 1.81 are likely to face high financial distress. A z-score of 2.99 or higher indicates no danger of bankruptcy. The zone between 1.81 and 2.99 is called zone of ignorance or gray area due to the predisposition of errors. The result of the study was that 94% of the bankrupt firms were correctly classified, while 95% of bankrupt and non-bankrupt were assigned appropriately (Altman, 1968).

$$Z = 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5$$

Where, X1 = working capital/total assets, X2 = retained earnings/total assets, X3 = earnings before interest and taxes/total assets, X4 = market value of equity/book value of total debt and X5 = sales/total assets, Z = overall index

**Interpretation of Z:**

| Z-score | Financial health |
|---|---|
| A z-score of less than 1.81 | Are likely to face high financial distress. |

| | |
|---|---|
| A z-score of 2.99 or higher | Indicates no danger of bankruptcy. |
| A z-score between 1.81 and 2.99 | Zone of ignorance or gray area due to the predisposition of errors. |

These financial ratios used in the model because they assess the financial health of a company or firm's (Atril & Eddie, 2006). X1 define or denote, working capital to total assets ratio, measures the net liquid assets relative to the total capitalization. X2 define or denote, the retained earnings / total assets measure the cumulative profitability of a company over time. X3 define or denote, earnings before interests and taxes (EBIT) / total assets, measures the true productivity of a company's assets. X4 define or denote the market to book which measures the amount a company's assets can decline in value before the liabilities exceed the assets and the company becomes bankrupt. X5 define or denote, the total asset turnover emphasizing the sales generating ability of the company's assets. In 2000, Altman give a revised z-score, named z'-score, for private companies by changing the one ratio X4 from the market value of equity to the book value of equity. In this revised model, The adjusted formula for the z'-score looks as follows:

$Z' = 0.717X1 + 0.847X2 + 3.107X3 + 0.420X4 + 0.998X5$

**Interpretation of Z' :**

| Z'-score | Financial health |
|---|---|
| A z'-score of Less than 1.23 | Are likely to face high financial distress. |
| A z'-score of 2.99 or higher | Indicates no danger of bankruptcy. |
| A z'-score between 1.23 and 2.99 | Zone of ignorance or gray area due to the predisposition of errors. |

Two years later, Altman revised the z-score for non-manufacturers, leaving out the fifth variable, the z''-score. (Altman, 2002).

$Z'' = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$

**Interpretation of Z'':**

| Z''-score | Financial health |
|---|---|
| A z''-score of Less than 1.1 | Are likely to face high financial distress. |

| | |
|---|---|
| A z''-score of 2.99 or higher | Indicates no danger of bankruptcy. |
| A z''-score between 1.1 and 2.99 | Zone of ignorance or gray area due to the predisposition of errors. |

## 2. Review of Literature

Nirosh Kuruppu, 2019: Benford's Law depend on mathematical distribution about the frequencies of naturally occurring numbers that useful in the detection of financial fraud and crimes. The objective of the study is to present a methodology or model for using Benford's Law for detecting and flagging potentially fraudulent financial transactions or event, that can be investigated. It describes the development of Benford's Law and reveals that how it can be used systematically to detect potential fraud. Given that the cost of financial fraud is substantial with firms losing their one sixths portion of overall revenues, the methodology presented in this study can be a valuable tool for auditors of Benford's Law for detecting fraud.

Lina Harjans, 2018: There are different models of predicting the bankruptcy of companies was developed by many researchers across the world. However, all these models had differed in terms of their nature, impact and time scale. The main objective of this study is to discuss or analysis's a variety of bankruptcy prediction models. This study mainly focus on two models using financial ratios. Altman's z-score and the J-model are compared and analyzed using a sample of US companies. In this study concluded that the J-model is a better predictor of bankruptcy in compared to Altman's z-score. A new model was recognized by adding a new seventh variable, the debt ratio, to the original J-UK model, whose foundation was based on Altman's z-score. The new model, the L-model of bankruptcy, gives a better prediction or picture of companies that fall into the classes of bankruptcy and non-bankruptcy in compared to Altman's z-score and the J-model.

**Nooraslinda Abdul Aris, et al., 2013:** Fraud includes any types of crime that uses deception in order to gain as the element of opportunity, pressure and rationalization. Now, it is very important to detect fraud before it causes and resultant the business is collapse. There are multiple techniques of Fraud detection i.e., Statistical methods, Benford's Law, Beneish Model, and data mining are said to be among the best techniques to detect fraud. Benford's Law is based on probability of frequency while Beneish model is based on ratio analysis. Beneish model can also be utilised in discovering anomalies and detection of fraud. This

study aim to focus on analysing the usage, process and application of Beneish Model and Benford's La in detection of financial fraud. Comparisons of both the model were made to conclude that techniques appear that both the model have their own benefit and some imitations in detecting and preventing fraud occurrence.

**Gagan Kukreja, et al., 2020:** increasing the number of fraudulent financial reporting by firms raises concerns about investors confidence. Academicians and industry practitioners used many diverse risk management techniques to detect frauds in financial statements. This study aims to determine the efficiency of the two modal - Beneish M-score and Altman Z-score models for the early detection of material misstatements at Comscore Inc. firm in the United States of America. In this study, data of Comscore Inc. were taken from 2012 to 2018 and analyzed with the primary objective of early fraud detection by using Beneish M-score and the Altman Z-score. This study's cancludes that the Beneish M-score is less predictable in fraud detection in comparison to other. The study results did not confirm the efficacy of the Beneish model in predicting fraudulent financial statements. The study concludes that forensic tool greatly influences fraud detection outcomes. findings can be helpful for policy maker, investors, financial auditors, and forensic auditors as this study provides some evidence of the effectiveness of forensic tools in the detection of financial statement fraud.

## 3. Research Methodology:

**1. Research Design:** This study uses a quantitative research design, employing financial ratio analysis using the Altman Z-Score Model to assess the financial health and detect early warning signs of financial distress or fraud in the top ten public sector banks (PSBs) in India.

**2. Problems statement:**

Now a days, we all seen that there are lot of frauds was happened since 2000. i.e. Nirav Modi-PNB Scam, Vijay Mallya-Kingfisher Airlines Debacle, Rotomac Pens Fraud, Punjab and Maharashtra Co-operative Bank (PMC Bank) Scandal, Satyam Computer Services Fraud, Bank of Baroda Forex Scam, Saradha Chit Fund Scam, Pearls Agrotech Corporation Limited (PACL) Scam, Winsome Diamonds and Forever Precious Diamonds Scam and IL&FS Financial Services Debacle. So I found a very attractive topic that any model which can predict the impact of these types of frauds in bankruptcy.

**3. Objectives of the Study**

**1.** To evaluate the financial health of selected public sector banks using the Altman Z-Score.

**2.** To assess whether the model can act as a predictive tool for detecting financial distress and potential fraud.

3. To analyze the trend of financial health of the banks over a specified period.

**4. Sample Selection**: **Population**: All public sector banks operating in India.

**Sample**: Top ten public sector banks by total assets or market capitalization. (e.g., State Bank of India, Punjab National Bank, Bank of Baroda, Bank of india, Canara Bank, Union Bank of India, Uco Bank, Central bank of india, Indian Bank and Indian Overseas Bank

**Sampling Technique**: Purposive sampling.

**5. Time Frame**

The study will cover five financial years (e.g., FY2018–FY2022), depending on data availability.

**6. Data Collection**

**Type of Data**: Secondary data are taken for analysis form CMIE ProwessIQ software. It includes all the component of Profit and loss A/c, Balance Sheet and Cash Flow Statement.

**Sources**: Annual reports of the banks**,** RBI reports**,** Financial databases (e.g., CMIE Prowess)**,** Government websites (e.g., Ministry of Finance) and Research papers and articles related to financial frauds and Z-Score applications used in the study.

**7. Data Analysis Tool**

**Altman Z-Score Model** (Modified version for non-manufacturing firms, especially financial institutions):

$$Z=6.56X1+3.26X2+6.72X3+1.05X4$$

**8. Interpretation Criteria**

**Z > 2.6** – Safe Zone

**1.1 < Z < 2.6** – Grey Zone

**Z < 1.1** – Distress Zone

**9. Limitations of the Study**

The Altman Z-Score is originally designed for manufacturing firms, so modifications are required for banking firms.

Banks have different balance sheet structures, making some ratio interpretations less straightforward.

Secondary data may not reflect real-time internal frauds until they are reported.

Potential lag in fraud detection and reporting.

## 4. Data analysis:

For analysis the data of component of profit and loss account, balance sheet and cash flow statement of top ten public sector banks uses ALTMAN Z SCORE MODEL which provides the status of Financial health of all the banks and all these banks is affected by financial frauds or not and resultant these financial frauds cause bankruptcy or not.

| year | State Bank Of India | Punjab National Bank | Bank of Baroda | Bank of india | Canara Bank | Union Bank Of India | Uco Bank | Central bank of india | Indian Bank | Indian Overseas Bank |
|---|---|---|---|---|---|---|---|---|---|---|
| **2018** | 1.429008 | 1.356208 | 1.788829 | 1.639709 | 1.117995 | 1.234338 | 0.994499 | 1.658251 | 1.28623 | 4.823111 |
| **2019** | 1.665045 | 1.414475 | 1.50458 | 5.360702 | 1.159195 | 1.205826 | 1.475187 | 1.270348 | 1.193801 | 1.731375 |
| **2020** | 1.33955 | 1.216553 | 1.260213 | 1.320459 | 1.050436 | 1.138198 | 1.403811 | 1.000228 | 0.762616 | 1.479234 |
| **2021** | 1.731124 | 1.319003 | 1.389432 | 1.771003 | 1.505382 | 1.049443 | 1.322794 | 1.1827 | 0.996026 | 1.839715 |
| **2022** | 1.861917 | 1.35487 | 1.461849 | 3.939882 | 4.757827 | 1.192075 | 1.487139 | 1.555737 | 1.356232 | 13.05701 |

**Table:1 Display the picture of value of Z (ALTMAN Z SCORE MODEL) of top ten public banks.**

**Interpretation of Z'':**

| Z''-score | Financial health |
|---|---|
| A z''-score of Less than 1.1 | Are likely to face high financial distress. |
| A z''-score of 2.99 or higher | Indicates no danger of bankruptcy. |
| A z''-score between 1.1 and 2.99 | Zone of ignorance or gray area due to the predisposition of errors. |

**Table:2 Display the interpretation of top ten public banks (ALTMAN Z SCORE MODEL)**

| year | State Bank of India | Punjab National Bank | Bank of Baroda | Bank of india | Canara Bank | Union Bank of India | Uco Bank | Central bank of india | Indian Bank | Indian Overseas Bank |
|---|---|---|---|---|---|---|---|---|---|---|
| 2018 | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Are likely to face high financial distress. | Zone of ignorance | Zone of ignorance | no danger of bankruptcy |
| 2019 | Zone of ignorance | Zone of ignorance | Zone of ignorance | no danger of bankruptcy | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance |
| 2020 | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Are likely to face high financial distress. | Zone of ignorance | Zone of ignorance | Are likely to face high financial distress. | Are likely to face high financial distress. | Zone of ignorance |
| 2021 | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | Are likely to face high financial distress. | Zone of ignorance | Zone of ignorance | Are likely to face high financial distress. | Zone of ignorance |
| 2022 | Zone of ignorance | Zone of ignorance | Zone of ignorance | no danger of bankruptcy. | no danger of bankruptcy. | Zone of ignorance | Zone of ignorance | Zone of ignorance | Zone of ignorance | no danger of bankruptcy. |

**Data Analysis and Findings**

The first objective of the study was to evaluate the financial health of selected public sector banks using the Altman Z-Score model. The analysis of Z-Scores from 2018 to 2022 revealed that the majority of banks operated within the grey zone (Z between 1.1 and 2.6), indicating

moderate financial stability with potential risks. Notably, UCO Bank and Indian Bank recorded scores below 1.1 in certain years, placing them in the distress zone, which signals a high risk of financial distress. On the other hand, Indian Overseas Bank and Canara Bank demonstrated significant financial improvement, with Z-Scores exceeding 2.6 in 2022, placing them in the safe zone. Indian Overseas Bank, in particular, achieved a remarkable score of 13.05, reflecting a strong financial turnaround.

The second objective aimed to assess whether the Altman Z-Score could act as a predictive tool for detecting financial distress and potential fraud. The study found that banks with low or consistently declining Z-Scores, such as UCO Bank, Indian Bank, and Union Bank of India, were often those that experienced regulatory scrutiny or were placed under the Reserve Bank of India's Prompt Corrective Action (PCA) framework. For instance, Indian Bank's Z-Score fell to 0.76 in 2020, a period that coincided with rising NPAs and financial stress. While the Altman Z-Score is not specifically designed to detect fraud, it can serve as an early warning indicator of financial deterioration, which may create conditions conducive to mismanagement or fraudulent activity. Thus, the model shows potential as a supporting tool for risk assessment in the banking sector.

The third objective was to analyze the trend of financial health of the selected banks over the five-year period. The trend analysis highlighted both improvements and inconsistencies across the banks. Canara Bank and Indian Overseas Bank demonstrated the most notable upward trends, moving from the distress or grey zone into the safe zone by 2022. Conversely, banks like Punjab National Bank, Central Bank of India, and Bank of Baroda showed fluctuating but mostly stagnant performance, remaining in the grey zone throughout the period. State Bank of India displayed a steady but modest upward trend, improving its Z-Score from 1.42 in 2018 to 1.86 in 2022. These findings suggest that while some banks have strengthened their financial positions, others continue to face moderate to high levels of financial risk.

## 5. Conclusions:

- As per table -2, In 2018, all the given banks scored between 1.1 and 2.99, which Indicates that Zone of ignorance or gray area due to the predisposition of errors excluding Uco Bank scored Less than 1.1, which Indicates that are likely to face high

financial distress and one more Indian Overseas Bank scored more than 2.99, which Indicates no danger of bankruptcy.

- In 2019, all the given banks scored between 1.1 and 2.99, which Indicates that Zone of ignorance or gray area due to the predisposition of errors excluding Bank of india scored more than 2.99, which Indicates no danger of bankruptcy.
- In 2020, all the given banks scored between 1.1 and 2.99, which Indicates that Zone of ignorance or gray area due to the predisposition of errors excluding Canara Bank, Central bank of india and Indian Bank scored Less than 1.1, which Indicates that are likely to face high financial distress.
- In 2021, all the given banks scored between 1.1 and 2.99, which Indicates that Zone of ignorance or gray area due to the predisposition of errors excluding Union Bank Of India and Indian Bank scored Less than 1.1, which Indicates that are likely to face high financial distress.
- In 2022, all the given banks scored between 1.1 and 2.99, which Indicates that Zone of ignorance or gray area due to the predisposition of errors excluding Bank of india, Canara Bank and Indian Overseas Bank scored more than 2.99, which Indicates no danger of bankruptcy.
- From 2018 to 2022, mostly all the given banks scored between 1.1 and 2.99, which Indicates that the Zone of ignorance or gray area due to the predisposition of errors. Which states that all the above bank was in good condition (financial health) and there is no chance of bankruptcy. Excluding some of the given below.
- Uco Bank in 2018, Canara Bank, Central bank of india and Indian Bank in 2020, Union Bank Of India and Indian Bank in 2021 scored Less than 1.1, which Indicates that the they are likely to face high financial distress. Which means that all theses banks face some issues or some factor affecting them like higher NPA, banking frauds happen in last decades and Covid-19 also.

**Suggstions:** Govt. have to take some strick action against defaulter. Banks also have to do some Changes in the sanction process of loan or disbursement of loan. Some strict laws, rules and regulations have to introduce by authority. All theses above precautions and steps may reduce the rate of banking frauds in india.

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