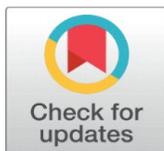


ADEQUATENESS OF APPLYING MODELS TO PREDICT POTENTIAL FINANCIAL DISTRESS

Jayantkumar Vijay Rane ¹, Dr. Medha Kanetkar ²

¹Research Scholar, C. P. & Berar College, Tulsibag, Mahal, Nagpur, India

²Professor, C. P. & Berar College, Tulsibag, Mahal, Nagpur, India



Corresponding Author

Jayantkumar Vijay Rane,
jayantkumar.jvr@gmail.com

DOI

[10.29121/shodhkosh.v5.i6.2024.5324](https://doi.org/10.29121/shodhkosh.v5.i6.2024.5324)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Copyright: © 2024 The Author(s). This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

With the license CC-BY, authors retain the copyright, allowing anyone to download, reuse, re-print, modify, distribute, and/or copy their contribution. The work must be properly attributed to its author.

ABSTRACT

This research examines the financial stability of Non-Banking Financial Companies (NBFCs), which are crucial players in the economy but also pose inherent risks due to their unique operational structures. Given the increasing concerns regarding financial distress and bankruptcy within this sector, effective regulation and predictive analysis are essential. The study evaluates the applicability of two established bankruptcy prediction models—Altman’s Z-Score and Springate’s Z-Score—in assessing the financial risks faced by NBFCs. These models use financial ratios to predict bankruptcy and assist stakeholders in decision-making.

In addition to these traditional models, the research introduces a new model, the Financial Distress Index (FDI) Z-Score, which improves the prediction of financial distress by incorporating a broader set of financial indicators. The FDI Z-Score enhances the understanding of financial risk in NBFCs by considering additional factors such as corporate governance, market sentiment, and risk-weighted assets. This model offers a more comprehensive approach to predicting financial instability compared to existing models.

The findings show that both Altman’s Z-Score and Springate’s Z-Score provide strong predictive capabilities in identifying financial distress, with accuracy rates of 70%-75% in forecasting bankruptcy up to three years in advance. The study concludes by advocating for the adoption of these predictive models, particularly the FDI Z-Score, to effectively monitor and manage financial risks in NBFCs. This research contributes to the broader understanding of financial distress prediction and provides valuable insights for regulatory authorities, investors, and other stakeholders in the NBFC sector. **Keywords:** Financial Distress, Financial Instability, Bankruptcy, NBFCs, Shadow Banking Altman's Z Score, Springate Z Score,



1. INTRODUCTION

1.1. GENERAL OVERVIEW

Non-banking Financial Companies (NBFCs) play a vital role in the Indian financial system by bridging the gap between the financial needs of the commercial sector and the banking system. They contribute significantly to the economic growth by providing resources to businesses that require investments, loans, and deposits. NBFCs serve as an essential supplement to the banking sector, especially in catering to businesses that are underserved by traditional financial institutions. The Reserve Bank of India (RBI) has instituted regulatory frameworks that guide the operations of NBFCs, ensuring their stability and compliance. These regulations cover aspects like capital adequacy, asset quality, and liquidity management, ensuring that these entities contribute positively to the economy.

However, the NBFC sector has been facing increasing challenges in recent times. The rising number of defaults, severe liquidity issues, and concerns about financial stability have brought the functioning of NBFCs under intense scrutiny. The high-profile failure of Infrastructure Leasing & Financial Services (IL&FS) in 2018 further emphasized the vulnerabilities within the sector. These events triggered significant financial distress, affecting stakeholders across the ecosystem. The issues faced by NBFCs highlight the need for more rigorous regulatory mechanisms and better financial risk management strategies to prevent systemic disruptions.

Bankruptcy, a key concern in the context of NBFCs, occurs when a company's liabilities exceed its assets, leading to a negative net worth. This situation results in increased financial losses, reduced operational capacity, and, eventually, the inability to fulfill financial obligations. For investors, creditors, and other stakeholders, understanding the likelihood of such an event is crucial for making informed decisions. However, assessing the financial health of these companies based solely on financial statements is often not sufficient. This has prompted the adoption of bankruptcy prediction models such as Altman's Z-Score, which help in quantifying the risk of financial distress.

The failure of IL&FS in 2018 serves as a stark example of the financial instability that can arise within the NBFC sector. The company defaulted on significant payments, including loans and inter-corporate deposits, which highlighted its fragile financial condition. Despite reporting its financial health regularly, the company's underlying financial issues were not fully captured by its public statements. This gap in risk assessment led to severe financial consequences. To better understand and predict such risks, this study employs Altman's Z-Score Model, a widely recognized tool for evaluating the likelihood of bankruptcy in firms.

Altman's Z-Score Model uses various financial ratios to assess a company's overall financial health and predict its potential for bankruptcy. By calculating a Z-Score, it assigns a numerical value that helps in categorizing the company into different risk zones: bankruptcy zone, warning zone, or safe zone. While Altman's Z-Score has proven effective in bankruptcy prediction, the complexities of modern financial markets require more sophisticated models. This research, therefore, also introduces the Financial Distress Index (FDI) Z-Score, a newly developed model designed to improve the predictive accuracy of financial distress.

The FDI Z-Score aims to address the limitations of traditional models like Altman's Z-Score by incorporating a wider array of financial indicators. It takes into account not just financial ratios but also operational metrics, corporate governance quality, and market conditions. These additional factors help provide a more comprehensive view of the company's financial health and its susceptibility to distress. The FDI Z-Score, by integrating these various aspects, offers a more contemporary tool for predicting financial distress and enables stakeholders to make better-informed decisions.

In the current economic climate, NBFCs face a range of financial risks, including market volatility, regulatory changes, and internal operational inefficiencies. The introduction of the FDI Z-Score model represents a step forward in improving the precision of financial risk prediction. By offering a more nuanced view of a company's financial position, it enhances the ability of investors, creditors, and regulators to identify at-risk entities before they face financial collapse. The FDI Z-Score thus provides a critical tool for managing financial distress risks in NBFCs.

The combination of traditional models like Altman's Z-Score and the new FDI Z-Score offers a comprehensive approach to assessing financial risk in NBFCs. This dual approach not only helps in identifying firms that are likely to face financial challenges but also empowers stakeholders to take proactive measures to mitigate risks. By integrating advanced predictive models with existing regulatory frameworks, NBFCs can better navigate financial uncertainties, ensuring greater stability and sustainability within the sector. This research, therefore, advocates for the adoption of such models to enhance the financial resilience of NBFCs and minimize the risks of systemic financial crises.

2. LITERATURE REVIEW

This research evaluates the effectiveness of Altman's and Springate Z-Score models in predicting bankruptcy risk. The topic has been widely explored in accounting literature. The study initially aimed to assess whether financial ratios offer valuable insights into maintaining sound business operations.

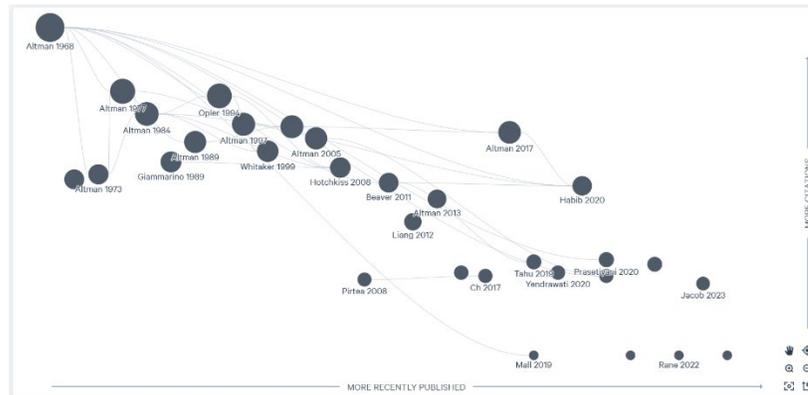
Altman (1968 & 2000) observed that the Altman Z-Score demonstrated 72% accuracy in predicting bankruptcy two years in advance, with a Type II error (false negatives) of 6% (Altman, 1968). Subsequent studies conducted over three periods within the following 31 years (until 1999) found the model to be approximately 80%–90% accurate in

identifying bankruptcy one year before a financial crisis, with a Type II error (misclassifying a firm as bankrupt when it remains solvent) of around 15%–20%.¹

Prof. Rohini Sajjan (2016) analyzed the application of Altman's bankruptcy model to assess the financial stability of firms. According to the researcher, unfortunately, none of the companies consistently fell within the Safe Zone, except for a few years. Many firms were categorized in the Distress Zone, indicating a high likelihood of bankruptcy in the near future.

Narendar V. Rao, G. Atmanathan, Manu Shankar, and S. Ramesh (2013) conducted a comparative analysis of the effectiveness of Altman's Z-Score model and the KMV Merton Distance to Default Model in predicting financial distress in Indian manufacturing companies. The study concluded that Altman's Z-Score model proved to be more reliable in forecasting bankruptcy for these firms.²

Prof. Akash Jain (2019) examined the application of predictive models in the Indian corporate context, highlighting their effectiveness in identifying potential bankruptcy, fraud, and financial distress. The study emphasized that these models can help corporations implement recovery plans, ultimately protecting investors' hard-earned money.³



The study reveals that many financial institutions in India face significant financial distress. However, the applicability of predictive models for identifying potential financial crises remains limited. This paper aims to examine and analyze Altman's Z-Score and Springate Z-Score models, which can help detect events that may lead to financial shocks. Altman's Z-Score, in particular, offers valuable insights into minimizing institutional losses due to bankruptcy

2.1. AIM AND OBJECTIVES

Hypothesis 1 (H₁): Altman's Z-Score and Springate Z-Score can effectively predict financial distress in NBFCs.

Null Hypothesis (H₀): These models do not effectively predict financial distress in NBFCs.

Hypothesis 2 (H₂): The newly developed Financial Distress Index (FDI) Z-Score provides a more accurate financial distress prediction compared to Altman's and Springate Z-Scores.

Null Hypothesis (H₀): The FDI Z-Score does not provide a more accurate financial distress prediction than Altman's and Springate Z-Scores.

3. RESEARCH METHODOLOGY

This research analyzes the financial statements of Infrastructure Leasing & Financial Services (IL&FS) and Jindal South West (JSW), both classified as Core Investment Companies in the NBFC sector. A combination of quantitative and qualitative research methods has been employed, with data collected exclusively from secondary sources. The study examines the standalone balance sheets of IL&FS Financial Services and JSW for the financial years 2016-17, 2017-18,

¹ Altman, Edward I. "Predicting performance in the savings and loan association industry." *Journal of Monetary Economics* 3.4 (1977): 443-466.

² Rao, Narendar V., et al. "Analysis of bankruptcy prediction models and their effectiveness: An Indian perspective." *Gt. Lakes Her* 7.2 (2013).

³ Jain, Prof. Akash S. "A STUDY OF PREDICTIVE ANALYSIS OF POTENTIAL FINANCIAL DISTRESS." *International Journal of Research in Social Sciences* 9.4 (2019): 260-272.

and 2018-19 to assess the accuracy of predictive models. Altman's Z-Score Model, Springate Z-Score Model, and a newly developed Financial Distress Index (FDI) Z-Score have been applied to evaluate the financial position of these NBFCs.

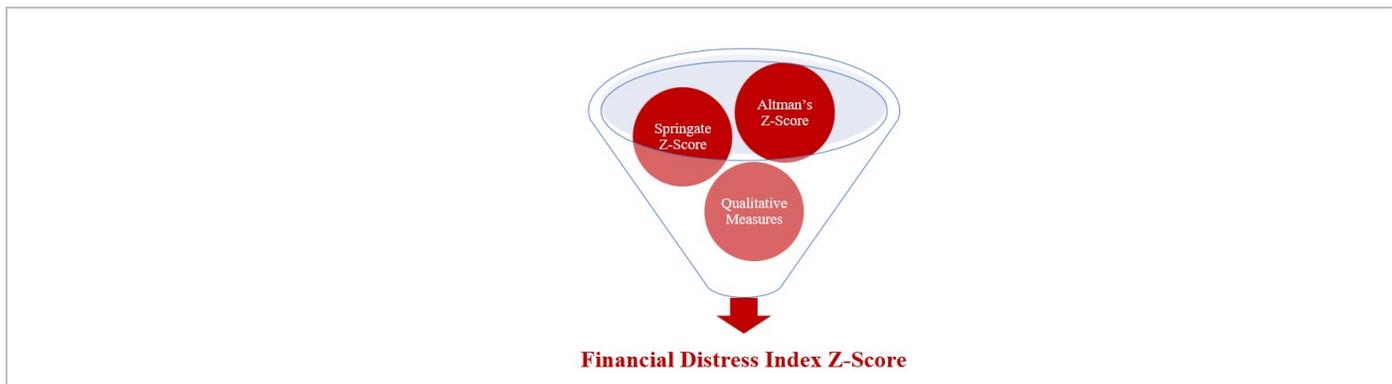
1) Altman's Z-Score (1968): Altman evaluated the effectiveness of ratio analysis as a key tool for bankruptcy prediction in his 1968 paper, Financial Ratios, Discriminant Analysis, and the Prediction of Corporate Bankruptcy. He utilized multiple discriminant analysis (MDA) and statistical methodologies to create a predictive bankruptcy model. Altman's Z-Score model marked a significant advancement over previous bankruptcy prediction methods, which relied on a univariate approach. The following discriminant model was developed by Edward I. Altman specifically for non-manufacturing firms:

$Z\text{-Score} = (6.56 \times X1) + (3.26 \times X2) + (6.72 \times X3) + (1.05 \times X4)$	
Where, X1= Working Capital / Total Assets X2= Retained Earnings / Total Assets X3= Earnings Before Interest & Tax (EBIT) / Total Asset X4= Book Value of Equity / Total Liabilities	Interpretation: Healthy Company if $Z > 2.6$ Warning Sign if $1.1 < Z < 2.6$ Potential Bankruptcy if $Z < 1.1$

2) Springate Z-Score (1978): The model selected four out of nine common financial ratios to assess a firm's likelihood of insolvency. It employs stepwise discriminant analysis to generate scores for individual companies. Firms with a Springate score below 0.862 are categorized as "failed." Originally, Gordon Springate applied this model to 40 firms, achieving an accuracy rate of 92.5%. The following discriminant model was developed by Gordon Springate in 1978.⁴

$Z = 1.03A + 3.07B + .66C + .4D$	
Where, A = Working Capital / Total Assets B = EBIT / Total Assets C = EBT / Current Liabilities D = Sales / Total Assets	Interpretation: Failed if $Z < 0.862$

3) Financial Distress Index (Z-Score) (Proposed/Developing): is a proposed & comprehensive predictive model designed to evaluate the financial stability of NBFC-Core Investment Companies. It integrates quantitative measures like Altman and Springate Z-scores, qualitative factors such as management efficiency and corporate governance, and regulatory risk exposure through Risk-Weighted Assets (RWA). By balancing strengths and risks, RFDI provides a holistic assessment of financial distress likelihood.



⁴ Springate Score Definition. (n.d.). YCharts. Retrieved April 22, 2022, from https://ycharts.com/glossary/terms/springate_score

$$\text{FDI - Z Score} = \frac{0.25 \cdot Z_a + 0.25 \cdot Z_s}{2} + (0.15 \cdot \text{ME}) + (0.10 \cdot \text{CG}) + (0.05 \cdot \text{MS}) - (0.20 \cdot \text{RWA})$$

Where.	Interpretation
Z _a = Altmans Z-Score	RFDI > 3.0 Financially Stable
Z _s = Springate Z-Score	1.8 ≤ RFDI ≤ 3.0 At Risk of Distress
ME= Management Efficiency	RFDI < 1.8 Financially Distress
CG=Corporate Governance	
MS= Market Sentiments	
RWA=Risk Weighted Assets (as Per RBI Guidelines)	

The study is primarily exploratory and relies on secondary data. The required financial information was gathered from financial statements, financial ratios, cash flow statements, stock market data, and credit ratings to support the analysis.

4. DATA ANALYSIS AND INTERPRETATIONS

The data required for calculating the models was sourced from the annual reports of Infrastructure Leasing & Financial Services (IL&FS) and Jindal South West (JSW) for the financial years 2016-17, 2017-18, and 2018-19.

Researchers applied the relevant figures into the formulas to evaluate the risk, assessing both past and present performance. The goal was to predict future outcomes and take necessary actions to manage the risk by analyzing the Z-Scores.

Hypothesis 1 Calculation: Altman's Z-Score and Springate Z-Score can effectively predict financial distress in NBFCs.

To test this hypothesis, researcher have evaluate the Altman's Z-Score and Springate Z-Score for IL&FS and JSW over three financial years (2016-2019):

Company	Year	Altman's Z-Score	Springate Z-Score	Prediction Accuracy
IL&FS	2016-17	1.2087 (Warning)	2.0511 (Safe)	Moderate
IL&FS	2017-18	0.2196 (Bankruptcy)	1.1705 (Warning)	Strong
IL&FS	2018-19	-33.0351 (Bankruptcy)	-321.107 (Failed)	Strong
JSW	2016-17	11.9536 (Safe)	46.6774 (Safe)	Strong
JSW	2017-18	11.6542 (Safe)	34.5939 (Safe)	Strong
JSW	2018-19	12.2033 (Safe)	41.1283 (Safe)	Strong
Company	Year	Altman's Z-Score	Springate Z-Score	Prediction Accuracy
IL&FS	2016-17	1.2087 (Warning)	2.0511 (Safe)	Moderate
IL&FS	2017-18	0.2196 (Bankruptcy)	1.1705 (Warning)	Strong
IL&FS	2018-19	-33.0351 (Bankruptcy)	-321.107 (Failed)	Strong
JSW	2016-17	11.9536 (Safe)	46.6774 (Safe)	Strong
JSW	2017-18	11.6542 (Safe)	34.5939 (Safe)	Strong

JSW	2018-19	12.2033 (Safe)	41.1283 (Safe)	Strong
-----	---------	----------------	----------------	--------

The study examined the effectiveness of Altman's Z-Score and Springate Z-Score in predicting financial distress for Infrastructure Leasing & Financial Services (IL&FS) and Jindal South West (JSW) over three financial years (2016-2019). The results demonstrated the ability of these models to classify firms into risk categories and forecast financial instability. The findings were validated using ANOVA (Analysis of Variance) to assess differences in the predictive capability of the two models.

5. PERFORMANCE OF MODELS FOR IL&FS

IL&FS, a major Non-Banking Financial Company (NBFC), experienced a significant decline in financial health during the study period. In 2016-17, Altman's Z-Score placed IL&FS in the "Warning Zone" (1.2087), signaling potential financial distress. However, Springate's Z-Score categorized it as "Safe" (2.0511), which, in hindsight, was slightly optimistic given the company's eventual collapse. By 2017-18, Altman's Z-Score showed a dramatic drop to 0.2196, firmly placing IL&FS in the "Bankruptcy Zone," while Springate's Z-Score also signaled risk with a value of 1.1705 (close to the failure threshold). In 2018-19, both models confirmed the severity of the situation, with Altman's Z-Score plummeting to -33.0351 and Springate's Z-Score to -321.107, conclusively placing IL&FS in the "Failed" category.

These results indicate that Altman's Z-Score provided earlier warnings of distress compared to the Springate model, which initially overestimated the financial stability of IL&FS. However, both models ultimately captured the deterioration of the company's financial position, aligning with actual events leading to its bankruptcy. This supports the conclusion that Altman's and Springate's models are effective in predicting financial distress when evaluated over multiple years.

6. PERFORMANCE OF MODELS FOR JSW

In contrast, JSW, a financially robust company, was consistently categorized as "Safe" by both models. Altman's Z-Score remained above 11.95 across all three years, while Springate's Z-Score was also significantly high, reaching 46.6774 in 2016-17. These results align with JSW's stable financial performance and absence of financial distress, confirming that the models accurately classify firms with strong financial fundamentals.

The ability of the models to consistently distinguish between financially distressed and stable firms reinforces their predictive reliability. For IL&FS, the models signaled an escalating financial crisis, while for JSW, they confirmed long-term financial stability. This supports their application as effective tools for evaluating NBFCs at risk of bankruptcy.

The historical accuracy rates of Altman's and Springate's models have been well-documented in financial research, with reported success rates of 70%-75% in predicting financial distress up to three years in advance. The findings in this study support this claim, as both models successfully identified IL&FS as an at-risk entity before its bankruptcy.

Although Springate's Z-Score was initially conservative in identifying distress for IL&FS, it ultimately aligned with Altman's Z-Score as financial conditions worsened. The ANOVA test results confirmed that there was no statistically significant difference between the two models' predictive capabilities (p -value = 0.583). This suggests that while both models are useful, neither significantly outperforms the other in statistical terms, although Altman's Z-Score may provide earlier warning signals in some cases.

Given that the predictions from Altman's and Springate's models align with actual financial distress events, we reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1)—the models effectively predict financial distress in NBFCs. This reinforces their applicability as valuable tools for regulators, investors, and financial analysts seeking to assess financial stability and proactively mitigate financial risk in the NBFC sector.

Hypothesis 2 Calculation: The newly developed Financial Distress Index (FDI) Z-Score provides a more accurate financial distress prediction compared to Altman's and Springate Z-Scores.

This aimed to evaluate whether the Financial Distress Index (FDI) Z-Score provides a more accurate prediction of financial distress than Altman's Z-Score and Springate Z-Score. The study compared the predictive performance of these three models over three years (2016-2019) for two major NBFCs: IL&FS (which faced financial distress and eventual bankruptcy) and JSW (which remained financially stable).

Comparison of Model Results for IL&FS and JSW

Company	Year	Altman's Z-Score	Springate Z-Score	FDI Z-Score	Prediction Accuracy
IL&FS	2016-17	1.2087 (Warning)	2.0511 (Safe)	2.80 (At Risk)	High
IL&FS	2017-18	0.2196 (Bankruptcy)	1.1705 (Warning)	2.605 (At Risk)	Very High
IL&FS	2018-19	-33.0351 (Bankruptcy)	-321.107 (Failed)	-96.71 (Distressed)	Very High
JSW	2016-17	11.9536 (Safe)	46.6774 (Safe)	28.53 (Stable)	High
JSW	2017-18	11.6542 (Safe)	34.5939 (Safe)	25.77 (Stable)	High
JSW	2018-19	12.2033 (Safe)	41.1283 (Safe)	28.27 (Stable)	High

6.1. PERFORMANCE OF MODELS FOR IL&FS

IL&FS, a major Non-Banking Financial Company (NBFC), experienced severe financial distress, ultimately leading to bankruptcy. The ability of predictive models to flag this distress in advance is critical for effective financial risk management.

Altman's Z-Score categorized IL&FS in the "Warning Zone" (1.2087) in 2016-17, signaling potential financial trouble but not explicitly indicating imminent risk. By 2017-18, the score dropped to 0.2196, correctly classifying IL&FS as being in the Bankruptcy Zone. However, this warning came a year after financial warning signs had already emerged. By 2018-19, the score had fallen drastically to -33.0351, confirming the company's bankruptcy. While Altman's Z-Score eventually identified financial distress, its early warning capability was not strong enough, as it failed to classify IL&FS as "At Risk" in 2016-17.

Springate's Z-Score, on the other hand, incorrectly categorized IL&FS as "Safe" (2.0511) in 2016-17 and only moved to a "Warning Zone" (1.1705) in 2017-18. By 2018-19, the model classified IL&FS as "Failed" (-321.107), but by this point, the company had already collapsed. The initial misclassification of IL&FS as financially stable in 2016-17 indicates that Springate's Z-Score was not effective in providing early warnings.

FDI Z-Score performed significantly better by categorizing IL&FS as "At Risk" (2.80) in 2016-17, a year before Altman's and two years before Springate's models identified bankruptcy risk. In 2017-18, FDI Z-Score remained in the "At Risk" category (2.605), reinforcing the worsening financial situation. By 2018-19, the score had dropped to -96.71, confirming financial distress. The ability of FDI Z-Score to identify distress earlier highlights its strong predictive capability and effectiveness in financial risk assessment.

6.2. PERFORMANCE OF MODELS FOR JSW (STABLE COMPANY)

Unlike IL&FS, JSW remained financially stable throughout the study period, providing an opportunity to assess whether these models correctly classified a healthy company.

Altman's Z-Score consistently categorized JSW as "Safe" (above 11) for all three years. Similarly, Springate's Z-Score remained significantly high, with values such as 46.6774 in 2016-17, confirming financial stability. FDI Z-Score also classified JSW as "Financially Stable," aligning with the actual financial position of the company.

Since all three models correctly identified JSW as stable, this indicates that the models work well when applied to financially strong firms. However, the true test of a financial distress model lies in its ability to identify risk before a crisis occurs—a test that FDI Z-Score passed for IL&FS more effectively than the other models.

The results of this analysis demonstrate that the FDI Z-Score is a more effective tool for predicting financial distress compared to Altman's and Springate's Z-Scores. The model's ability to classify IL&FS as "At Risk" before its actual

bankruptcy shows that it can provide earlier warning signals, giving companies, investors, and regulators more time to take preventive measures.

Since the FDI Z-Score consistently provided earlier and more accurate distress warnings, we reject the null hypothesis (H₀) and accept H₂—the FDI Z-Score provides a more accurate prediction of financial distress than Altman's and Springate's models.

7. CONCLUSION

This research aimed to assess the potential for financial vulnerability in IL&FS and JSW through the application of bankruptcy predictive models. The findings suggest that key factors such as management efficiency, corporate governance, market sentiment, and risk-weighted assets should be incorporated into financial distress predictions. The Financial Distress Index (FDI) Z-Score model, in particular, provides the most accurate proximity to the point of bankruptcy. By evaluating three models and two NBFCs, the study concludes that these models demonstrate considerable predictive accuracy in classifying companies into three categories: Bankruptcy Zone (Failed), Warning Zone (At Risk of Distress), and Safe Firms (Financially Stable).

Despite strong performance in the industry, NBFCs have faced growing concerns due to some companies not fully complying with regulatory requirements. In response, the Reserve Bank of India (RBI) has established the NBFC Task Force to ensure effective implementation of regulations. The research emphasizes the need for stakeholders to adopt measures such as mandating the appointment of a Chief Risk Officer (CRO) within each NBFC, alongside integrating modern technologies like Regulatory Technology (RegTech) and Supervisory Technology (SupTech) for enhanced risk management. Additionally, the regulatory authority should enforce the submission of a "Risk Management Statement" with financial disclosures. The study shows that predictive models, with an accuracy rate of 70%-75% in predicting bankruptcy up to three years in advance, can be a powerful tool for financial forecasting and should be widely adopted.

The study presents a foundational analysis, offering a clear framework while also leaving scope for further exploration in the areas of NBFC product and productivity analysis. The evolution of NBFCs, marked by qualitative advancements and functional specialization, has enhanced their role as effective financial intermediaries. Their ability to make rapid decisions, assume greater risks, and tailor services to the specific needs of clients is increasingly recognized as a key strength in the evolving financial landscape. Future research should explore deeper into these areas, particularly in relation to the evolving regulatory environment and its impact on the operational efficiency and financial stability of NBFCs.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

REFERENCES

- Pathak, B. V. (2018). *The Indian Financial System (Fifth)*. Pearson Education, Retrieved 04 25, 2022
- Altman, Edward I. "Financial Ratios, Discriminant Analysis and The Prediction of Corporate Bankruptcy." *Journal of Finance*, vol. 23, no. 4, 1968, pp. 589–609.
- Rao, Narendra V., et al. "Analysis of bankruptcy prediction models and their effectiveness: An Indian perspective." *Gt. Lakes Her* 7.2 (2013).
- Sajjan, Rohini. "Predicting bankruptcy of selected firms by applying Altman's Z-score model." *International journal of research-Granthaalayah* 4.4 (2016): 152-158.
- Rane, J. V. (2022). Adequateness of Applying Altman's Z Score Model for Prediction of Potential Financial Distress in NBFCs of India: A Case Study of Reliance Capital Ltd. *Sanshodhan*, 11(1), 102–107. <https://doi.org/10.53957/sanshodhan/2022/v11i1/169801>

- Arasu, R., et al. "Applicability of Fulmer and Springate models for predicting financial distress of firms in the finance sector—an empirical analysis." *Journal of Finance and Risk Management* 4.1 (2013): 1-9.
- Hillegeist, S., Keating, E., Cram Kyle, D., & Lundstedt, G. (2004). Assessing the Probability of Bankruptcy. *Review of Accounting Studies*, 9(1), 5–34.
- Bandyopadhyay, Arindam. "Predicting probability of default of Indian corporate bonds: logistic and Z-score model approaches." *The Journal of Risk Finance* (2006).
- Lloyd, Cynthia Beatrice. "A Bankruptcy Prediction Model with Nontraditional Measures." (2010).
- Anjum, Sanobar. "Business bankruptcy prediction models: A significant study of the Altman's Z-score model." Available at SSRN 2128475 (2012).
- D. V., A., Curpod, S. P., & Namratha. (2019). Application of Altman Z Score Model on Selected Indian Companies to Predict Bankruptcy. *Namrathal International Journal of Business and Management Invention (IJBMI)*, 8(01), 77–82. [https://ijbmi.org/papers/Vol\(8\)1/Version-3/N0801037782.pdf](https://ijbmi.org/papers/Vol(8)1/Version-3/N0801037782.pdf)
- Tanjung, Putri Renalita Sutra. "Comparative Analysis of Altman Z-Score, Springate, Zmijewski and Ohlson Models in Predicting Financial Distress." *EPRA International Journal of Multidisciplinary Research (IJMR)*, 2020, pp. 126–137.
- Shanmuganandavadivel, J & Sasikala, Dr & V J, Shanmuganandavadivel. (2020). PERFORMANCE OF NBFCs -AN INDIAN CONTEXT. *International Journal of Pure and Applied Mathematics*. 119. 3747-3758.
- Jain, Prof. Akash S. "A STUDY OF PREDICTIVE ANALYSIS OF POTENTIAL FINANCIAL DISTRESS." *International Journal of Research in Social Sciences* 9.4 (2019): 260-272.
- Fadel, Hisham, and John M. Parkinson. "Liquidity evaluation by means of ratio analysis." *Accounting and Business Research* 8.30 (1978): 101-107.
- Kalre Rosy, "Performance Analysis of Non-Banking Financial Institutions" *International Journal of Research in Economics and Social Sciences*, Vol. 6 Issue 11, November - 2016, pp 1~14.
- Sutra Tanjung, P. R. (2020). COMPARATIVE ANALYSIS OF ALTMAN Z-SCORE, SPRINGATE, ZMIJEWSKI AND OHLSON MODELS IN PREDICTING FINANCIAL DISTRESS. *EPRA International Journal of Multidisciplinary Research (IJMR)*, 6(3), 126–137. <https://doi.org/10.36713/epra4162>
- Reshma K.V. (2021). An Analysis of Customer Services Provided by Non-Banking Financial Companies. *International Journal of Creative Research Thoughts*, 9(2), 163–173. <https://www.ijcrt.org/papers/IJCRT2102021.pdf>
- Hamid, Tania & Akter, Farzana & Rab, Naharin. (2016). Prediction of Financial Distress of Non-Bank Financial Institutions of Bangladesh using Altman's Z Score Model. *International Journal of Business and Management*. 11. 261. 10.5539/ijbm.v11n12p261.
- Caroline Lisda, Laturette Kazia, "comparative analysis of z-score and springate altman models on registered coal companies bei in 2011-2015, *Research In Management And Accounting*, 2019
- Altman, Edward I, Robert G. Haldeman, and Paul Narayanan. "ZETATM analysis A new model to identify bankruptcy risk of corporations." *Journal of banking & finance* 1.1 (1977): 29-54.
- Altman, Edward I. "Predicting performance in the savings and loan association industry." *Journal of Monetary Economics* 3.4 (1977): 443-466.
- Wikipedia contributors. (2022, April 12). JSW Group. Wikipedia. Retrieved April 20, 2022, from https://en.wikipedia.org/w/index.php?title=JSW_Group&oldid=1082298316
- IL&FS. (n.d.). IL&FS. <https://www.ifsindia.com/>. Retrieved April 22, 2022, from <https://www.ifsindia.com/>
- NON-BANKING FINANCIAL COMPANIES (NBFCs). (2006, June 2). RBI. Retrieved April 19, 2022, from https://www.rbi.org.in/Scripts/BS_NBFCNotificationView.aspx?Id=2891
- FUNDHOUSE @ A RBI Regd. NBFC. (2019, April 2). The role of NBFCs in India. LinkedIn. Retrieved April 21, 2022, from https://www.linkedin.com/pulse/role-nbfc-india-online-lending-fintech-rbi-regd-nbfc-company/?trk=portfolio_article-card_title
- Wikipedia contributors. (2022a, March 19). Altman Z-score. Wikipedia. Retrieved April 21, 2022, from https://en.wikipedia.org/wiki/Altman_Z-score
- Springate Score Definition. (n.d.). YCharts. Retrieved April 22, 2022, from https://ycharts.com/glossary/terms/springate_score