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Performance and Stability Analysis of Foreign Banks in India: A Z-score Approach

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Abstract:

The performance and stability of the banking sector are crucial determinants of a nation's economic health, particularly in emerging economies like India. This paper examines the financial performance and stability of selected foreign banks operating in India, using the Z-score as a key indicator over the period 2018 to 2022, covering the pre-COVID, COVID, and post-COVID phases. The Z-score, a widely accepted measure of financial stability, is utilized to assess the risk of insolvency and overall soundness of the banking institutions. The study finds significant variations in the Z-score values across banks and time periods, highlighting fluctuating levels of financial health and resilience in the face of economic disruptions caused by the pandemic. Some banks, such as Deutsche Bank and Bank of America, demonstrated strong post-COVID recovery, while others exhibited declining stability. The study also calculates the slope of Z-score trends for each bank to evaluate the directional change in stability over the five-year period. The findings reveal that while a few banks showed consistent improvement, others experienced a sharp decline in performance, suggesting heterogeneous responses to economic and regulatory challenges. The analysis contributes to the existing literature by offering a focused evaluation of foreign banks in India, which often operate under different strategic objectives and constraints compared to domestic banks. While the study provides valuable insights, it is limited by the sample size and reliance on a single indicator. Future research could incorporate additional performance metrics and broader datasets. This study holds relevance for policymakers, investors, and regulators in framing strategies for banking supervision and financial resilience.

Keywords: Banking performance, Z-score, foreign banks, financial stability, India.

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Introduction

The banking sector plays a pivotal role in the economic development of a country by mobilizing savings, channelling investments, and facilitating financial intermediation. Numerous empirical studies have underscored the significant contribution of a stable and efficient banking system to economic growth, both in the short and long run (King & Levine, 1993; Abu-Bader & Abu-Qarn, 2008; Abusharbeh, 2017). In the Indian context, the sector has witnessed substantial transformation through a series of financial reforms, leading to improved operational efficiency and competitiveness (Jalan, 2002). However, despite these advancements, concerns related to banking stability, especially due to persistently high levels of non-performing assets (NPAs), continue to pose serious challenges (Sharma, Sharma & Barua, 2012).

Banking stability refers to the capacity of banks to withstand shocks, sustain profitability, and maintain smooth functioning without disruptions to the broader financial system. In contrast, financial fragility represents the vulnerability of banks to external or internal shocks that may impair their performance (Tsomocos, 2003). The global financial crisis of 2008 reignited the importance of assessing financial stability with greater precision, prompting researchers and policymakers to seek robust indicators of banking health (Beck, 2008; Carletti, 2008, 2010).

One of the widely used indicators in this regard is the Z-score, which measures the distance from insolvency by combining profitability, leverage, and volatility into a single composite metric. A higher Z-score indicates greater bank stability and a lower probability of default, making it a crucial tool for comparative performance and risk assessment across banks and time periods (Boyd & Runkle, 1993). In the Indian banking landscape characterized by heterogeneous structures involving public, private, and foreign banks the Z-score offers valuable insights into how ownership, governance, and external shocks such as the COVID-19 pandemic have affected financial stability.

This study attempts to evaluate the stability of foreign banks operating in India by analysing their Z-scores over a five-year period spanning the pre-COVID, COVID, and post-COVID phases. By examining the trends, determinants, and variability in the Z-score, the paper seeks to offer empirical evidence on the resilience of foreign banks in India, and whether dynamic panel estimation techniques such as the Generalized Method of Moments (GMM) are appropriate in addressing potential endogeneity concerns.

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Literature review

Several studies have explored the financial stability of banks using different models and across varied contexts. Altman's Z-score model has remained a dominant tool in predicting insolvency and assessing financial soundness. Firdaus et al. (2023) examined the stability of Islamic banks before and during the COVID-19 pandemic using Z-score and found that although stability was higher before the pandemic, Islamic banks maintained sound performance during the crisis. Similarly, Azam (2023) used the Z-score to analyse financial health across five Indian private sector banks from 2018 to 2022, identifying variations in stability levels and suggesting further scope for exploration.

In the African context, Ozili (2018) highlighted that institutional factors such as political stability, regulatory quality, and investor protection significantly impact banking stability, reinforcing that both micro and macro determinants are crucial. Mahmud (2023) supported this approach in the Bangladeshi context by using panel regression analysis and Z-score to identify key bank-specific determinants such as ROA, capital adequacy, and management efficiency.

Multiple studies have also focused on comparing public and private banks. Mathur (2022) employed the IMF's Banko-meter model and concluded that private banks in India demonstrated higher solvency scores than public sector banks. Parvin et al. (2016), using Altman's Z-score, found the opposite in Bangladesh, reporting better financial health among state-owned banks. Murari (2012) added that the probability of book value bankruptcy in Indian banks had declined over time, particularly in public sector banks.

Research by Kaur (2019) and Joshi (2020) also emphasized the predictive power of Z-score in identifying financial distress in Indian banks. Joshi linked rising NPAs to falling Z-scores and suggested that higher profits significantly improve bank stability. Likewise, Abirami (2018) and Pradhan (2014) applied the Z-score and Banko-meter models, respectively, to assess financial soundness and forecast insolvency in both public and private sector banks.

Further contributions by Li et al. (2017) introduced refined Z-score measures, such as risk-adjusted and systemic Z-scores, in New Zealand and Australian banks, advocating for their use in capturing individual and systemic banking risks.

Research gap

While numerous studies have assessed banking stability using Z-score and related models across different regions and timeframes, limited research has comparatively analysed the slope or trend of Z-scores over time to evaluate stability progression. Moreover, existing literature lacks a

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comprehensive bank-wise longitudinal analysis integrating pre, during and post-crisis periods, particularly in the context of foreign banks operating in India. This creates a gap for deeper insights into dynamic financial stability trends.

Objective of the paper

This study aims to evaluate the financial stability of 10 foreign banks during three distinct periods: pre-COVID-19, COVID-19, and post-COVID-19. The primary tool for this analysis is the Z-score, which measures the financial stability of banks. The study also examines the effects of macroeconomic variables and bank-specific ratios on Z-scores, using advanced statistical techniques to ensure robust results.

Hypothesis to be tested

1. There is no significant difference in the financial stability (measured by Z-score) of foreign banks in India between the pre-COVID-19 and COVID-19 periods.
2. There is no significant difference in the financial stability of foreign banks in India between the COVID-19 and post-COVID-19 periods.
3. There is no significant difference in the financial stability of foreign banks in India between the pre-COVID-19 and post-COVID-19 periods.
4. Bank-specific factors such as capital adequacy ratio (CAR), return on assets (ROA), bank size, and income components have no significant impact on Z-scores of foreign banks operating in India.
5. Macroeconomic factors such as GDP growth, inflation, and unemployment have no significant effect on the financial stability of foreign banks in India.

Research design and methodology

This study evaluates the financial stability of ten foreign banks from 2018 to 2022, covering the pre-COVID-19, COVID-19, and post-COVID-19 periods. Z-scores are used as the primary measure of bank stability, calculated by adding capital adequacy ratio (CAR) and return on assets (ROA), then dividing by the standard deviation of ROA. A five-year moving average of ROA's standard deviation is used for more robust results. To compare bank stability across the three periods, paired t-tests are conducted. Additionally, Generalized Method of Moments (GMM) panel data analysis is applied to examine the impact of macroeconomic variables like GDP, inflation and unemployment and bank-specific financial ratios viz. interest income, other

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income, bank size, bank age, ROA and CAR on Z-scores. The study also estimates the probability of bankruptcy (PoB) using a formula where the variance of the standard deviation is divided by the square of the sum of ROA and CAR. This mixed-method approach provides both descriptive and inferential insights into the stability of foreign banks during a global crisis. This study also established line chart using excel and evaluate the slope of z-scores of each bank during the study period to reach the robust result.

Analysis and Findings

This section presents a detailed analysis of the sampled banks covering the period from 2018 to 2022, encompassing the pre-COVID, COVID-19, and post-COVID phases. The findings offer valuable insights for policymakers, researchers, and academicians regarding the trends and shifts in financial stability during these periods.

Table 1: Z-score result of foreign banks in India

Z-SCORES	Pre-covid 19 period		Covid 19 period	Post-covid 19 period	
Bank Name	**2018**	**2019**	**2020**	**2021**	**2022**
American Express Banking Corpn.	10.244	27.900	53.864	15.040	11.728
Australia & New Zealand Banking Group Ltd.	258.579	67.080	49.831	80.535	61.161
B N P Paribas	153.344	173.965	51.647	47.442	47.444
Bank Of America N A	34.440	128.416	85.563	162.031	54.482
Citibank N A	139.693	112.021	103.645	59.342	45.294
Cooperatieve Rabobank U A	5.365	7.505	10.714	10.743	8.665
Credit Agricole Corporate & Invst. Bank	7.095	9.162	8.627	9.283	10.193
Deutsche Bank A G	55.266	53.900	48.059	108.824	125.159
Societe Generale	47.294	39.892	37.233	46.807	74.388
Standard Chartered Bank - India Branches	42.485	40.340	40.911	78.177	35.121
Max	258.579	173.965	103.645	162.031	125.159
Min	5.365	7.505	8.627	9.283	8.665
SD	78.665	52.299	27.668	45.687	33.711
Mean	73.605	65.111	48.933	61.552	47.945
Median	47.294	53.900	48.165	58.841	47.444

Source: Own computation

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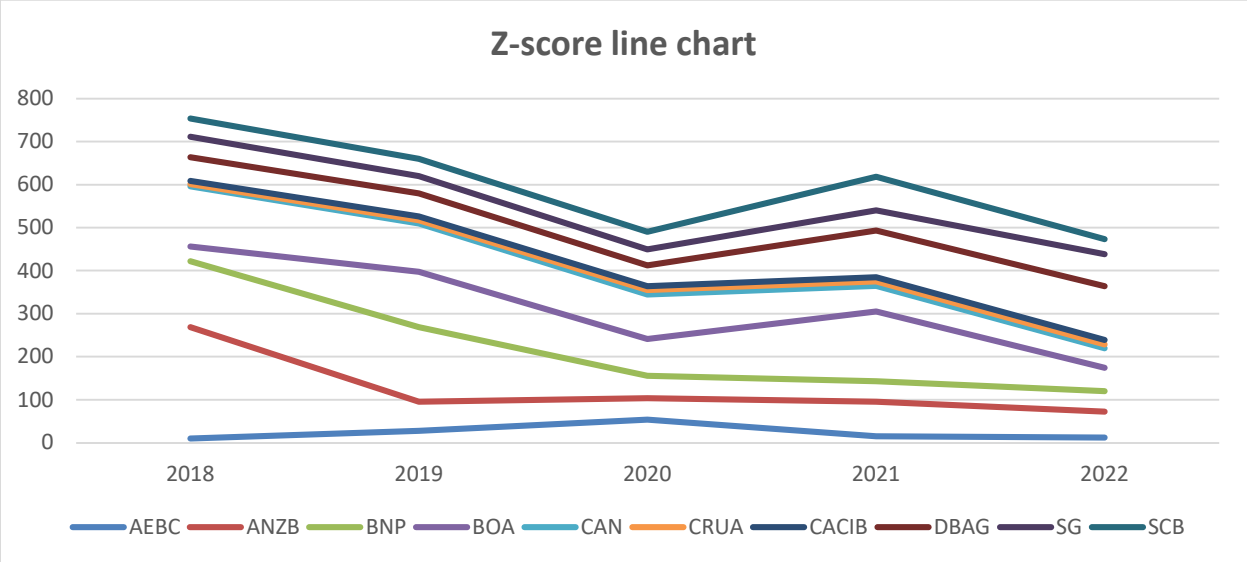
The Z-scores of selected foreign banks in India show notable variation across the pre-COVID-19, COVID-19, and post-COVID-19 periods.

During the **pre-COVID-19 period** (2018 and 2019), the mean Z-scores were relatively high, indicating strong financial stability, with a mean of 73.61 in 2018 and 65.11 in 2019. The maximum Z-score in this period was 258.58, while the minimum was 5.37, showing a wide disparity among banks. The standard deviation was also high, reflecting substantial variation.

In the **COVID-19 period** (2020 and 2021), the mean Z-score declined to 48.93 in 2020, indicating reduced stability amid the pandemic's economic uncertainty. However, it slightly recovered to 61.55 in 2021. Interestingly, despite the challenges, some banks like Bank of America and Deutsche Bank showed improved Z-scores in 2021. The median values remained close to the mean, suggesting a balanced distribution.

In the **post-COVID-19 period** (2022), the average Z-score further decreased to 47.95, reflecting a continued cautious environment and possibly ongoing adjustments in the banking sector. The standard deviation dropped over time, from 78.67 in 2018 to 33.71 in 2022, indicating a narrowing gap in financial stability among the banks.



Source: Own compilation (Chart-1)

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Table 2: Z-score slope of the of the individual banks

Bank Name	Slope
American Express Banking Corpn.	0.31386
Australia & New Zealand Banking Group Ltd.	-49.8683
B N P Paribas	-42.7939
Bank Of America N A	16.50059
Citibank N A	-28.6429
Cooperatieve Rabobank U A	1.437165
Credit Agricole Corporate & Invst. Bank	0.734624
Deutsche Bank A G	21.73446
Societe Generale	5.270355
Standard Chartered Bank - India Branches	5.205118

Source: Own computation

The analysis of the slope values of Z-scores for the selected foreign banks reveals distinct trends in their financial stability over the observed period. A positive slope indicates an improvement in financial soundness, suggesting that the bank's ability to absorb risk has increased over time. On the other hand, a negative slope reflects a decline in financial stability, pointing to increased risk exposure or weakening financial health.

Deutsche Bank AG and Bank of America N.A. exhibit strong positive slopes of 21.73 and 16.50, respectively. This indicates a consistent and significant improvement in their Z-scores, implying enhanced financial resilience, possibly due to improved capital adequacy, asset quality, or profitability. Standard Chartered Bank (India Branches) and Societe Generale also show moderate positive slopes of 5.21 and 5.27, suggesting a gradual strengthening in their financial positions. Similarly, Credit Agricole, Cooperatieve Rabobank, and American Express report marginal positive slopes, reflecting relatively stable financial conditions with slight improvements over time.

In contrast, some banks display sharply negative slope values, indicating a deterioration in financial stability. Australia & New Zealand Banking Group Ltd. and BNP Paribas show highly negative slopes of -49.87 and -42.79, respectively, which suggests a significant and continuous decline in their Z-scores. This trend could be attributed to increasing non-performing assets, reduced earnings, or other adverse financial developments. Citibank N.A. also shows a considerable negative slope of -28.64, indicating weakening financial strength. Mizuho Bank Ltd., with a slope of -0.08, remains relatively flat, reflecting minimal change in its financial position over time.

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Table 3: Probability of bankruptcy of Banks

Pandemic	Pre		During	Post	
Bank Name	**2018**	**2019**	**2020**	**2021**	**2022**
American Express Banking Corpn.	0.004764	0.000642	0.000172	0.002210	0.003635
Australia & New Zealand Banking Group Ltd.	0.000007	0.000111	0.000201	0.000077	0.000134
B N P Paribas	0.000021	0.000017	0.000187	0.000222	0.000222
Bank Of America N A	0.000422	0.000030	0.000068	0.000019	0.000168
Citibank N A	0.000026	0.000040	0.000047	0.000142	0.000244
Cooperatieve Rabobank U A	0.017374	0.008876	0.004355	0.004332	0.006659
Credit Agricole Corporate & Invst. Bank	0.009932	0.005956	0.006718	0.005802	0.004813
Deutsche Bank A G	0.000164	0.000172	0.000216	0.000042	0.000032
Societe Generale	0.000224	0.000314	0.000361	0.000228	0.000090
Standard Chartered Bank - India Branches	0.000277	0.000307	0.000299	0.000082	0.000405
Max	0.017374	0.008876	0.006718	0.005802	0.006659
Min	0.000007	0.000017	0.000047	0.000019	0.000032
SD	0.005677	0.002997	0.002226	0.002034	0.002369
Mean	0.003034	0.001511	0.001167	0.001209	0.001507
Median	0.000224	0.000172	0.000216	0.000144	0.000222

Source: Own computation

The Probability of Bankruptcy (PoB) for selected foreign banks in India demonstrates a clear pattern across the pre-COVID-19, COVID-19, and post-COVID-19 periods.

In the **pre-COVID-19 period** (2018 and 2019), the mean PoB was relatively higher, especially in 2018 (0.003034), indicating a greater perceived risk of bankruptcy among some banks. The standard deviation was also the highest during this period (0.005677), showing substantial variation in risk levels across banks. Notably, banks like Cooperatieve Rabobank and Credit Agricole had higher PoB values, which pulled up the overall average.

During the **COVID-19 period** (2020 and 2021), the mean PoB declined to 0.001167 in 2020 and remained almost stable at 0.001209 in 2021. Despite the global financial uncertainty caused by the pandemic, the lower mean and reduced standard deviation (2.226E-03 and 2.034E-03 respectively) suggest that most banks managed to maintain stability, with less variation in risk across institutions.

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In the **post-COVID-19 period** (2022), the mean PoB slightly increased to 0.001507, while the standard deviation remained moderate (0.002369). This reflects a mild resurgence in bankruptcy risk for some banks, possibly due to post-pandemic economic adjustments and tightening financial conditions. However, overall risk levels were still lower than in the pre- COVID-19 phase.

Table 4: Generalized Method of Moments (GMM) result

```
System dynamic panel-data estimation         Number of obs         =        40
Group variable: bank                         Number of groups      =        10
Time variable: year
                                             Obs per group:    min =         4
                                                               avg =         4
                                                               max =         4

Number of instruments =     18               Wald chi2(10)         =   3602.83
                                             Prob > chi2           =    0.0000
Two-step results
------------------------------------------------------------------------------
     zscores |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     zscores |
         L1. |  -3.486484   3.133106    -1.11   0.266    -9.627259    2.654292
          ii |  -1238.515   1197.535    -1.03   0.301     -3585.64    1108.609
          oi |   110.7005   95.31063     1.16   0.245    -76.10491    297.5059
          bs |   1518.028   1412.214     1.07   0.282     -1249.86    4285.917
          ba |   -1092.79   861.3838    -1.27   0.205    -2781.071    595.4914
         gdp |  -29.42889   25.58317    -1.15   0.250    -79.57099     20.7132
         inf |  -401.4152   393.9126    -1.02   0.308     -1173.47    370.6393
        unem |  -70.13443   164.1949    -0.43   0.669    -391.9505    251.6816
         roa |  -8.860512   11.03699    -0.80   0.422    -30.49261    12.77158
         car |   20.29225   17.21433     1.18   0.238    -13.44721    54.03171
```

Source: Own computation

The results from the System GMM dynamic panel-data estimation show the impact of various independent variables on the dependent variable, z-scores, using data from 10 banks over 4 years. The model reports a significant overall fit (Wald $chi^2 = 3602.83$, $p < 0.001$), indicating that the set of explanatory variables jointly explains variation in z-scores.

However, when we examine individual coefficients, none of the variables are statistically significant at the 5% level, as all p-values are above 0.05. The lag of z-scores (L1.z-scores) has a negative coefficient (-3.49), suggesting a possible inverse relationship with the current z-score,

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but it is not statistically significant (p = 0.266). Among the explanatory variables, CAR (capital adequacy ratio) has a positive coefficient (20.29), and OI (other income) also shows a positive relationship (110.70), indicating potential favourable effects on financial stability, though these effects are not statistically significant.

Variables such as II (interest income), GDP, INF (inflation), UNEM (unemployment), and ROA (return on assets) all show negative associations with z-scores, but again, the relationships are statistically weak. The lack of significance may be due to the small sample size or instrument proliferation, which can weaken the power of GMM estimations.

Table 5: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre	70.6993	10	60.41402	19.10459
	Cov	49.0094	10	29.16385	9.22242
Pair 2	Cov	49.0094	10	29.16385	9.22242
	Post	54.5930	10	37.79968	11.95331
Pair 3	Pre	70.6993	10	60.41402	19.10459
	Post	54.5930	10	37.79968	11.95331

Source: Own computation

The table shows the mean Z-scores of 10 banks across pre-COVID, COVID, and post-COVID periods, reflecting changes in financial stability over time. The average Z-score declined from 70.70 before the pandemic to 49.01 during COVID, indicating reduced stability, with high variability among banks, especially in the pre-COVID period. Post-COVID, the mean Z-score slightly increased to 54.59, suggesting a modest recovery. However, when comparing pre- and post-COVID periods, the Z-score remained lower than the pre-pandemic level, indicating that overall financial stability had not fully returned to its earlier state.

Table 6: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre & Cov	10	.570	.086
Pair 2	Cov & Post	10	.506	.136
Pair 3	Pre & Post	10	.383	.275

Source: Own computation

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The paired samples correlation analysis reveals moderate positive relationships between Z-scores across the different time periods, though none are statistically significant. The correlation between pre-COVID and COVID periods is 0.570 with a p-value of 0.086, suggesting a moderate association and a potential trend, but not significant at the 5% level. The COVID to post-COVID correlation is 0.506 (p = 0.136), and pre-COVID to post-COVID shows a weaker correlation of 0.383 (p = 0.275), both indicating non-significant associations.

Table 7: Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre - Cov	21.689	49.925	15.787	-14.024	57.404	1.374	9	.203
Cov - Post	-5.583	34.129	10.792	-29.998	18.830	-.517	9	.617
Pre – Post	16.106	57.697	18.245	-25.168	57.380	.883	9	.400

Source: Own computation

The paired samples test results indicate that there are no statistically significant differences in mean Z-scores across the three periods—Pre-COVID, COVID, and Post-COVID. Although the average Z-scores declined during COVID and remained lower post-COVID compared to the pre-pandemic period, the changes were not significant at the 5% level. This suggests that while fluctuations in financial stability were observed across periods, these variations were not strong enough to confirm a meaningful shift in the stability of the banks based on the sample.

Conclusion

In conclusion, the study aimed to evaluate the financial stability of foreign banks in India using Z-scores and to examine the influence of macroeconomic and bank-specific indicators on these scores. The findings suggest that while banks exhibited resilience during the COVID-19 period, overall stability levels declined compared to the pre-pandemic phase and showed only a modest recovery post-COVID. The probability of bankruptcy (PoB) values also indicates higher risk and

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variability before the pandemic, with a notable decline and stabilization during COVID, and a slight increase thereafter. However, the panel regression results reveal that none of the selected macroeconomic or bank-specific variables had a statistically significant impact on Z-scores, pointing to either limited explanatory power or the need for model refinement and larger data samples. Overall, the results highlight the need for continued monitoring and a more robust modelling approach to better understand the drivers of financial stability among foreign banks.

Recommendation

Based on the findings of the research, the following recommendations are proposed:

1. Foreign banks should strengthen capital buffers and diversify income sources to maintain resilience against economic shocks like pandemics.
2. Regulatory authorities should implement early-warning mechanisms using stability indicators such as Z-score to monitor risk exposure in foreign banks.
3. Foreign banks need to adopt more dynamic risk management strategies, including stress testing and scenario planning, to handle unexpected crises effectively.
4. Collaboration between regulators and foreign banks should focus on developing frameworks that account for both bank-specific and macroeconomic vulnerabilities to improve overall stability.

Limitation of the Study

1. The study covers only a five-year period (2018–2022), which may not fully capture the long-term trends or structural changes in banking stability.
2. The analysis relies solely on the Z-score as a measure of banking stability, which does not consider market-based indicators, customer perception, or qualitative aspects such as governance.
3. The focus on only foreign banks operating in India limits the generalizability of the findings across the entire Indian banking sector, including public and private domestic banks.

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Scope for further Research

The future research can broaden the scope by extending the study period beyond five years to better capture long-term trends and structural changes in banking stability. Incorporating additional indicators such as market-based measures, customer perception, and qualitative factors like corporate governance can provide a more comprehensive assessment of bank stability. Furthermore, including a wider range of banks, such as public and private domestic banks alongside foreign banks, would enhance the generalizability of the findings across the Indian banking sector. Comparative analyses across different ownership structures and timeframes could offer deeper insights into the evolving dynamics of banking stability in India.

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