



Assessing The Financial Distress Of Indian Banks: A Comparative Study Using Emerging Market Z Score Model

Farhaan Rashid *Research Scholar, Department of Management Studies, University of Kashmir;
farhaanrshd27@gmail.com

Dr Rafi Ahmad khan Associate Professor, Department of Management Studies, University of Kashmir;
mca_rafi@yahoo.com

Dr Ishtiaq Hussain Qureshi Associate Professor, Department of Management Studies, University of Kashmir;
Ishtiaqiq@yahoo.co.in

Younis Ahmed Ghulam Research Scholar, Department of Management Studies, University of Kashmir;
younisahmed885@gmail.com

Abstract

The Indian banking industry plays a significant role in advancing the economic growth of the nation. As a result, the stability and financial health of this industry are important concerns. The present study aims to assess the financial stability of Indian banks using the Emerging Market Z Score Model. In addition, it aims to analyse the variations in Altman's Z-score values among these banks and compare the Z-scores between scheduled public sector banks and scheduled private sector banks. The analysis is derived from secondary data obtained from a sample of ten banks collected from Prowess IQ. The sample comprises ten banks, consisting of five scheduled public sector banks and five scheduled private sector banks. The selection criteria were based on market capitalisation from 2013–14 to 2019–20. The findings indicate a strong financial outlook, with all banks consistently showing Z-scores above the safe threshold of 2.60, indicating a safe zone classification. The findings of a one-way ANOVA (F-test) demonstrate significant disparities in the averages of Z-scores among the ten banks, signifying differences in their financial performance. The t-test results also reveal a significant disparity in Z-scores between scheduled public sector banks and scheduled private sector banks, highlighting the distinctive financial attributes of these two groups. Scheduled private sector banks demonstrate slightly higher financial stability than scheduled public sector banks, but they also show greater variability compared to scheduled public sector banks. This suggests that the financial stability of private sector banks may exhibit greater variation. Overall, this study enhances the comprehension of the financial soundness and stability of banks in India, offering valuable observations for individuals involved in the banking sector and making a valuable contribution to ongoing studies on the analysis of financial performance.

Keywords: Financial Distress, Altman Z score, ANOVA, T test.

Introduction

The banking structure is a vital component of any nation (Jain & Gupta, 2004; Gupta, 2014). The banking industry in India assumes a crucial function in promoting economic growth, stability, and the facilitation of monetary transactions. The stability and health of a nation's banking industry are crucial measures of its economic well-being. A stable and well-functioning banking sector promotes economic development by enabling the mobilization of capital, ensuring prudent risk management, and facilitating efficient allocation of resources. The stability of banks plays a pivotal role in shaping investor confidence and decision-making. Investors are attracted to stable banks because they provide assurance of safety, consistent returns, dividend payments, a positive market reputation, and an overall environment favourable to wealth creation. The stability of banks plays a crucial role in supporting regulators in maintaining a robust and secure financial system, as the stability of banks supports the effective transmission of monetary policy. The stability within the banking sector ensures the safety of consumers' deposits and financial transactions. It ensures the security of deposits, facilitates access to credit, maintains stable interest rates, and facilitates a wide range of banking services that contribute to the financial well-being of individuals and households. The stability of financial institutions is also essential for maintaining public confidence in the financial system, as it fosters confidence among depositors and other stakeholders, preventing panic or a loss of trust in banks. A strong and stable banking sector attracts foreign investors and promotes international trade. Foreign investors are more prone to engage in investments in a country with stable banking institutions, as this indicates the overall economic stability. The Indian economy heavily depends on banking institutions, which provide essential financial services to both individual consumers and commercial enterprises. As an economic institution, banks are becoming increasingly directly and favourably correlated with economic performance. In the dynamic environment of the banking industry, evaluating the financial performance of banks becomes necessary for investors, consumers, regulators, and policymakers. It is also crucial for maintaining financial stability, managing risks, and promoting economic growth in the country. The information derived from such evaluations informs regulatory decisions, influences investor confidence, facilitates credit availability, and contributes to the overall health and resilience of the economy.

The Indian economy is reinforced by a diverse range of banking establishments, wherein the Reserve Bank of India (RBI) assumes the role of its central regulatory authority. This framework includes commercial banks, which consist of scheduled private sector banks, scheduled public sector banks, and foreign banks. These banks serve as the fundamental components of the system. Finally, at the grassroots level, there are cooperative banks and regional rural banks (RRBs). Cooperative banks meet the requirements of both rural and urban areas, whereas regional rural banks (RRBs) are particular establishments established exclusively for rural and semi-urban regions. The Reserve Bank of India (RBI) oversees the complex structure as a crucial component of

India's financial system to ensure integrity and stability. In India's financial system, commercial banks perform a pivotal function in the realm of economic growth and development. These banking organisations operate as middlemen, ensuring the movement of funds from savers to borrowers, thereby promoting investments, job creation, and economic growth. These financial institutions guarantee the smooth operation of the economy through the facilitation of monetary transactions and the provision of crucial amenities, including deposit facilitation, loan provisions, currency exchange, and investment opportunities. Their reliability and credibility serve as catalysts for savings and the cultivation of capital. Furthermore, the transmission of monetary policy greatly relies on the critical involvement of commercial banks, as they aid in the regulation of inflation and interest rates. Moreover, commercial banks aid in the progress of financial inclusion by extending banking services to remote and underserved areas, thereby generating enhanced economic opportunities for all parts of society. In essence, commercial banks serve as the life force of a flourishing economy, nurturing financial stability, facilitating access to credit, and fostering overall prosperity. Scheduled public sector banks are those in which the government owns more than fifty percent of the shares. These banks are considered a vital part of India's banking system and economy. These banking institutions are registered under Schedule II of the Reserve Bank of India Act, 1934. This schedule lists the banks that are eligible to be called "scheduled banks" and are subject to the regulatory framework of the RBI. The foundation of the Bank of Calcutta in 1806, later renamed the Bank of Bengal, marked the commencement of formal banking operations in British India. The consolidation of the three banking institutions in 1921 marked the culmination of the formation of the Imperial Bank of India, subsequently evolving into the State Bank of India in 1955. In 1969, the government took control of 14 commercial banks, and over time, more banks were nationalised, leading to a strong network of public sector banks. Scheduled public sector banks are further categorized into nationalized banks, the State Bank of India (SBI), and its associate banks. In 2019-2020, there were 12 scheduled public sector banks functioning in India. These banks have a key role in facilitating financial inclusion, supporting economic growth, and implementing government policies regarding banking and finance. Scheduled private sector banks, on the other hand, are banks in India that are owned by corporations or private individuals. They are also listed in the Second Schedule of the RBI Act, 1934, which designates them as "scheduled banks" subject to the regulations of the RBI. These banks operate with a strong focus on commercial success, aiming to achieve profitability and foster innovation in the realm of financial services. They engage in healthy competition with public sector banks and other financial institutions, striving to offer a diverse array of banking and financial products to cater to the needs of their valued customers. Scheduled private sector banks in India have a more diverse and fragmented history. They trace their origins to various private banks and financial institutions that were established during the colonial era and post-independence periods. Many private sector banks have a long and storied history of serving customers and fostering innovation in banking services. The period of economic liberalization in the 1990s witnessed India implementing significant reforms in the banking sector, which gave rise to new private sector banks. These banks, often referred to as "new-generation" banks, brought modern banking practices and technology to the Indian banking landscape. In 2019–

2020, there were a total of 21 scheduled private sector banks in India. The scheduled private sector and scheduled public sector banks both operate in a dynamic environment influenced by domestic and global economic circumstances, regulatory modifications, and changing consumer preferences. It is essential to have a profound understanding of their financial well-being, not only to assess the sector's capacity to endure challenges but also to offer guidance for policy interventions, investment decisions, and risk management practices. Moreover, the comparison of the financial performance of scheduled public sector banks and scheduled private sector banks is essential in evaluating their financial stability and risk levels. This comparison provides essential information to policymakers, regulators, investors, and depositors so that they can make informed decisions regarding the safety and desirability of these banks.

Literature Review

The terms "default," "bankruptcy," "insolvency," and "failure" can all be used interchangeably with "financial distress" (Geng et al., 2015). Beaver (1966) defines financial distress as a company's inability to fulfill debt repayments as they become due. As per Blum (1974), financial distress pertains to a condition where a company is incapable of fulfilling its financial commitments, which include debt settlements, outstanding accounts, and other liabilities. "Industrial sickness" or "corporate sickness" is another Indian term for financial distress. According to the Sick Industrial Companies (Special Provision) Act of 1985, a sick industrial company is defined as a company that has been registered for a minimum of five years and has accumulated losses exceeding its entire net worth at the end of any financial year. Doumpos et al. (1998) highlighted the occurrence of financial distress that arises due to the presence of negative net asset value. This situation arises when the total liabilities of a company surpass its total assets as perceived from an accounting perspective. According to Sung et al. (1999), financial distress can result in bankruptcy, which causes economic losses for stakeholders including employees, customers, equity holders, and managers. A company might experience financial distress if it is incapable of fulfilling its financial obligations as they become due (Lin, 2009). Financial distress occurs when a firm is unable to fulfill or encounters challenges in paying its debts to creditors (Bhunia and Sarkar, 2011; Khaliq et al., 2014). According to Putri and Dhini (2019), the term "financial distress" refers to a situation where a company's operational cash flow is inadequate to fulfill its obligations. According to Altman et al. (2019), bankruptcy occurs when a firm files for bankruptcy under the provisions of the National Bankruptcy Act, USA. The same argument was used by Zmijewski (1984), who defined financial distress as the act of filing a bankruptcy petition.

Many factors have been employed to assess financial distress in the existing body of literature. The majority of studies recommend that no individual collection of financial ratios is adequate to assess financial distress. Instead, it is recommended to use them in combination with other ratios to cover various aspects of a business, such as profitability, liquidity, solvency, and efficiency. Beaver (1966) conducted individual tests on a total of 30 financial ratios in order to assess the bankruptcy by employing univariate analysis. He found that the return on assets ratio, total debt to total assets ratio, and cash flow-to-total debt ratio are key indicators of a financial crisis in a company. He

concluded that the cash flow-to-total debt ratio is the most optimal indicator for forecasting bankruptcy. In addition, he also discovered that the net income-to-total debt ratio showed the highest predictive power one year prior to bankruptcy, followed by the net income-to-sales ratio. However, Altman (1968) argued that this approach is overly simplistic in its ability to comprehend the complexities of bankruptcy because it is not feasible to assess corporations exclusively on the basis of a single financial ratio at any point in time. As a result, he recommended a more reliable estimation model using multiple discriminant analysis, which is characterised by a set of multiple ratios. Multiple discriminant analysis generates a linear or quadratic combination of variables that aids in effective group differentiation. From the original compilation of twenty-two variables, he found it feasible to employ only five ratios. These five selected ratios include: net working capital to total assets ratio, which is relevant to liquidity; retained earnings to total assets ratio, which is connected to profitability; EBIT to total assets ratio, which focuses on productivity; market capitalization to total debt ratio, which examines leverage; and the proportion of sales to total assets ratio, which examines asset turnover. Altman observed that these five ratios exhibited superior performance compared to Beaver's (1966) ratio of cash flow to total debt. Edmister employed 19 financial factors to construct a linear model for forecasting bankruptcy (Edmister, 1972). According to Deakin (1972), bankruptcy may be predicted five years in advance using a linear combination of the 14 ratios. Ohlson (1980) raised concerns about the Multiple Discriminant Analysis model's restrictive statistical requirements. He used logistic regression to predict the company's failure to overcome these limitations. Ohlson used nine independent variables to predict bankruptcy, but he did not justify his choice theoretically. He found that the size of a firm, together with other variables measuring company performance, liquidity, and financial structure, must be incorporated in order to predict bankruptcy. Geng et al. (2015) included 31 variables from six distinct categories. They identified profitability, business development, and capital expansion as significant prediction areas. Cash flow, net profit, EBIT, and net asset ratios were the most critical variables. They concluded that profit and cash flow were major predictors of financial distress.

The Altman Z score is the most widely used model for the assessment of financial distress in Indian banking institutions. The model evaluates the financial stability of companies by analysing their financial statements and ratios. The Z-Score evaluates the financial health of a bank and takes into account factors such as profitability, leverage, liquidity, solvency, and activity. This model has been applied to the banking industry as a means of assessing banks' financial health. It has been implemented in both commercial banks and non-banking financial institutions (NBFIs) in India. Chaitanya (2005) measured the Industrial Development Bank of India's (IDBI's) financial distress by employing the Altman Z Score Model. The result stated that the bank's financial performance was inadequate and indicated a likelihood of bankruptcy. Chung et al. (2008) found that one year before bankruptcy, the Altman model outperformed other financial distress measures. Chotalia (2012) applied Altman's Z score model to evaluate the financial health of private sector banks in India. Chatterjee (2018) found that the Altman model was more accurate at assessing companies' financial health and soundness. Moreover, the Pearson chi-square test showed that the Altman model was significantly better at evaluating the financial stability of widely held large-cap firms in

India compared to the Ohlson model. Joshi (2020) measured the financial health of the selected Indian public sector banks based on their financial ratios. He found that the Altman Z score model is an effective indicator of the financial distress of public-sector banks in India. A number of studies have used the Z value to assess financial distress in banks, including Boyd and Runkle (1993), Laeven and Levine (2009), Demircuc-Kunt and Huizinga (2010), Houston et al. (2010), and Beltratti and Stulz (2012). Overall, these studies conclude that the Z value is an appropriate measure for assessing bank financial performance. It can identify banks at risk of financial distress and is a better indicator of financial distress compared to other widely used financial ratios. As a result, the Altman Z-score model can be an effective tool for regulators, investors, and other stakeholders who are interested in evaluating a bank's financial health.

This study intends to assess the financial performance of the selected Indian banks using the Emerging Market Z Score Model. It also aims to investigate potential variations in Z values among the selected banks, and conduct a comparative analysis of Z-scores between scheduled private sector banks and scheduled public sector banks. By achieving these goals, the study intends to provide valuable insights into the financial stability and health of the selected Indian banks, identify potential areas of concern, and contribute to the existing body of literature on financial distress assessment in the banking industry.

Research Objectives

The study will try to achieve the following objectives:

1. To measure the financial performance of selected Indian banks using the Emerging Market Z Score Model.
2. To investigate whether there is a significant difference in Z values among the selected banks
3. To make a comparison between the Z values of scheduled private sector banks and scheduled public sector banks.

Research Hypotheses

The following hypotheses were formulated:

H₀₁: There is no measure of financial performance for selected Indian banks.

H₀₂: There is no significant difference in the Z values of the selected Indian banks.

H₀₃: There is no significant difference in Z values between scheduled private sector banks and scheduled public sector banks.

Research Methodology

Sampling Technique

In this study, a sample of Indian banks was selected using a combination of stratified and purposive sampling techniques. Stratified sampling was employed to divide the banks into two distinct strata: scheduled private sector banks and scheduled public sector banks. This stratification ensured representation from both sectors in the sample, facilitating a comprehensive analysis of the characteristics and performance of banks in each sector. Purposive sampling was used to select

banks on the basis of their market capitalization, which served as a criterion for determining their size and market value.

Sample Size

The sample consists of five scheduled private sector banks and five scheduled public sector banks that have been selected based on their market capitalization. The scheduled private sector banks included in the sample are Housing Development Finance Corporation (HDFC) Bank, Kotak Mahindra Bank, Industrial Credit and Investment Corporation of India (ICICI) Bank, IndusInd Bank and Axis Bank. These banks reflect their significant presence and influence in the private banking sector. The scheduled public sector banks in the sample include the Punjab National Bank, State Bank of India, Bank of Baroda, Canara Bank, and Indian Overseas Bank. These banks are exhibiting their importance and market value in the public sector banking industry. Overall, this sample selection allows for a comparative analysis of the top scheduled public and private sector banks in terms of market capitalization, providing insights into their market position, financial performance, and potential implications for the banking sector as a whole.

Period of the study

The current analysis was performed for the financial years 2013–2014 to 2019–2020.

Data Collection

Data from secondary sources was used in this study. For the data collection process, the study relied on the Prowess IQ database

Methodology

India, being an emerging economy, is characterized by unique economic dynamics, regulatory frameworks, and growth patterns. Conventional financial evaluation models may not fully capture the complexities of emerging markets. The Emerging Market Z score model was employed to measure the financial distress of the selected Indian banks. The model of the emerging market is $Z = 3.25 + 6.56 \times X1 + 3.26 \times X2 + 6.72 \times X3 + 1.05 \times X4$. A Z value of 2.60 or higher is defined as being in the safe zone; the grey zone is defined as a Z value between 1.10 and 2.60; and a Z value less than 1.10 is defined as being in the distress zone (Altman et al., 2017). The Z value for each sample bank was calculated as follows:

$$Z = 3.25 + 6.56 \times X1 + 3.26 \times X2 + 6.72 \times X3 + 1.05 \times X4.$$

whereas:

Z denotes the overall index.

X1 denotes the ratio of the bank's working capital to its total assets.

X2 denotes the ratio of the bank's retained earnings to its total assets.

X3 denotes the ratio of the bank's earnings before interest and taxes (EBIT) to its total assets.

X4 denotes the ratio of the bank's book value of equity to the book value of its total liabilities.

The ratio of working capital to total assets (X1) compares a bank's net working capital to its total assets. Working capital is calculated by subtracting current liabilities from current assets. It assesses the potential of a bank to fulfill its short-term requirements. When a bank consistently incurs operating losses, the proportion of current assets to total assets diminishes. This ratio takes size and liquidity into account. The greater the ratio, the smaller the likelihood of financial distress.

The ratio of retained earnings to total assets (X2) computes retained profits as a proportion of total assets over time. A higher value for this ratio signifies that the bank has utilized a larger portion of its retained earnings to fund its assets instead of depending on debt capital. The larger the ratio, the stronger the financial health and the smaller the chance of financial distress.

The earnings before interest and taxes (EBIT) to total assets ratio (X3) compares a bank's profitability to its total assets. It measures the operating profit of a bank relative to its total assets. This ratio reveals how efficiently a bank's assets are used to create operating profit. A greater ratio reveals that the bank is earning a high operating income per unit of total assets, which indicates operational efficiency.

The ratio of the book value of equity to the book value of total liabilities (X4) indicates a bank's long-term financial soundness without relying on excessive debt capital. The capital invested by equity shareholders and preference shareholders is referred to as the "book value of equity." A higher ratio signifies investor confidence and a lower risk of bankruptcy.

Interpretation of the Z score model for Emerging Economies (Altman et al., 2017)

Z Score	Indicator	Remarks
Z > 2.60	Safe Zone	The bank exhibits strong financial stability, and there is little likelihood that it will go insolvent.
1.10 < Z < 2.60	Gray Zone	The likelihood of the bank facing financial difficulties in the near future is low.
Z < 1.10	Distress Zone	The likelihood of the bank facing financial difficulties in the near future is high.

An analysis of variance (ANOVA) single factor test was conducted to test for significant differences in the Z-score means among the selected banks, and a two-sample T test was used to see whether there is a significant variation in Z-scores between scheduled private sector banks and scheduled public sector banks.

Results and Discussion

Results of Z score

The Z-scores of the selected scheduled private sector banks are shown in Table 1. The results indicate that the selected scheduled private sector banks, including Housing Development Finance Corporation (HDFC) Bank, Kotak Mahindra Bank, Industrial Credit and Investment Corporation of India (ICICI) Bank, IndusInd Bank, and Axis Bank, have a low risk of bankruptcy and are financially stable. They are operating in a safe zone based on the emerging market Z score model. The average Z value for selected scheduled private sector banks is greater than 2.60, indicating that they are in a sound financial position. Furthermore, the standard deviations of the Z-scores for the selected scheduled private sector banks provide insight into the variability of their financial performance. Banks with lower standard deviations, such as HDFC Bank, ICICI Bank, and Axis Bank, have demonstrated relatively consistent and stable financial positions over the years. Kotak Mahindra Bank, on the other hand, has slightly higher variability, while IndusInd Bank has the highest standard deviation, indicating greater fluctuations in their financial performance.

Table 1. Z score of selected Scheduled Private Sector Banks

Year	HDFC Bank.	ICICI Bank.	Kotak Mahindra Bank.	Axis Bank.	IndusInd Bank.
2012-13	3.93	4.18	3.88	4.07	4.19
2013-14	4.27	4.19	4.06	4.14	4.08
2014-15	4.16	4.11	4.03	4.18	4.08
2015-16	4.08	4.13	4.08	4.10	4.16
2016-17	4.00	4.33	4.34	4.14	4.37
2017-18	4.38	4.26	4.13	3.90	4.26
2018-19	4.11	4.12	4.06	4.11	4.19
2019-20	4.01	4.31	4.31	4.22	4.27
Range	3.93-4.38	4.11-4.33	3.88-4.34	3.90-4.22	4.08-4.27
Average Z Score	4.12	4.21	4.12	4.09	4.33
Standard deviation	0.135	0.077	0.136	0.105	0.289
Zone	Safe	Safe	Safe	Safe	Safe

Source: Authors' own elaboration.

The Z-scores of the selected scheduled public sector banks are shown in Table 2. The results indicate that all the selected banks fall within the safe zone according to the criteria set by the emerging market Z score model. The mean Z values for the selected scheduled public sector banks, including Punjab National Bank, State Bank of India, Bank of Baroda, Canara Bank, and Indian Overseas Bank, are above 2.60, indicating that they are in a safe financial position and have a low risk of bankruptcy. These banks have a higher probability of remaining solvent and being able to meet their financial obligations. Furthermore, the standard deviations highlight the differences in stability and variability among scheduled public sector banks, with some banks being more consistent and others

experiencing more significant variations in their Z-scores. Banks with lower standard deviations, such as the Punjab National Bank and the State Bank of India, have relatively stable financial positions with little variability. Canara Bank and Indian Overseas Bank, on the other hand, have slightly higher variability. Bank of Baroda has the highest standard deviation, indicating higher fluctuations in their financial performance.

Table 2. Z score of selected Scheduled Public Sector Banks

Year	State Bank of India	Bank Of Baroda	Punjab National Bank	Canara Bank	Indian Overseas Bank
2012-13	4.03	4.56	4.05	4.32	4.18
2013-14	3.96	4.81	4.14	4.33	4.20
2014-15	4.16	4.89	4.17	4.37	4.32
2015-16	4.12	4.85	4.25	4.40	4.21
2016-17	4.12	5.03	4.40	4.41	4.25
2017-18	4.08	4.37	4.21	4.19	4.24
2018-19	4.19	4.32	4.11	4.38	4.58
2019-20	4.21	4.32	4.14	4.33	4.06
Range	3.96-4.21	4.32-5.03	4.05-4.40	4.19-4.41	4.06-4.58
Average Z Score	4.13	4.57	4.20	4.40	4.32
Standard Deviation	0.094	0.302	0.104	0.134	0.188
Zone	Safe	Safe	Safe	Safe	Safe

Source: Authors' own elaboration.

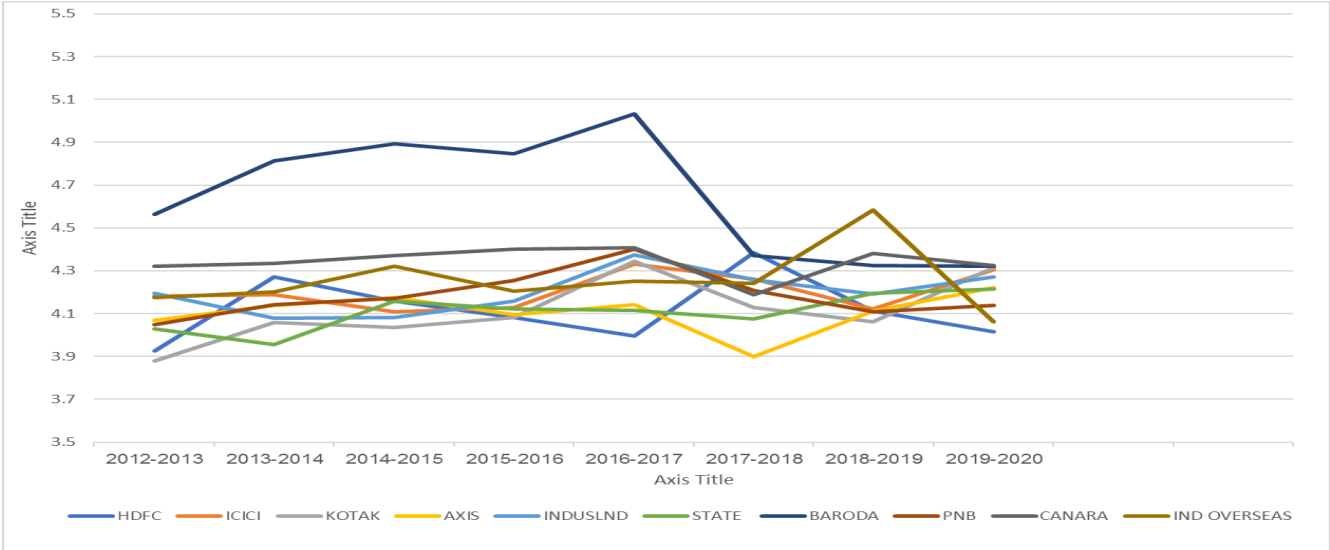
Results of ANOVA (F-test)

Figure 1 depicts the Z value of ten banks over an eight-year period. The analysis of the selected ten banks, which include both scheduled private sector banks and scheduled public sector banks, using the Emerging Market Z-score Model reveals a positive financial outlook. All banks consistently have a Z-score above the safe threshold of 2.60, indicating a safe zone classification. The selected banks demonstrated strong and stable financial health throughout the analysis period. The findings indicate that the selected Indian banks have strong financial performance and are well-positioned in terms of financial stability and health. However, it is essential to evaluate whether individual banks within each group may have varying Z-scores or not.

To test for significant differences in Z-score means among the ten banks, an analysis of variance (ANOVA) single-factor test was performed. The calculated F-value of 7.78, which is higher than the critical value of 1.98, and the corresponding p value of 2,1289E-08 provide strong evidence of a statistically significant variation in the average Z-scores among the selected banks, as indicated in Table 3. The computed p-value is significantly lower than the commonly accepted alpha level of

0.05, providing a strong justification for rejecting the null hypothesis (H01) of equal means. Therefore, we may conclude that the Z-score means for the ten banks are significantly distinct from one another. The results imply that factors beyond chance variation influenced the observed variation in Z-scores among banks. The significant difference in Z values among the selected ten banks may be because of disparities in financial performance, risk management techniques, management strategies, market conditions, and other relevant factors.

Figure 1. Altman’s Z-Score



Source: Authors' own elaboration.

Table 3. ANOVA (F-test)

Count	Sum	Average	Variance		
8	41.15725	4.115725	0.018477		
8	42.08442	4.208442	0.006039		
8	41.16916	4.116916	0.018553		
8	40.85719	4.085719	0.011128		
8	43.31032	4.331032	0.083686		
8	41.34687	4.134687	0.00892		
8	45.66105	4.566105	0.091657		
8	42.04906	4.204906	0.010828		
SS	df	MS	F	P-value	F crit
2.124068	7	0.236008	7.786322	2.12892E-08	1.985595
2.727948	90	0.030311			

Source: Authors' own elaboration.

Results of Two-sample t test

The two-sample t-test was performed in order to investigate whether there exists a significant difference in Z values between scheduled private sector banks and scheduled public sector banks. This is depicted in Table 4. The t test results indicate that the mean Z score for scheduled public sector banks is 4.17, while the mean Z value for scheduled private sector banks is 4.32. This indicates that scheduled private sector banks have slightly greater financial stability than scheduled public sector banks on average. The standard deviations for the two groups are not similar (0.18 and 0.23); the "equal variances not assumed" column has been used. The variance and standard deviation of scheduled public sector banks' Z scores are 0.033 and 0.183, respectively. The variance and standard deviation for scheduled private sector banks are greater, at 0.0536 and 0.2316, respectively. This indicates that the Z scores for scheduled private sector banks are more variable, indicating that the financial stability of private sector banks may be more diverse. The p-value for a test with one tail is 0.0002156, and the p-value for a test with two tails is 0.0004312. Both p-values are quite small, indicating that there is substantial evidence against the null hypothesis. For one-tailed and two-tailed tests, the critical t-values are 1.66 and 1.98, respectively. Due to the fact that the calculated t-statistic (-3.65) is smaller than both critical values, it falls within the rejection region. This indicates that the difference in Z-scores is not only statistically significant but also significant in both directions, providing a strong justification for rejecting the null hypothesis (H02). In summary, the t-test results show that there is a significant difference in Z-scores between scheduled private sector banks and scheduled public sector banks. This finding suggests that the financial performance and risk profiles of the two groups may differ, indicating the distinct characteristics and dynamics of the public and private sectors within the banking system.

Table 4. Two sample t-Test

Two-Sample t-Test with Unequal Variances		
	Z public	Z private
Mean	4.17	4.32
Variance	0.0335	0.0536
Standard Deviation	0.18	0.23
Observations	50	50
Hypothesized Mean Difference	0	
Df	93	
t Stat	-3.65	
P(T<=t) one-tail	0.000215601	
t Critical one-tail	1.66	
P(T<=t) two-tail	0.000431202	
t Critical two-tail	1.98	

Source: Authors' elaboration using Stata 16 software.

Conclusion

This study evaluates the financial viability of Indian banks, both in the scheduled public and scheduled private sectors, employing the Emerging Market Z Score Model. The findings indicate that the selected banks have a positive financial outlook, as all of them consistently have Z-scores above the safe threshold of 2.60, indicating a safe zone classification. This indicates that the banks under consideration have maintained strong financial health and stability throughout the time period under consideration. Furthermore, the one-way ANOVA (F-test) results show that the Z-score means differ significantly across the ten banks. This indicates that the financial performance of the selected banks differs. Additionally, the t-test outcomes indicate a significant variation in Z-scores between scheduled private sector banks and scheduled public sector banks. This implies that the two groups exhibit unique financial performance and risk profiles. The financial stability of scheduled private sector banks is moderately higher than that of scheduled public sector banks, but it also exhibits greater variability compared to scheduled public sector banks. This implies that the financial stability of private sector banks may be more diverse. The significant differences in Z-score means among banks, as well as the distinction between the public and private sectors, highlight the banking system's unique dynamics and characteristics. These findings contribute to a holistic awareness of the financial viability of Indian banks and provide useful observations for stakeholders, regulators, and researchers in the banking industry.

Contributions and Implications

The study on the financial distress of selected Indian banks using the Emerging Market Z Score Model has various practical implications and contributions. The practical applications of the study may apply to stakeholders, including investors, regulators, policymakers, consumers, and the selected banks themselves. The findings of the study, particularly the Z values and their variations, provide insights into the risk levels of the selected banks. Understanding these differences is valuable for stakeholders. Banks with consistently higher Z values are deemed to be in a safer financial zone, which is crucial information for investors, regulators, and other stakeholders. This can aid in more informed decision-making regarding investments, policymaking, and regulatory measures. The study can be used by potential investors to examine the financial health and risk associated with different banks. This information is essential for making investment decisions and the effective management of portfolios. The identification of banks in the safe zone based on Z values provides a quick reference for investors seeking financially sound institutions. To ensure stability in the financial system, it is essentially important for regulators to access the financial performance of banks so that appropriate actions can be taken to prevent financial and operational losses to the industry. The results of the study may influence regulatory policies, capital adequacy requirements, and numerous indicators aimed at securing the overall stability of the banking sector. As a result, regulators can use this study to regulate and monitor banks effectively. This information can also be utilized by policymakers to formulate strategies for strengthening the financial positions of banks. This is attributed to the fact that a comprehensive understanding of the financial well-being

of banks is essential for policymakers, as it facilitates the development of effective policies to safeguard the overall financial system. The comparative analysis of financial health between scheduled private sector banks and scheduled public sector banks provides an in-depth understanding of the comparative financial performance of these two sectors. It provides a better understanding of the weaknesses and strengths present in each sector. Stakeholders can make better decisions based on the relative financial health of scheduled private sector banks and scheduled public sector banks. This study can also be utilized by consumers for the purpose of decision making. The comparative financial performance of banks allows consumers to make decisions regarding where to deposit their funds, choose financial products, and avail services. The study can also be utilized by banks for the purpose of examining their own financial performance and comparing it to that of other banks. This can provide valuable insights for strategic planning and risk management initiatives. Banks with lower Z values may take necessary actions to improve their financial health, while those with higher Z values can focus on securing their dominant position. Competition among these banks, influenced by their relative financial performance, can result in better services, attractive interest rates, and more innovative financial products for consumers. The emerging Z Score Model, which is designed to predict the likelihood of financial distress or bankruptcy, can serve as an early warning system. Identifying banks with lower Z scores enables proactive measures to mitigate risks and maintain financial stability. The results of the study may influence the perception of the market toward individual banks. Higher Z scores may enhance a bank's reputation and attractiveness to investors and customers because the Z value has been used to evaluate the credibility of banks. The research contributes to the academic field by applying the Emerging Market Z Score Model to the context of Indian banks. It adds to the field of study on financial performance analysis and risk assessment, particularly in emerging markets.

Limitations and future research directions

The study on assessing the financial viability of Indian banks using the Emerging Market Z Score Model opened the way for various future research avenues. Some potential areas for further research include: A more extensive study with a larger sample size, including a broader range of banks from various sectors and regions, can provide a more complete understanding of the overall financial stability of the Indian banking industry. Comparing the financial health of Indian banks with banks from other countries or regions can provide valuable insights into the Indian banking sector's relative positioning and performance in a global context. Incorporating qualitative factors such as corporate governance practices, risk management frameworks, and market strategies can provide a more comprehensive assessment of a bank's financial stability. Investigating the impact of macroeconomic factors, regulatory changes, and market dynamics on bank financial health can provide deeper insights into the determinants of their viability and performance. A comparative analysis of financial performance measures beyond the Z-score, such as profitability ratios, asset quality indicators, and capital adequacy measures, can provide a more thorough evaluation of the banks' overall financial health. The results of the study are limited to a specific time period and the market conditions that prevailed during that time. The results may not hold true in different time

frames. Further post-hoc analysis, such as pairwise comparisons, can be performed to determine which specific banks have Z-score mean values that differ significantly from one another. This can provide a more in-depth understanding of the relative financial performance and standing of individual banks within the sample. In addition, it is important to address the fact that the emerging Z score model utilized here is designed specifically for emerging markets. Consequently, it may not be directly comparable to models or standards employed in other markets or regions. By addressing these areas in future research, a deeper understanding of the financial viability of banks in India and the factors influencing their performance can be achieved, leading to improved decision-making for stakeholders, regulators, and policymakers within the banking industry.

References

- Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The journal of finance*, 23(4), 589-609.
- Altman, E. I., Hotchkiss, E., & Wang, W. (2019). *Corporate financial distress, restructuring, and bankruptcy: analyze leveraged finance, distressed debt, and bankruptcy*. John Wiley & Sons.
- Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-score model. *Journal of International Financial Management & Accounting*, 28(2), 131-171.
- Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of accounting research*, 71-111.
- Beltratti, A., & Stulz, R. M. (2012). The credit crisis around the globe: Why did some banks perform better?. *Journal of financial economics*, 105(1), 1-17.
- Bhunia, A., & Sarkar, R. (2011). A study of financial distress based on MDA. *Journal of Management Research*, 3(2), 1-11.
- Blum, M. (1974). Failing company discriminant analysis. *Journal of accounting research*, 1-25.
- Boyd, J. H., & Runkle, D. E. (1993). Size and performance of banking firms: Testing the predictions of theory. *Journal of monetary economics*, 31(1), 47-67.
- Brown, K. (2003). Islamic banking comparative analysis. *The Arab Bank Review*, 5(2), 43-50.
- Chatterjee, A. (2018). Predicting corporate financial distress for widely held large-Cap companies in India: Altman model vs. Ohlson model. *Indian Journal of Finance*, 12(8), 36-49.
- Chotalia, P. (2012). Evaluation of financial health of sampled private sector banks with Altman Z-score model. *Circulation in more than 85 countries*, 7.

- Chung, K. C., Tan, S. S., & Holdsworth, D. K. (2008). Insolvency prediction model using multivariate discriminant analysis and artificial neural network for the finance industry in New Zealand. *International journal of business and management*, 39(1), 19-28.
- Deakin, E. B. (1972). A discriminant analysis of predictors of business failure. *Journal of accounting research*, 167-179.
- Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial economics*, 98(3), 626-650.
- Doumpos, M., & Zopounidis, C. (1999). A multicriteria discrimination method for the prediction of financial distress: The case of Greece. *Multinational Finance Journal*, 3(2), 71-101.
- Edmister, R. O. (1972). An empirical test of financial ratio analysis for small business failure prediction. *Journal of Financial and Quantitative analysis*, 7(2), 1477-1493.
- Geng, R., Bose, I., & Chen, X. (2015). Prediction of financial distress: An empirical study of listed Chinese companies using data mining. *European Journal of Operational Research*, 241(1), 236-247.
- Gupta, Ruchi. "An analysis of Indian public sector banks using CAMEL approach." *IOSR Journal of Business and Management* 16.1 (2014): 94-102.
- Houston, J. F., Lin, C., Lin, P., & Ma, Y. (2010). Creditor rights, information sharing, and bank risk taking. *Journal of financial Economics*, 96(3), 485-512.
- Jain, P. K., & Gupta, V. (2004). Asset-Liability management among commercial banks in India—A canonical correlation analysis. *Vision*, 8(1), 25-40.
- Joshi, Manoj Kumar. "Financial performance analysis of select Indian Public Sector Banks using Altman's Z-Score model." *SMART Journal of Business Management Studies* 16, no. 2 (2020): 74-87.
- Khaliq, A., Altarturi, B. H. M., Thaker, H. M. T., Harun, M. Y., & Nahar, N. (2014). Identifying Financial distress firms: a case study of Malaysia's government linked companies (GLC). *International Journal of Economics, Finance and Management*, 3(3), 141-150.
- Krishna Chaitanya, V. (2005). Measuring Financial Distress of IDBI Using Altman Z-Score Model. *The ICAFI Journal of Bank Management*, August, 4(3), 7-17.
- Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of financial economics*, 93(2), 259-275.
- Lin, T. H. (2009). A cross model study of corporate financial distress prediction in Taiwan: Multiple discriminant analysis, logit, probit and neural networks models. *Neurocomputing*, 72(16-18), 3507-3516.

- Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of accounting research*, 109-131.
- Olson, D., & Zoubi, T. A. (2011). Efficiency and bank profitability in MENA countries. *Emerging markets review*, 12(2), 94-110.
- Putri, H. R., & Dhini, A. (2019, July). Prediction of financial distress: Analyzing the industry performance in stock exchange market using data mining. In 2019 16th International Conference on Service Systems and Service Management (ICSSSM) (pp. 1-5). IEEE.
- Safiullah, M. (2010). Superiority of conventional banks & Islamic banks of Bangladesh: a comparative study. *International Journal of Economics and Finance*, 2(3), 199-207
- Sung, T. K., Chang, N., & Lee, G. (1999). Dynamics of modeling in data mining: interpretive approach to bankruptcy prediction. *Journal of management information systems*, 16(1), 63-85.
- Zmijewski, M. E. (1984). Methodological issues related to the estimation of financial distress prediction models. *Journal of Accounting research*, 59-82.