

**An Internship Report on
Impact of Camel on Bank Performance: A Study on Selected Private
Commercial Banks in Bangladesh**



*(This report is submitted for the partial fulfilment of the program of Bachelor of
Business Administration (BBA) with Major in Finance and Banking)*

SUBMITTED TO

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Session: 2020-21

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DATE OF SUBMISSION

20 April 2026



**Department of Finance and Banking
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Letter of Transmittal

20 April, 2026

Akila Rubaiyath

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Subject: Submission of internship report titled “**Impact of CAMEL on Bank Performance: A Study on Selected Private Commercial Banks in Bangladesh**”.

Respected ma'am,

With due respect and great pleasure, I am Mukta Akter Hira, a student of the BBA program, submitting the internship report titled Impact of CAMEL on Bank Performance: A Study on Selected Private Commercial Banks in Bangladesh. The report is a prerequisite for completing Bachelor of Business Administration at Comilla University. I convey my deepest appreciations to you for your continuous guidance and wholehearted supervision and supports in preparing this. I express my sincerest gratitude for having been given opportunity to prepare this and like to share that I enjoyed doing so.

I, therefore, would be grateful if you can enlighten me with your perspective on the assignment and assess the assignment keeping the limitations in mind.

Your sincerely,

Mukta Akter Hira

ID: 12117050

Session: 2020-21

Department of Finance and Banking

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Student Declaration

Myself, **Mukta Akter Hira**, student of Bachelor of Business Administration, Department of Finance and Banking, Comilla University, do hereby declare that the Internship Report on **Impact of CAMEL on Bank Performance: A Study on Selected Private Commercial Banks in Bangladesh** uniquely prepared by me after the completion of three months working at Agrani Bank PLC.

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

I also confirm that the report is only prepared for my academic requirement and didn't submit this report any other place before. I also assure you that; this report was not submitted for any other degree.

Signature:

.....

Mukta Akter Hira

ID: 12117050

Session: 2020-21

Bachelor of Business Administration

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Supervisor's Declaration

This is to certify that **Mukta Akter Hira, ID:12117050**, a student of the Bachelor of Business Administration (BBA) Program at Comilla University, has completed the internship report under my supervision. She has worked at Agrani Bank PLC as an intern and **Impact of CAMEL on Bank Performance: A Study on Selected Private Commercial Banks in Bangladesh** completed the report entitled as a partial requirement for obtaining a Bachelor of Business Administration (BBA) Degree. She has completed the report by herself. She has been permitted to submit the report.

I wish her Success.

Signature:

.....

Akila Rubaiyath

Lecturer

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Acknowledgement

Firstly, I would like to express my deep gratitude to Almighty for giving me the strength and the composure to finish the task.

I would like to express my sincere gratitude & appreciation to my supervisor **Akila Rubaiyath**, Lecturer, Department of Finance and Banking, Comilla University, who has been glad to give me right approach, guidance and support which helped me a lot in writing this report. I am grateful to her for her constant help and supervision, proposals. Without her help and guideline, it is difficult for me to complete the report.

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It was not the easiest task to complete the report on **Impact of CAMEL on Bank Performance: A Study on Selected Private Commercial Banks in Bangladesh**, where all the information needs to be gathered properly, analyzed and represent in a descriptive manner. There are so many individuals who had helped, encouraged to complete the report successfully.

Finally, I pay my obligation to those faculty members and teachers of Finance and Banking Department who helped me by providing lot of information and guidelines. Without their help it would not be possible for me to complete the project report as well as my BBA program also.

Internship Certificate

যৌতুক দেয়া-নেয়া শাস্তিযোগ্য অপরাধ

প্রিজন্নে বই উপহার দিন



অগ্রণী ব্যাংক পিএলসি

টমছমব্রীজ শাখা, কুমিল্লা।

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TO WHOM IT MAY CONCERN

This is to certify that Mukta Akter Hira, a student of Comilla University, Department of Finance and Banking, Program: BBA, Roll/ID No: 12117046 has been started her internship program From 01/02/2026 on Agrani Bank PLC, Tomsombridge Branch, Cumilla. She is sincere, dedicated and dutiful to her work.

I wish her every success in life.

With Regards


(Md. Nazrul Islam Choudhury)
SPO & Manager
Md. Nazrul Islam Choudhury
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Executive Summary

Bangladesh's private banking sector has faced continuous profitability pressures, as well as increased credit risk, emphasizing the importance of comprehensive performance review. This study evaluates how CAMEL-based indicators influence the profitability of selected private commercial banks in Bangladesh. A balanced panel dataset was constructed from audited annual reports covering ten banks over 2015–2024, yielding 100 bank-year observations. Bank performance is proxied by return on assets (ROA), while the explanatory variables capture capital adequacy (CAR), asset quality (non-performing loan ratio), management efficiency (cost-to-income ratio), earnings quality (net interest margin), and liquidity (loan-to-deposit ratio). Panel-data regression was employed, using pooled OLS as a baseline and a random-effects specification for the primary estimates; feasible generalized least squares with an AR(1) correction was applied to address serial correlation. The results show that higher non-performing loans and weaker cost efficiency are associated with significantly lower ROA, whereas a stronger net interest margin has a significant positive effect on ROA. In contrast, variations in CAR and the loan-to-deposit ratio are not statistically significant after controlling for other CAMEL dimensions. Overall, the evidence suggests that profitability improvements in Bangladesh's private banks depend chiefly on tighter credit risk management, sustained cost discipline, and strategies that protect core interest spreads, alongside ongoing prudential attention to capital and liquidity.

Acronyms

Abbreviation	Amplification
CAMEL	Capital Adequacy, Asset Quality, Management Efficiency, Earnings, Liquidity
ROA	Return on Assets
CAR	Capital Adequacy Ratio
NPL	Non-Performing Loan
NIM	Net Interest Margin
LDR	Loan-to-Deposit Ratio
CIR	Cost-to-Income Ratio
OLS	Ordinary Least Squares
FGLS	Feasible Generalized Least Squares
AR(1)	First-Order Autoregressive Process
VIF	Variance Inflation Factor
DSE	Dhaka Stock Exchange
PLC	Public Limited Company

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Chapter One

INTRODUCTION

1.0 Introduction

Bangladesh's banking sector plays a critical role in the economy, requiring rigorous performance evaluation to ensure financial stability. In this context, the CAMEL framework (Capital adequacy, Asset quality, Management efficiency, Earnings, Liquidity) is widely used to rate bank health. Recent studies of Bangladeshi banks have applied CAMEL analyses, finding varied results (e.g. Eastern Bank often ranks highest). However, high non-performing loans (now ~35–36% of loans) pose a major challenge, and it remains unclear how each CAMEL component (CAR, NPL ratio, CIR, NIM, LDR) drives profitability (ROA) in private banks. This study addresses that gap. It examines selected private commercial banks (2015–2024) to quantify the impact of CAMEL indicators on ROA. The following sections provide background context, define the research problem, state the objectives and questions, and discuss the study's significance.

1.1 Background of the Study

The banking sector is one of Bangladesh's fastest-growing and most important industries. It provides vital financing to businesses and households, and its stability is essential for economic growth. To maintain stability, regulators emphasize monitoring and continuous performance evaluation. The CAMEL framework is an internationally recognized model for assessing bank soundness. CAMEL examines five categories: capital adequacy, asset quality, management efficiency, earnings, and liquidity. Originally developed in the U.S. in 1979, the CAMEL rating system was introduced by Bangladesh Bank in 1993 as part of off-site supervision.

Empirical studies have applied CAMEL to Bangladeshi banks. For example, Majumder and Rahman (2017) analyzed 15 banks (2009–2013) and found that Eastern Bank Ltd. had the highest overall CAMEL score, while differences across banks were statistically significant. Islam and Shohidul (2018) similarly found that Eastern Bank led among 17 private banks (2010–2016). Another study covering 10 private banks (2013–2014)

concluded that most banks had only “satisfactory” performance, with asset quality a key weakness. More recently, Haq and Nasrin (2020) evaluated 21 private banks (2008–2018) and reported that none of the banks were rated “strong” – only one achieved a “satisfactory” rating. These findings indicate that while CAMEL is widely used, Bangladeshi banks face challenges (notably asset quality) and that empirical results can differ by study and sample.

In addition, current economic trends underscore the issue of non-performing loans (NPLs). Industry reports show that Bangladeshi banks’ NPL ratio has soared in recent years. For instance, by late 2025 roughly 36% of loans were non-performing. This level of bad debt threatens credit supply, investment, and financial stability. Such sector-wide problems reinforce the need to understand how CAMEL factors – especially asset quality – affect profitability. The period 2015–2024 is particularly relevant as it captures recent regulatory changes and the escalation of NPLs.

1.2 Statement of the Problem

Despite widespread use of CAMEL for supervision, the exact impact of its components on bank profitability is not well established in Bangladesh. High NPLs and other issues threaten financial health, yet regulators and bank managers lack clear empirical guidance on what drives profitability. Existing studies report mixed findings – some show capital adequacy or liquidity strongly linked to performance, others find weak effects of management or earnings ratios. In Bangladesh specifically, research has been limited: few analyses cover recent data or focus on private banks’ profitability. As of 2025, the banking sector faces a severe NPL crisis (nearly 36% of loans unpaid). If the relationships between CAR, NPL ratio, efficiency, earnings and ROA remain unclear, banks may not target the right areas for reform. Failure to address this could lead to continued credit crunch, weak investment, and instability. Thus, the problem this study addresses is: How do CAMEL indicators (CAR, NPL ratio, CIR, NIM, LDR) affect the return on assets of Bangladeshi private commercial banks in 2015–2024? Answering this is critical for filling the research gap and informing policy.

1.3 Research Objectives

The main objective of this study is to assess the effect of the CAMEL framework on the financial performance (ROA) of selected Bangladeshi private commercial banks during 2015–2024. Specifically, the study aims to:

1.3.1 General Objective

To assess the impact of the CAMEL framework on the financial performance of private commercial banks in Bangladesh.

1.3.2 Specific Objectives

- To evaluate the individual impact of Capital Adequacy (CAR) on the Return on Assets (ROA) of private commercial banks in Bangladesh.
- To examine the relationship between Asset Quality (NPL Ratio) and the financial performance (ROA) of private commercial banks in Bangladesh.
- To determine the effect of Management Efficiency (Cost-to-Income Ratio) on the profitability of private commercial banks in Bangladesh.
- To investigate the influence of Earnings Quality (NIM) on the performance of private commercial banks in Bangladesh.
- To analyze the role of Liquidity (LDR) in shaping the performance of private commercial banks in Bangladesh.

1.4 Research Questions

Based on the objectives, this study poses the following research questions:

- What is the impact of Capital Adequacy (CAR) on the financial performance (ROA) of private commercial banks in Bangladesh?
- How does Asset Quality (NPL Ratio) affect the profitability of private commercial banks in Bangladesh?
- To what extent does Management Efficiency (Operating Expense Ratio) influence the financial performance of private banks?
- How do Earnings Quality (NIM) affect bank performance in Bangladesh?
- What role does Liquidity (LDR) play in determining the performance of private commercial banks in Bangladesh?

1.5 Significance of the Study

This research contributes both academically and practically. Academically, it fills a gap in the literature on Bangladeshi banking. While CAMEL is acknowledged as a key supervisory tool, empirical studies on its effect in Bangladesh are sparse. By using recent data and focusing on private banks, this study updates and extends past work. The findings will help scholars and analysts better understand the determinants of bank profitability in emerging markets. Practically, the results will guide bank managers and regulators. For instance, earlier work noted that CAMEL-based insights can help identify banks needing attention. This study will similarly indicate which financial ratios most influence performance, allowing management to target capital planning, cost control, asset quality improvement, or liquidity management appropriately. Policymakers (e.g. Bangladesh Bank) can use the results to refine supervision and support measures. In sum, this study aids investors, regulators, and banks by clarifying how CAMEL components drive profitability.

Chapter Two

LITERATURE REVIEW

2.0. Literature Review

This chapter reviews existing theoretical and empirical literature on the CAMEL framework and its impact on bank performance, particularly Return on Assets (ROA). It establishes the theoretical foundation and empirical evidence supporting the analysis of CAMEL components on ROA for selected private commercial banks in Bangladesh. The CAMEL framework—encompassing Capital Adequacy, Asset Quality, Management Efficiency, Earnings Quality, and Liquidity—provides a structured approach to evaluating bank soundness, directly linking these elements to profitability metrics like ROA, which reflects efficient asset utilization in Bangladesh's competitive private banking sector (Moudud-Ul-Huq, 2017; Islam and Shohidul, 2018).

2.1. Capital Adequacy (CAR) and Bank Performance (ROA)

The Capital Adequacy Ratio (CAR) measures a bank's capital to its risk-weighted assets to ensure it can handle financial shocks. The Risk-Return Trade-off Theory says that having more capital makes people less likely to take risks, but it can also lower returns because borrowing costs more. The Capital Buffer Theory says that having enough capital makes a business more stable and profitable by reducing losses (Bodla and Verma, 2006; Roman and Şargu, 2013). The Basel regulatory framework requires minimum CAR levels (e.g., 8–10.5%) to ensure that financial systems worldwide are safe.

Empirical investigations yield inconclusive results regarding the relationship between CAR and ROA. Chowdhury and Hossain (2019) found that CAR positively affects ROA in Bangladesh's commercial banks, consistent with trends in emerging economies, where capital strength enhances profitability. On the other hand, Mahmud (2023) found that CAR had little influence on bank profitability in Bangladesh. In developing countries such as Pakistan and Nepal, Babar and Zeb (2011) and Hamal and Adhikari (2020) found favorable CAR-ROA relationships. In contrast, Indian research, such as that by Suman and Swati (2022), found stronger effects in private banks. Comparisons

in developed markets, such as Muhmad and Hashim (2015) in Malaysia, show good but limited effects. Regulatory variances and economic cycles cause inconsistencies. For example, Bangladesh's private banks, such as BRAC and Dutch-Bangla, have different CAR-ROA ratios due to capital requirements after the pandemic (Ahmed et al., 2025).

2.2. Asset Quality (NPL Ratio) and Bank Performance (ROA)

The Non-Performing Loan (NPL) Ratio, which is the number of NPLs divided by the total number of loans, indicates the extent of credit risk. Credit Risk Theory posits that subpar asset quality diminishes revenues via provisions, whereas Information Asymmetry Theory underscores that monitoring deficiencies exacerbate defaults (Alam et al., 2011; Islam and Yasmin, 2021).

Empirical research largely indicates unfavorable connections between NPL and ROA. Islam and Yasmin (2021) found that NPLs are a significant CAMEL driver in Bangladesh, reducing ROA by increasing provisioning in commercial banks. Hossain and Ahamed (2015) and Mohiuddin (2014) also found that profitability was severely affected. Negative findings predominate in developing nations: Ferrouhi (2014) in Morocco and Olweny and Shipho (2011) in Kenya indicated that non-performing loans (NPLs) adversely affect return on assets (ROA). Some South Asian research, such as Jha and Hui (2012) in Nepal, shows insignificant impacts, which is likely due to limited data. Bangladesh has serious problems with non-performing loans (NPLs), especially in private banks such as City Bank and Prime Bank, where lending growth is faster than recovery, worsening the situation (Islam and Shohidul, 2018; Ahmed et al., 2025).

2.3. Management Efficiency (Cost-to-Income Ratio) and Bank Performance (ROA)

Cost-to-Income Ratio (CIR), which is the ratio of operating expenses to total assets or income, indicates how effectively management controls costs. Agency Theory posits that ineffective management exacerbates principal-agent disparities, leading to elevated costs, whereas Efficiency Structure Theory correlates effective management with competitive cost structures that boost profitability (Samad, 2019; Afroj, 2022).

Studies show that OER negatively affects ROA because short-term costs exceed long-term benefits. Samad (2019) and Islam et al. (2014) examine Bangladesh and find that

greater OER reduces commercial banks' efficiency. Hossain and Ahamed (2015) found that CAMEL ratings consistently had negative consequences. Evidence from emerging economies, including Masood et al. (2016) across regions and Suman and Swati (2022) in India, shows the same: stable enterprises become more efficient over time. Bodla and Verma (2006) found short-term negatives but long-term positives in Indian cases, indicating that inconsistencies persist. For Bangladesh's private banks, such as Eastern Bank and Southeast Bank, a high OER during digital transformation indicates inefficiencies (Chowdhury and Hossain, 2019).

2.4. Earnings Quality (NIM) and Bank Performance (ROA)

Net Interest Margin (NIM), defined as the difference between interest income generated and interest paid relative to interest-earning assets, is a primary measure of a bank's intermediation efficiency and pricing power. Financial Intermediation Theory holds that NIM reflects the core spread through which banks transform deposits into profitable loans, while Profitability Theory suggests that sustained net interest margins enhance overall asset returns (Hossain and Ahamed, 2015; Sufian and Chong, 2008).

Empirical studies consistently show that NIM positively influences Return on Assets (ROA) in emerging economies. Mahmud (2023) and Chowdhury and Hossain (2022) found that higher NIM significantly improves ROA in Bangladeshi banks, as it indicates better loan pricing and deposit cost management. Islam and Ashrafuzzaman (2015) substantiated this relationship for traditional commercial banks, showing NIM as a key driver of operating profitability. Regional evidence from Nepal (Hamal and Adhikari, 2020) and India (Suman and Swati, 2022) confirms that favourable NIM leads to stronger bank performance, particularly in competitive lending environments. For private banks in Bangladesh, such as Mutual Trust and Bank Asia, Islam and Shohidul (2018) argue that NIM remains a robust predictor of ROA even during periods of intensified loan competition.

2.5. Liquidity (LDR) and Bank Performance (ROA)

The Loan to Deposit Ratio (LDR) assesses liquidity by comparing loans to stable deposits, thereby maintaining a balance between intermediation and solvency. The Liquidity Preference Theory supports having too much liquidity for stability, but the Risk-Liquidity Trade-off forecasts the optimal LDRs that yield the most without causing stress (Ferrouhi, 2014; Roman and Şargu, 2013).

There is disagreement among empirical studies about the effects of LDR-ROA. In Bangladesh, Ahmed et al. (2025) found that LDR improves ROA by making private banks more efficient at lending. Rafiq (2016) discovered the same thing in regular banks. Negative consequences are more common elsewhere. Ferrouhi (2014) in Morocco and Olweny and Shipho (2011) in Kenya both found that high LDRs lead to liquidity squeezes that decrease ROA. Desta (2016) reported mixed results in Africa. Bangladesh's industry, which has LDRs typically between 80% and 90%, is struggling with liquidity because deposits are fluctuating at banks like United Commercial and Dhaka Bank. This is made worse by stricter regulations (Islam and Shohidul, 2018).

2.6. Literature Gap

2.6.1. Conceptual Gaps

There are few studies that examine all five CAMEL components and ROA for private commercial banks in Bangladesh. Most of them blend public, private, and Islamic organizations (Moudud-Ul-Huq, 2017; Islam and Shohidul, 2018). There are other ways to measure earnings quality (e.g., ROE vs. NIM), but they don't account for multicollinearity.

2.6.2. Methodological Gaps

Relying too heavily on descriptive CAMEL ratings ignores panel-data regressions for dynamic effects; robustness tests and heterogeneity controls are hard to find (Chowdhury and Hossain, 2019; Islam and Yasmin, 2021).

2.6.3. Regional Gaps

Limited post-2020 evaluations neglect the pandemic's effects on specific banks, such as BRAC and Dutch-Bangla, and make no deliberate emphasis on ten consistent private entities (Mahmud, 2023).

This study fills in the gaps by using panel data from ten private banks, robust regressions, and full CAMEL-ROA integration.

2.7. Hypothesis Development

H1: Capital Adequacy Ratio (CAR) positively affects ROA of private commercial banks in Bangladesh.

H2: NPL Ratio negatively affects ROA of private commercial banks in Bangladesh.

H3: Cost-to-Income Ratio (CIR) negatively affects ROA of private commercial banks in Bangladesh.

H4: Earnings Quality (measured by NIM) positively affects ROA of private commercial banks in Bangladesh.

H5: Loan to Deposit Ratio (LDR) positively affects ROA of private commercial banks in Bangladesh.

Chapter Three

METHODOLOGY

3.0 Research Methodology

This chapter presents the methodological framework adopted to investigate the impact of CAMEL components on the financial performance of private commercial banks in Bangladesh. The chapter systematically outlines the research design, conceptual framework, sample selection criteria, data sources, variable measurements, econometric models, hypothesis development, and analytical techniques employed to ensure the robustness and validity of the findings.

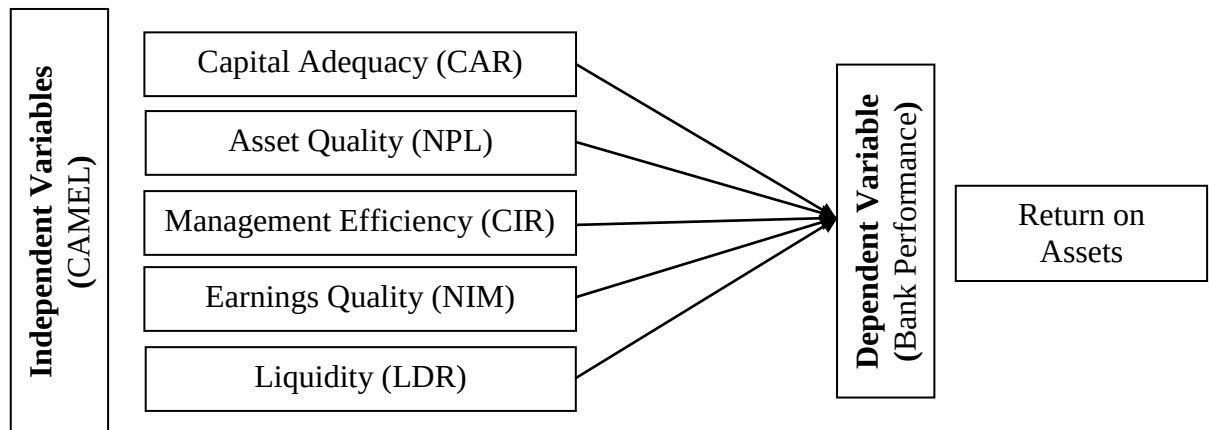
3.1 Research Design

This study adopts a quantitative research design utilising panel data econometrics to examine the relationship between CAMEL components and bank performance. The research is causal-explanatory in nature, as it seeks to establish the cause-and-effect relationships between the independent variables (capital adequacy, asset quality, management efficiency, earnings quality, and liquidity) and the dependent variable (Return on Assets).

3.2 Conceptual Framework

A conceptual framework serves as a structured approach that helps in identifying and categorizing the fundamental concepts, theories, and variables relevant to a study (Al-Amin and Saha, 2024). It functions as a roadmap, guiding the research by establishing relationships between key constructs and providing a foundation for developing research questions and hypotheses. In essence, it clarifies the scope and methodology of the investigation by outlining the concepts and assumptions that will steer the research process.

Figure 1: Relationship Between CAMEL Components and Bank Performance



Source: Author's compilation based on CAMEL framework and relevant literature.

The above figure illustrates the expected relationships between CAMEL components and the financial performance of private commercial banks in Bangladesh, as measured by Return on Assets (ROA). Each component is hypothesised to have a direct impact on bank profitability, with capital adequacy, earnings quality, and liquidity expected to positively influence performance, while higher non-performing loans and cost-to-income ratios are expected to negatively affect ROA.

3.3 Sample Selection and Data Source

3.3.1 Population and Sample

The target population of this study comprises all private commercial banks operating in Bangladesh. According to Bangladesh Bank (2024), the banking sector consists of 61 scheduled banks, including 43 private commercial banks. From this population, a sample of ten (10) private commercial banks was selected using purposive sampling techniques.

The selected banks are:

1. Bank Asia PLC
2. BRAC Bank PLC
3. City Bank PLC
4. Dhaka Bank PLC

5. Dutch-Bangla Bank PLC
6. Eastern Bank PLC
7. Mercantile Bank PLC
8. Mutual Trust Bank PLC
9. Southeast Bank PLC
10. United Commercial Bank PLC

3.3.2 Data Source

The study relies exclusively on secondary data extracted from the published annual reports of the selected banks for the fiscal years 2015 to 2024. Annual reports are considered reliable sources as they are audited by external auditors and approved by regulatory authorities, including Bangladesh Bank. Additional data were obtained from the websites of the respective banks and the Dhaka Stock Exchange (DSE) database where necessary.

3.4 Variables and Measurement

This section provides a detailed description of the variables employed in this study, including their definitions, measurement techniques, and sources. The dependent variable represents bank financial performance, while the independent variables represent the five components of the CAMEL framework. Table 1 presents a comprehensive summary of all variables used in the analysis.

Table 1: Summary of Variable Definitions and Measurements

Serial No.	Variable Name	Variable Definition	Sources
Dependent Variable			
1	Return on Assets (ROA)	ROA measures the overall profitability of a bank relative to its total assets,	(Suroso, 2022)

		reflecting how efficiently the bank uses its assets to generate net income.	
Independent Variables			
2	Capital Adequacy Ratio (CAR)	CAR indicates a bank's capital relative to its risk-weighted assets. Higher CAR values reflect greater capital buffers to absorb losses.	(Sukmadewi, 2020)
3	Non-Performing Loan Ratio (NPL)	NPL represents the proportion of loans that are in default or overdue, serving as a measure of asset quality. Higher NPL ratios negatively impact profitability.	(Mahaseth, 2024)
4	Cost-to-Income Ratio (CIR)	CIR measures management efficiency by assessing operating costs relative to operating income. Lower CIR indicates better operational efficiency.	(Irawan et al., 2025)
5	Net Interest Margin (NIM)	NIM measures earnings quality from a bank's core lending and investment activities, calculated as net interest income divided by earning assets.	(Mahaseth, 2024)
6	Loan-to-Deposit Ratio (LDR)	LDR reflects the proportion of deposits lent out as loans, indicating liquidity management. Optimal LDR supports profitability without compromising liquidity.	(Susesti et al., 2024)

Source: Author's compilation based on existing literature

3.5 Econometric Model

Based on the theoretical framework and empirical literature, the following panel regression model is specified to examine the impact of CAMEL components on bank performance:

$$\mathbf{ROA_{it} = \beta_0 + \beta_1CAR_{it} + \beta_2NPL_{it} + \beta_3CIR_{it} + \beta_4NIM_{it} + \beta_5LDR_{it} + \varepsilon_{it}}$$

Where:

- ROA_{it} = Return on Assets for bank i in year t
- CAR_{it} = Capital Adequacy Ratio for bank i in year t
- NPL_{it} = Non-Performing Loan Ratio for bank i in year t
- CIR_{it} = Cost-to-Income Ratio for bank i in year t
- NIM_{it} = Net Interest Margin for bank i in year t
- LDR_{it} = Loan-to-Deposit Ratio for bank i in year t
- β_0 = Intercept term
- β_1 to β_5 = Coefficients of independent variables
- ε_{it} = Error term

Chapter Four

DATA ANALYSIS

4.0 Data Analysis and Discussion

This section presents the analysis of data collected from ten selected private commercial banks in Bangladesh over the period 2015-2024. The analysis is structured into six parts: descriptive statistics, trend analysis of bank performance, correlation analysis among the study variables, diagnostic tests to verify regression assumptions, regression analysis to examine the impact of CAMEL components on bank profitability (ROA), and overall findings.

4.1 Descriptive Statistics

Descriptive statistics provide a preliminary overview of the key variables used in this study. Table 2 presents the number of observations, mean, standard deviation, minimum, maximum, 1st percentile, 99th percentile, skewness, and kurtosis for Return on Assets (ROA), Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), Cost-to-Income Ratio (CIR), Net Interest Margin (NIM), and Loan-to-Deposit Ratio (LDR) for the entire sample of 100 bank-year observations.

Table 2: Descriptive Statistics of Study Variables (2015-2024)

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Roa	100	0.920	0.377	0.370	1.700	0.370	1.700	0.370	2.169
Car	100	13.788	1.520	10.840	16.400	10.840	16.400	-0.181	2.255
Npl	100	4.781	1.470	2.630	8.010	2.630	8.010	0.589	2.680
Cir	100	50.094	7.572	37.580	62.560	37.580	62.560	0.021	1.828

Nim	100	2.804	1.285	0.660	4.879	0.660	4.879	0.052	1.914
Ldr	100	93.548	8.570	79.039	107.141	79.039	107.141	-0.170	1.905
Notes: The table shows the descriptive statistics for the variables used in this study based on data from 10 selected private commercial banks in Bangladesh from 2015 to 2024.									

Source: Authors' self-contribution based on the output developed by STATA 18.0

The average ROA for the selected banks over the ten-year period is 0.92%, with a range from 0.37% to 1.70%, indicating considerable variability in profitability across banks and years. The mean Capital Adequacy Ratio (CAR) of 13.79% suggests that, on average, banks maintain a capital buffer well above the regulatory minimum requirement. The average Non-Performing Loan (NPL) ratio stands at 4.78%, with a minimum of 2.63% and a maximum of 8.01%, reflecting differences in asset quality management among the sample banks. The Cost-to-Income Ratio (CIR) averages 50.09%, indicating moderate operational efficiency, though the range from 37.58% to 62.56% reveals significant variation in cost management practices. Net Interest Margin (NIM) has a mean of 2.80%, serving as a key measure of core profitability from lending activities. Finally, the Loan-to-Deposit Ratio (LDR) averages 93.55%, suggesting that banks actively deploy deposits into loans, with some banks exceeding 100% LDR, indicating aggressive lending strategies.

4.2 Trend Analysis of Bank Performance (ROA)

To understand the performance progression of the selected banks, a trend analysis of ROA was conducted. Table 3 presents the ROA for each bank from 2015 to 2024, along with their individual averages and the yearly industry averages.

Table 3: Trend Analysis of ROA by Bank and Year (2015–2024)

Bank Name	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Average
BRAC Bank PLC	1.13	1.70	1.70	1.70	1.65	1.19	1.31	1.14	1.13	1.46	1.411
Bank Asia PLC	1.26	0.65	0.76	0.76	0.59	0.53	0.64	0.67	0.51	0.55	0.692
City Bank PLC	1.70	1.70	1.40	0.70	0.70	1.10	1.20	1.00	1.20	1.70	1.240
Dhaka Bank PLC	0.86	0.77	0.69	0.54	0.56	0.70	0.65	0.49	0.48	0.37	0.611
Dutch-Bangla Bank PLC	1.30	0.70	0.90	1.30	1.20	1.30	1.10	1.10	1.40	0.70	1.100
Eastern Bank PLC	1.23	1.33	1.04	1.15	1.30	1.22	1.28	1.21	1.27	1.34	1.237
Mercantile Bank PLC	0.79	1.15	1.30	1.09	0.78	0.73	0.99	0.59	0.52	0.37	0.831
Mutual Trust Bank PLC	1.04	0.94	1.08	0.82	0.56	0.37	1.03	0.72	0.79	0.77	0.812
Southeast Bank PLC	1.23	0.88	0.37	0.69	0.62	0.47	0.37	0.37	0.42	0.37	0.579
United Commercial Bank PLC	1.42	0.84	0.70	0.62	0.65	0.61	0.60	0.67	0.41	0.37	0.689
Yearly Average	1.196	1.066	0.994	0.937	0.861	0.822	0.917	0.796	0.813	0.800	0.920

Notes: The table shows the trend analysis of Return on Assets (ROA) for 10 selected private commercial banks in Bangladesh from 2015 to 2024. The last row presents the yearly average ROA across all banks, and the last column presents each bank's 10-year average ROA.

Source: Authors' self-contribution based on the output developed by STATA 18.0

The yearly average ROA reveals a general declining trend in profitability over the study period, falling from 1.20% in 2015 to 0.80% in 2024. This suggests increasing pressure on the profitability of the banking sector over the decade. While there was a slight recovery in 2021 (0.92%), the overall trajectory remains downward. A closer examination of individual banks shows considerable heterogeneity in performance. BRAC Bank PLC stands out with the highest average ROA (1.41%) and demonstrated relatively stable performance throughout the period. In contrast, Southeast Bank PLC recorded the lowest average ROA (0.58%) and exhibited a steep decline in profitability in the later years. City Bank PLC showed strong recovery in 2024 (1.70%) after a period of lower profitability, while United Commercial Bank PLC experienced a dramatic decline from 1.42% in 2015 to 0.37% in 2024. These patterns indicate that bank-specific factors play a significant role in determining profitability trends.

4.3 Correlation Analysis

A pairwise correlation analysis was conducted to examine the direction and strength of the linear relationships between the dependent variable (ROA) and the independent variables (CAR, NPL, CIR, NIM, LDR). The results are presented in Table 4.

Table 4: Pairwise Correlations

Variables	(1) roa	(2) car	(3) npl	(4) cir	(5) nim	(6) ldr
(1) roa	1.000					
(2) car	0.106	1.000				
(3) npl	-0.477***	-0.239*	1.000			
(4) cir	0.051	0.097	-0.003	1.000		
(5) nim	0.559***	0.155	-0.183*	0.189	1.000	

(6) ldr	-0.015	0.183*	-0.204**	-0.451***	-0.079	1.000
Notes: The table shows the pairwise correlation coefficients among the study variables. P-values are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.						

Source: Authors' self-contribution based on the output developed by STATA 18.0

The correlation matrix reveals several significant relationships. ROA has a strong, positive, and statistically significant correlation with Net Interest Margin (NIM) ($r = 0.559$, $p < 0.01$), which is expected as NIM is a direct driver of bank profitability from core lending operations. Conversely, ROA shows a significant negative correlation with Non-Performing Loans (NPL) ($r = -0.477$, $p < 0.01$), confirming that higher levels of bad debts are associated with lower profitability. This supports the theoretical expectation that deteriorating asset quality erodes bank earnings.

The correlation between ROA and Capital Adequacy Ratio (CAR) is positive but weak and not statistically significant ($r = 0.106$, $p = 0.296$). Similarly, ROA's correlations with Cost-to-Income Ratio (CIR) ($r = 0.051$, $p = 0.617$) and Loan-to-Deposit Ratio (LDR) ($r = -0.015$, $p = 0.879$) are very weak and statistically insignificant, suggesting that on a bivariate level, these factors do not have clear linear relationships with profitability.

Among the independent variables, several notable correlations exist. LDR shows a significant negative correlation with both CIR ($r = -0.451$, $p < 0.01$) and NPL ($r = -0.204$, $p < 0.05$), indicating that banks with higher loan-to-deposit ratios tend to have better cost efficiency and lower non-performing loans. CAR has a significant negative correlation with NPL ($r = -0.239$, $p < 0.05$), implying that banks with higher capital adequacy tend to have better asset quality.

4.4 Diagnostic Tests

Before proceeding with regression analysis, several diagnostic tests were conducted to verify that the data meet the assumptions of classical linear regression and to determine the appropriate estimation method for the panel data structure.

4.4.1 Multicollinearity Test

Variance Inflation Factor (VIF) was used to detect multicollinearity among the independent variables. Table 5 presents the VIF values.

Table 5: Variance Inflation Factor (VIF) Results

Variable	VIF	1/VIF
nim	1.39	0.718
npl	1.34	0.746
ldr	1.14	0.881
car	1.13	0.887
cir	1.09	0.918
Mean VIF	1.22	

Notes: The table shows the Variance Inflation Factor (VIF) for each independent variable. VIF values below 5 indicate no serious multicollinearity.

Source: Authors' self-contribution based on the output developed by STATA 18.0

All VIF values are well below the conservative threshold of 5, indicating that multicollinearity is not a concern in this model. The independent variables are not highly correlated with each other, which ensures the reliability and precision of the coefficient estimates.

4.4.2 Heteroskedasticity Test

The Breusch-Pagan/Cook-Weisberg test was conducted to detect heteroskedasticity. Table 6 presents the results.

Table 6: Breusch-Pagan/Cook-Weisberg Test for Heteroskedasticity

chi2(1)	Prob > chi2
3.46	0.0628
Notes: The null hypothesis (H0) is constant variance (homoskedasticity). A p-value greater than 0.05 indicates no significant heteroskedasticity.	

Source: Authors' self-contribution based on the output developed by STATA 18.0

The test yields a chi-square value of 3.46 with a p-value of 0.0628. Since the p-value is greater than the conventional significance level of 0.05, we fail to reject the null hypothesis of constant variance. This indicates that heteroskedasticity is not a severe problem in the model at the 5% significance level, though it is marginally close to the threshold.

4.4.3 Autocorrelation Test

The Wooldridge test for autocorrelation in panel data was employed to detect serial correlation in the residuals. Table 7 presents the results.

Table 7: Wooldridge Test for Autocorrelation in Panel Data

F(1, 9)	Prob > F
15.108	0.0037
Notes: The null hypothesis (H0) is no first-order autocorrelation. A p-value less than 0.05 indicates the presence of autocorrelation.	

Source: Authors' self-contribution based on the output developed by STATA 18.0

The test produces an F-statistic of 15.108 with a p-value of 0.0037. Since the p-value is less than 0.05, we reject the null hypothesis of no first-order autocorrelation. This indicates that autocorrelation is present in the panel data, meaning that the error terms are correlated over time for each bank. To address this violation of the classical

regression assumptions, a Feasible Generalized Least Squares (FGLS) model with an AR(1) correlation structure was estimated as an alternative specification.

The FGLS regression results, presented in the following section, incorporate a common first-order autoregressive coefficient of 0.5003 for all panels, which corrects for the detected autocorrelation and provides more reliable coefficient estimates.

4.4.4 Hausman Specification Test

The Hausman specification test was conducted to determine whether the fixed effects model or the random effects model is more appropriate for the panel data. Table 8 presents the results.

Table 8: Hausman (1978) Specification Test

Chi-square test value	P-value
8.988	0.11
Notes: The null hypothesis (H0) is that the random effects model is consistent. A p-value greater than 0.05 favors the random effects model.	

Source: Authors' self-contribution based on the output developed by STATA 18.0

The test yields a chi-square value of 8.988 with a p-value of 0.11. Since the p-value is greater than 0.05, we fail to reject the null hypothesis that the random effects model is consistent. This indicates that the random effects model is preferred over the fixed effects model for this analysis. The random effects model will provide more efficient estimates while accounting for bank-specific heterogeneity.

4.5 Regression Analysis

Based on the diagnostic test results, three regression approaches were employed to examine the impact of CAMEL components on bank profitability. First, pooled Ordinary Least Squares (OLS) was applied as a baseline model. However, given the presence of first-order autocorrelation confirmed by the Wooldridge test ($p = 0.0037$), a Feasible Generalized Least Squares (FGLS) model with an AR(1) correction was

estimated to obtain reliable coefficient estimates. Additionally, panel data techniques were employed to account for unobserved heterogeneity across banks. The random effects model is preferred over the fixed effects model as the Hausman test ($\chi^2 = 8.988$, $p = 0.11$) confirmed its consistency and efficiency. The regression models use Return on Assets (ROA) as the dependent variable and Capital Adequacy Ratio (CAR), Non-Performing Loan ratio (NPL), Cost-to-Income Ratio (CIR), Net Interest Margin (NIM), and Loan-to-Deposit Ratio (LDR) as independent variables. The results of the key regression models are presented in Table 9 below:

Table 9: Determinants of Profitability in the Bangladesh Banking Sector

Variables	Model-I Pooled OLS	Model-II FGLS (AR1)	Model-III Random Effects	Model-IV Fixed Effects
	ROA (Coefficient)	ROA (Coefficient)	ROA (Coefficient)	ROA (Coefficient)
Capital Adequacy (CAR)	-0.012 (0.558)	0.011 (0.548)	-0.002 (0.917)	-0.009 (0.608)
Asset Quality (NPL)	-0.107*** (0.000)	-0.103*** (0.000)	-0.085*** (0.000)	-0.084*** (0.000)
Management Efficiency (CIR)	-0.004 (0.360)	-0.008* (0.052)	-0.018*** (0.000)	-0.026*** (0.000)
Earnings Quality (NIM)	0.146*** (0.000)	0.135*** (0.000)	0.128*** (0.000)	0.084*** (0.047)
Liquidity (LDR)	-0.004 (0.323)	-0.006 (0.132)	-0.006 (0.103)	-0.006 (0.156)

Constant	1.743*** (0.002)	1.873*** (0.001)	2.498*** (0.000)	3.023*** (0.000)
R-squared	0.469	-	0.379	0.420
F-Stat / Chi²	16.600***	62.692***	62.905***	12.305***
No. of Observations	100	100	100	100

*Statistically Significant: *** p<0.01, ** p<0.05, * p<0.1

Notes: P-values are reported in parentheses. Model-I presents the Pooled OLS results. Model-II uses Feasible Generalized Least Squares with a common AR(1) coefficient to correct for autocorrelation. Models III and IV are panel data models, with the Hausman test (p=0.11) confirming the Random Effects model as the preferred specification.

Source: Authors' self-contribution based on the output developed by STATA 18.0

The regression analysis provides robust evidence on the determinants of bank profitability (ROA). Asset Quality (NPL) and Earnings Quality (NIM) are consistently significant across all four models. The NPL ratio exhibits a negative and highly significant (p<0.01) relationship with ROA, confirming that higher non-performing loans erode profitability (supporting H2). Conversely, NIM demonstrates a strong positive and significant impact on ROA, indicating that a higher net interest margin directly enhances bank performance (supporting H4).

Management Efficiency (CIR) emerges as a significant negative determinant in the preferred Random Effects and Fixed Effects models (p<0.01), and is marginally significant in the FGLS model (p<0.10). This confirms that lower operating expenses (greater efficiency) are associated with higher profitability, supporting H3. However, Capital Adequacy (CAR) and Liquidity (LDR) are not statistically significant in any model specification, leading to the rejection of H1 and H5. This suggests that, for the sampled banks and period, variations in capital ratios and loan-to-deposit ratios do not have a direct linear impact on ROA after controlling for other factors. The Random Effects model, confirmed by the Hausman test as the most appropriate, indicates that NPL, CIR, and NIM are the primary drivers of bank performance.

Chapter Five

Findings, Recommendations & Conclusion

5.1 Findings of the Study

The empirical analysis reveals that asset quality (measured by NPL ratio) and management efficiency (cost-to-income ratio) are the strongest determinants of bank profitability (ROA) in our sample. Specifically, higher NPL ratios are associated with significantly lower ROA (H_2 supported), and higher cost-to-income ratios likewise reduce ROA (H_3 supported). In contrast, capital adequacy (CAR) and loan-to-deposit ratio (LDR) do not have significant effects (H_1 and H_5 not supported). Earnings quality (net interest margin, NIM) has a positive and significant impact on ROA (H_4 supported). In sum, the data show that banks' profitability is driven mainly by asset quality, efficiency, and earnings spreads, whereas the level of capital and liquidity are less important in the short run.

These findings align well with prior studies. For example, Islam and Rana (2017) also find that higher NPLs and operating costs significantly depress ROA in Bangladeshi private banks, whereas a high LDR has only a positive but insignificant effect. Likewise, international evidence suggests that banks with higher cost-to-income ratios tend to be less profitable. By comparison, our result that CAR is not significantly related to ROA is consistent with Balango and Rao (2017), who report a positive but insignificant CAR–ROA link for Ethiopian banks.

Overall, the study confirms that NPL control and cost efficiency are crucial for profitability, echoing the CAMEL literature. The positive effect of NIM on ROA also matches conventional wisdom that higher interest spreads boost earnings (as seen in various banking sector analyses). In cases where our results diverge from earlier work, it is generally because of sample differences: for instance, macro factors or market structure may vary.

5.2 Recommendations

Based on the above findings, we offer the following recommendations for policy and practice:

- **For Bank Management:** Focus on improving asset quality and operational efficiency. This means strengthening credit-risk screening and recovery processes to lower NPL ratios. Banks should streamline operations and reduce unnecessary costs (e.g. by investing in technology or re-engineering workflows) to improve the cost-to-income ratio, since a leaner cost structure directly raises profitability. At the same time, strategies to enhance net interest margins – such as optimizing loan pricing and reducing funding costs – will also support higher ROA. Although capital buffers remain important for safety, managers need not rely on higher CAR for short-run profit gains; instead they should allocate capital prudently without sacrificing income-generating activities.
- **For Regulators and Policymakers:** Continue rigorous oversight of banks' credit quality and efficiency. Regulators should ensure that banks maintain prudent lending standards and promptly provision for bad loans, given the demonstrated negative impact of NPLs on profitability. Supervision and stress-testing should emphasize asset-quality metrics rather than focusing solely on capital ratios. Policymakers can also encourage banks to adopt best practices in cost control (for example through regulatory incentives for efficiency programs), since higher efficiency leads to stronger bank performance. Finally, while liquidity (LDR) appeared insignificant in our results, regulators should still guard against excessive risk-taking in lending; preserving adequate liquidity remains a key systemic stability goal even if it does not immediately boost ROA.

5.3 Conclusion

This study set out to evaluate how the CAMEL components affect the financial performance of private commercial banks in Bangladesh. In line with our research questions, we find that asset quality (NPL) and management efficiency (CIR) are the key drivers of bank profitability, with NPL having a strong negative and CIR a strong positive (inverted) effect on ROA. Earnings quality (NIM) also significantly boosts

profitability (H_4 supported). In contrast, higher capital ratios and larger LDR do not significantly improve ROA in the sample (H_1 and H_5 unsupported). These results largely confirm the expectations from the CAMEL framework and are consistent with prior empirical studies in Bangladesh and other countries. The main contribution of this research is to provide updated, panel-data evidence on the CAMEL–ROA relationship for Bangladeshi private banks over a recent ten-year period. By filling some gaps in the literature (especially by including all five CAMEL factors simultaneously with modern econometrics), the study offers new insight into which factors truly matter for bank success.

Overall, the analysis demonstrates that improving credit quality and cost efficiency should be top priorities for Bangladeshi banks seeking higher profitability. At the same time, the findings inform regulators that focusing supervisory resources on asset-side risks and operational efficiency is likely to yield the greatest benefits for banking sector health. In sum, this research underscores the critical links between CAMEL indicators and bank performance, and provides empirical guidance for both policy and future academic work.

5.4. Contribution of the Study

This study contributes to the existing literature in several important ways. First, it provides updated empirical evidence on the relationship between CAMEL indicators and bank profitability in the context of Bangladeshi private commercial banks using recent data from 2015 to 2024. Many earlier studies either relied on older data or focused mainly on descriptive CAMEL rankings. In contrast, this study applied panel-data regression techniques to examine how individual CAMEL variables affect profitability more rigorously.

Second, the study specifically concentrated on ten selected private commercial banks and used ROA as a consistent measure of financial performance. By incorporating all five CAMEL dimensions together in one analytical framework, the study offers a more integrated understanding of which aspects of banking operations matter most for profitability.

Third, the study has practical significance because it generates evidence that may be useful for bank managers, regulators, researchers, and policymakers. The results clearly

highlight that asset quality, cost efficiency, and earnings spread are the main drivers of profitability in the selected banks. In this way, the study adds both academic and practical value to the discussion of bank performance in Bangladesh.

5.5. Limitations of the Study

Like any empirical research, this study has some limitations. First, the analysis is based on a sample of only ten private commercial banks, which may limit the generalizability of the findings to the entire banking industry of Bangladesh. State-owned banks, Islamic banks, and foreign commercial banks were excluded, so the results mainly reflect the experience of selected private banks.

Second, the study relied entirely on secondary data collected from annual reports and related published sources. Although these are reliable sources, secondary data may not fully capture managerial, institutional, or behavioral factors that also influence profitability.

Third, the study used only five explanatory variables derived from the CAMEL framework. Other important determinants of bank performance, such as bank size, inflation, GDP growth, market competition, governance quality, or macroeconomic shocks, were not included in the model.

Fourth, the study covered the period from 2015 to 2024 only, which, although recent, may still not capture longer structural changes in the banking sector.

Finally, while the econometric methods used were appropriate for the available data, the findings remain subject to the usual limitations of model specification and data availability. Therefore, the results should be interpreted with these limitations in mind.

5.6. Direction of Future Research

Future research can extend this study in several directions. One possible area is to expand the sample by including state-owned, Islamic, and foreign commercial banks so that a more comprehensive comparison of the banking sector in Bangladesh can be made. Researchers may also use a longer time horizon or include more recent years to examine whether the relationships found in this study remain stable over time. This

would be especially useful for understanding post-pandemic restructuring, regulatory reform, and changing credit conditions in the banking industry.

Another important direction would be to include additional bank-specific and macroeconomic variables, such as bank size, inflation, GDP growth, exchange rate movements, corporate governance practices, or market concentration. Future studies may also apply more advanced techniques such as dynamic panel estimation, generalized method of moments (GMM), or comparative cross-country analysis. In addition, qualitative or mixed-method research could help explain why some banks manage asset quality and efficiency better than others. Such future work would deepen the understanding of bank performance and help develop more effective policy guidance for the financial sector of Bangladesh.

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Annual Report

- ✓ Annual report of Bank Asia PLC 2015-2024
- ✓ Annual report of BRAC Bank PLC 2015-2024
- ✓ Annual report of City Bank PLC 2015-2024
- ✓ Annual report of Dhaka Bank PLC 2015-2024
- ✓ Annual report of Dutch-Bangla Bank PLC 2015-2024
- ✓ Annual report of Eastern Bank PLC 2015-2024
- ✓ Annual report of Mercantile Bank PLC 2015-2024
- ✓ Annual report of Mutual Trust Bank PLC 2015-2024
- ✓ Annual report of Southeast Bank PLC 2015-2024
- ✓ Annual report of United Commercial Bank PLC 2015-2024

Appendix

Stata Output

1. Descriptive Statistics

Stats	wwroa	wwcar	wwnpl	wwcir	wwnim	wwldr
Mean	.9202	13.7878	4.7809	50.0936	2.80396	93.54827
Max	1.7	16.4	8.01	62.56	4.878673	107.1409
Min	.37	10.84	2.63	37.58	.66	79.03887
SD	.37722	1.519733	1.470175	7.57169	1.285232	8.569659
Range	1.33	5.56	5.38	24.98	4.218673	28.10206
Kurtosis	2.168832	2.254798	2.67962	1.82769	1.914398	1.904709
Skewness	.3699459	-.1811189	.5890261	.0211418	.0517886	-.1700917
p50	.83	13.85	4.68	50.155	2.839169	94.93063

2. Trend Analysis

	year										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
banksname											
BRAC Bank PLC	1.13	1.7	1.7	1.7	1.65	1.19	1.31	1.14	1.13	1.46	1.411
Bank Asia PLC	1.26	.65	.76	.76	.59	.53	.64	.67	.51	.55	.692
City Bank PLC	1.7	1.7	1.4	.7	.7	1.1	1.2	1	1.2	1.7	1.24
Dhaka Bank PLC	.86	.77	.69	.54	.56	.7	.65	.49	.48	.37	.611
Dutch-Bangla Bank PLC	1.3	.7	.9	1.3	1.2	1.3	1.1	1.1	1.4	.7	1.1
Eastern Bank PLC	1.23	1.33	1.04	1.15	1.3	1.22	1.28	1.21	1.27	1.34	1.237
Mercantile Bank PLC	.79	1.15	1.3	1.09	.78	.73	.99	.59	.52	.37	.831
Mutual Trust Bank PLC	1.04	.94	1.08	.82	.56	.37	1.03	.72	.79	.77	.812
Southeast Bank PLC	1.23	.88	.37	.69	.62	.47	.37	.37	.42	.37	.579
United Comercial Bank PLC	1.42	.84	.7	.62	.65	.61	.6	.67	.41	.37	.689
Total	1.196	1.066	.994	.937	.861	.822	.917	.796	.813	.8	.9202

3. Pairwise correlations

	wwroa	wwcar	wwnpl	wwcir	wwnim	wwldr
wwroa	1.0000					
wwcar	0.1056 0.2957	1.0000				
wwnpl	-0.4769 0.0000	-0.2391 0.0166	1.0000			
wwcir	0.0506 0.6170	0.0973 0.3357	-0.0034 0.9730	1.0000		
wwnim	0.5590 0.0000	0.1551 0.1232	-0.1831 0.0683	0.1886 0.0602	1.0000	
wwldr	-0.0155 0.8785	0.1830 0.0684	-0.2041 0.0416	-0.4509 0.0000	-0.0794 0.4322	1.0000

4. Linear regression

Source	SS	df	MS	Number of obs	=	100
Model	6.60580116	5	1.32116023	F(5, 94)	=	16.60
Residual	7.48139484	94	.079589307	Prob > F	=	0.0000
				R-squared	=	0.4689
				Adj R-squared	=	0.4407
Total	14.087196	99	.142294909	Root MSE	=	.28212

wwroa	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
wwcar	-.0116875	.0198804	-0.59	0.558	-.0511604	.0277855
wwnpl	-.1065094	.0204833	-5.20	0.000	-.1471795	-.0658393
wwcir	-.0039836	.0043343	-0.92	0.360	-.0125894	.0046221
wwnim	.14629	.0230204	6.35	0.000	.1005825	.1919975
wwldr	-.0038763	.0039049	-0.99	0.323	-.0116296	.003877
_cons	1.742541	.5504007	3.17	0.002	.6497076	2.835375

5. VIF

Variable	VIF	1/VIF
wwldr	1.39	0.717904
wwcir	1.34	0.746456
wwcar	1.14	0.880714
wwnpl	1.13	0.886504
wwnim	1.09	0.918399
Mean VIF	1.22	

6. estat hottest

Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of `wwroa`

H0: Constant variance

chi2(1) = 3.46
Prob > chi2 = 0.0628

7. Autocorrelation test

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation

F(1, 9) = 15.108
Prob > F = 0.0037

8. Cross-sectional time-series FGLS regression

Cross-sectional time-series FGLS regression

Coefficients: generalized least squares

Panels: homoskedastic

Correlation: common AR(1) coefficient for all panels (0.5003)

Estimated covariances	=	1	Number of obs	=	100
Estimated autocorrelations	=	1	Number of groups	=	10
Estimated coefficients	=	6	Time periods	=	10
			Wald chi2(5)	=	62.69
			Prob > chi2	=	0.0000

wwroa	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
wwcar	.0110468	.0183991	0.60	0.548	-.0250148	.0471083
wwnpl	-.1033488	.019298	-5.36	0.000	-.1411722	-.0655255
wwcir	-.0081243	.0041759	-1.95	0.052	-.0163088	.0000602
wwnim	.1346809	.0268493	5.02	0.000	.0820572	.1873046
wwldr	-.0060506	.0040216	-1.50	0.132	-.0139328	.0018316
_cons	1.872645	.5493651	3.41	0.001	.7959093	2.949381

9. Random-effects GLS regression

Random-effects GLS regression

Group variable: banksname_id

Number of obs = 100

Number of groups = 10

R-squared:

Within = 0.4060

Between = 0.3589

Overall = 0.3787

Obs per group:

min = 10

avg = 10.0

max = 10

corr(u_i, X) = 0 (assumed)	Wald chi2(5)	=	62.90
	Prob > chi2	=	0.0000

wwroa	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
wwcar	-.0018051	.0173135	-0.10	0.917	-.0357389	.0321287
wwnpl	-.0852184	.0175184	-4.86	0.000	-.1195539	-.050883
wwcir	-.0184105	.0048531	-3.79	0.000	-.0279224	-.0088987
wwnim	.1275849	.032779	3.89	0.000	.0633393	.1918305
wwldr	-.0062153	.0038175	-1.63	0.103	-.0136975	.0012668
_cons	2.498451	.565652	4.42	0.000	1.389794	3.607109
sigma_u	.20438548					
sigma_e	.20162289					
rho	.50680394	(fraction of variance due to u_i)				

10. Fixed-effects (within) regression

```

Fixed-effects (within) regression               Number of obs   =       100
Group variable: banksname_id                   Number of groups =        10

R-squared:                                     Obs per group:
    Within = 0.4199                             min =          10
    Between = 0.1065                             avg =         10.0
    Overall = 0.2211                             max =          10

corr(u_i, Xb) = -0.1884                       F(5, 85)         =       12.31
                                                Prob > F         =       0.0000

```

wwroa	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
wwcar	-.0092966	.0180605	-0.51	0.608	-.0452056	.0266125
wnnpl	-.0835326	.0174597	-4.78	0.000	-.1182472	-.0488179
wwcir	-.0255892	.0056202	-4.55	0.000	-.0367636	-.0144148
wnnim	.0838701	.0415325	2.02	0.047	.0012924	.1664477
wwldr	-.005646	.0039441	-1.43	0.156	-.0134879	.0021958
_cons	3.022602	.6246592	4.84	0.000	1.780612	4.264592
sigma_u	.29427274					
sigma_e	.20162289					
rho	.6805316	(fraction of variance due to u_i)				

```

F test that all u_i=0: F(9, 85) = 11.00          Prob > F = 0.0000

```

11. Hausman (1978) specification test

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
	(b) f1	(B) r1		
wwcar	-.0092966	-.0018051	-.0074915	.0064593
wnnpl	-.0835326	-.0852184	.0016859	.0034995
wwcir	-.0255892	-.0184105	-.0071786	.0030847
wnnim	.0838701	.1275849	-.0437148	.0270443
wwldr	-.005646	-.0062153	.0005693	.0013084

b = Consistent under H0 and Ha; obtained from xtreg.
 B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

```

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
        = 8.99
Prob > chi2 = 0.1096

```