EPRA International Journal of Environmental Economics, Commerce and Educational Management
Journal DOI: 10.36713/epra0414 |ISI I.F Value: 0.815|SJIF Impact Factor (2023): 8.153 ISSN: 2348 – 814X
Volume: 11 | Issue: 1 |January 2024

USING ALTMAN Z-SCORE MODEL OF FINANCIAL SOUNDNESS OF BANKING INDUSTRY IN INDIA BY – A CASE STUDY ON SELECT PUBLIC SECTOR BANKS IN INDIA-AN EMPIRICAL EVIDENCE

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Article DOI: https://doi.org/10.36713/epra15484
DOI No: 10.36713/epra15484

ABSTRACT

Nearly three quarters of the country's financial activity is conducted by these nationalised institutions. The government owns the majority of these banks. Since merging with its five affiliate banks (as of 1st April 2017), SBI has grown to become one of the world's top 50 banks, and it is also the biggest public sector bank in India in terms of volume. The stability of a country's financial system is essential to its overall economic health. The collapse of multinational financial institutions has the potential to wreak havoc on economies all across the world. A recent example of this infectious impact is the collapse of the Lehman Brothers. As such, assessing the stability of domestic banks' finances is of the utmost importance. Financial metrics such as the CAMEL rating, which incorporates capital adequacy ratio, profitability, and liquidity are some of the current tools that could be useful for analysing banks' financial situations. When assessing the health or instability of a company's finances, the Altman Z score model is a crucial tool. Unfortunately, scholars did not delve into it much while examining the financial stability of institutions. The current research makes an effort to adapt the Altman model for use in the Indian banking sector based on this reference. The majority of Indian banks' financial situations were deemed adequate by the research, with only two outliers. were both discovered to be in a precarious financial situation. But when compared to other banks in their industry, both of these ones had a sufficient capital adequacy ratio. In order to draw any firm-specific conclusions about its viability, the research recommends using a hybrid model.

KEYWORDS: *Altman Model, Financial Position, Hybrid Model, Public Sector Banks.*
JEL CODES: *D40, D46, D48, D49*

1. INTRODUCTION

Banks are essential to the whole financial system because they accept deposits from people all throughout the country and then utilise those funds to invest, either by lending them money or purchasing assets. The banking sector is now vital to the monetary security of people, companies, countries, and the world at large, and it assumes a vital part in the monetary improvement of any country. A review of the fundamental ideas, primary areas, and current developments in the banking industry's business model is presented in this article. One example of a financial institution is the bank, which offers a variety of banking and financial-related services to its clients. The world's economies rely on banks, which are part of the financial services sector. They play a crucial role in promoting expansion of the economy. Banks assume a urgent part in the public eye. Financial development and prosperity are made possible by the smooth flow of money managed by banks. Banks facilitate the transfer of capital from savers to spenders, a need for both private companies and public agencies.

The banking sector was unable to withstand the global financial crisis, which was accompanied by rising inflation, depreciating currencies, fiscal instability, high interest rates, and low industrial productivity. Many global financial organisations were thrown into turmoil when Lehman Brothers and Merrill Lynch collapsed. Capital sufficiency proportion, benefit, liquidity, and cross breed models like CAMEL ratings are some ways to gauge this distress. The Altman score model is a valuable device for evaluating an organization's monetary

wellbeing. Using Z-scores, the model determines if a business house is financially stable. Edward Altman first developed the Z score to indicate that industrial units would go bankrupt. Private firms, non-manufacturers, and organisations engaging in developing credit have been added to it via several updates since then. The algorithm asserts a predictive accuracy of above 70% when it comes to business bankruptcies. Unfortunately, scholars did not delve into it much while examining the financial stability of institutions. This is why the current research looks at the Indian banking industry to see how well the Altman model works.

2. REVIEW OF LITERATURE

- **Dutta Purkayastha, Rajashree (2022):** The Paper explained the argument that "Empirical analysis of commercial banks' credit risk management" can be found. The findings of the analysis are of significance both for theoretical and practical development. In total, 520 Ahmedabad District participants were invited to conduct a survey focusing on various aspects of credit-risk management in a structured banking environment that mould and reduce the risk profile. Based upon the findings of the report, the relationship of management commitment to credit risk management appears to be positive. Due to the mild impact this should be expected.
- **Chintan Arunkumar Vora (2021):** The Study Explain importance with regard to changing trends in the financial and economic climate and business banks' operations in India. This analysis is divided into three parts. The analysis begins with the changes since 2009 in the banking scenario and in the Indian Banking sector, the implementation of Basel III. To make banks more robust during financial crises, the second part of the Basel standards framework explains why the move from Basel II to Basel III is necessary and lays out the guidelines for the standards. Part III addresses the Basel III conformity mechanism and the Indian banks' internal evaluation exercises. The conclusion is that there are emerging problems for the Indian Banking sector.
- **Turgut Tursoy (2020):** A study conducted by the author proposes that the new Basel Committee recommendations, which create tougher measures to tackle the growing risks associated with banking, form the latest revisions applied by the committee. BIS application should be introduced in banks to deal with losses suffered when performing banking activities. In the aftermath of the Lehman bankruptcy, the recent crises led the Basel Committee to establish a new paradigm for low liquidity coverage in banks to achieve high and stable levels. This report found some substantial findings with respect to the application by the Basel monetary authority: First, it is important for international banks to fund their business in a healthy way that a financially stable financial authority is formed.
- **Sharad Kumar (2019):** The author explained the Risk Management that is applied to schedule, lead, coordinate, and monitor the broad range of risks that are present in the daily and long-term functioning of the company. This research aims to identify the risks that are related to the banking industry, as well as the strategies used for risk management. Finally, the author draws the conclusion that, when banks deal with risk carefully, it is a benefit to successful management of the banking industry.
- **Eatessam Al-shakrchy (2018):** This Study empirically tests the effect of commercial banks on credit risk management's profitability in Sweden's leading place with an emphasis on the 2008 financial crisis. Author explores the risk of a bankruptcy being reduced by the danger of financial ruin and how the Swedish bank can cope with its credit crises. Finding out what the biggest issues are with banks lending and the resulting financial instability was the driving force for this investigation.
- **AnwenMd.Shafiqul Bari (2018):** The author explains that it is true that the industry is benefiting from the recession, which somewhat protects it, credit risk management is much more important for financial institutions because of the success of financial transactions. Also, it is an instrument or principle that impacts a company's financial performance, the growth of a company over time, and profit consistency. The aim of this paper is to analyse the relationship between credit risk management and its effect on Ethiopia's business banks' financial performance.
- **Waemustafa, SurianiSukri (2017):** This study explores the connection between macroeconomic and bank-specific credit risk factors in Islamic and traditional banks. The multivariate regression used in this study is applied between 2000 and 2010 on the sample of 15 traditional banks and 13 Islamic banks in Malaysia. This result indicates that financial institutions exert a unique impact on the formation of Islamic and traditional banks' credit risk. When determining the credit risk of conventional banks, a number of criteria are considered. These include loan loss allowance, debt-to-total asset ratio, regulatory capital, duration, earnings administration, and liquidity.
- **Boris Siljkovic(2016):** The author demonstrated that while the public is aware of risk management in banks during periods of global economic crisis, it has not been followed. Risk management has now become a vital feature in the banking sector, and banking regulators are putting checks in place between

financial institutions to reduce potentially adverse effects for the industry as a whole. Therefore, this report provides details on market risks, as well as how banks use those risks to their advantage.

- **Rob Nijskens, Wolf Wagner (2016):** The author assesses both the systemic risk preceding the crisis and how credit-default swap (CDS) and collateralized loan bond (CLB) exposure differs between banks (CLOs). As a result, the price beta of the business rises dramatically following their initial use of either risk transfer form. The results support the idea that the consumer was aware of the risks associated with these approaches well before the crisis. In other words, while banks are holding back on their own credit risk, they potentially present a greater systemic risk. As a result, it poses a new challenge with regard to financial regulation, which is normally based on each institution.
- **Somanadevi Thiagarajan, et al (2015):** In this study, the author has assigned to both public and private banks, a broad R-square and health model as well as its ability to forecast the financial situation of the organizations, which models. The results indicate that late assets have a substantial and virtually essential positive impact on current non-performing assets. Banks and governments have changed their positions in the economy drastically with GDP and credit risk shifting in the opposite directions of public and private banking sectors. The research has found that macroeconomic and credit quality conditions of commercial banks are important in the assessment of the risk of the business banking sector.

3. STATEMENT OF THE PROBLEM

Risk analysis and risk management have become increasingly relevant in the Indian economy during this period of liberalization. The most pressing issue facing the banking industry today is the challenge of identifying and managing risk. The banking industry's very presence instils the threat of risk. A bank's principal function is to mediate between savers and spenders of money. As a result, operating risk must be assessed alongside other credit and market risk factors in order to determine the required composite estimate. As a result, the study focuses on Credit Risk Management in Small Finance Banks.

4. RESEARCH GAP

In order to quantify the degree of financial hardship among RSE-listed commercial companies from 2017–18 to 2021–2022, this research used Altman's Z Score approach.While previous research on India's public sector banks has relied on ratios to gauge their health and performance, this study takes a different approach.

5. OBJECTIVES OF THE STUDY

- To research the impact on the Indian economy of a few major public sector banks in the country.
- To examine the stability of several public sector banks in India, we will use Altman's Z-Score Model.
- To examine how Altman's z-score nonperforming assets (NPAs) relate to net profits.
- To make an approximation of the disparities in the Altman's Z Score Values among the chosen Indian public sector banks,

6. HYPOTHESES OF THE STUDY

H0: There is no Relationship between Altman's z score Non-Performing Assets (NPAs) and Net Profits during this Period.

H1: There is no Relationship between Altman's z score Non-Performing Assets (NPAs) and Net Profits during this Period.

7. RESEARCH METHODOLOGY

From 2017–18 through 2021–22, four small finance banks are included in this study's Z score projections. This research looks at small financing banks in India using the Altman Z score methodology. This hybrid model takes into consideration four factors—"Working Capital, Retained Earnings, Earnings before Interest and Tax, Book Value of Equity, Total Liability and Total Assets"—to ascertain the Z score of the business. Researchers used secondary sources such as "Economics Times, Money Control and Annual Financial Reports of Small Finance Banks" to compile their findings. This team has calculated the Z-score.

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

X1 = "Working Capital / Total Assets"
X2 = "Retained Earnings / Total Assets"
X3 = "Earnings before Interest and Taxes / Total Assets"
X4 = "Book value of Equity / Total Liabilities".
X5 = "Sales/Total Assets"

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8. STATISTICAL TOOLS USED

- **Unit root test** is applied to know the fixed of the information and it is done with the help of following method
- The impact of a free factor on the reliant variable may be found using the Ordinary Least Square Method. In this study, credit risk (Z bank score) acts as an independent variable and Bank's stability have dependent variable (Operating Profit).

9. SCOPE OF THE STUDY

Sl No	Bank Name	Headquarter	Tag Line
1	Punjab National Bank	New Delhi	
2	Indian Bank	Chennai	
3	State Bank of India	Mumbai	
4	Canara Bank	Bangalore	
5	Union Bank of India	Mumbai	

10. LIMITATIONS OF THE STUDY

- The current research only includes four small finance banks. The research relies heavily on secondary data, which has its own set of limitations that are relevant to this investigation.
- The primary emphasis of the literature review on the banking industry was on instances of success derived from secondary sources of data.

11. DISCUSSION AND RESULTS

- **Using Altman's Z-Score Model, we will examine the stability of some public sector banks in India.**

Years	Punjab National Bank With Z-Score Model					
	X1	X2	X3	X4	X5	Altman Z score
	Working Capital/Total Assets	Retained Earnings / Total Assets	EBIT / Total Assets	Equity/ Total Liability	Sales / Total Assets	Risk Factor/Indicator
2021-2022	0.863	0.078	0.096	0.028	1.528	4.004
2020-2021	0.867	0.048	0.006	0.025	1.343	5.664
2019-2020	0.845	0.039	0.049	0.021	1.072	2.312
2018-2019	0.884	-0.022	-0.041	0.012	0.733	1.632
2017-2018	0.884	-0.012	0.004	0.008	0.665	1.730

Discussion: Above Table explain regarding the Punjab National Bank credit risk by calculating and considering the components of Credit Risk such as working capital, retained earnings, market value, EBIT, sales and total asset under Altman Z Score method. The result indicates as per the Basel-III norms from 2020-2021 Z score observed to be more in the year 5.664 meaning there is less chances of bankruptcy for this company in that year and in the year 2017-2018 is 1.730.

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Years	Indian Bank With Z-Score Model					
	X1	X2	X3	X4	X5	Altman Z score
	Working Capital/Total Assets	Retained Earnings / Total Assets	EBIT / Total Assets	Equity/ Total Liability	Sales / Total Assets	Risk Factor/Indicator
2021-2022	0.907	0.005	0.005	0.012	0.061	1.181
2020-2021	0.898	-0.007	-0.007	0.014	0.066	1.119
2019-2020	0.902	0.003	0.002	0.015	0.062	1.165
2018-2019	0.899	-0.002	-0.003	0.008	0.062	1.135
2017-2018	0.811	-0.002	-0.004	0	0.068	1.026

Discussion: Above Table Explain having a higher chance of bankruptcy from 2017 to 222**Indian Bank** Altman's z score of 2021-22 is 1.181, indicating that the bank faces a high credit risk. The study found that Indian Bank's credit score (Altman Z score) has gone down because retained profits as a level of all out resources and EBIT as a level of aggregate assets have both gone down, going from 0.005 to -0.007. Indian Bank plans to improve its status by focusing on the following ratios: EBIT to add up to resources, held profit to add up to resources, and market worth of value/book worth of all out obligation.

Years	State Bank of India with Z-Score Model					
	X1	X2	X3	X4	X5	Altman Z score
	Working Capital/Total Assets	Retained Earnings / Total Assets	EBIT / Total Assets	Equity/ Total Liability	Sales / Total Assets	Risk Factor/Indicator
2021-2022	0.931	0.005	0.006	0.068	0.153	1.337
2020-2021	0.925	-0.022	-0.022	0.066	0.154	1.199
2019-2020	0.928	-0.032	-0.006	0.152	0.160	1.300
2018-2019	0.912	-0.059	-0.024	0.530	0.154	1.403
2017-2018	0.915	0.000	-0.022	1.487	0.163	2.080

Discussion: Above Table here describes regarding the Altman Z score **State Bank of India** from the year 2017-18 to 2021-22. The outcome of the study indicates about the highest chances of risk pertaining to be in the year 2017-18, 2018-19 and 2020-21 with the credit risk as 2.080, 1.403and 1.300. The further year's Altman Z score also decreased with the score as 1.403 meaning there are the high chances of risk for the Capital small bank finance. The results of the study implies the less bankruptcy in the year 2020-22 with the credit risk of 2.080 which implies the less risk comparatively than other years.

Years	Canara Bank with Z-Score Model					
	X1	X2	X3	X4	X5	Altman Z score
	Working Capital/Total Assets	Retained Earnings / Total Assets	EBIT / Total Assets	Equity/ Total Liability	Sales / Total Assets	Risk Factor/Indicator
2021-2022	0.702	0.085	0.021	0.012	0.090	1.127
2020-2021	0.746	0.070	0.014	0.021	0.085	1.138
2019-2020	0.743	0.077	0.018	0.019	0.081	1.150
2018-2019	0.740	0.078	0.018	0.016	0.074	1.141
2017-2018	0.670	0.071	0.021	0.017	0.081	1.065

Discussion: Above Table here describes regarding the Altman Z score **Canara Bank** from the year 2017-18 to 2021-22. The outcome of the study indicates about the highest chances of risk pertaining to be in the year 2017-18, 2018-19 and 2020-21 with the credit risk as 2.080, 1.403and 1.300. The further year's Altman Z score also

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decreased with the score as 1.403 meaning there are the high chances of risk for the **Canara Bank**. The results of the study implies the less bankruptcy in the year 2020-22 with the credit risk of 2.080 which implies the less risk comparatively than other years.

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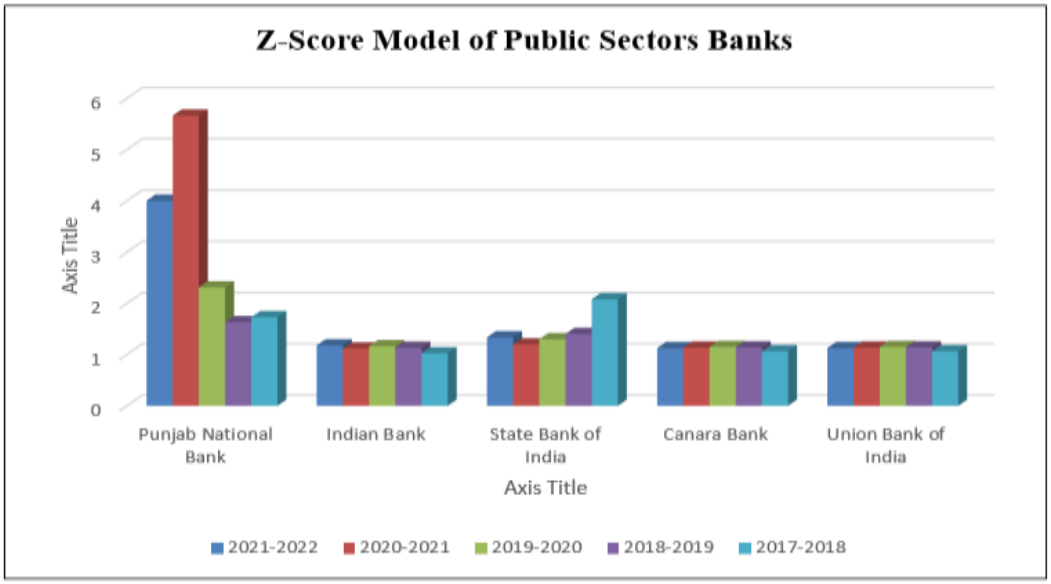
Years	Union Bank of India with Z-Score Model					
	X1	X2	X3	X4	X5	Altman Z score
	Working Capital/Total Assets	Retained Earnings / Total Assets	EBIT / Total Assets	Equity/ Total Liability	Sales / Total Assets	Risk Factor/Indicator
2021-2022	0.702	0.085	0.021	0.012	0.090	1.127
2020-2021	0.746	0.070	0.014	0.021	0.085	1.138
2019-2020	0.743	0.077	0.018	0.019	0.081	1.150
2018-2019	0.740	0.078	0.018	0.016	0.074	1.141
2017-2018	0.670	0.071	0.021	0.017	0.081	1.065

Discussion: Above Table here describes regarding the Altman Z score **Union Bank of India from** the year 2017-18 to 2021-22. The outcome of the study indicates about the highest chances of risk pertaining to be in the year 2017-18, 2018-19 and 2020-21 with the credit risk as 2.080, 1.403and 1.300. The further year's Altman Z score also decreased with the score as 1.403 meaning there are the high chances of risk for the **Union Bank of India.** The results of the study implies the less bankruptcy in the year 2020-22 with the credit risk of 2.080 which implies the less risk comparatively than other years.

❖ **To Study the Relationship between Altman's z score NPAs and Net Profits during this Period.**

Z-Score Model of Public Sectors Banks					
Years	Punjab National Bank	Indian Bank	State Bank of India	Canara Bank	Union Bank of India
2021-2022	4.004	1.181	1.337	1.127	1.127
2020-2021	5.664	1.119	1.199	1.138	1.138
2019-2020	2.312	1.165	1.300	1.150	1.150
2018-2019	1.632	1.135	1.403	1.141	1.141
2017-2018	1.730	1.026	2.080	1.065	1.065



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❖ **Identifying the disparities in the Altman's Z Score Values across a subset of India's public sector banks**

Ordinary Least Square of Punjab National Bank.

Dependent Variable: OPERATING_PROFIT_PNB				
Method: Least Squares				
Sample: 1 5				
Included observations: 5				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	97.43043	4.226769	23.05080	0.0002
Altman's z score of _PNB	-0.963520	1.814594	4.530984	0.0322
R-squared	0.885908	Mean dependent var		95.24452
Adjusted R-squared	-0.218790	S.D. dependent var		1.940945
S.E. of regression	2.142781	Akaike info criterion		4.651260
Sum squared resid	13.77453	Schwarz criterion		4.495035
Log likelihood	-9.628150	Hannan-Quinn criter.		4.231968
F-statistic	0.281944	Durbin-Watson stat		3.056428
Prob(F-statistic)	0.000228			

Ordinary Least Square of Indian Bank

Dependent Variable: OPERATING_PROFIT_IB				
Method: Least Squares				
Sample: 1 5				
Included observations: 5				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	126.5520	35.58450	3.556381	0.0379
Altman's z score of _IB	-32.50705	31.59573	-5.028843	0.0092
R-squared	0.660814	"Mean dependent var"		95.24452
Adjusted R-squared	0.614419	"S.D. dependent var"		1.940945
S.E. of regression	3.824071	"Akaike info criterion"		4.651260
Sum squared resid	43.87056	"Schwarz criterion"		4.495035
Log likelihood	-12.52421	"Hannan-Quinn criter.		4.231968
F-statistic	8.058518	"Durbin-Watson stat"		3.056428
Prob(F-statistic)	0.000247			

Ordinary Least Square of State Bank of India

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Dependent Variable: OPERATING_PROFIT_SBI				
Method: Least Squares				
Sample: 1 5				
Included observations: 5				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	107.6953	7.353704	14.64505	0.0007
Altman's z score of _SBI	-1.853840	4.911407	-1.191887	0.0190
R-squared	0.621358	"Mean dependent var"		116.2639
Adjusted R-squared	0.695144	"S.D. dependent var"		3.637733
S.E. of regression	3.460354	"Akaike info criterion"		5.609793
Sum squared resid	35.92216	"Schwarz criterion"		5.453569
Log likelihood	-12.02448	"Hannan-Quinn criter.		5.190501
F-statistic	1.420594	"Durbin-Watson stat"		2.515824
Prob(F-statistic)	0.000247			

Ordinary Least Square of Canara Bank.

Dependent Variable: OPERATING_PROFIT_CB				
Method: Least Squares				
Sample: 1 5				
Included observations: 5				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	67.36901	39.28443	1.714904	0.1849
Altman's z score of _CB	-51.18783	34.93120	1.465390	0.0391
R-squared	0.417178	"Mean dependent var"		116.2639
Adjusted R-squared	0.222904	"S.D. dependent var"		3.637733
S.E. of regression	2.367238	"Akaike info criterion"		5.609793
Sum squared resid	16.81145	"Schwarz criterion"		5.453569
Log likelihood	-10.12625	"Hannan-Quinn criter.		5.190501
F-statistic	6.147368	"Durbin-Watson stat"		2.515824
Prob(F-statistic)	0.000058			

Ordinary Least Square of Union Bank of India

Dependent Variable: OPERATING_PROFIT_UBI				
Method: Least Squares				
Sample: 1 5				
Included observations: 5				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	67.36901	39.28443	1.714904	0.1849
Altman's z score of _UBI	-51.18783	34.93120	1.465390	0.0391
R-squared	0.417178	"Mean dependent var"		116.2639
Adjusted R-squared	0.222904	"S.D. dependent var"		3.637733
S.E. of regression	2.367238	"Akaike info criterion"		5.609793
Sum squared resid	16.81145	"Schwarz criterion"		5.453569
Log likelihood	-10.12625	"Hannan-Quinn criter.		5.190501
F-statistic	6.147368	"Durbin-Watson stat"		2.515824
Prob(F-statistic)	0.000058			

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12. CONCLUSION OFTHE STUDY

The study form Altman Z score result indicated that, Z score for the selected Small Finance bank is below the 1.8, which states that the Credit risk is observed to be higher for selected SFB. Hence the study suggests the Small Finance banks should work to improve the working capital ratio, so that the Credit risk management will improve significantly. The study result indicated that the change in Credit risk will have the adverse effect on the Operating profit of Small Finance bank. Hence the study suggests the bankers should focus on the management of the credit activities in order to reduce improper loans, which would ultimately reduce risk in a bank and increase the capital base. The most up-to-date methods for managing credit risk should be available to banks in order to safeguard their money and reduce the likelihood of bankruptcy.

In order to avoid these risks, banks should generate credit derivatives markets.The findings of the Basel III preparation highlighted the need for banks to be prepared with comprehensive tools in advance so that problems do not hinder effective execution. Therefore, considering the impact of distinct dimensions on bank preparedness, they need to devise methods to control expenses and overcome problems while at the same moment deriving maximum execution benefit.

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