

The Impact Of Credit Risk Management On The Financial Performance Of Major Private Commercial Banks In Bangladesh

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Abstract:

The financial performance of major private commercial banks is critical to the stability and growth of any economy. This study investigates the impact of credit risk management practices on the financial performance of major private commercial banks in Bangladesh from 2015 to 2019. Employing both random and fixed effects models, the analysis explores the influence of Capital Adequacy Ratio (CAR), Loan Loss Provision (LLP), Deposit-to-Equity Ratio (DPR), Loan Ratio (LR), and bank size (SZ) on Return on Assets (ROA) and Return on Equity (ROE) for a sample of 23 conventional private commercial banks. The Hausman test guided the selection of the most appropriate model for each relationship. The findings reveal a moderate-to-good fit for both ROA and ROE models, indicating a significant association between credit risk management and financial performance. Higher capital adequacy ratios positively and significantly correlate with ROA and ROE, suggesting improved financial performance with more substantial capital buffers. Conversely, higher Loan Loss Provision (LLP) exhibits a strong and negative correlation with ROA and ROE, highlighting the importance of effective loan management in mitigating bad debts and enhancing profitability. The influence of Deposit-to-Equity Ratio (DPR), Loan Ratio (LR), and bank size (SZ) requires further investigation due to non-significant coefficients in the chosen model. However, the study underscores the critical role of robust credit risk management practices for financial stability in Bangladeshi banking. These findings contribute valuable evidence for policymakers and bank management, emphasizing the need for continuous improvement and adoption of advanced techniques to strengthen credit risk management and build a more resilient banking system.

Keywords: *Credit risk, Private commercial banks (PCBs), Financial performance, ROA, ROE, NIM*

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I. Introduction

The private Bank of Bangladesh has played an emerging role in Bangladesh accelerating the Country's economic growth. This private initiative is helping Bangladesh's industrial sectors to expand their business and create jobs for the people of Bangladesh. The private bank of Bangladesh is a big part of the country's financial system. The Government also works to engage the citizens to take the services from the Bank to develop their lifestyle and become an entrepreneur thronging efforts. The bank is the main motioning power of the economy of any country. The banking system accelerated business transactions and brought transparency in financial activities. Basically, a Bank is two types regulatory bank and a scheduled Bank.

Bangladesh has two types of banks to serve the people and accelerate the economic activities of the country one is a Schedule Bank and another is a Non-Scheduled Bank, but both of the banks are supervised by the central bank of Bangladesh which is called Bangladesh Bank. So Bangladesh Bank is the regulatory of all banks which was established by the Bangladesh Bank Order, 1972 and the Bank Company Act, 1991. Currently, in the banking sector of Bangladesh, there are a total of sixty one banks running their operations. Fifty-eight banks are performed commercially from the aggrandized banks, according to Bangladesh Bank statistics. Private commercial banks have been established by individuals and a group of private entrepreneurs to accelerate the economy and create new business scope under the Bangladesh Bank Act. In the 1980's banking industry achieved significant expansion with the entrance of private banks. There are 43 private commercial private Bank. Private Banks in Bangladesh are two types: Conventional Private Bank PCBs and Islami Shariah-based PCBs. As the economy of Bangladesh has been growing in recent years, the infrastructural structural projects and business activities have also expanded, which contributes to the flourishing of the whole economy. But after that, the current banking sector performance is not satisfactory due to the mismanagement, and the surging of default loan amounts tended by the borrowers in recent years. Well, some banks perform outstandingly, which is trying to set a role model in the banking industry. As mentioned before economic activity has sprouted in recent years, and the demand for loans has ascended by the borrowers for their business perspective. So, banks have identified the profitable projects measuring their creditworthiness through their recent financial activity and categorized them into different credit ratings using the point rating scale. So, we can realize the essentiality of credit risk management

in the banking industry to calculate profitability. There is no alternative way to build an attractive investment portfolio for outstanding banking performance through the mechanism, of credit risk management.

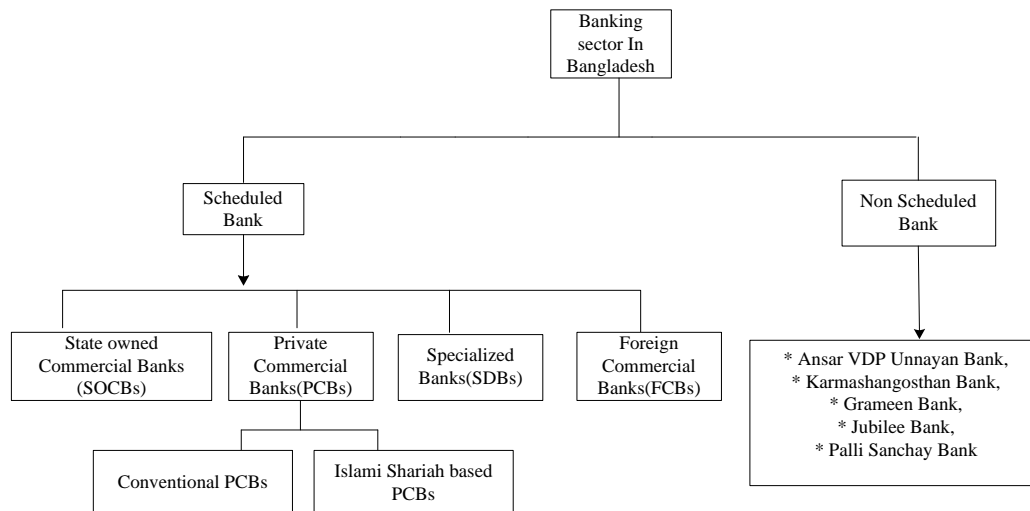


Figure 1.1 Banking industry in Bangladesh

Research purpose

This study's primary objective is to investigate the complex relationship between credit risk management practices and the financial performance of the largest private commercial banks in Bangladesh. The purpose of this study is to cast light on how the strategies and measures implemented by these banks to mitigate credit risk affect their overall financial health and performance.

This research seeks to determine the extent to which credit risk management practices influence key financial performance indicators, such as Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM). The purpose of this study is to shed light on the intrinsic relationship between risk management and financial outcomes by examining the effectiveness of credit risk management strategies in enhancing banks' capacity to manage potential losses and optimize resource allocation.

In addition, this research aims to provide empirical evidence that contributes to the existing corpus of banking and finance knowledge. This study endeavors to provide a nuanced understanding of how credit risk management strategies can potentially influence the trajectory of financial performance by meticulously examining the practices and outcomes of the largest private commercial banks in Bangladesh. The findings of this study are intended to inform banking practitioners, policymakers, and academics about the critical dynamics underlying credit risk management and its implications for the long-term financial success of private commercial banks operating within the Bangladeshi banking landscape.

Statement of the Problem

“What is the relationship between credit risk management practices and financial performance in major private commercial banks in Bangladesh, and how does it impact the return on assets, return on equity and net interest margin?”

II. Literature Review

Risk is the position where the actual return on investment is different than the expected return. Risk means the possibility of losing the actual investment and the number of interests accrued on it. Credit risk arises whenever a borrower is expecting to use future cash flows to pay a current debt investopedia.com. Although it's almost impossible to predict which side of the contract may default on obligations, properly assessing and managing credit risk can lessen the severity of a loss. Interest payments from the borrower of a debt obligation are a lender's reward for assuming credit risk capital.com. Still, in practice, there is no 100% guarantee that borrowers will have the funds to pay off their debts. In banking, it is the main factor in determining the interest rate on loans. The higher the level of risk, the higher the interest rate, as a rule. The interest payments paid by the borrower or the issuer of the promissory note are the reward for the lender or investor for taking credit risk (Charles Lutwidge, 2020) expressed in his article "An introduction to credit risk". The goal of credit risk management is to maximize a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters. Banks need to manage the credit risk inherent in the entire portfolio as well as the risk in individual credits or transactions (Basel Committee on Banking Supervision, 2020). In their empirical

investigation on "what drives credit risk in the Indian banking industry" revealed that the size of banks in India influences their credit risk (Gulati et al., 2019). The authors indicated that larger banks in the industry are exposed to greater credit risk. Another study by (Ejoh et al., 2014) in "Deposit Money Bank in Nigeria" expressed that Credit risk is the risk due to the failure of the debtor or other parties in meeting obligations to the bank. Credit risk is the possibility that the borrower will fail on the loan. In this context, failure is broadly defined when the borrower does not fulfill the terms of his contractual obligations with the lender. Credit risk is a serious threat to bank performance which, if not examined, will cause a total collapse of the bank. In the study of "A risk-returned framework" implies that risk analysis should be done in their correct contexts, for instance, credit risk should be analyzed in the context of cash flow projections and simulations. This will allow financial institutions like banks to implement the correct risk measures on risks and train their well its staff to handle the risks well (Bhattachary, 2011). Credit risk management has been deeply discussed in Base III. Base II has developed and devised Appropriate methods to deal with risk emerging from the credit portfolios of financial institutions. Effective management of risk related to credit portfolio not only enables banks to attain higher profitability from their business activities, they, more importantly, play a significant role in ensuring systematic stability as well as efficient allocation of capital (Psillaki et al., 2010).

Loan criteria and Bank performance on credit risk management

"Risk Management Impact on Non-Performing Loans and Profitability in the Namibian Banking Sector" expressed those non-performing loans do not have such a massive impact on the profit of the banks. It still does however have an impact as the profit could've been more because of outstanding interest on loans that are 90 days past due (Bernardus Franco Maseke, Eswual M. Swartz, 2021). In another study from (Ahmadyan, 2018) on "Measuring Credit Risk Management and Its Impact on Bank Performance in Iran" explained banking studies that the loan is classified as NPL when the payment of interest and principal are overdue by 90 days or more. Higher NPL, causes the banks to experience lower profit margins and if the problem increases, it can lead to a crisis, Potential influences on the NPL include the types of borrowers, bank management, and adverse changes in the economic situation. The importance of efficient credit risk management invites many parties especially researchers, regulators, and bank management to investigate the determinants of credit risk in banking, This will help them to understand and propose a comprehensive credit risk management framework. The level of credit risk is found to be a significant influence on the performance of banks, a group of Bangladeshi researchers (Munna Rani Biswas et al, 2021) in their study "Effect of credit risk on commercial banks profitability: A case study of Bangladesh" found that the size of NPLs in Bangladesh is very high. The high loan ratio diminishes the overall credit quality of the banking sector in Bangladesh. This study results also revealed that the highest loan ratio of CB (central bank) in Bangladesh was 35.28%. This high NPL ratio limits the new lending capacity of CB. Moreover, rising, levels of NPLs require banks to raise provisions against loan losses and banks with high NPLs cannot take the risk due to lower profits (Shreya Pradhan, Ajay K. Shah, 2019) empirical study on "Credit Risk Management of Commercial Banks in Nepal" mentioned that commercial banks in Nepal's credit risk management such as complying with credit risk policy, clearly defined role and responsibility for the responsible employees of the credit risk department, Similarly, banks should provide the employees with required skills and knowledge to help them perform regular activities and make tactful decisions to ensure profitability and performance of the bank. Commercial banks tactfully follow credit risk mitigation measures to avoid the risk of having NPAs and LLPs. The process from decision-making to the loan sanction should be carefully monitored and analyzed to reduce credit risk and improve loan repayment. Credit risk is the risk of loss of principal or loss of a financial reward stemming from a borrower's failure to repay a loan or otherwise meet a contractual obligation.

Relationship with Financial Performance and Profitability

In their study (Li and Zou, 2014) "The Impact of Credit Risk Management on Profitability of Commercial Banks Europe" found that the indicator of non-performing loans had a positive impact on a bank's profitability as measured by return on equity (ROE) and return on assets (ROA). In other studies, "Credit risk management and profitability in commercial banks in Sweden" by (Hosna Manzura and Juanjuan, 2009) found that non-performing loans indicator affected profitability as measured by return on equity (ROE) more than capital adequacy ratio (CAR) and the effect of credit risk management on profitability was not the same for all the banks included in their study, (Muhamet and Arbana, 2016) "The effect of Credit Risk Management on Banks Profitability in Kosovo" on this study explained their results reflected that a higher risk asset ratio would lead to a marginal decline in 'profitability' whereas greater non-performing loans had a positive and more significant effect. (Kodithuwakku, 2015) in his study on "Impact of Credit Risk Management on the Performance of Commercial Banks in Sri Lanka" conducted the empirical result which exhibited that non-performing loans and provisions have a significantly argumentative impact on the profitability, likely that non-performing loans are the most significant determinant of the ROA in UAE commercial banks with the highest coefficient compared to the other financial credit risk measures found by (Jamil Salem Al Zaidanin, Omar Jamil Al Zaidanin, 2021) on "The

impact of credit risk management on the financial performance of the United Arab Emirates commercial banks". Another study "Credit risk management practices of commercial banks in Kenya" by (Afande, 2014) conducted that commercial banks practice credit risk management with thorough loan appraisal, asking for collateral, and checking the credit history of the borrowers. (Dimitrios, Helen, & Mike, 2016) found while they study In Turkey determinants of PL ratio were studied utilizing the GMM method for the pre-crisis (2002Q4-2008Q3) and the post-crisis (2008Q4-2015Q4) periods using a sample size of 21 deposit banks considering capital adequacy ratio, lending, profitability, inefficiency and bank size as the independent variables and the NPL ratio as the dependent variable and research results found that the lending and inefficiency ratios have positive significant impact on the PL ratio and the remaining explanatory variables are insignificant.

in their study (Louhichi and Boujelbene, 2016) on "Interest-free vs. interest-based banking industries" claimed that capital plays an important role in the banks "management of credit risk. Banks' capital consists of ordinary shares and retained earnings. Traditionally, banks hold larger amounts of capital to reduce the risk of insolvency and to buffer losses from unexpected circumstances. (Hakim and Neaime, 2011) tried to examine "performance and credit risk in banking. A comparative study for Egypt and Lebanon" and found that there were sound risk management actions and applications of these bank's rules and laws. Credit risk is one of the significant risks of banks by the nature of their activities. Through effective management of credit risk exposure, banks not only support the viability and profitability of their own business but also contribute to systemic stability and an efficient allocation of capital in the economy explained (Iwedi & Onuegbu, 2014) in "Credit Risk and Performance of Selected Deposit Money Banks in Nigeria" like same results found by (Boahene, Dasah, and Agyei, 2012) on "Credit Risk and Profitability of Selected Banks in Ghana while examined on their study in the relationship between credit risk and banks profitability. They found a positive relationship between credit risk and bank profitability, (Nawaz and Munir, 2012) found in their study of "Credit Risk and the Performance of Nigerian Bank" that credit risk management affected on the banks' profitability, and they recommended that management should be cautious in setting up a credit policy that might not negatively affect profitability. (Aruwa and Musa, 2012) investigated the effects of credit risk and other risk components on the banks' financial performance. They found a strong relationship between risk components and the banks' financial performance and (Kurawa and Garba, 2014) revealed that the variables of credit risk management affected the bank's profitability in their study "An Evaluation of the Effect of Credit Risk Management (CRM) on the Profitability of Nigerian Banks".

Relation of Risk indicating factors on financial performance

Financial risk management is measured through credit risk, interest rate risk, and liquidity risk, while financial performance is measured through return on assets, return on equity and return on investment explained in "A Case Study of Commercial Banks in Pakistan" (Zeeshan Ahmedi et al, 2021). The correlation analysis results reveal that credit risk and profitability which are measured using ROA are negatively and significantly associated with (Kolapo et al, 2012). In their study on "Credit risk and commercial banks performance in Nigeria". Another explanation in "Risk Management on Profitability on Commercial Bank in Kenya" by (Kinyua Tony Gitonga and Joseph Lumumba Barasa, 2021) showed that the effect of credit risk on bank performance measured by ROA Was Cross-sectional invariant, though the degree to which individual banks were affected was not captured by the method of analysis employed in the study. (Isik, O. & Bolat, S., 2017) found while they are studying "Deposits Bank on Turkey" determinants that Capital adequacy plays a very critical role in banks' survival. When banks have more suitable equity capital, they are safe from insolvency risks. Capital adequacy which is measured by the total equity divided by total assets has a positive relationship with the PLs as when banks have higher equity to assets, it means they have more cushion or buffer against insolvency risk which resulted in encouraging banks to engage in risky investments leads to higher PLs levels. In other words, capital adequacy or solvency ratio can be used interchangeably as both can be used as a proxy of solvency risk which is considered the second-highest risk after credit risk that can force banks to go bankrupt because the credit risk is the risk that the borrowers may default in meeting their loans obligation to the bank which could result in deteriorating the quality of the assets by reducing its size to the equity. On the other side, if the equity fails to keep itself larger from the value of the liability it means that the bank becomes insolvent, and even if the bank sold all its assets, it won't meet its obligations and become forced to file its bankruptcy. (Alshatti, 2015) study done for Jordanian commercial banks showed an outcome of the credit risk pointers of non-performing loans/gross loans ratio and negative effect of Provision for facilities, loss/net facilities ratio on financial performance, and no effect of the 'capital adequacy' ratio, credit interest/credit facilities ratio on banks financial performance when it was measured by (Karim Mohamed Parag Shehata, 2020) recommended in the research "The Bank-specific determinants of credit risk in Egypt" that bank regulators to consider the ROA in their NPL. Size predictions to have better forecasting and insight into the factors that affect the NPL ratio in listed banks and accordingly they could modify bank regulations for the better and sound financial performance of banks of Egypt. The top managers of the listed banks in Egypt should consider the macroeconomic factors so that the NPL ratio of the listed banks of Egypt is

more sensitive to the changes in the macroeconomic factors in comparison to the NPL ratio of the non-listed banks. Moreover, they should consider the ROA as it is confirmed by many authors that it has a negative relationship with the NPL ratio so they can use it for predicting the size of the incoming NPLs. (Curak, Pepur & Poposki, 2013) studied the impact of bank-specific variables on the NPL ratio using a sample of 69 banks in southeastern Europe from 2003 through 2010 considering bank size, loan growth, solvency ratio, and Return On Assets (ROA) as the independent variables and the PL ratio as the dependent variable employing the Generalized Method of Moments (GMM) and findings revealed that ROA and bank size have negative significant impact on loan ratio while Solvency has positive significant impact and only loans growth has a negative insignificant impact. (Monika Gupta and Tarika Singh Sikarwar, 2020), explore the connection between 'credit risk management' and 'profitability' while studying "Modelling credit risk management and bank's profitability commercial banks in India" to see the fit of the conceptual model presented that the association between, debt-equity and ROA; 'leverage' ratio and ROA is negatively insignificant but with 'capital adequacy' it is positive and insignificant. The findings are the same as ROE. As it is known that sufficient capital is required for absorbing risk and any losses arising from the business, a higher debt-equity ratio demands more 'profitability' from a firm. (Shreya Pradhan and Ajay K. Shah, 2019) showed that Commercial banks tactfully follow the credit risk mitigation measures to avoid the risk of having PAs and LUPs while they studied in "Credit Risk Management of Commercial Banks in Nepal" also they found a statistical significant positive relationship between bank efficiency, capital adequacy, and credit. In addition, other factors used to measure bank efficiency, including profitability, deposits, spending, and size of banks, GDP growth, and inflation, are not statistically significant. Since capital adequacy and loans have statistically significant positive correlations, they committed that credit risk management's efficiency significantly affects bank efficiency (Arbana Sahiti & Arben Sahiti, 2021). In another study on "commercial bank credit risk efficiency in Kosovo" (Siyabola, Trimisiu Tunji & Adebayo and Kajogbade Kamel, 2021) found a prior expectations were confirmed with the actual findings to be positive and credit risk management has a significant effect on CAR while the insignificant effect on ROE became significant after being moderated by Bank Size while capital adequacy ratio, liquidity ratio, and loans -to-deposits ratio all have a very weak positive relationship on the return on assets, non-performing loans ratio, and cost-income ratio have a significant negative impact on commercial banks profitability in the United Arab Emirates revealed in the study on The impact of credit risk management on the "financial performance of the United Arab Emirates commercial banks" explained by (Jamil Salem Al Zaidanin, Omar Jamil Al Zaidanin, 2021). (Musyoki and Kadubo, 2012) seek to assess various parameters pertinent to credit risk management as it affects banks' financial performance. They concluded that all these parameters had an inverse impact on banks' financial performance; however, the default rate was the most predictor of bank financial performance, contrary to the other indicators of credit risk management. (Poudel, 2012) explored various parameters pertinent to credit risk management as they affect banks' financial performance. The study revealed that all these parameters had an inverse impact on banks' financial performance; however, the default rate is the biggest predictor of bank financial performance.

Examined the factors that affect the NPL ratio in emerging market economies by employing the dynamic panel regression analysis by (Bayar, 2019) for the period of 2000 to 2013 and research results unveiled that GDP, inflation, ROA, ROE, regularity capital to risk-weighted assets and non-interest income to total income have significant negative impact on the PL ratio while public debt, unemployment rate, credit growth, lagged values of PLs, and cost to income ratio have a positive significant impact on NPL ratio. (Lalon, 2015) wrote this descriptive research article in Bangladesh and the researcher found that Credit risk management encompasses identification, measurement, matching mitigations, monitoring, and control of the credit risk spotlights. The research result found that there is a positive relationship between RM practices and bank profitability (ROA). (Prof. Dr. Md. Ali Noor, et.al, 2018) in their study was designed to measure the impact of POCL on RO1, ROE, and ROA and to test the co-integration among the variables. In the study, it has been found that there exists co-integration among the study variables. In regression analysis, it has also been found that POCL has a significant negative impact on ROI. However, the impact of POCL is not significant on ROA and ROE. It has been found that co-integration exists among the study variables. It has also been found that there is short-run causality between POCL and ROI.

Research Methodology and Data collection

The fundamental purpose of this study is to provide an overview on the impact of Credit risk management on the financial performance in terms of major private commercial Banks in Bangladesh. This study describes and explores the credit policy and its implementation toward diversification of investments. So, descriptive, exploratory and analytical methods are combined, as the study demands, for the best result. The research design is thus an integrated frame of descriptive study and exploratory study.

Research Methodology Model Equation and Framework

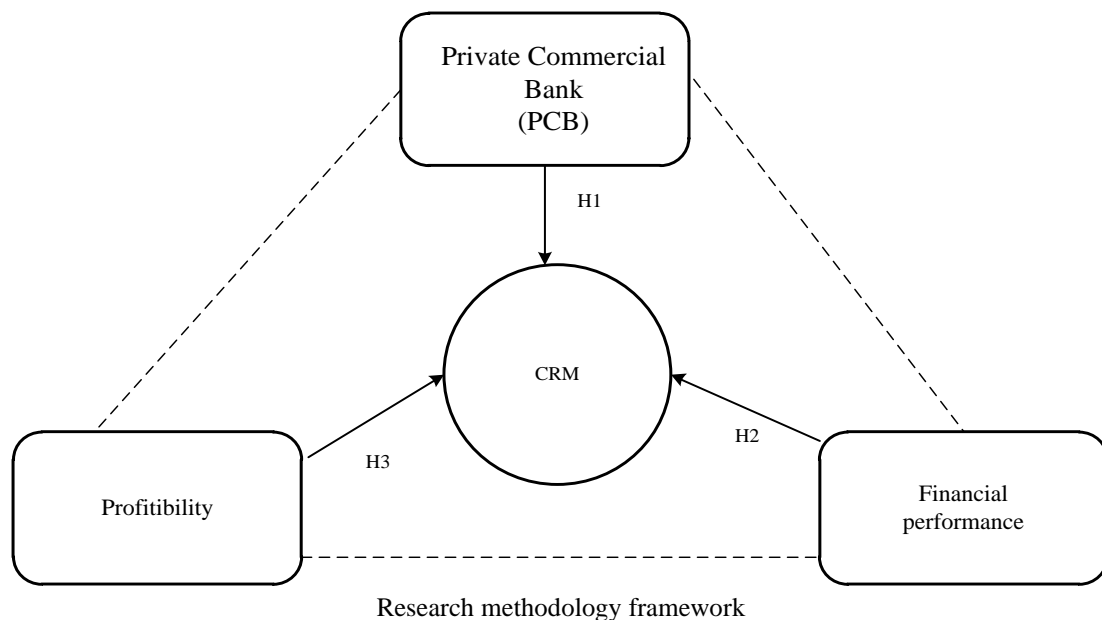
The econometric model inspired by (Menicucci et al., 2016) and (Farooq, S., Khan et al, 2020). A set of dependent variables and independent variables represents the econometric model divided into three equations replaced by three performance measures.

$$ROA = \alpha + \beta_1 (CAR) + \beta_2 (DPR) + B_3 (LLP) + \beta_4 (LR) + \beta_5 (SZ) + \epsilon \dots \dots \dots (1)$$

$$ROE = \alpha + \beta_1 (CAR) + \beta_2 (DPR) + B_3 (LLP) + \beta_4 (LR) + \beta_5 (SZ) + \epsilon \dots \dots \dots (2)$$

$$NIM = \alpha + \beta_1 (CAR) + \beta_2 (DPR) + B_3 (LLP) + \beta_4 (LR) + \beta_5 (SZ) + \epsilon \dots \dots \dots (3)$$

The above, three equations measure the profitability of private commercial banks in Bangladesh. Hence the study based its analysis on three different models to empirically examine/measure the banks' performance in Bangladesh. It is worth mentioning that each of the models comprises a different measure of profitability (dependent variable). Three indicators, namely, ROA (Return on Assets), ROE (Return on Equity) and NIM (Net Interest Margin), indicates three different performance measures, which are used to measure the performance of bank i in period t. On the other hand LLP, CR, LR, DPR, and SZ are Loan Loss Provisions, Capital Ratio, Loan Ratio, size and Deposit of the bank, are used as key determinants profitability. The subscript i represents individual bank and t denotes time whereas the ϵ in all three equations denotes a normally distributed error term.



Measurement of variable

This study utilizes a quantitative methodology, drawing data from publicly accessible sources and financial records unique to banks. The analysis will encompass a span of five years (2015-2019) and will specifically concentrate on a representative selection of prominent private commercial banks that are active in Bangladesh. The effectiveness of credit risk management strategies and their link with important financial performance metrics such as ROA, ROE, and NIM ratio will be evaluated using descriptive statistics, exploratory data analysis, and regression analysis. This research methodology offers a strong framework for examining the influence of credit risk management on the financial well-being and profitability of private commercial banks in Bangladesh. It gives significant insights for both academic and practical audiences.

Table 4.1 Measurement of variable

	Abbreviation variables	Description	Measurement
1	CAR	Capital adequacy ratio	Tier 1 capital + Tier 2 capital/Risk Weighted assets or Equity/ total assets
2	NIM	Net Interest Margin	Net Interest Income/ Earning assets
3	LLP	Loan Loss Provision	Loan loss provision/ Total loans
4	LR	Loan Ratio	Net loan/ Total Assets
5	SZ	Bank size	Log of total assets
6	ROA	Return on assets	Net income/ Total equity
7	ROE	Return on equity	Net income/ Total assets
8	DPR	Deposits ratio	Total deposits/ Total assets

ROA: Return on asset is a profitability ratio that provides how much profit a company is able to generate from its assets. In other words, return on assets (ROA) measures how efficient a company is management is in generating earnings from their economic resources of asset on their balance sheet.

ROE: Return on equity (ROE) is a measure of financial performance calculated by dividing net income by shareholders' equity. Because shareholders' equity is equal to a company's assets minus its deb, ROE is considered the return on net assets. ROE is considered a gauge of a corporation's profitability and how efficient it is in generating profits.

NIM: Net interest margin (NIM) is a measurement comparing the net interest income a financial firm generates from credit products like loans and mortgages. This metric helps prospective investors determine whether or not to invest in a given financial services firm by providing visibility into the profitability of their interest income versus their interest expenses.

CAR: The capital adequacy ratio (CAR) is a measurement of a bank's available capital expressed as a percentage of a bank's risk-weighted credit exposures. The capital adequacy ratio, also known as capital-to-risk weighted assets ratio (CAR), is used to protect depositors and promote the stability and efficiency of financial systems around the world.

LLP: A loan loss provision is an income statement expense set aside as an allowance for uncollected loans and loan payments. This provision is used to cover different kinds of loan losses such as non-performing loans, customer bankruptcy, and renegotiated loans that incur lower-than-previously-estimated payments. Loan loss provisions are then added to the loan loss reserves, a balance sheet item that represents the total amount of loan losses subtracted a company's loans.

LR: measures the percentage of assets that is tied up in loans. The higher the ratio, the less liquid the bank is. Short- term borrowings. This ratio indicates the percentage of the total deposits locked into non-liquid assets.

DPR: The loan-to-deposit ratio is used to assess a bank's liquidity by comparing a bank's total loans to its total deposits for the same period. The PR is expressed as a percentage. If the ratio is too high, it means that the bank may not have enough liquidity to cover any unforeseen fund requirements. Conversely, if the ratio is too low, the bank may not be earning as much as it could be.

SZ: Bank size is measured as the natural logarithm of the value of total assets. It represents the ownership of assets by banks. High asset ownership enables banks to offer more financial services at low cost.

Empirical analysis

Data type

Panel data approach was employed in the study to analyze the cross-sectional data of commercial banks in Bangladesh. To test the relationship and impact over the period 2015-2019, the study involved 23 conventional private commercial banks. Notably, for this article there no data used in terms of state-owned commercial banks, specialized banks, Islami Shariah based banks, and non-scheduled banks.

Population for industry

The twenty three banks are: AB Bank Ltd, Bangladesh Commerce Bank Ltd, Bank Asia Ltd, Dhaka Bank Ltd, Dutch Bangla Bank Ltd, Eastern Bank Ltd, Jamuna Bank Ltd, Mercantile Bank Ltd, Midland Bank Ltd, Mutual Trust Bank Ltd, National Bank Ltd, NCC Bank Ltd, NRB Bank Ltd, NRB Commercial Bank Ltd, One Bank Ltd, Premier Bank Ltd, Prime Bank Ltd, Pubali Bank Ltd, SBAC Bank Ltd, Southeast Bank Ltd, The City Bank Ltd, Trust Bank Ltd, United Commercial Bank Ltd, The 23 banks control more than half of customers' base, deposits and even extend more than half of the total risk assets in the country. A blend of purposive and judgmental sampling technique was employed in sample selection. Data of the selected banks were obtained exclusively from their published Annual Reports and Accounts for the period spanning 2009 and 2015. The data are secondary in nature and are annual financial data.

Descriptive Statistics

Table shows the average value of ROA, ROE and NIM as 0.9 percent, 9.9 percent, 3.2 percent, Standard Deviation at 0.009, 0.069, 0.017, with minimum value at -0.058, - 0.324, -0.002 and maximum value at 0.023, 0.197 and 0.101 respectively. The negative values of the performance measures indicate commercial banks experienced massive losses during the period of analysis. Another possible reason for the existence of wide variations in minimum and maximum is the presence of the largest banks on the sampled data set. The table shows that the average value of LLP during the period under review remained at 2.4 percent with as low as -0.004 and as maximum as 0.13. Further, the average LR remained at 69 percent which manifests the presence of a huge loan portfolio on banks' balance sheets, showing the presence of credit risk in the banking sector. The minimum value and maximum value of LR remained at 0.596 and 0.906 respectively. The high average value of deposit ratio at 97 percent shows that banks hold huge liabilities to their depositors. This high ratio also suggests that banks are

either reluctant to utilize their deposits or they are unable to invest them due to unfavorable external environment. The average capital adequacy ratio at 13 percent indicates that banks in contrast to total assets held around 13 percent in equity. This ratio remained as low as 1.4 percent and as a maximum of 27 percent. Banks' total assets are taken into account to represent the bank size, The mean value of size during the period of analysis remained at 11.16 percent with the lowest value at 8.09 percent and the highest value at 11.68 percent, respectively.

Table 1: Result of Descriptive Statistics

	ROA	ROE	NIM	CAR	DPR	LLP	LR	SZ
Mean	0.0091	0.0995	0.0320	0.1320	0.8030	0.0246	0.6869	11.1602
Median	0.0097	0.1049	0.0290	0.1303	0.8150	0.0168	0.6949	11.3500
Maximum	0.0232	0.1970	0.1019	0.2744	0.9749	0.1334	0.9062	11.6800
Minimum	-0.0587	-0.3245	0.0022	0.0142	0.6426	0.0004	0.5963	8.0900
Std. Dev.	0.0090	0.0693	0.0177	0.0045	0.0645	0.0231	0.0596	0.5279
Skewness	-4.5006	-2.5455	1.6675	1.6294	-0.2842	2.1860	0.4189	-2.6674
Kurtosis	32.88649	15.147	6.6657	11.3333	3.3450	8.5847	4.7020	13.272
Observations =115								

Correlation Analysis

The correlation matrix presents mixed results for all variables of the study. The correlation matrix shows mixed results about the statistical significance as well as the correlation of variables. Column shows that only loan ratio negatively affecting the banks (selected banks) ROA. However, all variables in the column, except the loan ratio and capital ratio are statistically significant, with bank size being statistically significant throughout the table. Furthermore, all variables, except loan loss provision ratio with ROE of the banks during the period of study, with all variable being statistically significant. The table shows that all the ratios are inversely correlated to the NIM of the banks over the period 2015-2019 whereas deposit ratio, loan ratio, capital adequacy ratio, and size are positively correlated to the NIM. Regarding statistical significance, the table shows that LLP statistically insignificant whereas CAR, LR, DPR and SZ remain statistically significant during the period of empirical investigation of this study.

Table 2: Correlation analysis

	ROA	ROE	NIM	CAR	DPR	LLP	LR	SZ
ROA	1							
ROE	0.731907	1						
NIM	0.180145	0.254263	1					
CAR	0.747877	0.501149	0.067222	1				
DPR	0.281045	0.326636	0.392245	0.248826	1			
LLP	-0.50757	-0.50192	0.038873	-0.42587	-0.06373	1		
LR	0.174069	0.360354	0.120059	0.073911	0.572288	-0.12941	1	
SZ	0.030204	0.263775	0.061949	-0.1334	0.092137	0.056911	0.312883	1

Fixed Effect Model (ROA)

Based on the outcomes of the Fixed Effect Model presented in the table, achieving an R-squared value of 0.8059 signifies that 80.59% of the variability in the dependent variable (ROA) can be accounted for by the independent variables in this model. This indicates a high level of compatibility for the model. Nevertheless, the adjusted R-squared value of 0.7457 is marginally reduced, as anticipated, due to the inclusion of additional factors, which is penalized. The F-statistic of 13.3794, along with a p-value of 0.0000, demonstrates that the model is statistically significant. This indicates that the independent factors collectively account for a substantial amount of the variability in the dependent variable. The Durbin-Watson value of 2.3423 is within the acceptable range of 1.5 to 2.5, indicating the absence of severe autocorrelation in the residuals of this model. The results indicate that the fixed effects model offers a statistically significant and reliable explanation for the correlation between credit risk management methods and return on assets (ROA). These findings indicate that the selected independent variables, namely CAR, DPR, LLP, LR, and SZ, play a significant role in determining bank profitability.

Table 3: ROA (Fixed Effect Model)

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	0.0217	0.0236	0.9178	0.3613
CAR	0.0451	0.0233	1.9356	0.0562
DPR	-0.0086	0.0171	-0.5020	0.6169
LLP	-0.2385	0.0352	-6.7689	0.0000
LR	-0.0201	0.0159	-1.2631	0.2099
SZ	0.0007	0.0017	0.4227	0.6735
R-Squared 0.8059	Adjusted R-Squared 0.7457		F- statistics 13.3794	
Prob (F-Stat) 0.0000	Durbin-Watson 2.3423		N=120	

Random effect model (ROA)

Based on the outcomes of the Fixed Effect Model presented in the table, achieving an R-squared value of 0.8059 signifies that 80.59% of the variability in the dependent variable (ROA) can be accounted for by the independent variables in this model. This indicates a high level of compatibility for the model. Nevertheless, the adjusted R-squared value of 0.7457 is marginally reduced, as anticipated, due to the inclusion of additional factors, which is penalized. The F-statistic of 13.3794, along with a p-value of 0.0000, demonstrates that the model is statistically significant. This indicates that the independent factors collectively account for a substantial amount of the variability in the dependent variable. The Durbin-Watson value of 2.3423 is within the acceptable range of 1.5 to 2.5, indicating the absence of severe autocorrelation in the residuals of this model. The results indicate that the fixed effects model offers a statistically significant and reliable explanation for the correlation between credit risk management methods and return on assets (ROA). These findings indicate that the selected independent variables, namely CAR, DPR, LLP, LR, and SZ, play a significant role in determining bank profitability.

Table 4: ROA (Random Effect model)

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-0.0323	0.0120	-2.6943	0.0082
CAR	0.1132	0.0118	9.5644	0.0000
DPR	0.0126	0.0097	1.2939	0.1984
LLP	-0.0115	0.0231	-4.9958	0.0000
LR	-0.0053	0.0104	-0.5071	0.6131
SZ	0.0020	0.0009	2.0701	
R-Squared 0.8059	Adjusted R-Squared 0.7457		F- statistics 13.3794	
Prob (F-Stat) 0.0000	Durbin-Watson 2.3423		N=120	

The constant term (-0.0323) signifies the estimated value of ROA when all independent variables have a value of zero. Here, the presence of a negative coefficient indicates that even in the absence of any impact from the independent variables, the projected Return on Assets (ROA) is somewhat below zero. The coefficient for CAR is 0.1132, and its p-value is 0.0000. The data suggests a strong and statistically significant correlation between the capital adequacy ratio (CAR) and return on assets (ROA). Consequently, a positive correlation exists between a higher Capital Adequacy Ratio (CAR) and a higher Return on Assets (ROA), indicating that banks with larger capital reserves are more capable of absorbing losses and sustaining profitability.

The coefficient for the variable DPR is 0.0126, and its corresponding p-value is 0.1984. The data suggests a positive correlation between the deposit-to-equity ratio (DPR) and return on assets (ROA), however, this correlation is not statistically significant. This implies that the effect of DPR on ROA is inconclusive and necessitates additional examination. The coefficient for LLP is -0.0115, and it has a p-value of 0.0000. The data demonstrates a strong and statistically significant inverse correlation between loan loss provision (LLP) and return on assets (ROA). Consequently, a higher level of Loan Loss Provision (LLP) results in a correspondingly lower Return on Assets (ROA), as anticipated.

The LR coefficient is -0.0053, and its corresponding p-value is 0.6131. The data suggests a correlation between the loan ratio (LR) and ROA, but it is not statistically significant. This implies that the influence of LR on ROA is similarly uncertain and deserves additional examination.

The coefficient for SZ is 0.0020, and its corresponding p-value is 0.8372. The data suggests a positive correlation between the size of a bank (SZ) and its return on assets (ROA), however, this correlation is not statistically significant. This implies that the effect of size on return on assets (ROA) is inconclusive and necessitates additional investigation.

Fixed Effect model (ROE)

Based on the information presented in this table, The R-squared value of 0.4024 indicates that this model accounts for roughly 40.24% of the variability seen in the ROE. This suggests that the independent variables incorporated are pertinent and enlightening. The adjusted R-squared value of 0.3311 is marginally lower than the R-squared value, as anticipated, since it accounts for the impact of including additional factors. Nevertheless, it still suggests a reasonable level of compatibility, taking into account the quantity of independent variables in the model. The F-statistic of 15.1474, along with a p-value of 0.0000, indicates that this model is statistically significant. This indicates that the independent factors collectively contribute to explaining a substantial amount of the variability in return on equity (ROE), above what would be anticipated by random chance. The Durbin-Watson value of 1.5354 is within the permitted range, indicating the absence of considerable autocorrelation in the residuals model. This implies that the discrepancies in the model are not interrelated, which is a fundamental prerequisite for doing linear regression analysis. These results indicate that fixed-effects model offers a statistically significant and reliable explanation for the correlation between credit risk management practices and return on equity (ROE).

Table 5: ROE (Fixed Effect model)

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-0.1475	0.1732	-0.8520	0.3965
CAR	0.2933	0.1708	1.7174	0.0895
DPR	0.1000	0.1254	0.7991	0.4264
LLP	-1.2754	0.2580	-4.9417	0.0000
LR	-0.0880	0.1166	-0.7548	0.4524
SZ	0.0196	0.0125	1.5717	0.1196
R-Squared 0.4024	Adj R-Squared 0.3311		F-Statistic 15.1474	
Prob (F-Stat) 0.0000	Durbin-Watson 1.5354		N=115	

Random Effect model (ROE)

The R-Squared value of 0.5961 indicates that this model accounts for 59.61% of the variability observed in the ROE. This suggests a satisfactory fit for the model. The adjusted R-Squared value of 0.5776 is marginally reduced when accounting for the influence of the number of independent variables. Nevertheless, it falls within the permissible range.

The F-Statistic of 32.1862, along with a p-value of 0.0000, demonstrates that your model is statistically significant. This indicates that the independent factors collectively play a major role in explaining a substantial amount of the variability in Return on Equity (ROE), surpassing what would be anticipated by random chance.

The Durbin-Watson statistic state that the value of 1.6894 is within the permitted range of 1.5 to 2.5, indicating that there is no severe autocorrelation in the residuals of your model. This guarantees the accuracy of the assumptions made by the model. The presence of a negative coefficient indicates that, even in the absence of any impact from the independent variables, the projected return on equity (ROE) is slightly negative.

Automobile the positive and statistically significant coefficient demonstrates a direct relationship between CAR and ROE, implying that banks with larger capital buffers have a stronger capacity to create profits. Deposit per ratio although positive, does not reach statistical significance, suggesting that additional analysis is needed to determine the impact of DPR on ROE.

Table 6: ROE (Random Effect Model)

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-0.0323	0.0120	-2.6943	0.0082
CAR	0.1132	0.0118	9.5644	0.0000
DPR	0.0126	0.0097	1.2939	0.1984
LLP	-0.1157	0.0231	-4.9958	0.0000
LR	-0.005	0.0104	-0.5071	0.6131
SZ	0.0020	0.0009	2.0701	0.0408
R-Squared 0.5961	Adj R-Squared 0.5776		F-Statistic 32.1862	
Prob F-Stat) 0.0000	Durbin-Watson 1.6894		N=115	

Fixed Effect Model (NIM)

This model explains a large part (69.81%) of the range in NIM, as shown by an R-squared value of 0.6981. This makes it look like the model will work well. However, the adjusted R-squared of 0.6044 is a little lower, which is to be expected since adding more independent factors hurts the result. Even though this model has a lot of factors, it still shows a moderate to good fit. It's clear that this prediction is statistically significant since the F-statistic is 7.4515 and the p-value is 0.0000. In other words, the independent variables help explain a lot of the variation in NIM, which is more than what would be predicted by chance. With a value of 1.4746, the Durbin-Watson statistic is within the reasonable range of 1.5 to 2.5. This means that there isn't any significant autocorrelation in this model's residuals.

Table 7: NIM (Fixed Effect model)

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-0.0757	0.0582	-1.3003	0.1969
CAR	0.0076	0.0574	0.1328	0.8946
DPR	0.0572	0.0422	1.3561	0.1786
LLP	0.0462	0.0867	0.5325	0.5957
LR	0.0234	0.0392	0.5964	0.5524
SZ	0.003	0.0042	0.9281	0.3559
R-Squared 0.6981	Adj R-Squared 0.6044		F-Statistic 7.4515	
Prob (F-Stat) 0.0000	Durbin-Watson 1.5746		N=115	

Random Effect Model (NIM)

The F-statistic of 16.3534, along with a p-value of 0.0000, indicates that this model is statistically significant. This indicates that the independent factors collectively account for a substantial amount of the variation in NIM, above what would be anticipated by random chance. The Durbin-Watson value of 1.2303 is within the allowed range of 1.5 to 2.5, indicating that there is no significant autocorrelation in the residuals of your model. This implies that the errors in this model are independent of each other, which is a crucial assumption for doing linear regression analysis. Achieving an R-squared value of 0.4286 signifies that your model accounts for 42.86% of the variability observed in NIM. This indicates a satisfactory level of compatibility for the model.

The modified R-squared value of 0.4024 is marginally lower, as anticipated, owing to the penalty imposed for including additional independent variables. Given the number of variables in your model, it still suggests a moderate level of fit.

Table 8: NIM (Random Effect model)

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	-0.3368	0.1381	-2.4378	0.0164
CAR	0.4031	0.1339	3.0091	0.0033
DPR	0.1255	0.1043	1.2029	0.2316
LLP	-1.2163	0.2246	-5.4145	0.0000
LR	-0.0159	0.1024	-0.1555	0.8767
SZ	0.0289	0.0104	2.7695	0.0066
R-Squared 0.4286	Adjusted R-Squared 0.4024		F-Statistic 16.3534	
Prob (F-Stat) 0.0000	Durbin-Watson 1.2303		N=115	

Interpretation: The large Chi-Sq. statistic 42.69 and the very low p-value (0.0000) suggest that we reject the null hypothesis. This implies that the Fixed Effect model is more consistent and efficient than the RE model for the data.

Table 9: Hausman test for ROA

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	42.6999403.	5	0.0000

Hausman test for ROE

Interpretation: The Chi-Sq. statistic of 6.249081 is relatively low, and the p-value of 0.2827 is greater than a typical significance level like 0.05.

This suggests that we fail to reject the null hypothesis of the Hausman test. Therefore, based on the Hausman test results, it appears that the random-effects (RE) model is consistent and efficient for the data. It suggest that continue using the Random Effect model for this analysis.

Table 10: Hausman test for ROE

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	6.249081	5	0.2827

Hausman test for NIM

Interpretation: The Chi-Sq. statistic of 2.352897 is relatively low, and the p-value of 0.7985 is greater than a typical significance level like 0.05.

This suggests that we fail to reject the null hypothesis of the Hausman test. Therefore, based on the Hausman test results, it appears that the random-effects (RE) model is consistent and efficient for the data. It suggest that continue using the Random Effect model for this analysis.

Table 11: Hausman test for NIM

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.352897	5	0.7985

Findings

The correlation between Credit Risk Management and Financial Performance: The R-squared values for both the ROA and ROE models suggest a moderate-to-good fit, accounting for 59.61% and 40.24% of the variability in the respective dependent variables. There is a strong correlation between credit risk management methods and financial performance.

F-statistics: All models exhibit statistically significant F-statistics with p-values of 0.0000, suggesting that the independent variables account for a substantial proportion of the variation in the dependent variables beyond what would be anticipated by random chance.

Specific coefficients for each individual:

There is a clear and strong correlation between the Capital Adequacy Ratio (CAR) and both Return on Assets (ROA) and Return on Equity (ROE). This indicates that more significant capital reserves are linked to enhanced financial performance. The influence of the Deposit-to-Equity Ratio (DPR) on both Return on Assets (ROA) and Return on Equity (ROE) necessitates additional examination, as its coefficient exhibits a positive trend but lacks statistical significance.

There is a strong and statistically significant inverse correlation between Loan Loss Provision (LLP) and both Return on Assets (ROA) and Return on Equity (ROE). It suggests that an increase in LLPs is associated with decreased financial performance, as anticipated. The relationship between Loan Ratio (LR) and both Return on Assets (ROA) and Return on Equity (ROE) has to be examined more closely, as the coefficient of LR is negative but lacks statistical significance. The relationship between bank size (SZ) and return on assets (ROA) has to be further examined, as the coefficient is positive but lacks statistical significance.

Effect on Return on Assets (ROA): The model for Return on Assets (ROA) demonstrates a moderate level of fit, accounting for 59.61% of the variation.

Key factors: A more excellent Capital Adequacy Ratio (CAR) and a lower Loan Loss Provision (LLP) are correlated with a better Return on Assets (ROA).

Additional inquiry is required: Additional analysis is needed to determine the influence of DPR, LR, and SZ on ROA.

Effect on Return on Equity (ROE): The Return on Equity (ROE) model exhibits a moderate fit, accounting for 40.24% of the variance.

Key factors: A more excellent capital adequacy ratio (CAR) and a lower loan loss provision (LLP) are linked to a higher return on equity (ROE).

Explicit Results:

Loan loss provision: Increased LLPs result in decreased financial performance, as anticipated. This emphasizes the significance of efficient loan screening and credit risk assessment in reducing non-performing loans and enhancing profitability.

Capital adequacy ratio: Increased capital reserves are linked to enhanced financial performance. This highlights the significance of capital sufficiency in bolstering banks' capacity to absorb losses and uphold financial stability.

III. Conclusion & Limitations

Conclusion

Beyond the immediate implications for Bangladesh, this study offers valuable contributions to the broader literature on credit risk management and financial performance. It highlights the context-specific nature of these relationships, emphasizing the need for research that considers the unique regulatory frameworks and economic conditions of emerging economies. Additionally, the study demonstrates the effectiveness of using panel data models to account for time-series and cross-sectional variations, providing a robust foundation for future research in this area.

This study examined the notable correlation between credit risk management strategies and financial performance in private commercial banks in Bangladesh. Enhanced financial performance was associated with increased capital adequacy ratios and decreased loan loss provisions. Although the deposit-to-equity ratio, loan ratio, and bank size need more examination, studying the impact of sophisticated credit risk management tools such as credit scoring models and stress testing on financial performance offers a promising direction for future research. While it is important to use caution when applying these findings to different systems because of possible differences, regulatory agencies should promote effective credit risk management techniques. Financial institutions ought to allocate resources towards enhancing their credit risk frameworks, which entails using sophisticated methodologies, in order to ensure long-term viability and systemic robustness. This study highlights the pivotal significance of proficient credit risk management in ensuring financial stability and profitability. It offers significant evidence for policymakers and bank management to enhance these practices and establish a more resilient and enduring banking system. It is recommended to conduct additional study in order to overcome constraints and improve the applicability of the results, ultimately leading to a more profound comprehension of the intricate correlation between credit risk and financial success.

Furthermore, the potential influence of other credit risk management practices, such as stress testing and credit scoring models, warrants further exploration. Implementing advanced risk management tools and fostering a culture of risk awareness within banks can further enhance financial stability and resilience. By adopting a multi-pronged approach to credit risk management, Bangladeshi banks can navigate a dynamic financial landscape and contribute to the long-term sustainability of the banking sector.

However, limitations exist. The study focuses on a specific timeframe in Bangladesh, and the generalizability of the findings to other countries or periods might require further investigation. Additionally, the chosen control variables represent a subset of potential factors influencing financial performance. Future research could incorporate a broader range of control variables or delve into specific credit risk management techniques in greater detail.

Limitations

- * The study relies on data exclusively obtained from private commercial banks in Bangladesh, hence constraining the applicability of the findings.
- * The analysis is dependent on secondary data, which has the potential to include errors or inaccuracies.
- * The study exclusively examines a restricted range of credit risk management practices.
- * The findings are relevant to the Bangladeshi banking sector within its specific regulatory framework and economic environment. The relationship between credit risk management and financial performance might differ in other countries with diverse regulatory structures and economic conditions.

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