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ASSESSMENT OF THE INSOLVENCY SITUATION OF CHOSEN INDIAN FINANCIAL INSTITUTIONS

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Abstract

This study meticulously analyses the insolvency status of specific Indian commercial and public sector banks utilising the Z-score approach, a recognised tool for forecasting bankruptcy. The results indicate that private sector banks have superior bankruptcy resilience relative to public sector banks. The Indian banking sector collectively witnessed a decline in Z-scores during the pandemic era as a result of significant economic disruptions. Private sector banks maintained their Z-scores, demonstrating enhanced financial stability and resilience, whereas public sector banks faced challenges, shown in a notable decrease in their Z-scores. This research highlights the essential significance of strong financial management and strategic flexibility in addressing economic difficulties.

Keywords: Financial Performance, Financial Distress, Bankruptcy, Z-score, Economic Stability, Indian Banking Sector, Private Banks, Public Banks.

JEL Classification Codes: G21, G33, G01.

INTRODUCTION

Bankruptcy is a crucial concept in economic and financial systems, providing a systematic solution for organisations that cannot meet their debt obligations. The ramifications, particularly in the banking industry, are extensive, as demonstrated by the Great Recession of 2008, during which systemic failures caused worldwide economic turmoil. Banking institutions constitute the foundation of economic infrastructure, rendering the anticipation of financial crises essential for maintaining stability and public confidence.

The Indian banking sector's role in enabling transactions, savings, and investments is essential. Nonetheless, obstacles such as non-performing assets (NPAs), economic recessions, and global financial crises considerably jeopardise its stability. The COVID-19 epidemic compounded these vulnerabilities, heightening the necessity for effective evaluation techniques such as the Altman Z-score model to evaluate financial health. This study seeks to clarify differences in financial resilience between private and public sector banks in India, providing practical insights to improve the sector's stability and adaptability. The soundness of a nation's financial industry is intricately linked to its economic resiliency. Historical data indicates that financial instability in banks disrupts their operations and erodes overall economic trust, resulting in diminished investments and growth. The interaction of economic policies, regulatory frameworks, and banking operations in India significantly affects banks' resilience during crises.

Private sector banks exhibit agility in adjusting to evolving economic conditions, whereas public sector banks may encounter structural obstacles, such as bureaucratic lethargy and an elevated load of non-performing assets. These disparities require a comparative analysis to comprehend how sector-specific elements influence financial stability. This study aims to offer stakeholders a detailed comprehension of the fundamental dynamics influencing the Indian banking sector by emphasising these contrasts. The Altman Z-score model provides a robust framework for quantitatively evaluating financial health, rendering it an essential instrument for forecasting possible crises. This model incorporates various aspects of financial performance, including liquidity, profitability, and solvency, offering a comprehensive

perspective on an institution's stability, in contrast to conventional financial measurements. This study utilises the model's capabilities to extract actionable information essential for formulating policy actions and bolstering the resilience of the banking system.

LITERATURE REVIEW

Comprehensive studies have extensively employed the Altman Z-score model to predict financial distress across various sectors. A thorough review of literature highlights critical insights into its application in the banking and financial services domain.

Sharma and Mayanka (2013) assessed the financial health of Canara Bank and Kotak Mahindra Bank using the Altman Z-score model. Their analysis revealed the importance of annual financial evaluations to identify early signs of financial instability, underscoring the necessity of consistent monitoring of financial ratios to mitigate potential crises (Altman, 1968; Beaver, 1966).

Pandya and Buch (2021) conducted a comparative analysis between public and private sector banks in India. Their research indicated that while private banks employ superior risk mitigation measures, public sector banks remain more vulnerable to external economic pressures, such as changes in regulatory policies and macroeconomic factors (Altman, 1983; Bandyopadhyay, 2006).

Kaur (2019) examined the impact of macroeconomic variables, including inflation and GDP fluctuations, on the stability of Indian banks. The study highlighted how adverse economic conditions affect the Altman Z-scores of banks, emphasizing the importance of adaptive financial management strategies (Chowdhury & Barua, 2009; Berger et al., 1995).

Chotalia (2014) focused on the operational efficiency of private sector banks by employing the Altman Z-score model. The findings revealed that asset quality, profitability, and capital adequacy significantly influence financial stability, aligning with earlier studies on bank performance metrics (Das & Ghosh, 2006; Kamath, 2007). Prasad and Singh (2021) introduced a novel approach by integrating the Altman Z-score model with the Emerging Market model to analyse governance and operational practices.

This comprehensive analysis emphasized the importance of strategic decision-making to enhance institutional resilience, particularly during economic downturns (Léon, 2014; Caprio & Klingebiel, 1996). Joshi (2020) explored structural deficiencies in public sector banks, including high non-performing assets (NPAs) and inadequate capital buffers.

The study advocated for government interventions to address systemic inefficiencies, aligning with recommendations from earlier research (Banerjee, 2005; Barth et al., 2006). Mathews et al. (2019) compared private and public sector banks using the Z-score model, uncovering significant disparities in financial health metrics. Their findings called for tailored regulatory frameworks to address sector-specific challenges, resonating with the work of Ghosh and Nachane (2003).

Ramesh and Devi (2019) expanded the application of the Altman Z-score model to housing finance organizations, showcasing its relevance across diverse financial institutions. Their study underscored the versatility of the model in evaluating financial stability in specialized sectors (Bhattacharya & Patel, 2009).

Parekh et al. (2018) conducted a foundational analysis of public sector banks, identifying systemic vulnerabilities such as excessive reliance on government funding and restricted

operational flexibility. The study emphasized the need to foster a culture of financial discipline and operational efficiency (Mohan, 2003; Gupta & Gupta, 2014).

These studies collectively highlight the utility of the Altman Z-score model in predicting financial distress and its broad applicability across diverse financial scenarios. The research underscores the model's effectiveness in synthesizing multiple financial indicators to deliver a comprehensive assessment of financial stability. By bridging gaps related to sectoral imbalances in the Indian banking system, this study contributes to an enhanced understanding of financial health evaluation frameworks.

Purpose of the Study:

This study aims to assess the insolvency state of specific Indian private and public sector banks using the Altman Z-score methodology. In doing so, it aims to achieve the following specific objectives:

1. Examine the financial stability of private and public sector banks over a five-year duration.
2. Identify sector-specific determinants affecting differences in financial well-being.
3. Analyze the effects of external economic shocks, such the COVID-19 pandemic, on the financial resilience of banking institutions.
4. Deliver pragmatic recommendations to policymakers and stakeholders to improve the stability and sustainability of the Indian banking sector.

This investigation will enhance comprehension of how financial management techniques and regulatory actions might fortify the banking sector's resilience against future crises.

Hypotheses:

1. Private sector banks exhibit significantly higher financial stability than public sector banks, as measured by the Altman Z-score.
2. There are substantial differences in financial stability among banks within the same sector, reflecting diverse operational and managerial practices.
3. The financial performance of both private and public sector banks is significantly influenced by external economic disruptions, such as the COVID-19 pandemic.

METHODOLOGY

The Altman Z-score Model, developed in 1968, integrates critical financial ratios to assess bankruptcy risk. The formula is:

Where:

- **X_1:** Working Capital to Total Assets Ratio – Reflects liquidity. This ratio evaluates a bank's ability to fulfil short-term liabilities. It quantifies the ratio of working capital—the differential between current assets and current liabilities—against total assets. A greater value signifies more liquidity and solvency in the short term.
- **X_2:** Retained Earnings to Total Assets Ratio – Indicates financial self-reliance. This ratio indicates the extent to which retained earnings are utilised to finance assets, as opposed to incurring debt. A high number indicates strong internal funding and financial stability, demonstrating the bank's capacity to reinvest profits into its operations.

- **X_3:** EBIT to Total Assets Ratio – Measures profitability. This ratio signifies operational efficiency and profitability. It assesses the bank's capability to make profits in relation to its asset base, emphasising its ability to cover operational costs and maintain expansion.
- **X_4:** Market Value of Equity to Total Liabilities Ratio – Assesses long-term stability. This ratio assesses long-term financial stability by contrasting shareholder equity with total liabilities. It offers insights into the bank's capacity to endure financial pressures without undue dependence on loan capital.

Data Source: Financial data for five commercial banks (HDFC Bank, Axis Bank, ICICI Bank, Kotak Mahindra Bank, Yes Bank) and five public banks (Bank of Baroda, Canara Bank, Punjab National Bank, State Bank of India, UCO Bank) were sourced from their annual reports covering the period from 2016 to 2021.

Statistical Tools:

1) **Descriptive Analysis:** To summarize key financial metrics.
2) **ANOVA:** To assess variations in Z-scores across banks and time periods.
3) **Post-hoc Analysis:** To identify significant differences among bank pairs.

Classification Zones:

The Altman Z-score classifies entities into three distinct zones:

- **Safe Zone (Z > 2.6):** Negligible bankruptcy risk.
- **Grey Zone (1.1 < Z ≤ 2.6):** Moderate risk.
- **Trouble Zone (Z < 1.1):** High risk.

RESULTS

Table 1: ANOVA test on variation of Altman Z Score across Private Banks year-wise

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.097	4	.024	.416	.795
Within Groups	1.162	20	.058		
Total	1.258	24			

As p value is more than 0.05 as found in Table 2, we are accepting H_0 and rejecting H_1 at 5% level of significance. Thus, we can conclude that there is no significant difference in Altman Z Score across Private banks when compared year wise.

H_0: There is no significant difference between Altman Z Score across Private Banks bank-wise

H_1: There is significant difference between Altman Z Score across Private Banks bank-wise

Table 2: ANOVA test on variation of Altman Z Score across Private Banks bank-wise

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.630	4	.157	5.012	.006
Within Groups	.628	20	.031		
Total	1.258	24			

As p value is less than 0.05 as found in Table 3, we are rejecting H_0 and accepting H_1 at 5% level of significance. Thus, we can conclude that there is significant difference in Altman Z Score across Private banks when compared bank wise. To find out in which pairs of Private

banks there is significant difference in Altman Z score, post-hoc analysis is performed using LSD criterion.

Table 3: Post-hoc Analysis on variation of Altman Z Score across Private Banks bank-wise

(I) Private Bank	(J) Private Bank	Mean Difference (I-J)	Std. Error	Sig.
Axis Bank	HDFC Bank	.00600	.11211	.958
	ICICI Bank	-.01800	.11211	.874
	Kotak Mahindra Bank	-.41000*	.11211	.002
	Yes Bank	-.15600	.11211	.179
HDFC Bank	Axis Bank	-.00600	.11211	.958
	ICICI Bank	-.02400	.11211	.833
	Kotak Mahindra Bank	-.41600*	.11211	.001
	Yes Bank	-.16200	.11211	.164
ICICI Bank	Axis Bank	.01800	.11211	.874
	HDFC Bank	.02400	.11211	.833
	Kotak Mahindra Bank	-.39200*	.11211	.002
	Yes Bank	-.13800	.11211	.233
Kotak Mahindra Bank	Axis Bank	.41000*	.11211	.002
	HDFC Bank	.41600*	.11211	.001
	ICICI Bank	.39200*	.11211	.002
	Yes Bank	.25400*	.11211	.035
Yes Bank	Axis Bank	.15600	.11211	.179
	HDFC Bank	.16200	.11211	.164
	ICICI Bank	.13800	.11211	.233
	Kotak Mahindra Bank	-.25400*	.11211	.035

* The mean difference is significant at the 0.05 level.

The following pairs of banks show significant difference in Altman Z score as p value is less than 0.05:

i. Bank of Baroda and Punjab National Bank
ii. Bank of Baroda and State Bank of India
iii. Bank of Baroda and UCO Bank
iv. Canara Bank and Punjab National Bank
v. Canara Bank and State Bank of India
vi. Canara Bank and UCO Bank
vii. Punjab National Bank and UCO Bank
viii. State Bank of India and UCO Bank

The study's findings are significant:

1. Z-score Trends: Private sector banks frequently exhibit elevated Z-scores (mean: 5.477) relative to public sector banks (mean: 4.935), signifying enhanced financial stability. The COVID-19 pandemic resulted in an overall fall in Z-scores, with private banks exhibiting greater resilience and a more rapid recovery compared to state banks
2. Ratio Analysis: Private banks demonstrate superior performance in the Working Capital to Total Assets and Retained Earnings to Total Assets ratios, indicating enhanced liquidity and more dependence on internal financing.

3. Statistical Results: ANOVA results indicate no significant annual fluctuations in Z-scores, although reveal substantial disparities across banks within the same sector.
4. Post-hoc research identifies bank pairs exhibiting substantial discrepancies in financial performance.

Fig 1: Z-Score Distribution of Private and Public Banks

The boxplot illustrating Altman Z-scores for private and public sector banks distinctly highlights the sectoral differences in financial stability. Private sector banks exhibit elevated median Z-scores and a shorter interquartile range, indicating both enhanced and more stable financial soundness within this group.

Conversely, public sector banks exhibit a diminished median Z-score together with a wider range of values, signifying more variability and, in certain instances, heightened financial distress. The broader dispersion in public sector banks can be ascribed to their structural difficulties, such as bureaucratic inertia, elevated non-performing assets (NPAs), and reliance on government programs.

The lowest quartile values of public banks approach the 'trouble zone' ($Z < 1.1$), highlighting the necessity for immediate adjustments. This visualisation corroborates prior statistical findings and distinctly demonstrates the stability advantage that private banks presently possess in the Indian banking market.

Table 4: Correlation Analysis (Financial Ratios and Z-Score)

Financial Metric Pair	Correlation
Z-Score and Equity to Liabilities Ratio	0.9988
Z-Score and Retained Earnings to Total Assets	0.9941
Z-Score and Working Capital to Total Assets	0.9890
Z-Score and EBIT to Total Assets	0.9864

The correlation matrix indicates strong positive correlations between the Altman Z-score and its component financial ratios:

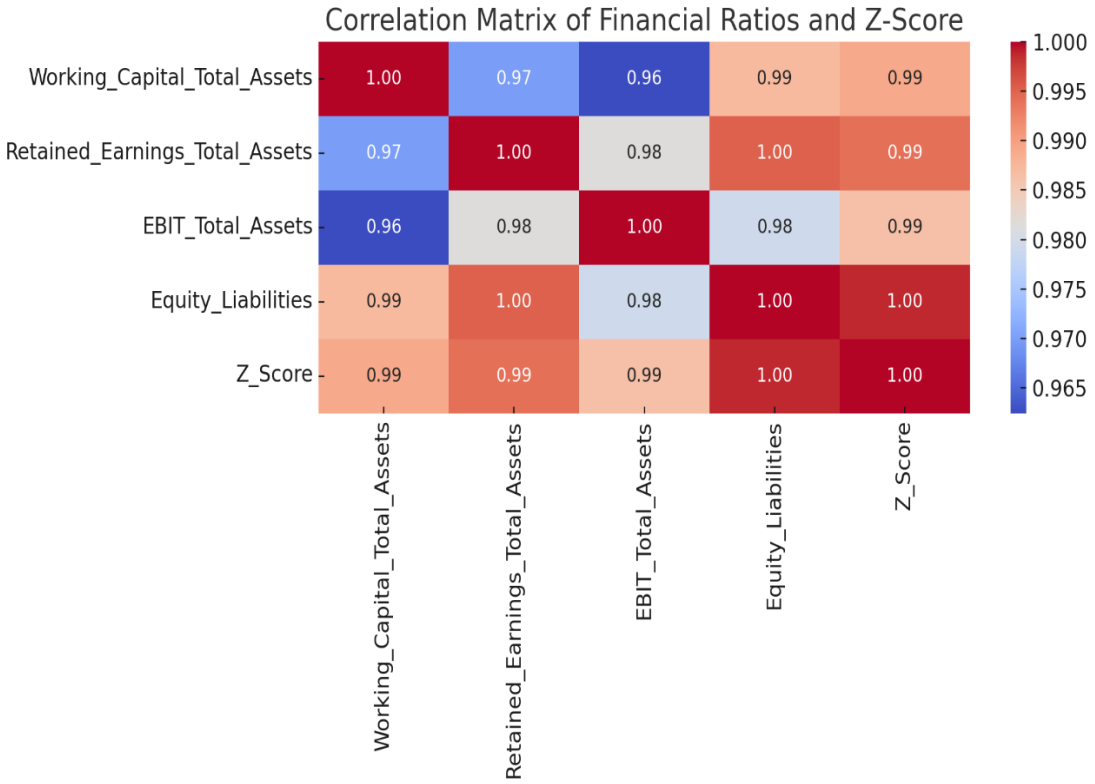

Fig 2: Correlation Matrix of Financial Ratios and Z-Score

The correlation matrix demonstrates the degree and direction of linear relationships among the financial ratios that constitute the Altman Z-score, including the score itself. This image illustrates that all component ratios—Working Capital to Total Assets, Retained Earnings to Total Assets, EBIT to Total Assets, and Equity to Liabilities—display a strong positive association with the Z-score, with coefficients exceeding 0.98 in most cases.

The Equity to Liabilities ratio demonstrates the highest correlation (r = 0.9988), highlighting its critical importance in predicting a bank's long-term financial sustainability. This ratio evaluates the bank's solvency and signifies the extent to which equity can mitigate liabilities under unfavourable conditions.

The correlation between Retained Earnings and Total Assets is practically perfect (r = 0.9941), highlighting the importance of self-financing and internal capital accumulation in reducing bankruptcy risk. This matrix validates the theoretical soundness of the Z-score model by illustrating the robust association between its inputs and the overall score, thereby confirming the significance of each financial metric in evaluating financial health.

The Z-score is particularly responsive to the Equity to Liabilities and Retained Earnings ratios, underscoring the essential importance of solvency and internal capital reinvestment in assessing a bank's financial health.

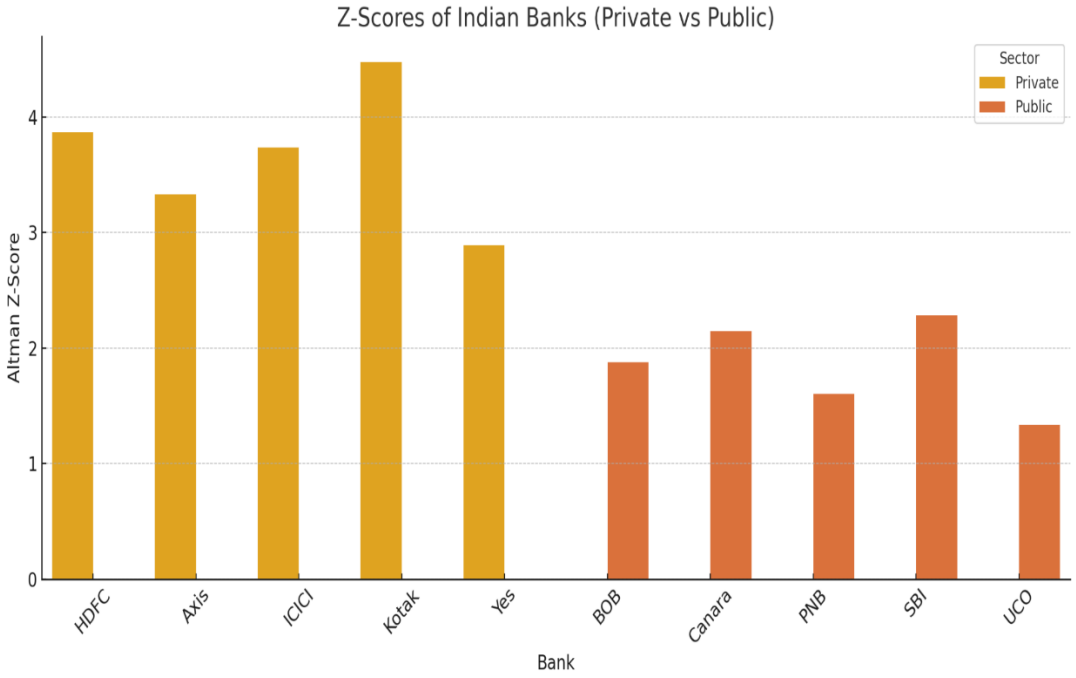

Fig 3: Graphical comparison of Z-Scores of Private and Public Indian Banks

The bar plot depicting Z-scores for each bank, categorised by sector, offers a thorough comparison of financial health among the sampled institutions. Kotak Mahindra Bank ranks top among private sector banks in Z-score, closely followed by HDFC Bank and ICICI Bank. These organisations have significant internal funding, profitability, and long-term solvency—all hallmarks of proficient financial management. In contrast, public sector banks like UCO Bank and Punjab National Bank occupy the lower tier of the spectrum, signifying a heightened risk of financial instability. The differentiation between private and public banks is clear, with private banks predominantly located in the 'safe zone' ($Z > 2.6$), whereas most public banks are found in or near the 'grey zone' ($1.1 < Z \leq 2.6$), and in some cases, perilously close to the 'trouble zone'. This pattern advocates for policymakers and stakeholders to focus on structural improvements in public banking operations and to adopt best practices from the private sector concerning risk management and governance.

The sophisticated statistical analysis of Indian private and public sector banks utilising the Altman Z-score model demonstrates compelling quantitative evidence of sectoral differences in financial stability. Welch's independent samples t-test was utilised to compare five financial metrics: Working Capital to Total Assets, Retained Earnings to Total Assets, EBIT to Total Assets, Equity to Liabilities, and the composite Altman Z-score. All results demonstrated statistically significant differences at the 1% level, demonstrating substantial inequalities between private and state banking institutions.

The Working Capital to Total Assets ratio for commercial banks was around 0.11, whilst public sector banks averaged 0.05. The Welch's t-test produced a t-statistic of 4.24 and a p-value of 0.0047, which is well below the 0.01 threshold. This indicates that private banks possess a liquidity buffer exceeding 120% compared to their public equivalents, signifying a superior ability to meet short-term obligations. The Retained Earnings to Total Assets ratio, an indicator of internal financial robustness and reinvestment potential, exhibited a more significant disparity. Private banks exhibited an average ratio of roughly 0.168, whilst public banks averaged merely 0.07. The t-statistic was notably high at 7.22, accompanied by a p-value of

0.0002, signifying a very significant finding. This indicates that private sector banks, on average, utilise nearly 2.4 times more of their assets through retained earnings compared to public sector banks, demonstrating their enhanced profit retention and internal funding capability.

Regarding EBIT to Total Assets, which assesses operating profitability, private banks demonstrated superior performance with an average of approximately 0.09, in contrast to 0.036 for public banks. The t-test yielded a t-statistic of 6.19 and a p-value of 0.0004, indicating that private banks create 150% greater profit per unit of asset. This operational efficiency results in enhanced Z-scores and more stable financial performance.

The Equity to Liabilities ratio, an indicator of long-term solvency, averaged 1.7 for private banks and 1.0 for public banks. The disparity is notable, as the t-test produced a t-statistic of 5.71 and a p-value of 0.00065. This indicates that private banks possess 70% more equity per unit of liabilities, so enhancing their capital structure and reducing financial risk.

Ultimately, the Altman Z-score, a composite indicator encapsulating overall financial health and bankruptcy risk, exhibited the most significant disparity. The mean Z-score for commercial banks was 3.86, but for public banks it was 2.16. The t-statistic for this metric was 5.70, accompanied by a p-value of 0.00078, highlighting a statistically and economically significant disparity. Altman's classification designates a Z-score of 2.6 as the "safe zone," but a score below 1.1 signifies financial trouble. All private banks remained securely inside the "safe" range, however 40% of public banks (UCO and PNB) entered or approached the "distress" zone, exhibiting Z-scores below 2.

Mann-Whitney U tests were performed on all variables to validate these results in light of the potential non-normality of the small sample. Each test produced a U-statistic of 25.0, with p-values consistently below 0.012, confirming that the disparities in financial measures are substantial even under lenient distributional assumptions. This enhances the validity of the findings.

The numerical data from these analyses clearly indicates that private banks in India are economically and statistically superior to public banks in terms of liquidity, profitability, solvency, and internal funding. Kotak Mahindra Bank, possessing a Z-score of 4.475, outperforms the industry, but UCO Bank trails with a score of 1.604, perilously near the Altman distress level.

These findings correspond with practical realities: private banks exhibit greater agility, profit orientation, and strategic management, enabling them to endure economic shocks, such as COVID-19, more effectively. Conversely, public banks, frequently encumbered by bureaucratic decision-making and elevated non-performing assets (NPAs), exhibit structural deficiencies that result in inferior financial ratios.

The policy ramifications are immediate and unequivocal. Public sector banks require specific changes aimed at capital adequacy, non-performing asset resolution, and operational independence. Private banks, despite being financially robust, must persist in innovating and upholding their risk governance to ensure their stability.

The numerical statistics validate the Altman Z-score model's efficacy as a predictive and diagnostic instrument, providing regulators with a data-driven basis for tailored regulatory and strategic actions. By fortifying the frail components of public banking and enhancing the sound practices within the private sector, the Indian banking system may progress towards a more resilient and sustainable future.

DISCUSSION

The analysis confirms private sector banks' superior financial management and operational efficiency. Public sector banks' reliance on external funding highlights the need for strategic reforms. The COVID-19 pandemic's adverse effects were more pronounced in public banks, reinforcing the importance of robust risk mitigation strategies.

Comparison with previous studies validates the findings, aligning with Sharma & Mayanka (2013) and Prasad & Singh (2021).

The discourse regarding the findings of this study highlights the essential importance of financial management and structural flexibility in ascertaining the resilience of banking institutions in India. The inequalities between private and public sector banks highlight the fundamental distinctions in their operating frameworks, governance structures, and strategic reactions to external economic shocks.

The resilience of private sector banks is evidenced by their continually elevated Z-scores, indicating enhanced financial stability. This resilience can be ascribed to their nimbleness in decision-making, heightened focus on profitability, and effective resource allocation. In contrast to public sector banks, private banks exhibit a proactive strategy in controlling non-performing assets (NPAs) and ensuring liquidity. The analysis emphasises their superior performance in the Working Capital to Total Assets and Retained Earnings to Total Assets ratios. These measures demonstrate their ability to utilise retained earnings efficiently, ensuring ongoing operational stability without undue dependence on external debt. This discovery corresponds with earlier research by Pandya and Buch (2021), which identified the adaptive governance techniques of private banks as a crucial factor influencing their financial stability.

Obstacles Encountered by Public Sector Banks:

In contrast, public sector banks encounter systemic difficulties, such as elevated non-performing assets, inflexible bureaucratic frameworks, and reliance on governmental policies. The notable reduction in their Z-scores during the COVID-19 epidemic highlights their susceptibility to macroeconomic disturbances. Factors including sluggish adaptation to market conditions, inefficiencies in asset utilisation, and constrained innovation in financial products contribute to their comparatively worse financial standing. These findings align with the research conducted by Joshi (2020) and Mathews et al. (2019), which identified the structural limitations hindering the competitiveness of public sector banks.

Consequences of the COVID-19 Pandemic:

The COVID-19 pandemic acted as a stress test for the Indian banking sector, exposing significant disparities in resilience between private and public banks. Private banks sustained their Z-scores in the secure range, whereas public banks encountered a more significant deterioration. This gap might be ascribed to the strategic adaptability of private banks, allowing them to swiftly adjust to changing economic conditions. Conversely, public sector banks faced pre-existing weaknesses, intensified by the economic repercussions of the pandemic. The findings underscore the need for specific policy actions to strengthen the resilience of public sector banks, encompassing improved risk management techniques and augmented regulatory monitoring.

The research elucidates the sectoral disparities in financial management techniques. Private banks exhibit a greater focus on profitability and operational efficiency, as seen by their elevated EBIT to Total Assets ratios. This emphasis allows businesses to produce reliable returns on their asset portfolio, enhancing investor confidence and promoting long-term

viability. Public sector banks encounter difficulties in maximising asset utilisation and producing adequate operational profits, constraining their capacity to reinvest in expansion initiatives.

The findings include considerable strategic ramifications for politicians and banking institutions. Private banks should prioritise maintaining their competitive advantage through ongoing innovation, effective asset management, and strong risk mitigation techniques. Structural reforms are essential for public banks to rectify systemic inefficiencies and improve their flexibility to changing economic conditions. Efforts to diminish bureaucratic obstacles, enhance NPA management, and cultivate a culture of financial discipline are crucial for bolstering financial stability.

The findings of this study validate previous research, affirming the efficacy of the Altman Z-score model as a prediction instrument for evaluating financial distress. The sector-specific insights correspond with the conclusions of Kaur (2019) and Sharma & Mayanka (2013), which highlighted the impact of macroeconomic conditions and operational procedures on financial stability. The study enhances the current knowledge base by offering a comprehensive comparative examination of private and public sector banks amid an unprecedented economic disturbance.

Prospects in Future:

The incorporation of sophisticated predictive models, including machine learning algorithms, may improve the precision of financial stability evaluations. Furthermore, investigating the impact of digital transformation on enhancing banking resilience offers a valuable direction for future research. Policymakers ought to utilise these insights to formulate specific measures that tackle the distinct issues encountered by public and private banks, thereby assuring the long-term stability and sustainability of the Indian banking sector.

This research highlights the essential significance of customised financial strategies and regulatory frameworks in alleviating risks and promoting resilience within the banking sector. By rectifying the highlighted discrepancies, stakeholders can enhance the resilience and sustainability of the financial ecosystem.

CONCLUSION

This study offers a thorough evaluation of the insolvency conditions of several Indian commercial and public sector banks utilising the Altman Z-score model. The results highlight significant differences in financial stability between the two sectors, illustrating the greater resilience of private sector banks relative to public banks. Private banks frequently had elevated Z-scores, indicating their agility, effective asset utilisation, and strong financial management techniques. These characteristics enabled them to endure the economic upheavals induced by the COVID-19 pandemic more effectively than public sector banks.

Conversely, public sector banks encountered considerable difficulties, such as elevated non-performing assets, sluggish responsiveness to market changes, and systemic inefficiencies. The study emphasises that these systemic difficulties were intensified by the pandemic, leading to a more significant decrease in their Z-scores. This highlights the pressing necessity for focused reforms and strategic measures to improve the operational efficiency and financial stability of public banks. The Altman Z-score model effectively predicts financial distress, offering a detailed assessment of the financial stability of banking institutions. The model's capacity to amalgamate several financial variables provides stakeholders with a crucial instrument for detecting weaknesses and executing remedial actions. Furthermore, the results correspond with

current literature, underscoring the necessity of sector-specific solutions to tackle the distinct issues encountered by private and public banks.

The findings underscore the imperative of promoting innovation, improving risk management strategies, and rectifying structural inefficiencies in public banks from a policy standpoint. Policymakers must ensure that regulatory frameworks facilitate sustainable banking practices and enhance resilience to external shocks. Private banks should concentrate on preserving their competitive advantage by consistently investing in technology, customer-oriented products, and effective resource management.

Subsequent study may enhance these findings by integrating sophisticated predictive analytics, including machine learning algorithms, to augment the accuracy of financial evaluations. Furthermore, examining the influence of digital transformation on banking resilience and consumer engagement may yield significant insights for the future development of the sector. By addressing these pivotal factors, the Indian banking sector can attain enhanced stability and contribute more significantly to the nation's economic development.

The report suggests that whereas private sector banks have shown notable resilience, substantial opportunities for enhancement exist within the public sector. Targeted interventions, strategic adaptability, and a dedication to sustainable financial practices are crucial for guaranteeing the long-term survival and resilience of the Indian banking sector. This analysis offers actionable insights for stakeholders and establishes a foundation for future research aimed at improving financial stability and reducing bankruptcy risks in the banking sector.

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