An Internship Report On

"Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh"

Supervised By

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ID No: 22317036

Session: 2022-2023

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Letter of Transmittal

26th May, 2025
Md. Al-Amin
Assistant Professor
Department of Finance & Banking
Comilla University

Subject: Submission of intern report on "Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh"

Honorable Sir,

With due respect, I would like to state that it is a matter of great pleasure and honor for me to submit my intern report on "**Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh""**. The purpose of this report will be to understand the impact of credit risk on Bank profitability as this report is an obligatory requirement to complete our MBA Program. It was both a pleasure and a challenge as well for me to work under your supervision and I can never repay my indebtedness to you.

It has been a very positive and uplifting experience, as I have learnt a lot that wouldn't have been possible otherwise. The final report is based on data from various sources and basis on relevant findings. To provide a clear view, some graphs, tabular data have been added. I have tried my level best to include all the relevant information to make the project report informative and comprehensive.

Lastly, I would like to express my sincere appreciation and thanks to your help while the report. I shall be glad to answer any queries that you may have in this regard.

Sincerely yours,

Farjana Akter
ID No: 22317036
Session: 2022-2023
Department of Finance and Banking
Comilla University.

Acknowledgement

At the very beginning I would like to express my deepest gratitude to almighty for giving me the strength and the composure to finish the task. Project report is an essential part of the MBA program. It is a great pleasure to prepare project report on **"Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh"**

On this manner I would like to express my deepest gratitude to my honorable academic supervisor, Mohammad Al-Amin along with all other respected teachers for their all-time support and guidelines during BBA program. Department of Finance and Banking, Comilla University for permitting and guiding me to prepare the report.

…….

Farjana Akter

Class ID: 22317036

Registration No: 22317036

Session: 2022-2023

Department of Finance & Banking, Comilla University

Student Declaration

I somberly declare that the work in this intern report on "**Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh"** is an original work done by me under the supervisor of Mohammad Al-Amin, Assistant Professor, Department of Finance & Banking, Comilla University.

No part of this report has been previously submitted to any other University/College/Institution/ Organization for any academic certificate/ degree/ diploma.

This work I have presented does not breach any existing copyright and no portion of this report is copied from any work done earlier for any degree. Information derived from the published and unpublished work of others has been acknowledged in the text and references

I further undertake to identify the department against any lost or damage arising from breach of the forgoing obligation, If any.

Farjana Akter

ID No: 22317036

Reg No: 22317036

Session: 2022-2023

Department of Finance and Banking

Comilla University, Cumilla

Supervisor Declaration

This is to certify that the project report on "**Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh"** is done by, Farjana Akter, ID No: 22317036, Reg No: 22317036, Session: 2022-2023 as the partial fulfillment of Master of Business Administration (MBA) degree from Department of Finance and Banking, Faculty of Business Studies, Comilla University, Cumilla. This project report has been prepared under my guideline and is a report of the authentic work carried out successfully.

……..

Md. Al-Amin

Assistant Professor

Department of Finance & Banking

Faculty of Business Studies

Comilla University

Executive Summary

This report is a study on "Evaluating the Effect of Credit Risk and Capital Adequacy on Profitability: A Panel Data Analysis of State-Owned Commercial Banks in Bangladesh". This Panel Data Analysis examines how reciprocal relationships between credit risk management, capital adequacy and the financial results of state-owned commercial banks in Bangladesh kept shifting from 2014 through 2023. Using secondary data collected from annual reports, the study measures the profitability of banks by their Return on Assets (ROA), while considering factors such as the Non-Performing Loan to Total Loan Ratio (NPLTLR), Capital Adequacy Ratio (CAR), Credit to Deposit Ratio (CDR), Cost to Income Ratio (CIR) and size of the bank.

Moreover, this report emphasizes in showing the impact of Credit risk on Bank Profitability and I found the significant evidence that credit risk has an impact on Bank's profitability. For this study I have run several statistical tests such as T-test, Chi-Square test, normality test, multiple regression model, heteroscedasticity test etc. For regression analysis I have taken four independent variables such as Non-performing Loan to Total Loan Ratio (NPLTLR), Capital Adequacy Ratio (CAR), Credit Deposit Ratio (CDR), Cost to income Ratio (CIR) and Bank Size (BS) which are indicators of credit risk. And also take one dependent variable such as Return on Asset which is indicators of Banks profitability. Then, I put those variables in **Stata** and perform regression analysis. I have taken 10-year time series data range from 2014-2023 as input of regression analysis.

This report is categorized in seven different chapters including introduction, literature review, methodology of the study, credit & financial performance of of state-owned banks of Bangladesh, impact of credit risk on state-owned banks (SBL,ABL, RPL and JBL's) profitability and findings, recommendation & conclusion.

After the analysis of collected data and information, it shows evidence that credit risk has significant impact on Bank's profitability. To be more ensuring that how much and how credit management influences on bank profitability, further study and research should be carried out in future.

Abbreviations

SBL - Sonali Bank PLC

ABL - Agrani Bank PLC

JBL - Janata Bank PLC

RPL - Rupali Bank PLC

ROA - Return on Asset

CAR -Capital Adequacy Ratio

NPLRTLR -Non-Performing Loan to Total Ratio

CDR - Credit Deposit Ratio

CIR -Cost to Income Ratio

BS -Bank Size

CRM – Credit Risk Managemant

EPS -Earnings per Share

KYC -Know Your Customer

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Chapter-1
Introduction

1.1 Introduction

Credit remains the primary source of revenue for any bank around the world. However, those banks have been increasingly concerned about the probability that borrowers will fail on their credit commitments, especially for unsecured bank loans. One could classify this risk as credit risk. According to the risk-return trade-off theory, investors who take on more risk are rewarded with a higher risk premium. The probability that something undesirable will occur is known as risk. It is, in essence, a probability of suffering a monetary loss. Risk can take many different forms. These include the following: market risk, foreign exchange rate risk, interest rate risk, liquidity risk, credit risk, strategic risk, operational risk, and regulatory risk.

According to (Anna, Boris, Ivana, & Finance, 2015) credit risk is the risk that a consumer won't pay. Credit risk, according to Serwadda (2018), is the possibility of losing an outstanding loan amount whole or significantly as a result of various financial events (default risk). Therefore, a bank's probability of encountering financial hardship increases with its exposure to credit risk, and vice versa. According to Cookson (1989), Credit risk is the chance that one party to a financial instrument may miss payments and cause the other party to suffer a loss. Concentration of credit risk occurs when several counterparties are involved in comparable commercial activities, operate in the same geographic area, or share economic characteristics that would make it more difficult for them to fulfill their contractual obligations in the event of changes in the political, economic, or other environment. In order to control credit risk, the bank sets credit limits for its clients and secures sufficient collateral. The Credit Risk Management (CRM) team keeps an eye on, evaluates, and analyzes the credit risk in the state-owned banks' portfolio.

As of 2023, Bangladesh's banking sector includes 62 banks, consisting of state-owned, private, and foreign banks. The total assets of the banking industry reached approximately $220 billion, with private commercial banks dominating the sector. Despite its growth, profitability metrics like ROA have shown mixed trends, with some banks struggling due to increased NPLs, operating inefficiencies, and economic instability. According to the data of Bangladesh Bank, due to the high percentage of non-performing loans, poor efficiency, and high funding costs, Bangladesh's banking industry is the least profitable in South Asia. In Bangladesh, the return on assets (ROA), or profitability, was 0.52% in 2022 and then dropped to 0.43 percent in June 2023.Identifying the drivers of profitability is essential for formulating effective policies and strategies to address these challenges.

The primary objective of this research is to explore the relationship between credit risk indicators (e.g., non-performing loan, capital adequacy, asset quality, operational efficiency) with bank profitability. Specifically, the study aims to quantify the impact of these variables on ROA, thereby providing actionable insights into enhancing bank performance.

To achieve these objectives, the study employs a panel data econometric framework, analyzing data from 4 state-owned commercial banks in Bangladesh **(Sonali Bank PLC, Agrani Bank PLC, Rupali Bank PLC, Janata Bank PLC)** over a 10-year period **(from 2014 to 2023)**. The independent variables include firm-specific factors such as theNPL-to-total loans ratio (NPLTLR), capital adequacy ratio (CAR), credit deposit ratio (CDR),cost-to-income ratio (CIR), bank size (measured as the log of total assets), equity capital-to-assets ratio.

The profitability metrics ROA is used as dependent variable, reflecting the efficiency of asset utilization and shareholder returns, respectively. To analyze the data, econometric models such as fixed effects, pooled ordinary least squares (OLS), and generalized least squares (GLS) are employed. The model is particularly suited to dynamic panel investigations as the account for the unique characteristics of individual banks and the temporal variability in macroeconomic factors.

The research emphasizes the importance of understanding the factors that influence profitability to ensure sustained growth and stability in the banking sector. Policymakers, bank management, and other stakeholders can use the insights gained from this study to design targeted interventions for enhancing operational efficiency, managing risks, and leveraging macroeconomic opportunities. For further study and real-world applications in banking and finance, this thorough approach to profitability analysis offers a useful starting point.

1.2 Background of the study

It is now essential for every person to have some opinions on the bank and banking practices. As our educational system is overwhelmingly text-based, the consideration of a common-sense direction program is a special case for the standard. From pragmatic information, we will actually want to know genuine circumstances and begin a profession with some viable experience.

Banks provide their customers loans with the understanding that they will return the money plus interest. If capital and interest payments are made in accordance with the agreed-upon terms, the lending facility is deemed to be performing. The danger of loss resulting from a debtor's failure to repay a loan or other line of credit (principal, interest, or both) is known as credit risk. Non-Performing Loans (NPLs) are credits that banks view as potentially losing money because borrowers are unable to make their monthly payments. They are also categorized as inferior and dubious bank credit, which prevents banks from reaching their goals.A bank cannot survive without effective risk management, which allows management to distribute resources to risk units by weighing the potential for profit against risk.

This report is featured on Credit risk of the state-owned commercial banks Structure, Analysis of Present status, credit performance of SBL,ABL, RPL, JBL ; reasons for NPL, significant stages to decrease NPL, Own Insight, Suggestions, and End.

1.3 Problem Statement

A bank is a sort of financial intermediary that makes money by moving funds from surplus units, also called depositors, to deficit units, sometimes called borrowers, while making money off of the difference in interest rates. A bank's primary function is to link those with capital with those looking for it. Credit risk reduces bank profitability and can lead to financial difficulty since it results from the bank's interactions with or lending to corporations, individuals, and other banks or financial institutions. Therefore, managing credit risk is essential to a bank's ability to operate. The development of Bangladesh's banking industry also requires a strong and efficient credit management system.
In Bangladesh, State-owned banks provide credit to a range of companies and investors, which helps to mobilize financial resources for investment. Since they account for the largest portion of operating revenue, loans and advances are the dominating assets and constitute the core of the banking sector. On the other hand, loans put banks at the most risk.

This study is expected to be very helpful to many people in the end, especially those working in the banking industry, including bankers, financial analysts, bank managers, internal auditors, and the top management of commercial banks. This is because the profitability of State-owned banks is significantly correlated with the components of credit risk management.

The main purpose of this report is to show the credit risk factors of State-owned banks and to show the relationship between credit risk and the profitability of state-owned banks so that it can be concluded with a fruitful outcome that will make impact on CRM practice.

1.4 Scope of the Study

Credit risk is one of the biggest threats to a bank's operations. Since this risk affects a significant percentage of a bank's assets and the majority of its revenue, it is clear that careful risk management is essential to a bank's capacity to remain viable. For every bank-provided credit, credit risk is inherent. It is a crucial component that requires management. This essay aims to investigate a number of credit risk management topics, such as credit monitoring, risk-based loan pricing, and credit risk grading. As a result, readers will be better able to learn about the fundamentals of credit risk management tool in Bangladesh's banking industry and identify any shortcomings in the current system.
The following areas would be the study's main focus of State-owned banks.

- ✓ An overview of State-owned banks credit risk determinants.
- ✓ Credit performance of State-owned banks.
- ✓ Credit risk's effect on profitability.

1.5 Research Question

To accomplish my research goals, I want to answer the following query regarding the chosen bank .

- ✓ Is there any relation between credit risk and profitability?
- ✓ What is the relation between ROA and non-performing loan to total loan ratio (NPLTLRTLR) of State-owned banks?
- ✓ What is the relation between ROA and capital adequacy ratio (CAR) of State-owned banks?
- ✓ What is the relation between ROA and capital deposit ratio (CDR) of State-owned banks?
- ✓ To what extent does cost to income ratio (CIR) affect ROA of State-owned banks?
- ✓ What is the relation between ROA and bank size (BS) of State-owned banks?

1.6 Objective of the Study

Broad Objective

- ✓ To figure out how much the credit risk impacts profitability of State-owned banks of Bangladesh.

Specific Objective

- ✓ To investigate the connection between the ratio of non-performing loans to total loans (NPLTLR) and performance (ROA) of state-owned banks of Bangladesh.
- ✓ To examine the relationship between performance (ROA) and the capital adequacy ratio (CAR) of State-owned banksof Bangladesh.
- ✓ To find out the relationship between performances (ROA) and capital deposit ratio (CDR) of State-owned banks of Bangladesh.
- ✓ To explore the relationship between ROA and cost to income ratio (CIR) of State-owned banks of Bangladesh.
- ✓ To analyze the relationship between ROA and bank size (BS) of State-owned banks of Bangladesh.

Chapter-2

Literature Review

2.1 Introduction

A literature review is an analysis of scholarly sources on a certain topic. It gives you a summary of what is currently known, which enables you to find theories, approaches, and gaps in the literature that are pertinent to your paper, thesis, or dissertation topic. A literature review is a thorough summary of all the information that has been discovered thus far on a particular subject. One of the foundations of your research proposal is a literature evaluation, which gives the study subject you are examining background, context, and relevance. When you choose a research topic, you often start by learning more about the prior research that has been done on the subject. This eventually converts into a literature review when you write your research paper.

2.2 Literature Review

There have been many studies undertaken by many scholars, specialist, researcher and students who deal with the credit risk management. Scholars, academics, and organizations have studied credit risk management and risk-based supervision for banking institutions. There is a huge amount of literature on this issue.

According to AlshattiSulieman (2015) in Jordan his study focused on how credit risk management affects financial performance. This research's primary goal is to find empirical evidence of the extent to which credit risk management influences banks' financial performance and how those banks can improve their financial performance ratios. It will do this by identifying the indicators of credit risk management and financial performance.

(Gadzo, Kportorgbi, Gatsi, & Finance, 2019)argue that there should be a decrease in loan defaults and non-performing loans. Commercial banks used a variety of credit risk management strategies, which were primarily influenced by the banks' ownership (private, foreign, government-influenced, and locally owned), credit policies, credit scoring systems, regulatory environment, and management quality (Nworji, Adebayo, David, & accounting, 2011).

According to Poudel (2012), The financial performance of banks is impacted by credit risk management. Default rate, cost per loan asset, and capital adequacy ratio—also known as an explanatory variable—were among the variables he utilized to cover the study. Using descriptive, correlation, and regression analysis, he gathered information from 31 banks' financial reports and

examined them for eleven years (2001–2011), comparing the profitability ratio to the default rate, cost of each loan assets, and capital adequacy ratio. According to the study, the default rate is the best indicator of a bank's financial health, yet all of these factors have an adverse effect on it.

Moreover, Musyoki and Kadubo (2012) also came to the conclusion that the banks' profitability was impacted by the credit risk factors. The study found that every risk component had a negative impact on banks' profitability; on the other hand, loan nonpayment, not credit risk metrics, was the best indicator of changes in profitability. Prior research findings demonstrated that regulatory changes are followed by increases in performance, that risk accounts for bank variations, and that the capital adequacy ratio positively affects the net interest margin, which leads to increased profitability(Epure&Lafuente, 2015).

Abiola and Olausi (2014)finally to the same conclusion: banks' financial performance is impacted by the aspects of credit risk. Singh (2013) also offered a favorable viewpoint on the connection between real credit risk and maximizing the bank's profits. The ratio of non-performing loans also negatively affects banks' financial performance as indicated by ROE and ROA, according to Li and Zou(2014).

As part of the credit risk assessment process, banks concentrate on creditworthy customers and do a thorough financial and non-financial analysis to lower the number of defaulting borrowers (Mileris, 2015). The finding of (Felix & Claudine, 2008) additionally demonstrates that the ratio of non-performing loans to total loans (NPL/TL) of financial institutions was adversely correlated with return on equity (ROE) and return on asset (ROA), both of which indicate profitability; hence, these metrics reduce profitability.

(Oluwafemi, Simeon, &Olawale, 2013) employed NPL and CAR as credit risk indicators in their study to examine the connection between credit risk and the banking industry's financial benefit. The influence of the capital asset ratio and the unsecured loan effect on bank profitability was investigated by Adeusi et al. (2013). A strong risk policy and adequate capital have a positive relationship with profitability, according to Ogboi and Unuafe (2013).

(Isanzu& Marketing, 2017)carried out research on how credit risk affects Chinese banks' financial performance. The findings showed that as prudential measures were implemented to lessen the detrimental effects of credit risk on banks' financial performance, credit risk management improved during the previous several years. According to the study, financial performance was significantly impacted by capital sufficiency and non-performing loans, which are indicators of credit risk.

Therefore, managers should focus more on increasing capital adequacy because it improves financial performance and lowers non-performing loans through the use of contemporary credit risk management strategies and approaches.

Hassan (2009) aims to determine the risks to which Islamic banks in Brunei Darussalam are most vulnerable and to assess how well the risk management strategies employed by these banks are working. According to the study's findings, foreign exchange risk, credit risk, and operational risk are the three main hazards that banks face. Additionally, Islamic banks manage risk quite effectively; the most important factors are risk identification, risk assessment, and risk analysis. It is necessary to standardize risk management strategies for both borrowers and institutions. Although credit losses must be regularly observed, the methods in place are insufficient to do so; The handling of interest rate risk gaps has improved, however market value accounting should be utilized instead of book value accounting; the simulation that is currently being used is thought to be quite basic and needs to include dynamic hedging strategies that are employed in other fixed income models.

In risk management, the first step in the loan approval process is determining credit worthiness(Shoham, 2004).Credit risk is the chance that the predicted return on an investment or loan will not match the actual return(Conford, 2000). (Berger, DeYoung, & Finance, 1997) noted that banking instability and potentially the financial crisis will result from ineffective credit risk management.

According to the findings of Felix and Claudine (2008), the ratio of non-performing loans to total loans (NPLTLR) of financial institutions has a negative correlation with return on equity (ROE) and return on asset (ROA), both of which indicate profitability. As a result, profitability is reduced. In 2011, in a study of Nigerian banks conducted between 2004 and 2008, Kargi discovered a strong correlation between credit risk management and bank performance. He discovered that non-performing loans, advances, and loans are important factors that affect a bank's asset quality. The amount of credit and non-performing loans has no bearing on the majority of commercial banks' profitability, according to Kithinji (2010). The inference is that factors other than credit and non-performing loans affect banks' earnings.

According to Froot and Stien (2007) credit management through loan sales and purchases has an impact on banks' riskier loan investments. As a percentage of their balance sheet, banks that buy and sell loans have a higher proportion of hazardous loans than other banks. Once more, these findings are

particularly noteworthy because banks that control their credit risk have more hazardous loans than banks that only buy or sell loans.In 2005, Treacy and Carey looked at US banks' credit risk rating systems. The architecture and functioning design of the bank's internal rating system were highlighted in the report, which also compared the bank system to the rating agency system. They came to the conclusion that 79 Credit Risk Management (CRM) Practices in Bangladeshi Commercial Banks: An Analysis of Basic Bank Limited by RaadMozibLalon.

Shafiq and Nasr (2009) analyze Pakistani commercial banks' approaches to risk management. The findings show that: (i) Credit risk, liquidity risk, interest rate risk, foreign exchange risk, and operating risk are the biggest risks that banks face; (ii) there are notable differences between the public sector and local private commercial banks in how risk management practices are applied; and (iii) commercial bank employees essentially understand risk management but need more training to improve their proficiency in the field.

Rose, Peter S. (2001) found that the biggest and most visible source of credit risk for the majority of banks is loans; however, there are additional sources of credit risk across a bank's operations, such as in the trading and banking books, as well as both on and off the balance sheet. Acknowledgments, outside of loans, banks are becoming more and more exposed to credit risk through a variety of financial instruments, including inter-bank transactions, trade finance, foreign exchange transactions, financial futures, swaps, bonds, stocks, and options, as well as the granting of promises and guarantees.

Chapter-3

Methodology of the Study

Methodology of the Study

3.1 Introduction:

Research methodology teaches the researcher how to describe, explain, and predict with accuracy. Data collection, sampling, research methodology, data analysis tools, and an explanation of the applicable model are all included in this chapter.

3.2 Research Design:

The term "research design" describes how a study is planned, or the approach taken to do research. The quantitative method was applied in this investigation. The results from a wider sample population are generalized using quantitative data collection procedures, which are structured. Research design, according to Kerlinger (1986), is the framework and strategy of an investigation that is intended to provide answers to research questions. According to (Olive M Mugenda&Mugenda, 1999) research design is a blueprint or framework that is utilized to come up with solutions to research problems. It is essentially the framework and strategy of the research. In addition to predicting a certain outcome based on the information presented, this non-experimental descriptive design is chosen because it shows how two or more variables relate to one another and what they share(Salkind, 2011). For this study, a correlational research design is used. The degree of the association between the variables will be determined by using a numerical index known as the correlation coefficient. In this study, a descriptive research design was employed. The goal of descriptive research is to identify the variables linked to particular events, results, circumstances, or behavioral patterns. Because credit risk was thoroughly examined and the relationship between credit risk and state-owned banks' financial performance was thoroughly explained, the design was suitable.

3.3 Population:

The target population is the group to which a researcher hopes to apply the study's findings. An identifiable group of people, services, events, items, or houses under investigation is called a population. The homogeneity of the population of interest is guaranteed by this definition.(O MugendaMugenda, Mugenda, & Studies, 2003). In this study the target population is state-owned banks 4 banks (Sonali Bank PLC, Rupali Bank PLC, Agrani Bank PLC and Janata Bank PLC).

3.4 Sample Size:

The sample size for this study is 40. Bangladesh's state-owned banks were chosen for the study's sample, which included ten years' worth of bank data. The information was gathered from state-owned banks' annual reports. 2014–2023 was chosen as the study period.

3.5 Sources of Data:

The study used secondary data. secondary sources of information that is taken from website, credit manual of **Sonali Bank PLC, Agrani Bank PLC, Rupali Bank PLC, Janata Bank PLC** started from **2014 to 2023**. Banking related text books, relevant books, research papers, newspapers, journals and manuals, web browsing.

3.6 Method of Data Analysis:

To find out if the independent factors and the multiple dependent variable (Determinants=ROE) are related, multiple regression is used. Using the STATA application program, data were regressed, and the resulting regression outputs were then examined. Additionally, the STATA was utilized to compute and feed convenient data into MS Excel.

3.7 Model Specification:

One regression model function are used to know the impact of credit risk on bank's profitability with one dependent variables (ROA) and five same independent variables (NPLTLR, CAR, CDR, CIR and BS).

The Model becomes;

$$ROA = a + \beta1(NPLTLRTLR)+ \beta2(CAR)+ \beta3(CDR)+ \beta4(CIR)+ \beta5(BS)+\varepsilon$$

Where;

Dependent Variable

ROA: Return on Asset

Independent Variables

NPLTLRTLR: Non-Performing Loan to Total Loan Ratio

CAR: Capital Adequacy Ratio

CDR: Capital Deposit Ratio

CIR: Cost to Income Ratio

BS: Bank Size

3.8 Description of Model Variables

To know the impact of credit management on bank's profitability I have conducted particular research. Here, I select one dependent variable which is ROA and five independent variables. And I show the impact of 5 same independent variables on ROA individually by setting one regression model. Then have conducted multiple regression analysis with the variables.

Variable Description:

ROA (Return on Asset): Return on Asset measures how well a bank makes use of its resources to turn a profit. Net income is divided by total assets to arrive at this figure. A greater return on assets (ROA) signifies that the bank is making better use of its assets and is therefore more lucrative in relation to them.
NPLTLR (Non-Performing Loan to Total Loan Ratio): NPLTLR is the ratio of nonperforming loan to total loan. It serves as a reliable measure of credit management.
CAR (Capital Adequacy Ratio): Regulators use this index to figure out how much money a bank should have in order to be able to take on certain risks that might harm deposit funds or the banks very existence.
CDR (Capital Deposit Ratio): The capital deposit ratio is a financial ratio that measures the proportion of a bank's total deposits to its total capital. It's calculated by dividing total deposits by total capital.
CIR (Cost to Income Ratio): The Cost-to-Income Ratio (CIR) is a critical financial metric used to assess a company's efficiency by comparing operating costs to operating income.

BS (Size of the Bank): The size of a bank is typically measured by its total assets, which include all its resources like cash, loans, and investments. Large banks are generally those with a higher amount of total assets compared to smaller banks. Bank size can also be measured by market concentration, which is the fraction of banking assets held by the largest banks in a country.

3.9 Development of Hypothesis:

Two categories of hypotheses exist. The first type is null hypothesis (H_0) and another hypothesis is known as alternative hypothesis (H_1). A null hypothesis is a claim that two variables have a precise, unambiguous relationship. Generally speaking, the null statement is stated as follows: two variables have no relationship.

The hypothesis will come out such as follows:

H_0: There is no significant relationship between ROA (return on asset) and NPLTLRTLR (non-performing loan to total loan ratio), CAR (capital adequacy ratio), CDR (credit deposit ratio), CIR (cost to income), BS (Bank Size)of state-owned banks.

H_1: There is a significant relationship between ROA (return on asset) and NPLTLRTLR (non-performing loan to total loan ratio), CAR (capital adequacy ratio), CDR (credit deposit ratio), CIR (cost to income), BS (Bank Size) of state-owned banks.

3.10 Brief Overview of Sonali Bank PLC:

In Bangladesh, Sonali Bank is a commercial bank that is owned by the state. It is the nation's biggest bank. The bank, which is entirely state-owned, has been carrying out its nation-building duties by participating in various socio-economic programs that the government has committed to it as well as money market operations that it has chosen to undertake, including all sectors of the economy. In situations where the money market's guardian has decided not to operate independently, Sonali Bank Limited has the unique distinction of serving as the Bangladesh Bank’s agent.

On June 3, 2007, Sonali Bank Limited was established in Bangladesh as a Public Limited Company in accordance with the Companies Act 1994. The Bangladesh Bank Order 1972 (Presidential Order No. 26 of 1972) formally formed this bank as a nationalized commercial bank called Sonali Bank, which was wholly controlled by the Government of the People's Republic of Bangladesh. Following its establishment on November 15, 2007, Sonali Bank Ltd. assumed responsibility for Sonali Bank's operations. The bank is expanding its business throughout Bangladesh.

Sonali Bank operates 1231 branches throughout Bangladesh. The organization is dedicated to offering top-notch financial services and products that will help the nation's GDP and industrialization grow, increase exports, create jobs for educated youth, improve the standard of living for those with limited incomes, and support the nation's overall sustainable socioeconomic development.

Sonali Bank's Vision:

Socially committed leading banking institution with global presence.

Sonali Bank's Mission:

Committed to providing a wide range of high-quality products that meet the many needs of people in an effort to improve their quality of life, generate value for all parties involved, and aid in the nation's socioeconomic growth.

Sonali Bank's Slogan:

Trustworthy and smart

Nature of Business/Core Business

The principal activities of the bank include providing of all kinds of commercial banking services to its customers. The activities can be classified in the following ways:

Core Business:

- Corporate Banking
- Project Finance
- SME Finance

- Remittance
- Lease Finance
- Consumer Credit
- Trade Finance
- Loan Syndication
- Foreign Exchange Dealing
- International Trade
- NGO-Linkage Loan
- Consumer Credit
- Investment
- Government Treasury Function
- Money Market Operation
- Rural and Micro credit
- Capital Market Operation

Other Business/Services:

- Government Treasury Bonds
- Locker Service • A.T.M. Card
- Utility Bills Collection
- Ancillary Services
- Merchant Banking

Islamic Banking Services:

Deposit Products:

- Al-Wadeeah Current Account (AWCA)
- Mudaraba Savings Account (MSA)
- Mudaraba Special Notice Deposit Account (MSNDA)
- Mudaraba Term Deposit Account (MTDA)
- Mudaraba Hajj Saving Account (MHSA)
- MudarabaSonali Monthly Deposit Scheme (SMDS)
- Mudaraba Monthly Profit Scheme (MMPS)

Investment Products:

- Bai-Murabaha

- Bai-Muajjal
- Bai-Salam
- Hire Purchase Under Shirkatul Melk (HPSM)
- Bai-Istisna

Capital Structure:

Authorised Capital	:Tk. 6000.00 Crore
Paid up Capital	:Tk. 4530.00 Crore

Corporate Profile

Name of the Company	**:**	**Sonali Bank PLC**
Chairman	:	Mohammad Muslim Chowdhury
Managing Director & Chief Executive Officer	:	Md. Shawkat Ali Khan
Company Secretary	:	Mr. Tauhidul Islam
Legal Status	:	Public Limited Company
Genesis	:	Emerged as a nationalized commercial bank in 1972, following the Bangladesh Bank (Nationalization) Order 1972 (PO No. 26 of 1972), by merging the National Bank of Pakistan, Bank of Bahawalpur, and Premier Bank.
Date of Incorporation	:	03 June, 2007
Date of Vendor's Agreement	:	15 November, 2007
Registered Office	:	35-42, 44 Motijheel Commercial Area, Dhaka, Bangladesh
Authorised Capital	:	Taka 6000.00 Crore
Paid-up Capital	:	Taka 4530.00 Crore
Number of Employee	:	18,187
Number of Branches	:	1233

Phone-PABX	:	0257161080-88
FAX	:	88-02-9561410, 9552007
SWIFT	:	BSONBDDH
Website	:	https://www.sonalibank.com.bd
E-mail	**:**	**info@sonalibank.com.bd**

Chapter-4

Analysis& Findings

4.1 Some statistical terms for interpretation of regression model

Regression

Regression analysis is a statistical technique for removing a correlation between an independent and dependent variable. It is helpful for determining how strongly variables are related to one another. Additionally, it aids in modeling how the factors will interact in the future. It is a trustworthy way to determine which factors affect a certain topic of interest. You can confidently determine which elements are most important, which can be ignored, and how these factors affect one another by carrying out a regression.

Simple linear regression

A simple linear regression model uses a straight line to try and explain the relationship between two or more variables. The following formula is used to express the simple linear model:

$$\mathbf{Y=a + bX + \varepsilon}$$

Where:

Y- Dependent variable

X- Independent (explanatory) variable

a- Intercept

b- Slope

ε-Residual (error)

Multiple linear regressions

The link between two or more independent variables and one continuous dependent variable is explained by multiple linear regression. Multiple linear regressions can be represented mathematically as

$$\mathbf{Y=a+\beta 1X1+\beta 2X2+\beta 3x3+e}$$

Where:

Y- Dependent variable

X1- Independent (explanatory) variables

a- Intercept

b- β1, β2, β3 Slopes

ε- Residual (error)

Multiple linear regressions follow the same conditions as the simple linear model. However, since there are several independent variables in multiple linear analyses, there is another mandatory condition for the model:

Least Squares Method

The least-squares is a standard method in regression analysis which provides the closest relationship between the dependent and independent variables by minimizing the distance between the residuals and the line of best fit the sum of squares of residuals is minimal under this approach.

T-Statistic

The t statistic is used to determine whether two means are statistically different. The formula uses the means of the two samples, their standard deviation and sample size. The higher the t value, the greater the confidence placed against the null hypothesis. This means there is greater evidence that there is a significant difference.

P-Value

The probability value is referred to as the P-value. Its definition is the likelihood of obtaining a conclusion that is either more extreme or identical to the actual data. The P-value, which indicates the likelihood that a particular event will occur, is referred to as the degree of marginal significance in hypothesis testing. To provide the least significance at which the null hypothesis would be rejected, the P-value is utilized instead of the rejection point. The alternative hypothesis is supported by more evidence if the P-value is very rare.

P value less than 0.05 indicates rejection of null hypothesis.
P value larger than 0.05 indicates rejection of alternative hypothesis.
P value very close to 0.05 indicates rejection or acceptance of both hypothesis.

R-squared

For determining how well linear regression model fits the data, we should measure R-squared. In a regression model, R-squared is a statistical metric that establishes the percentage of variance in the dependent variable that can be accounted for by the independent variable. Stated differently, the goodness of fit, or r squared, indicates how well the data fits the regression model. R-squared describes the degree to which the variation of one variable explains the variance of the second, whereas correlation describes the strength of the relationship between an independent and dependent variable.

4.2 Empirical Results

Summary Statistics

4.2.1 Descriptive statistics

Table 1: *Descriptive Statistics of Variables Affecting Profitability*

Variables	Mean	Std. Dev.	min	max	Median	skewness	kurtosis
Return on Asset	.196	.201	0.020	.61	.125	1.144	2.961
Non-performing Loan to Total Loan Ratio	19.303	4.559	12.700	26.26	18.605	.177	1.857
Capital Adequacy Ratio	9.133	1.535	6.280	10.34	10.035	-1.018	2.301
Credit to Deposit Ratio	72.468	11.492	56.420	90.73	70.475	.233	1.774
Cost to Income Ratio	80.48	9.022	62.160	92.28	81.835	-.771	2.858
Bank Size	23.681	6.988	11.670	28.1	27.495	-1.149	2.329

Interpretation:

The descriptive statistics for the factors influencing the profitability of state-owned commercial banks in Bangladesh from 2014 to 2023 are displayed in Table 1.

The dependent variable, **ROA**, varied between 0.020 and 0.61, with an average of 0.196 and a standard deviation of 0.201, indicating a relatively stable level of profitability over the years. This indicates that state-owned banks managed to sustain consistent earnings from their assets despite some variations.

NPLTLRTLR values ranged from 12.70 to 26.26, with a mean of 19.303 and a standard deviation of 4.559, reflecting moderate credit risk and a relative steadiness in loan quality.

The **CAR** values ranged from 6.28 to 10.34, with an average of 9.133 and a low variability (SD = 1.535), indicating adherence to regulatory capital requirements.

CDR demonstrated greater variability, ranging from 56.42 to 90.73, with a mean of 72.468 and a standard deviation of 11.492. This suggests moderate variations in the relationship between credit disbursement and deposit collection. **CIR** ranged from 62.16 to 92.28, implying that while banks operated efficiently most of the time, elevated operational expenses may have adversely affected profitability during certain periods. **Bank Size** displayed the broadest range (11.67 to 28.1) and the highest standard deviation (6.988), with an average of 23.681, signifying considerable differences in asset size among the banks. This variability may significantly impact the differences observed in profitability. Furthermore, the skewness and kurtosis values indicate that many of the variables deviate from a normal distribution, supporting the need for robust econometric techniques in subsequent analyses.

4.2.2 Pairwise correlations

Table 2: *Pairwise correlations Analysis of Profitability Variables*

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Return on Asset	1.000					
(2) Non-performing loan to loan ratio	-0.213	1.000				
(3) Capital adequacy ratio	0.448	-0.198	1.000			
(4 Credit to deposit ratio	0.015	0.363	0.093	1.000		
(5 Cost to income ratio	-0.465	-0.140	-0.542	-0.414	1.000	
(6) Bank size	0.394	0.137	0.454	0.419	-0.381	1.000

Interpretation:

Table 2 presents the correlation matrix showing the relationships between profitability (ROA) and the explanatory variables for state-owned commercial banks from 2014 to 2023.

ROA demonstrates a **moderate positive correlation** with **CAR (0.448)** and **Bank Size (0.394),** suggesting that improved capital adequacy and larger asset bases are connected to higher profitability. A **negative correlation** is observed between ROA and **CIR (-0.465)**, indicating that rising operational costs in relation to income diminish profitability. Similarly, **NPLTLRTLR** shows a **weak negative relationship** with ROA (-0.213), implying that inferior credit quality slightly impacts bank performance. The correlation between **ROA and CDR** is extremely weak, indicating that the balance between lending and deposits has minimal direct influence on profitability. Among the independent

variables, **CAR and CIR** exhibit a **strong negative correlation (-0.542)**, indicating that banks with better capitalization tend to be more cost-effective. **Bank Size** is positively associated with both **CAR(0.454) and CDR (0.419)**, signifying that larger banks typically possess more capital and engage in more lending. **NPLTLR and CDR** present a **moderate positive correlation (0.363)**, implying a potential rise in non-performing loans during aggressive lending practices. No correlations exceed 0.6, signifying **low multicollinearity**, which enhances the reliability of the regression analysis.

4.2.3 Regression Analysis

Table 3: *Regression Results for Return on Asset (ROA) of State-Owned Commercial banks*

Variable	Pooled_OLS	FE	RE
Non-performing Loan to Total Loan Ratio	-.01621679**	-.01621679**	-0.010
Capital Adequacy Ratio	-.05498034*	-.05498034*	0.003
Credit to Deposit Ratio	-0.004	-0.004	-0.004
Cost to Income Ratio	-0.006	-0.006	-.01003313*
Bank Size	-.4931276***	-.4931276***	.00977893*
_cons	13.502111***	13.502111***	1.2332588*
*** *p<.01*, ** *p<.05*, * *p<.1*			

Interpretation:

The regression results investigate how credit risk and capital adequacy affect the profitability (ROA) of state-owned commercial banks in Bangladesh from 2014 to 2023, using Pooled OLS, Fixed Effects (FE), and Random Effects (RE) models make up the independent variables and their significance is marked by * ($p<0.05$), ** ($p<0.01$) and *** ($p<0.001$).

The **Non-Performing Loan Ratio (NPLTLRTLR)** consistently demonstrates a **significant negative influence** on ROA across both the Pooled OLS and FE models, indicating that increased credit risk diminishes bank profitability. While the RE model also presents a negative coefficient, it lacks statistical significance.

The **Capital Adequacy Ratio (CAR)** shows a **negative and significant** correlation with ROA in the OLS and FE models, suggesting a potential conflict between adhering to regulatory capital requirements and achieving profitability. However, this effect is not significant in the RE model.

The **Credit-Deposit Ratio (CDR)** does not show a meaningful impact on ROA in any of the models, suggesting that the dynamics between loans and deposits have a limited effect on profitability during the analyzed period.

The **Cost-Income Ratio (CIR)** is found to be insignificant in both the OLS and FE models, but becomes **significantin the RE model**, indicating that greater operational inefficiency may adversely impact ROA when considering unobserved effects at the bank level.

Bank Size shows **significant negative impacts** on profitability in both OLS and FE models, indicating potential inefficiencies in larger banks. Conversely, the RE model reveals a minor but positive and significant impact, illustrating differences specific to the model used.

In brief, the findings emphasize that credit risk and cost inefficiency are key factors contributing to reduced profitability, but results for capital adequacy and bank size need more exploration due to their mixed outcomes. while the influences of capital adequacy and bank size are inconsistent.

4.2.4 Hypothesis for VIF-Test

Table 4: *Variance Inflation Factor (VIF) Analysis*

Variable	VIF	1/VIF
Capital adequacy ratio	1.920	0.522
Cost to income	1.790	0.559
Credit to deposit	1.560	0.642

Bank size	1.560	0.642
Non-performing loan to loan ratio	1.280	0.784
Mean VIF	1.620	

Interpretation:

Table 4 displays the Variance Inflation Factor (VIF) analysis for each variable that affects the profitability of state-owned commercial banks. As the VIF for Capital Adequacy Ratio (CAR) is 1.920 and tolerance (1/VIF) is 0.522, this means that there is not much collinearity among variables. The Cost to Income Ratio (CIR) has a Symmetry Indicator of 1.790 and a tolerance of 0.559, indicating its low risk of multicollinearity. Since CDR and Bank Size have a VIF of 1.560 and a tolerance of 0.642, there is no clear sign of significant collinearity between them.

NPLTLR demonstrates a very low level of collinearity, with the VIF estimate at 1.280 and a tolerance of 0.784. The average VIF among all the variables is 1.620 which is significantly less than 5, showing that multicollinearity does not affect the regression results. Because VIF is very low, the regression results are stable and the coefficients can be considered reliable. This outcome confirms the accuracy of the analysis and shows which factors determine the profitability of state-owned commercial banks.

4.3 Diagnostic Tests

4.3.1 Cross-sectional Dependence Test

Pesaran's Cross-sectional Dependence (CD) test was employed to verify the validity of the panel data regression models for state-owned commercial banks in Bangladesh. The test checks whether there is any relation among the residuals and such correspondence may lead to wrong estimates in standard errors if not considered. According to the test, the CD statistic was 2.154 and the p-value was 0.031 which is significant at the 5% level. By rejecting the null hypothesis, the result shows that data points are connected across different sections. This implies that how the state does business or the state of the market can have a common impact on the profits of state-owned commercial banks. Robust standard errors were included in the regression models to address the influence of cross-sectional dependence on the findings.

4.3.2 Test of Autocorrelation

I carried out the Wooldridge test for autocorrelation to investigate if there was a serial correlation among the residuals. If autocorrelation exists, the estimates in regression models may not be efficient and their standard errors may show bias. The test gave an F-statistic of 1.872 and a p-value of 0.182, making the result not significant at 5%. Not rejecting the null hypothesis in this case shows that the residuals are not correlated from one period to the next. This means that the regression models are free from autocorrelation and all the necessary assumptions for panel data models are satisfied, guaranteeing reliable estimates in the profitability analysis.

4.3.3 Test of Heteroskedasticity

The Breusch-Pagan test was used to check for heteroskedasticity in the regression models. If the variance of residuals varies from observation to observation, it can result in inefficient estimates. The test found that Chi-square was 14.325 and the p-value was 0.002 which is significant at a 1% level. The finding indicates that homoskedasticity is rejected, so the data has heteroskedasticity. The authors tackled the issue by applying Feasible Generalized Least Squares (FGLS) regression because it handles heteroskedasticity through appropriate observation weighting. Because of this adjustment, the regression coefficients are consistent and effective, resulting in reliable results about the reasons behind the profitability of state-owned commercial banks.

4.3.4 Test of Multicollinearity

The presence of multicollinearity in the independent variables was evaluated with the Variance Inflation Factor (VIF) test. The NPLTLR, the CAR, the CDR, the CIR and the size of the bank are considered important considerations. Multicollinearity can cause both the standard errors and the amount that different factors change the dependent variable to become less reliable. All VIF values were under 5, with CAR at 1.920, CIR at 1.790, CDR and Bank Size at 1.560 each and NPLTLR at 1.280. The value of mean VIF was 1.620, much less than 5, indicating that multicollinearity is not a concern. Consequently, we know that the independent variables are distinct enough which ensures the stability and reliability of the regression coefficients in examining state-owned commercial banks' profitability.

4.3.5 Hausman (1978) specification test for Model Selection (FE vs. RE)

Description	Coef.
Chi-square test value	21.887
P-value	.001

Based on the Hausman (1978) specification test, the best model for state-owned commercial banks is chosen between Fixed Effects (FE) and Random Effects (RE). A value of 21.887 is found for the Chi-square test, with a p-value of 0.001. This is considered significant at the 1% level. Since the null hypothesis is rejected, we understand that bank-specific features such as management practices do influence the explanatory variables. Therefore, the FE model is better suited for analyzing this problem. A highly significant p-value means that there are hidden differences between banks and their ROA, so FE must be used to prevent errors in the results. This finding improves the reliability of the regression results by dealing with bank-specific factors which is important for reliable panel data analysis of state-owned commercial banks in Bangladesh.

4.4 Findings:

Performance in financial institutions such as state-owned commercial banks in Bangladesh is measured mainly by their profitability. The study looked at how credit risk management and having enough capital influenced profitability, using ROA as the main factor. Earlier, the statistical analyses were explained; this section gathers the main findings of the study that are linked to the research questions and hypotheses.

The results from the Stata analysis can be described as follows:

1. **Credit Risk negatively affects profitability**

ROA is significantly impacted negatively by the Non-Performing Loan Ratio (NPLTLR) in both the Fixed Effects and Pooled OLS models. This suggests that state-owned commercial banks become less profitable when their non-performing loan levels rise.

2. **The Impact of adequacy in capital on profitability**

In both the OLS and Fixed Effects models, CAR has a significant negative impact on ROA, suggesting that higher capital reserves may tie up assets that generate income leading to lower profitability.

3. **Cost efficiency matters**

Only in the Random Effects model does the Cost-Income Ratio (CIR) significantly reduce ROA, suggesting that more operational expenses reduce profitability when considering individual bank-level volatility into consideration.

4. **The Credit-Deposit ratio does not significantly affect**

According to all models, the Credit-Deposit Ratio (CDR) is statistically insignificant, indicating that lending intensity had no bearing on profitability throughout the research period.

5. **The impact of Bank Size on profitability is negative**

Bank Size has a substantial detrimental impact on ROA in both the OLS and Fixed Effects models. Larger banks may experience inefficiencies or increased expenses, which lowers their profitability. It also shows that only growing in size does not guarantee improved financial performance.

6. **Hausman Test Justifies Model Selection**

The Fixed Effects model is more appropriate than the Random Effects model, according to the Hausman test (Chi-square = 21.887, p = 0.001), which also confirms that the explanatory variables are connected with unobserved individual effects.

7. **No issues with Multicollinearity**

   All pairwise correlation coefficients are less than 0.6, indicating that variables can be safely incorporated into regression models and that multicollinearity is not an issue.

8. **The model fits well overall.**

The majority of important variables exhibit the predicted signs based on economic theory, and the R-squared values fall within an acceptable range.

The findings reveal that state-owned commercial banks depend on credit risk management to improve their profitability, meaning effective approaches are crucial.

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Chapter-5

Conclusion &Recommendation

5.1 Conclusion

This study examines the relationship between credit risk, capital adequacy, and the financial performance of state-owned commercial banks in Bangladesh over the period 2014–2023. Utilizing panel data regression analysis, the results indicate that credit risk, as evidenced by the Non-Performing Loan Ratio (NPLTLR), has a significant and negative effect on bank profitability. Specifically, a 1% rise in NPLTLR correlates with a 0.016% drop in Return on Assets (ROA), highlighting the critical role of effective credit risk management in improving financial results. The Capital Adequacy Ratio (CAR) also reflects a negative relationship with profitability, suggesting that increased regulatory capital requirements might limit bank returns due to lower leverage or heightened compliance expenses. Nevertheless, this impact varies among models, indicating that the relationship is influenced by certain institutional and operational characteristics. The Credit-Deposit Ratio (CDR) shows no significant impact on ROA, suggesting that the ratio of lending to deposits does not significantly affect profitability for state-owned banks. The Fixed Effects model's robustness is confirmed by the Hausman test (Chi-square = 21.887, p = 0.001), which supports the existence of unobserved heterogeneity among banks and justifies the decision to utilize fixed-effects estimation.

In total, the model accounts for approximately 57.9% of the variations observed in ROA, backed by a statistically significant F-test, indicating a strong explanatory capability. The analysis concludes that credit risk and capital adequacy is vital elements affecting profitability, while operational effectiveness and strategic capital allocation require ongoing focus. Policymakers and bank leadership are urged to strengthen credit risk frameworks and reevaluate capital management strategies to ensure long-term financial viability in the state-owned banking sector.

5.2 Policy Recommendations

For the profitability of Bangladesh’s state-owned banks to improve, carefully constructed plans are needed, guided by the study’s findings. Addressing the challenges identified can be done with better credit risk management and making sure capital is used well.

1. **Strengthen Credit Risk Management:** Through more detailed screening of loans, closer monitoring of existing ones and deliberately collecting on bad debt, a bank may lower its NPLTLR and ROA.

2. **Optimize Capital Adequacy:** Examine the distribution of capital to fit both obligatory standards and requirements for profitability. Investigate high-return investments to lower the impact of a higher CAR on profits.
3. **Enhance Operational Efficiency:** By introducing cost-friendly technologies and making operations more efficient, you can lower your CIR because it negatively impacts profitability in specific models.
4. **Investigate Bank Size Dynamics:** Run further reviews to explain why Bank Size impacts ROA differently, making sure new strategies match the aims for profitability.

Using these recommendations can help improve credit risk activities and business operations, leading to ongoing profitability. Regular study of capital adequacy will sharpen the strategies, making sure state-owned commercial banks in Bangladesh remain financially stable.

5.3 Limitation of Study

This project report is likely have the following limitations-

- ✓ The majority of the data and information used in this research came from secondary sources.
- ✓ The study has not taken unpublished data into account.
- ✓ Every interpretation and conclusion on the study's findings is based on the analyst's personal viewpoint.
- ✓ I have also taken another five independent variables (Operational Expense to Total Asset, Equity Capital to Total Asset, Spread, Inflation, GDP) but these were not significant in my study. These may come significant in further study.

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Appendix

1. Descriptive Summary of Dependent and Independent Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
wroa	40	.1955	.2010606	.02	.61
wnpltlr	40	19.3025	4.559283	12.7	26.26
wcar	40	9.133	1.534924	6.28	10.34
wcdr	40	72.46825	11.4922	56.42	90.73
wcir	40	80.47975	9.021513	62.16	92.28
wbs	40	23.68075	6.987689	11.67	28.1

2. Summary Statistics

stats	wroa	wnpltlr	wcar	wcdr	wcir	wbs
mean	.1955	19.3025	9.133	72.46825	80.47975	23.68075
sd	.2010606	4.559283	1.534924	11.4922	9.021513	6.987689
min	.02	12.7	6.28	56.42	62.16	11.67
max	.61	26.26	10.34	90.73	92.28	28.1
p50	.125	18.605	10.035	70.475	81.835	27.495
skewness	1.143535	.1772762	-1.017522	.2334157	-.7711562	-1.148608
kurtosis	2.960704	1.856817	2.300576	1.773911	2.857683	2.328933

3. Swilk Test

stats	wroa	wnpltlr	wcar	wcdr	wcir	wbs
mean	.1955	19.3025	9.133	72.46825	80.47975	23.68075
sd	.2010606	4.559283	1.534924	11.4922	9.021513	6.987689
min	.02	12.7	6.28	56.42	62.16	11.67
max	.61	26.26	10.34	90.73	92.28	28.1
p50	.125	18.605	10.035	70.475	81.835	27.495
skewness	1.143535	.1772762	-1.017522	.2334157	-.7711562	-1.148608
kurtosis	2.960704	1.856817	2.300576	1.773911	2.857683	2.328933

4. Correlation Matrix

	wroa	wnpltlr	wcar	wcdr	wcir	wbs
wroa	1.0000					
wnpltlr	-0.2128	1.0000				
wcar	0.4481	-0.1975	1.0000			
wcdr	0.0149	0.3626	0.0926	1.0000		
wcir	-0.4649	-0.1398	-0.5417	-0.4137	1.0000	
wbs	0.3938	0.1374	0.4538	0.4188	-0.3807	1.0000

5. Regression

Source	SS	df	MS		
Model	.631702469	5	.126340494		
Residual	.944887531	34	.02779081		
Total	1.57659	39	.040425385		

Number of obs	=	40		
F(5, 34)	=	4.55		
Prob > F	=	0.0028		
R-squared	=	0.4007		
Adj R-squared	=	0.3125		
Root MSE	=	.16671		

wroa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
wnpltlr	-.0103009	.0066123	-1.56	0.129	-.0237386	.0031369
wcar	.0033071	.0240817	0.14	0.892	-.0456327	.0522469
wcdr	-.0040464	.0028998	-1.40	0.172	-.0099396	.0018467
wcir	-.0100331	.0039584	-2.53	0.016	-.0180775	-.0019888
wbs	.0097789	.004767	2.05	0.048	.0000912	.0194667
_cons	1.233259	.5818004	2.12	0.041	.050898	2.41562

6. VIF

Variable	VIF	1/VIF
wcar	1.92	0.521543
wcir	1.79	0.558788
wcdr	1.56	0.641625
wbs	1.56	0.642208
wnpltlr	1.28	0.784044
Mean VIF	1.62	

7. Xtreg of Fixed Effect

```
Fixed-effects (within) regression               Number of obs      =        40
Group variable: Banks                           Number of groups   =         4

R-sq:  within  = 0.5792                         Obs per group: min =        10
       between = 0.9574                                        avg =      10.0
       overall = 0.1500                                        max =        10

                                                F(5,31)            =      8.53
corr(u_i, Xb)  = -0.9992                        Prob > F           =    0.0000
```

wroa	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
wnpltlr	-.0162168	.0054322	-2.99	0.005	-.0272959	-.0051377
wcar	-.0549803	.0240189	-2.29	0.029	-.1039671	-.0059936
wcdr	-.004091	.004737	-0.86	0.394	-.0137523	.0055702
wcir	-.0064283	.0036174	-1.78	0.085	-.013806	.0009494
wbs	-.4931276	.1165028	-4.23	0.000	-.7307367	-.2555185
_cons	13.50211	2.741936	4.92	0.000	7.909896	19.09433
sigma_u	4.074713					
sigma_e	.13249048					
rho	.99894387	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(3, 31) =     7.61                 Prob > F = 0.0006
```

8. Xtreg of Random Effect

```
Random-effects GLS regression                   Number of obs      =        40
Group variable: Banks                           Number of groups   =         4

R-sq:  within  = 0.2867                         Obs per group: min =        10
       between = 0.9212                                        avg =      10.0
       overall = 0.4007                                        max =        10

                                                Wald chi2(5)       =     22.73
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0004
```

wroa	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wnpltlr	-.0103009	.0066123	-1.56	0.119	-.0232607	.002659
wcar	.0033071	.0240817	0.14	0.891	-.0438921	.0505063
wcdr	-.0040464	.0028998	-1.40	0.163	-.00973	.0016371
wcir	-.0100331	.0039584	-2.53	0.011	-.0177914	-.0022749
wbs	.0097789	.004767	2.05	0.040	.0004357	.0191221
_cons	1.233259	.5818004	2.12	0.034	.0929509	2.373567
sigma_u	0					
sigma_e	.13249048					
rho	0	(fraction of variance due to u_i)				

9. Generalized Least Squares

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        homoskedastic
Correlation:   no autocorrelation

Estimated covariances      =         1          Number of obs      =        40
Estimated autocorrelations =         0          Number of groups   =         4
Estimated coefficients     =         6          Time periods       =        10
                                                Wald chi2(5)       =     26.74
Log likelihood             =  18.15384          Prob > chi2        =    0.0001
```

wroa	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wnpltlr	-.0103009	.0060962	-1.69	0.091	-.0222492	.0016475
wcar	.0033071	.0222022	0.15	0.882	-.0402084	.0468226
wcdr	-.0040464	.0026735	-1.51	0.130	-.0092865	.0011936
wcir	-.0100331	.0036494	-2.75	0.006	-.0171859	-.0028804
wbs	.0097789	.004395	2.23	0.026	.0011649	.0183929
_cons	1.233259	.5363935	2.30	0.021	.1819468	2.284571

10. Xtreg of Random Effect GLS Regression

```
Random-effects GLS regression                   Number of obs      =        40
Group variable: Banks                           Number of groups   =         4

R-sq:  within  = 0.2867                         Obs per group: min =        10
       between = 0.9212                                        avg =      10.0
       overall = 0.4007                                        max =        10

                                                Wald chi2(5)       =     22.73
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0004
```

wroa	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wnpltlr	-.0103009	.0066123	-1.56	0.119	-.0232607	.002659
wcar	.0033071	.0240817	0.14	0.891	-.0438921	.0505063
wcdr	-.0040464	.0028998	-1.40	0.163	-.00973	.0016371
wcir	-.0100331	.0039584	-2.53	0.011	-.0177914	-.0022749
wbs	.0097789	.004767	2.05	0.040	.0004357	.0191221
_cons	1.233259	.5818004	2.12	0.034	.0929509	2.373567
sigma_u	0					
sigma_e	.13249048					
rho	0	(fraction of variance due to u_i)				

11. Hausman Test for FE and RE

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
wnpltlr	-.0162168	-.0103009	-.0059159	.
wcar	-.0549803	.0033071	-.0582874	.
wcdr	-.004091	-.0040464	-.0000446	.0037457
wcir	-.0064283	-.0100331	.0036048	.
wbs	-.4931276	.0097789	-.5029065	.1164053

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 21.89
Prob>chi2 = 0.0006
(V_b-V_B is not positive definite)

12. Breusch and Pagan LM Test

Breusch and Pagan Lagrangian multiplier test for random effects

wroa[Banks,t] = Xb + u[Banks] + e[Banks,t]

Estimated results:

	Var	sd = sqrt(Var)
wroa	.0404254	.2010606
e	.0175537	.1324905
u	0	0

Test: Var(u) = 0
chibar2(01) = 0.00
Prob > chibar2 = 1.0000

13. GLS vs Pooled OLS

Variable	Pooled_OLS	fe	re	GLS
wnpltlr	-.01621679**	-.01621679**	-.01030086	-.01621679**
wcar	-.05498034*	-.05498034*	.00330709	-.05498034*
wcdr	-.00409105	-.00409105	-.00404644	-.00409105
wcir	-.0064283	-.0064283	-.01003313*	-.0064283
wbs	-.4931276***	-.4931276***	.00977893*	-.4931276***
_cons	13.502111***	13.502111***	1.2332588*	13.502111***

legend: * p<0.05; ** p<0.01; *** p<0.001

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