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Factors Influencing Profitability in the Bangladeshi Commercial Banking sector

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Abstract- **This study explores the determinants of Bangladesh-based commercial banks' profitability of commercial banks in an emerging economy, Bangladesh. For this study, commercial banks' annual report data [over the period 2013-2024] was used. Probable determinants were shortlisted using empirical literatures. The study uses return on asset (ROA) and return on equity (ROE) as the dependent variable. Panel regressions were run using fixed effects model and random effects model. The findings show a significant positive relationship between asset quality and bank performance, and a significant negative relationship between capital adequacy and performance across all baseline models.**

Keywords: **ROA, ROE, asset quality, bank performance, capital adequacy, fixed effect model and random effect model.**

I. INTRODUCTION

Banks are depository financial institutions connecting the savers and users of fund. These mediators are interpolated between the final borrowers and lenders allowing them well-organized allocation of funds in the economy. Entities having excess funds can advance them for rational return to entrepreneurs and other economic units who need funds to take the advantage of economically and financially feasible investment ventures. The presence of financial markets and financial organizations allows such transfer of financial resources. Thus, both the borrowers and lenders are well off compared to without financial organizations and intermediaries. It is argued that financial establishments have a progressive role in funding and investment in a multidimensional practice linking the difficulty of numerous interconnected and inter-reliant factors of differentiated nature. It is difficult to assess the contribution of each factor independently. The pivotal purpose of financial organization with other non-depository institutions is to support in the distribution of country's scarce capital among several alternative investment areas. Thus, the financial market plays a twin role, providing numerous types of investment fund and disciplining

businesses, which are incompetent and fail to follow profitable income objectives. Thus, it is observed that financial institutions especially commercial banks if rightly organized and directed can help expansion of our economy.

In the context of Bangladesh has an option, efforts to be designed at nurturing banking activities for accelerating the economic wheel of the country. Notwithstanding its significant merits, it is also not desirable to overlook the problems of the nation's crisis oriented banking structure, which requires appropriate guideline of the banking procedure in order to safeguard effective use and watching of business funds.

II. LITERATURE REVIEW

In this chapter an attempt has been made to highlight an insight into the different literature relating to bank's asset quality, capital adequacy and bank performance in international and domestic settings. It is observed that different studies have been undertaken using different methodologies in different countries and in different financial environments. Some of the studies used primary sources of data and other focuses on secondary sources. The results of these studies are diverse in natures documenting differences in different countries with respect to profitability, asset quality and bank performance. In this chapter the researcher has also tried to identified a number of potential factors that can influence commercial bank's profitability, asset quality, capital adequacy and other related issues.

This chapter provides a comprehensive overview of the literature concerning bank asset quality, capital adequacy, and overall performance across both international and domestic contexts. A wide range of studies have been conducted using varied methodologies, reflecting the diversity of financial environments and regulatory frameworks in different countries. Some researchers have relied on primary data sources, while others have utilized secondary data, resulting in a broad spectrum of findings. [1] suggested that bank asset quality could serve as a potential rescue mechanism for banks in the future. In their study of Nigerian banks, [2] highlighted the importance of continuously analyzing and investigating the factors influencing bank performance. Their findings pointed to persistent underperformance in the banking

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sector, characterized by elevated credit risk and a rising incidence of bad loans.

Nigerian banks have emphasized the critical need for ongoing analysis and investigation into the factors affecting bank performance, particularly in light of persistent underperformance marked by high credit risk and a growing volume of bad loans. [10] identified asset management as a key management concern for banks, noting that global surveys consistently highlight asset quality as a shared priority among bankers worldwide. [1] concluded that asset quality significantly influences a bank's ranking, with ratings and management evaluations closely tied to asset performance. [9] further supported this view, finding that high-quality assets are a defining trait of top-performing banks, while poor asset quality often correlates with lower bank ratings. [2] observed an inverse relationship between non-performing assets (NPAs) and bank income, underscoring the negative impact on overall bank performance. To safeguard investor interests, they advocated for prudent credit risk management and robust asset protection strategies.

[11] noted that bank capital requirements are designed to ensure that institutions maintain adequate capital levels to mitigate risks associated with asset growth—particularly when assets are both profitable and inherently risky. This regulatory approach aims to safeguard financial stability by balancing growth with prudent risk management.

According to [13], asset quality is assessed by comparing the classification of credit—such as doubtful, substandard, and bad loans—with the total credit extended by the bank. This evaluation provides insight into the bank's ability to manage its income-generating assets. [5] further emphasized that the primary goal of allocating bank funds to productive assets is to generate the expected revenue, highlighting the importance of effective asset management in achieving financial performance.

[11] conducted an analysis of the CAMEL framework—comprising capital adequacy, managerial competence, earnings quality, and liquidity—for both domestic and international banks operating in Malaysia during the period from 2008 to 2012.

Researchers across the globe had used the ratios of profitability to risk and solvency to liquidity to investigate the success or failure of various financial organisations. In addition, [1] used nine financial metrics in order to assess the effectiveness and efficiency of banking institutions. These parameters included things like profitability as well as credit risk and liquidity risk. [2] emphasized the need of considering a number of factors when assessing an bank's degree of performance. [3] determined whether bad debts have an effect on Turkish banks' profitability. He employed the regression analysis method to explore time series data set that includes 1809 observations. The association between non-performing or bad loans and profitability, as determined by ROA and ROE, was found to be negatively skewed. Return on equity and return on assets were both low when asset quality were poor and nonperforming loans were high. [13] used IFRS-compliant quarterly financial reports from 55 Turkish banking sector banks. The time frame for the study was the first quarter of 2005 to the third quarter of 2016. Quality of Asset was evaluated by the proportion of bad or non-performing (follow-up) loans to total assets. According to the findings of the panel regression study, there was a significant inverse relationship between non-performing loans and the ratio of ROA/ROE variable, a measure of bank profitability. A decline in asset quality or a large number of bad loans could result in the bankruptcy of banks during an economic crisis. [14] found that in the past 25 years, both domestic and international agencies had implemented legislation to assess asset quality in relation to its significance. [7] conducted a study on bank leverage (debt) and its drivers in the United Kingdom, leverage was the dependent variable, while long-term loans, short-term debts, and retained earnings were the independent factors. [7] demonstrated that debt (also known as leverage) was negatively correlated with risky assets, long-term debt, and short-term debt. The [4] evaluated indicators of capital adequacy, as well as their consequences on financial risk indicators, bank revenues, and bank valuations. The banking industry is susceptible to interest rate risk, liquidity risk, and credit risk.- [3] conducted research to develop a model for evaluating Egyptian banks and to establish a standard that incorporated various elements required to evaluate capital adequacy. The model of [3] was reflective of the majority of the risks that commercial banks faced in general and credit, inflation, liquidity, and market risks in particular. [8] evaluated the various factors that determined the level of security maintained by Jordanian commercial banks over a specific time period (1992 – 2002). According to the research findings, there was a strong positive relationship between banking security and ROE and ROI. A large range of circumstances had a favorable or negative impact on the returns of assets held by commercial banks in Kosovo. These factors consist of Banks were essential to the expansion and growth of a nation's economy. The reason was that there was a positive association between the state of the banking industry and economic growth [6]. In addition to the Central Bank, banking organizations, governments, and

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other financial authorities, bank management was important in understanding the correlation between adequate capital and financial sector performance. This was due to the fact that the financial industry could not function efficiently without sufficient cash.
There were other factors that contributed to having sufficient cash. [14] argued that regulators could combat moral hazard by focusing on capital adequacy regulation. The regulation of capital adequacy protected small depositors. Small depositors make up the majority of bank's fund, thus this protection was very important.

III. BANKING SECTOR OF BANGLADESH

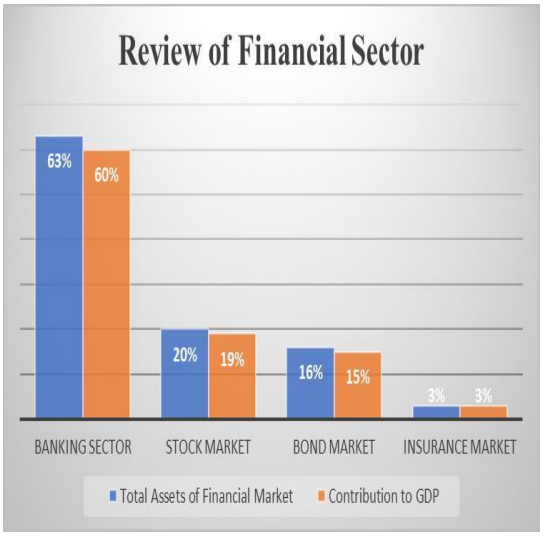
The banking sector of Bangladesh exemplifies the country's unwavering pursuit of financial excellence. This summary sheds light on the fascinating story of banking performance in this bright country. The primary objective of the Bangladesh Bank (BB) for the fiscal year 2024 was to preserve the economic health of the nation. Bangladesh Bank (BB) has devised a comprehensive plan to maintain resilience in order to ensure that the economy will continue to expand while remaining stable throughout fiscal year 2024. The Bank of Bangladesh (BB) forecasted that Bangladesh's economy would continue to flourish and remain stable in fiscal year 2024 if these policies were maintained.

3.1Overall Financial Sector's Performance in Bangladesh

The percentages of shares of the different sectors in terms of total assets in the financial market and contribution to GDP in 2023 are given in Figure-3.1.

Figure- 3.1

Financial Sector's Contribution to GDP



Source: Financial Express, 2023

It is observed that in all of the financial sectors, the banking sector's contribution is greater than the sum of other sectors' contributions in terms of total assets held to Gross Domestic Product (GDP). Commercial banks have made a significant impact on Bangladesh's economy over the years. They provide the public sector as well as the private industry with investable capital to accelerate the economic wheel of the country.

3.2 Major Performance Indicators of Banks in Bangladesh:

Bank's performance can be measured by different theoretical and other mathematical parameters. In this section attempts have been made to focus on the major performance indicators of banks operating in Bangladesh.

3.3 Capital Adequacy Ratio of Bangladeshi Banks:

While there has been a substantial advancement in the asset quality of the banking sector in Bangladesh over the last several years, there are still issues with nonperforming loans (NPLs), loan classification, and loan provisioning. To guarantee the long-term health of the nation's financial sector, it would be essential for the Bangladesh Bank and other regulatory agencies to continue addressing these issues.

Appropriate Levels of Capital adequacy refers to the degree of protection a bank provides for its depositors and other creditors against potential losses. The higher the capital adequacy ratio (CAR), the lesser the insolvency risk for banks. In recent years, the banking sector in Bangladesh has struggled to maintain the required level of capital adequacy due to a number of obstacles, including inadequate governance, high levels of non-performing loans (NPLs), etc.The Aggregate Capital Adequacy Ratio (ACAR) of Bangladeshi banks for the years 2014 to 2024 is shown in Figure- 3.2 which represents the trend of capital adequacy ratio maintained by the banks.

Figure- 3.2

Aggregate Capital Adequacy Ratio

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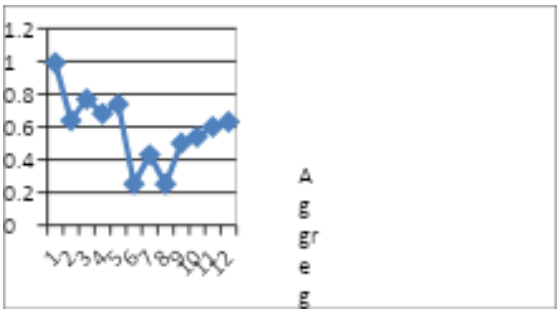
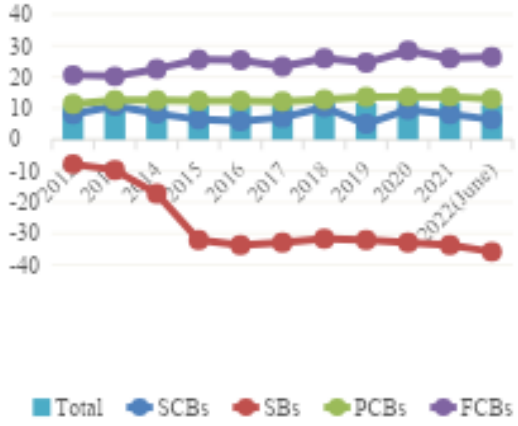


Source: Bangladesh Bank Annual Report, 2024

According to the available data, the overall CAR for Bangladeshi banks was 9.90% in 2012 and grew to 10.50% in 2013. The aggregate CAR significantly declined to 11.30% in 2014 before stabilizing at 10.80% for the three years 2015–2017. The banks' aggregate capital adequacy ratio (CAR) improved to 12.10% in 2018, showing that they have more capital on hand to cover future losses. The CAR has been showing improving trend from 2012 to 2022 as revealed from Figure-3.3.

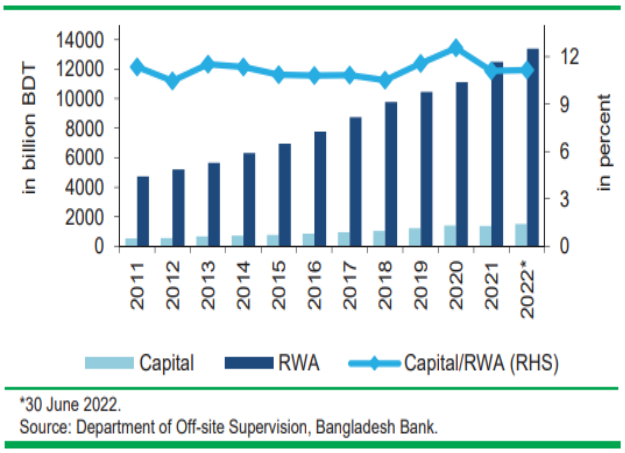
Figure3.3
Capital Adequacy Ratio by Types of Banks



Source*:* Annual Report, Bangladesh Bank, 2022

The total regulatory capital of the banking industry was BDT 1495.51 billion as of December 31, 2021, but has reduced to BDT 1495.06 billion as of June 30, 2022. Capital to Risk-Weighted Assets Ratio (CRAR) for various banking institutions is Figure-3.7. As of June 30, 2022, the CRAR for SCBs was 6.4%, for PCBs it was 13.0%, and for FCBs, it was 26.4%. BKB and RAKUB did not fulfill the MCR on a risk-weighted asset basis. In addition, five SCBs and five PCBs failed to maintain their required levels of capital. The CRAR for the banking sector was 11.2% as of the end of June 2022 as shown in Figure -3.3.

Figure - 3.4
Capital Adequacy Position (Aggregate)



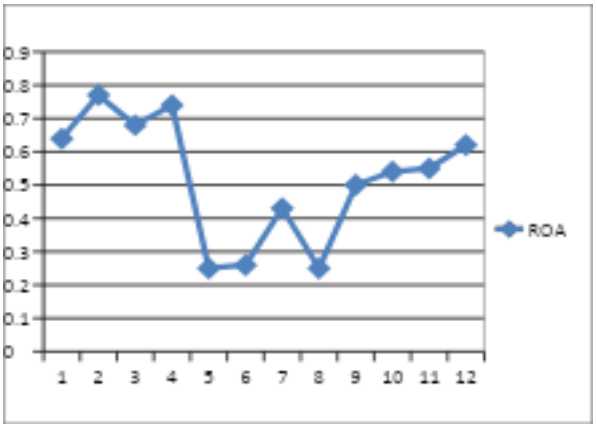
*30 June 2022.
Source: Department of Off-site Supervision, Bangladesh Bank.

Source: Annual report, Bangladesh Bank, 2022

Figure-3.4 reveals that like the ROA, the aggregate ROE of the Bangladeshi banks is also the same as the aggregate ROA. In 2013, it was the highest bank performance in the last 10 years and in 2018 and 2020, the banks generated the lowest ROE (3.86% and 4.28%). But it is a matter of hope that the ROE of the banks in the last year has increased almost twice that of the previous year.

Figure 3.4

Aggregate Returns on Assets of Banks in Bangladesh



Source*:* Annual Report, Bangladesh Bank, 2022

3.2.1 Measurement of Return on Asset (ROA) and Return on Equity (ROE)

The profitability of banks can be measured by the Return

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on Asset (ROA) and Return on Equity (ROE). The performance of Bangladeshi banks in the last 10 years 2013-2024 is shown in Figure-3.9 and Figure-3.10 to get an insight into the banking industry performance in Bangladesh.

The trend of aggregate return on assets presents a summary of bank performance. In the above trend analysis, it is seen that the banks' performance has experienced an up-and-down situation. The performance of banks was the highest in 2013 (0.90%) and the worst in 2019 and 2020 (0.25%). Overall, the bank's performance has fallen by 0.14% from 2013 to 2024 which is not a good sign for Bangladeshi Banks.

Table-3.1

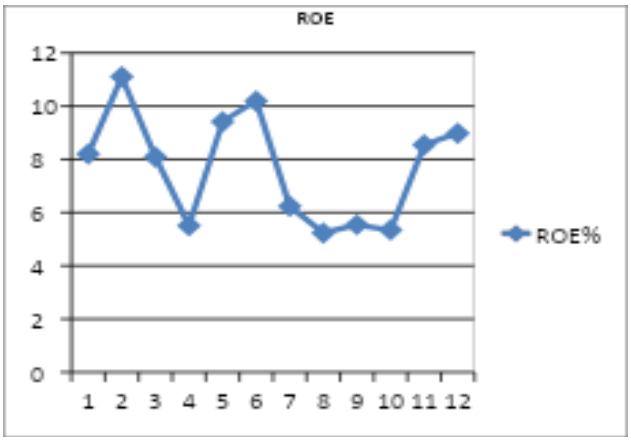
Return on Assets (ROA) by Types of Banks (in percent)

Return on Asset ((ROA)										
Types	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024 (June)
SCBs	0.59	-0.55	-0.04	-0.16	0.21	-1.3	-0.61	-1.07	-0.68	0.21
SBs	-0.4	-0.68	-1.15	-2.8	-0.62	-2.77	-3.31	-3.01	-3.03	-3.31
PCBs	0.95	0.99	1	1.03	0.89	0.79	0.77	0.7	0.62	0.59
FCBs	2.98	3.38	2.92	2.56	2.24	2.23	2.3	2.13	1.17	2.57
Total	0.9	0.64	0.77	0.68	0.74	0.25	0.43	0.25	0.25	0.52

Source*:* Annual Report, Bangladesh Bank, 2024

Figure - 3.6

Aggregate Return on Equity of Banks in Bangladesh



Source*:* Annual Report, Bangladesh Bank, 2024

In 2022, the ROE of Bangladesh's banking sector has increased by 4.93% which is also more than 100% growth, making it one of the most profitable in the world. Table-3.2 provides an overview of the consequences caused by the epidemic. In 2019, the ROA for the industry was 6.83%, but it dropped to 4.28% in 2020. Yet, the market demonstrated a significant amount of growth in 2022 too, accounting for 9.37% of ROE. Apart from SBs, all the other banks saw positive profitability growth.The profitability increased by 27.04% for SCBs, 8.44% for FCBs and 0.04% for PCBs.

Table - 3.2

Return on Equity (ROE) by Types of Banks (in percent)

ROE										
Types	2014	2015	2016	2017	2018	2019	2020	2022	2023	2024(June)
SCBs	10.93	-13.46	-1.47	-6.02	3.45	-29.61	-13.68	-29.57	-21.61	5.43
SBs	-5.81	-5.97	-5.79	-13.88	-3.07	-13.47	-17.04	-13.85	-13.21	-13.68
PCBs	9.76	10.26	10.75	11.09	12.01	10.98	11.16	10.22	9.34	9.38
FCBs	16.93	17.67	14.59	13.08	11.31	12.42	13.43	13.1	7.59	16.03
Total	11.1	8.09	10.51	9.42	10.6	3.86	6.83	4.28	4.44	9.37

Source*:* Annual Report, Bangladesh Bank, 2024

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3.2.2 Measurement of Net Interest Margin (NIM) important determinant

Net Interest Margin (NIM) is one of the important determinants for analyzing the operational efficiency and performance of a bank. Table -3.3 reveals that the Net Interest Margin for the banking sector decreased to 2.5% in 2021 from 2.7% in 2020. These data also indicate that PCBs and FCBs have continuously maintained an NIM that is greater than the market average. In 2013, the NIM for SCBs was negative, but between 2014 and 2021, it progressively increased. Although the NIM for the total banking industry climbed significantly in 2018, the trend from 2014 to 2021 was clearly downward. The NIM for all banks reached 2.4% at the end of June 2022 as revealed in Table-3.4.

Table-3.3
Net Interest Margin (NIM) for Different Banks

(in percent)

Bank Types	2013	2014	2015	2016	2017	2018	2019	2020	2021	End June 2022
SCBs	-0.3	2.0	1.6	1.8	2.0	2.4	1.9	1.8	1.6	1.9
SBs	2.0	1.5	1.4	0.8	2.1	0.6	0.0	-0.2	-0.6	-0.6
PCBs	2.8	4.1	3.9	3.9	3.5	3.6	3.5	3.0	2.9	2.5
FCBs	3.7	6.0	6.1	5.0	4.4	4.4	4.2	4.1	3.0	3.0
Total	**2.0**	**3.6**	**3.3**	**3.3**	**3.1**	**3.2**	**3.1**	**2.7**	**2.5**	**2.4**

Source: Department of Off-site Supervision, Bangladesh Bank.

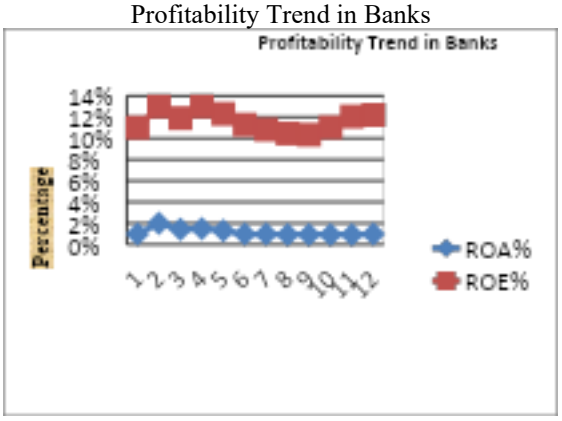
Source: Annual Report, Bangladesh Bank, 2022

The Bangladeshi banking industry's NIM has decreased in recent years. Increased competition among banks, particularly in the retail banking market, is a significant contributor to this decline. Some banks have decreased their lending rates in an attempt to attract new customers as a result of increased competition caused by a bigger number of banks on the market. As a consequence of the reduction in interest rates, banks' net interest margins are decreasing (NIM).

The decreasing interest rate environment in Bangladesh has also contributed to the decline in NIM. Bangladesh Bank has decreased the policy interest rate in recent years, resulting in a decline in bank deposit rates. As a result, banks have reduced their deposit interest rates, which have reduced their financing costs and net interest margin (NIM).

Moreover, the increase in NPLs has had an effect on the NIM of banks in Bangladesh. The rise in nonperforming loans needed by these banks has reduced their interest income and, therefore, their net interest margin (NIM). Numerous sectors, including textiles, manufacturing, and hospitality, have witnessed an increase in nonperforming loans as a result of the pandemic-caused economic slowdown.

Figure-3.6
Profitability Trend in Banks



Source: Annual Report, Bangladesh Bank, 2024

Commercial bank's profitability is one of the major determinants of the financial performance of of banking industry. It is generally measured by the ROA and ROE of banks. In order to capture the the above mentioned parameters the Bangladesh banking industry's profitability was shown in Figure-3.11 with respect to ROA and ROE. It is revealed from Figure-3.6 that ROA and ROE has been showing constantly decreasing trends for the years 2013 to 2024.

IV. MEASUREMENT OF QUALITY OF ASSETS AND NON-PERFORMING LOAN

4.1. The Ratio of Non-performing Loans (NPLs)

The ratio of non-performing loans (NPLs) is one of the most significant indicators of a bank's asset quality because it shows the share of loans that are either in default or that have been overdue for a particular period of time. In recent years, Bangladesh's banking system has struggled to maintain a low level of nonperforming loans (NPLs) due to factors such as inadequate governance, the consequences of the COVID-19 pandemic, and lax lending rules.

4.2. The Ratio of Gross and Net NPLs

The ratio of gross NPLs to total loans, as well as the ratio of net NPLs to net total loans, is the most significant indicator of asset quality. The banking industry as a whole has a gross nonperforming loan ratio of 8.93% at the end of December 2022. In the last month of 2022, Table- 3.6 reveals that FCBs had the lowest gross NPL ratio, while SCBs had the highest. FCBs (4.29%) had the lowest gross NPL ratio compared to SCBs (19.28%), PCBs (5.31%), and SBs (12.02%) at the end of December 2022.

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Table - 3.6
Gross NPL to Total Loan in case of four types of Bangladesh

(in percent)

Bank Types	2013	2014	2015	2016	2017	2018	2019	2020	2021	End June 2022
SCBs	19.8	22.2	21.5	25.0	26.5	30.0	23.9	20.9	19.3	21.9
SBs	26.8	32.8	23.2	26.0	23.4	19.5	15.1	13.3	12.0	11.7
PCBs	4.5	4.9	4.9	4.6	4.9	5.5	5.8	4.7	5.3	6.0
FCBs	5.5	7.3	7.8	9.6	7.0	6.5	5.7	3.5	4.3	4.4
Total	**8.9**	**9.7**	**8.8**	**9.2**	**9.3**	**10.3**	**9.3**	**7.7**	**7.9**	**9.0**

Source: Banking Regulation and Policy Department, Bangladesh Bank

Source*:* Annual Report, Bangladesh Bank, 2022

The ratio of gross non-performing loans to total loans and advances for the banking industry between 2013 and June 2022 is shown in Table 3.6. In 2013, the nonperforming loan ratio for the banking sector was 8.9%.

4.3. Non-Performing Loans (NPLs) for Different Types of Banks

The current situation of SCB and SB asset quality may be attributable to relatively poor appraisal and inadequate loan monitoring and supervision. Low asset quality in SBs has been demonstrated to be connected with both poor governance and a lack of accountability.

Nonetheless, banks have adopted a variety of measures (such as boosting the recovery unit and developing a specific recovery program) to enhance loan recovery. Restructuring, rescheduling, reducing interest, and erasing classified loans are but a few of the policy measures implemented by BB to reduce NPLs. At the end of 2022, the ratio of net non-performing loans (net of provisions and interest suspense) to net total loans was negative (-0.4%), as shown in Table 3.7 By the end of December 2022, the net nonperforming loan ratios for SCBs, SBs, PCBs, and FCBs were 2.5%, 0.4%, -1.1%, and 0.7%, respectively.phenomenology. There exist subtle differences between these two research philosophies as per three dimensions: axiology, ontology and epistemology.

Table- 3.7
NPL in Different Types of Banks in Bangladesh

(in billion BDT)

Bank Types	2013	2014	2015	2016	2017	2018	2019	2020	2021	End June 2022
SCBs	166.1	227.6	237.5	310.3	373.3	487.0	439.9	422.7	449.8	554.3
SBs	83.6	72.6	49.7	56.8	54.3	47.9	40.6	40.6	39.9	41.9
PCBs	143.1	184.3	207.6	230.6	294.0	381.4	441.7	403.6	515.2	626.8
FCBs	13.0	17.1	18.9	24.1	21.5	22.9	21.0	20.4	27.9	29.6
Total	**405.8**	**501.6**	**513.7**	**621.8**	**743.1**	**939.2**	**943.3**	**887.3**	**1032.7**	**1252.6**

Source: Banking Regulation and Policy Department, Bangladesh Bank

Source*:* Annual Report, Bangladesh Bank, 2022

Among the four types of banks, SPBs had the lowest NPA ratio, indicating a more successful approach to risk management. State-controlled banks (SCBs) are government-owned financial institutions that have traditionally failed to maintain healthy loan portfolios due to poor management, political interference, and a lack of accountability. To reduce SCBs' nonperforming loan (NPL) levels, the Bangladesh Bank has worked to improve their governance and efficiency.

V. METHODOLOGY

Sampling the population used in this study is banking companies classified as a State-Owned Commercial Bank and a National Private Commercial Bank in Bangladesh from 2012 to 2024. Both State-Owned and Private Commercial Banks had the following characteristics:

It is not an Islamic bank. Researcher has complete annual reports from 2014–2024 Based on the characteristics mentioned above, the number of banks that could meet the criteria were 94 banks, consisting of 29 state-owned commercial banks and 65 national private banks.

This research focused only on Bangladesh-based commercial banks; so quite naturally, Bangladesh based all the commercial banks constituted the population. There exist variations in the business model since Islamic banks follow Shariah principle and commercial banks do not follow Shariah principle. The researcher employed purposive sampling [also known as judgemental or subjective sampling] for this research. Research philosophy refers to the conceptual framework of the research process that determines how the research objectives will be achieved (Saunders et al., 2007). So, research philosophy actually guides the researcher in several stages – null hypothesis formation, data collection, interpretation of results. Research philosophy can be broadly categorized into two streams – positivism and

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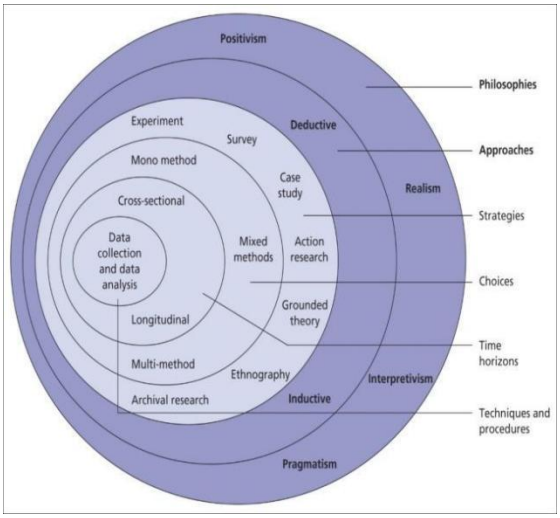
Figure 1: Saunders's Research onion



Source: Saunders et al. (2007)

Research philosophy actually guides the researcher in several stages – null hypothesis formation, data collection, interpretation of results. Research philosophy can be broadly categorized into two streams – positivism and phenomenology.

The researcher specifically tried to focus on commercial bank's profitability and that why she purposely chosen only non-Islamic commercial banks. The researcher has used panel database. The research time period spanned from 2012 to 2024. It is worth mentioning that there is a systematic lag of one with respect to annual data. This panel database had both cross-sectional and time-series variations.In order to understand the determinant factors of commercial bank's profitability, the researcher has run a series of regressions. Now, the researcher will present the specifications related to the regression analysis.

$ROA_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + a_i + \Delta_t + \varepsilon_{i,t}$ [Model I]

$CAPE_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + a_i + \Delta_t + \varepsilon_{i,t}$ [Model II]

If the regression parameter is unbiased, then the expected value of sample statistics is equal to the true population parameter (Woolridge, 2015). The OLS pre-conditions are as follows:

- The estimated relationship projected between the factor and independent variable is linear.
- The data is collected through random sampling.
- Zero conditional mean: E [u|X] = 0
- There exists no perfect multicollinearity among the pairs of independent variables.
- Non-zero variance in all the independent variables.

Given, these pre-conditions in a single factor model, we can estimate beta estimators using the following way.

$$\hat{\beta}1 = \frac{Covariance}{Variance} = \frac{\sum (yi-\underline{y})(xi-\underline{X})}{\sum(xi-\underline{X})^2} = \frac{\sum (yi\,(xi-\underline{X})}{\sum(xi-\underline{X})^2}$$

[Alternatively $\hat{\beta}1 = \frac{\sum Cov(xi,yi)}{\sum(xi-\underline{X})^2}$

$$= \frac{\sum (\beta o + \beta 1\, Xi + ui)(xi-\underline{X})}{\sum(xi-\underline{X})^2}$$ [Note: in the population model: $Yi = \beta_o + \beta_1 Xi + ui$]

$$= \frac{\sum (\beta o + \beta 1\, Xi + ui)(xi-\underline{X})}{Var\,(xi)}$$

$$= \frac{\sum \beta o(xi-\underline{X})}{Var\,(xi)} + \frac{\sum \beta 1 Xi(xi-\underline{X})}{Var\,(xi)} + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$$= \beta o \frac{\sum (xi-\underline{x})}{Var\,(xi)} + \beta 1 \frac{\sum Xi(xi-\underline{X})}{Var\,(xi)} + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$$= \beta o * 0 + \beta 1 \frac{var(xi)}{Var\,(xi)} + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$[\sum (xi-\underline{x}) = 0;\ \sum Xi(xi-\underline{X}) = var(xi)]$]

$$= 0 + \beta 1 * 1 + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$$\hat{\beta}1 = \beta 1 + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

There is no other way to simply the expression any more. In order to simply this expression further, the researcher is going to use expectation operator. By taking expectation operator in both the sides:

$$E(\hat{\beta}1) = E\left[\beta 1 + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}\right]$$

$$= E(\beta 1) + E\frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)} = \beta 1 + \frac{E(\sum ui\,(xi-\underline{x})}{E\,[var\,(xi)]} = \beta 1 + \frac{E(\sum ui\,(xi-\underline{x})}{var\,(xi)}$$ [note: E(constant) = constant]

$$E(\hat{\beta}1) = \beta 1 + \frac{E(\sum ui\,(xi-\underline{x})}{var\,(xi)}$$

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$\rightarrow E(\hat{\beta}1 \mid xi) = \beta1 + \frac{E(\sum ui\,(xi-\underline{x}) \mid Xi)}{var\,(xi)}$

Since we are running a CLRM, the mean independence condition must have been fulfilled. And Mean independence: E[ui | Xi]= 0; E(uixi) = 0

$\rightarrow E(\hat{\beta}1 \mid xi) = \beta1 + \frac{E(uixi \mid Xi)}{Var(xi)} * - \frac{E(ui\underline{x}) \mid xi)}{Var\,(xi)}$

$\rightarrow E(\hat{\beta}1 \mid xi) = \beta1 + 0$

$\rightarrow E(\hat{\beta}1 \mid xi) = \beta1$

By taking expectation operator in both the sides:

$E[E(\hat{\beta}1 \mid xi)] = E[\beta1]$

$E(\hat{\beta}1) = \beta1$ [proved]

This single factor regression model-based proof of unbiasedness can be extended in a multi-factor model and the research area of interest revolves around a multi-factor model [where commercial banks' profitability is dependent on a number of factors] (Woolridge,2015). So, the above-mentioned proof of unbiasedness is a legit framework in a multi-factor model.

Consistency of regression estimators: If the regression parameter is consistent, then when sample size increases, the sample beta statistics converges to the true population parameter (Woolridge, 2015). The OLS pre-conditions are as follows:

The OLS pre-conditions are as follows:

- The estimated relationship projected between the factor and independent variable is linear.
- The data is collected through random sampling.
- The covariance [hence correlation] between independent variables and error is zero.
- There exists no perfect multicollinearity among the pairs of independent variables.
- Non-zero variance in all the independent variables.

Given, these pre-conditions in a single factor model, we can estimate beta estimators using the following way.

I. $\hat{\beta}1 = \frac{Covariance}{Variance} = \frac{\sum (yi-\underline{y})(xi-\underline{X})}{\sum(xi-\underline{X})^2} = \frac{Cov\,(xi,yi)}{\sum(xi-\underline{X})^2}$

II. $= \frac{cov(xi,\beta0+\beta1xi+ui)}{\sum(xi-\underline{X})^2}$ [Note: in the population model: $Y_i = \beta_o + \beta_1 Xi + ui$]

III. $= \frac{cov(xi,\beta0+\beta1xi+ui)}{Var\,(xi)}$

IV. $= \frac{cov\,(\beta o,xi)}{Var\,(xi)} + \frac{cov\,(\beta1xi,xi)}{Var\,(xi)} + \frac{cov\,(ui,xi)}{Var\,(xi)}$

$= 0 + \beta1 \frac{cov\,(xi,xi)}{Var\,(xi)} + \frac{cov\,(ui,xi)}{Var\,(xi)}$ [cov(constant, xi)=0]

$= \beta1 \frac{var(xi)}{Var\,(xi)} + \frac{cov\,(ui,xi)}{Var\,(xi)}$ [cov(xi,xi)=var(xi)]

$= 0 + \beta1 * 1 + \frac{cov\,(ui,xi)}{Var\,(xi)}$

$\hat{\beta}1 = \beta1 + \frac{cov\,(ui,xi)}{Var\,(xi)}$

There is no other way to simply the expression any more. In order to simply this expression further, the researcher is going to use plim operator. By taking plim operator in both the sides:

$Plim\ \hat{\beta}1 = plim\,[\beta1 + \frac{cov\,(ui,xi)}{Var\,(xi)}]$

$= plim(\beta1) + \frac{plim\,[cov(ui,xi)]}{plim\,[var\,(xi)]}$

$= \beta1 + \frac{0}{var\,(xi)}$ [note: plim [cov(ui, xi) = 0]

$= \beta1$

$\hat{\beta} = \beta1$ [proved]

This single factor regression model-based proof of consistency can be extended in a multi-factor model and the research area of interest revolves around a multi-factor model [where commercial banks' profitability is dependent on a number of factors] (Woolridge,2015). So, the above-mentioned proof of consistency is a legit framework in a multi-factor model.

Efficiency of regression estimators*:* If the regression parameter is efficient, then the beta coefficient's variance should be the lowest among all other beta coefficients estimated through MLE and MM methodology (Woolridge, 2015). The OLS pre-conditions are as follows:

The OLS pre-conditions are as follows:

The estimated relationship projected between the factor and independent variable is linear.

The data is collected through random sampling.
Homoscedasticity: Var [u|X] = Constant
There exists no perfect multicollinearity among the pairs of independent variables.

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V. Non-zero variance in all the independent variables.

Given, these pre-conditions in a single factor model, we can estimate beta estimators using the following way.

$$\hat{\beta}1 = \frac{Covariance}{Variance} = \frac{\sum (yi-\underline{y})(xi-\underline{X})}{\sum(xi-\underline{X})^2} = \frac{\sum (yi\,(xi-\underline{X})}{\sum(xi-\underline{X})^2}$$

[Alternatively $\hat{\beta}1 = \frac{\sum Cov(xi,yi)}{\sum(xi-\underline{X})^2}$]

$$= \frac{\sum (\beta o + \beta 1\, Xi + ui)(xi-\underline{X})}{\sum(xi-\underline{X})^2}$$ [Note: in the population model: $Yi = \beta_o + \beta_1 Xi + ui$]

$$= \frac{\sum (\beta o + \beta 1\, Xi + ui)(xi-\underline{X})}{Var\,(xi)}$$

$$= \frac{\sum \beta o(xi-\underline{X})}{Var\,(xi)} + \frac{\sum \beta 1 Xi(xi-\underline{X})}{Var\,(xi)} + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$$= \beta o \frac{\sum (xi-\underline{x})}{Var\,(xi)} + \beta 1 \frac{\sum Xi(xi-\underline{X})}{Var\,(xi)} + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$$= \beta o * 0 + \beta 1 \frac{var(xi)}{Var\,(xi)} + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$[\sum (xi-\underline{x}) = 0; \sum Xi(xi-\underline{X}) = var(xi)]$

$$= 0 + \beta 1 * 1 + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

$$\hat{\beta}1 = \beta 1 + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}$$

There is no other way to simply the expression any more. In order to simply this expression further, the researcher is going to use 'Var' operator. By taking variance operator in both the sides:

$$Var\,(\hat{\beta}1|X) = Var\,[\beta 1 + \frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}|X]$$

$$= Var\,(\beta 1|X) + Var[\frac{\sum ui\,(xi-\underline{X})}{Var\,(xi)}|X] = 0 + \frac{Var\,(\sum ui\,(xi-\underline{x})}{Var\,[var\,(xi)|X]}|X] = \frac{var\,(x)\sum (xi-\ddot{x})^2}{\sum (xi-\ddot{x})^4}$$

$$Var\,(\hat{\beta}1|X) = \frac{var\,(x)}{\sum (xi-\ddot{x})^2} = \text{constant}$$

[Proved]

So, under homoscedasticity assumption, the variance of OLS estimators is constant. On the other hand, if the variances are not constant then, $Var\,(\hat{\beta}1|X) = f(X)$.This single factor regression model-based proof of efficiency can be extended in a multi-factor model and the research area of interest revolves around a multi-factor model [where commercial banks' profitability is dependent on a number of factors] (Woolridge,2015). So, the above-mentioned proof of efficiency is a legit framework in a multi-factor model.

VI. RESULT AND FINDINGS

Determinants of Commercial banks' Profitability:

In order to estimate a determinant model for bank's profitability, The researcher has run a number of panel regressions. Before running panel regressions, it was important to determine whether the estimated effects would be a random-effects or a fixed effects model. At a conceptual level, making this choice is relatively easier. A fixed-effects model posits that there exists cross-sectional heterogeneity in the dataset and it can be managed within the given structure. On the other hand, in case of random-effects model, it is assumed that there exists no cross-sectional heterogeneity – a very restrictive and impractical assumption. By performing the Wu-Durbin-Hausman test, one can also determine whether a fixed-effects model or a random effects model to better suit the purpose. The null and alternative hypothesis related to the Wu-Durbin-Hausman test are as follows:

Null hypothesis: The given panel regression can be better explained by random effects framework.

Alternative hypothesis: The given panel regression can be better explained by fixed effects framework.

Based on a 95% confidence level, these hypotheses were tested. For all the regression models, the preferred model is fixed effects model. Panel regressions are run within the OLS framework and that is why panel regressions must meet certain OLS pre-conditions.

The estimated relationship projected between the factor and independent variable is linear.
The data is collected through random sampling.
The covariance [hence correlation] between independent variables and error is zero.
There exists no perfect multicollinearity among the pairs of independent variables.

The first and the third specified assumption are not always realistic. That is why the major objective of was to estimate consistent regression estimates. For ensuring consistency in the regression parameters, the sample size should be increased. Now, the researcher is going to present the panel regression models.

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$ROA_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + a_i + \Delta_t + \varepsilon_{i,t}$

In the above-mentioned model, ROA is the dependent variable and the researcher has tried to estimate a determinant model for ROA. $\varepsilon_{i,t}$ refers to the disturbance element and it can be decomposed into three sub-components such as – cross-sectional, time invariant heterogeneity (ω_i), time effect (δ_t) and noise ($\gamma_{i,t}$).

Table 1: Baseline Regression results

	(1)
VARIABLES	ROA
Size	0.00603**
	2.069
Capital Adequacy	-0.0268***
	(-7.454)
Activity Mix	0.0145**
	(2.027)
Asset Quality	0.000175
	(0.558)
NIM	0.611***
	(19.17)
HHI	0.177
	(0.398)
Cost Management	0.00437*
	(1.885)
Interest Rate	0.182
	(0.424)
Inflation	-0.00770
	(-1.111)
GDP Growth Rate	0.0893
	(1.298)
Constant	0.0370
	(0.673)
Observations	298
R-squared	0.746
Number of Firm Code	23
Firm FE	Yes
Firm Cluster	No
seasonal adjustment	No
R2 within	0.746
R2 overall	0.571
R2 between	0.0800
F-stat	77.96
Prob > F	0
t-statistics in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Complied by: The researcher

Interpretation of the first baseline regression:

- Conceptual framework: The researcher has tried to understand the relationship between ROA and various firm-specific and macro-economic variables through regression.
- Regression sign and magnitude: The individual, factor-specific test of hypothesis was conducted by t-test. The null hypothesis [Ho: $\beta_1 = 0$] is rejected at 5% level of significance. It was evident that business size, activity mix, cost management, interest rate, GDP growth rate, asset quality, net interest margin positively influenced the ROA of commercial banks. It was also evident that capital adequacy and inflation rate negatively influenced the ROA of commercial banks.
- R-square: It refers to the explanatory power of the model. It is around 74%; so, 74% of the changes in the dependent variable (ROA) can be explained by the combined changes in the independent variable.
- Model significance: It was hypothesized that the estimated model is not significant; so, it was assumed that Ho: $\beta_1 = \beta_2 = \ldots = \beta_{10} = 0$. This joint test of hypothesis was conducted through F-test and at a 5% level of significance this joint hypothesis was rejected. So, at least one of the factors is different from zero and it is a significant model to predict ROA.

The second baseline regression model can be represented through the following equation.

Economic $profit_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + a_i + \Delta_t + \varepsilon_{i,t}$

In the above-mentioned model, economic profit is the dependent variable and the researcher has tried to estimate a determinant model for economic profit. $\varepsilon_{i,t}$ refers to the disturbance element and it can be decomposed into three sub-components such as – cross-sectional, time invariant heterogeneity (ω_i), time effect (δ_t) and noise ($\gamma_{i,t}$).

Table 2: Baseline Regression results

	(2)
VARIABLES	Economic Profit

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Size	0.0067
	0.62
Capital Adequacy	-5.728e+08**
	(-2.561)
Activity Mix	1.267e+09***
	2.842
Asset Quality	4.653e+06
	(0.239)
NIM	3.035e+09
	(1.533)
HHI	7.957e+10***
	(2.878)
Cost Management	2.172e+07
	(0.151)
Interest Rate	2.462e+10
	(0.924)
Inflation	4.614e+08
	(1.071)
GDP Growth Rate	4.367e+09
	(1.023)
Constant	-3.674e+09
	(-1.075)
Observations	298
R-squared	0.128
Number of Firm Code	23
Firm FE	Yes
Firm Cluster	No
seasonal adjustment	No
R2 within	0.128
R2 overall	0.115
R2 between	0.0571
F-stat	3.906
Prob > F	5.70e-05
t-statistics in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Complied by: The researcher

Interpretation of the second baseline regression:

- Conceptual framework: The researcher has tried to understand the relationship between economic profit and various firm-specific and macro-economic variables through regression.
- Regression sign and magnitude: The individual, factor-specific test of hypothesis was conducted by t-test. The null hypothesis [Ho: $\beta_1 = 0$] is rejected at 5% level of significance. It was evident that business size, activity mix, cost management, interest rate, GDP growth rate, asset quality, net interest margin positively influenced the economic profit of commercial banks. It was also evident that capital adequacy and inflation rate negatively influenced the economic profit of commercial banks.
- R-square: It refers to the explanatory power of the model. It is around 13%; so 13% of the changes in the dependent variable (economic profit) can be explained by the combined changes in the independent variable.
- Model significance: It was hypothesized that the estimated model is not significant; so it was assumed that Ho: $\beta_1 = \beta_2 = \ldots = \beta_{10} = 0$. This joint test of hypothesis was conducted through F-test and at a 5% level of significance this joint hypothesis was rejected. So, at least one of the factor is different from zero and it is a significant model to predict economic profit.

The third baseline regression model can be represented through the following equation.

$CAPE_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + a_i + \Delta_t + \varepsilon_{i,t}$

In the above-mentioned model, CAPE is the dependent variable and the researcher has tried to estimate a determinant model for CAPE. $\varepsilon_{i,t}$ refers to the disturbance element and it can be decomposed into three sub-components such as – cross-sectional, time invariant heterogeneity (ω_i), time effect (δ_t) and noise ($\gamma_{i,t}$).

Table 3: Baseline Regression results

	(3)
VARIABLES	CAPE
Size	1.750
	0.726
Capital Adequacy	-2.921
	(-0.981)
Activity Mix	10.27*
	1.732
Asset Quality	0.102
	(0.396)
NIM	7.916
	(0.301)
HHI	101.6
	(0.276)

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Cost Management	2.529
	(1.319)
Interest Rate	114.6
	(0.323)
Inflation	-3.852
	(-0.672)
GDP Growth Rate	21.72
	(0.382)
Constant	17.32
	(0.381)
Observations	298
R-squared	0.027
Number of Firm Code	23
Firm FE	Yes
Firm Cluster	No
seasonal adjustment	No
R2 within	0.0269
R2 overall	0.0428
R2 between	0.111
F-stat	0.732
Prob > F	0.003
t-statistics in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Complied by: The researcher

Interpretation of the third baseline regression:

- Conceptual framework: The researcher has tried to understand the relationship between CAPE and various firm-specific and macro-economic variables through regression.
- Regression sign and magnitude: The individual, factor-specific test of hypothesis was conducted by t-test. The null hypothesis [Ho: $\beta_1 = 0$] is rejected at 5% level of significance. It was evident that business size, activity mix, cost management, interest rate, GDP growth rate, asset quality, net interest margin positively influenced the CAPE of commercial banks. It was also evident that capital adequacy and inflation rate negatively influenced the CAPE of commercial banks.
- R-square: It refers to the explanatory power of the model. It is around 3%; so, 3% of the changes in the dependent variable (CAPE) can be explained by the combined changes in the independent variable.
- Model significance: It was hypothesized that the estimated model is not significant; so, it was assumed that Ho: $\beta_1 = \beta_2 = \ldots = \beta_{10} = 0$. This joint test of hypothesis was conducted through F-test and at a 5% level of significance this joint hypothesis was rejected. So, at least one of the factors is different from zero and it is a significant model to predict CAPE.

Omitted variable bias: After reviewing the literature, the researcher has identified a number of bank-specific and macro-factors that may have influenced commercial bank's profitability. There are at least three key variables which were omitted from the baseline models. These are:

Liquidity management: Theoretically there should be a negative relationship between liquid cash stacked in the bank's account and standard products used as a storage of liquidity and commercial banks' profitability (Lipunga,2014).

Management efficiency: Managerial efficiency results in reduction in agency cost and therefore these efficiency proxies should be positively connected with the commercial bank's profitability (Bilal et al., 2013)

Labor efficiency: Much like the case with managerial efficiency, commercial banks' profitability is positively connected with commercial banks' profitability (Indranarain, 2009).

The researcher is now going to present the baseline regression results where the partial effect of various factor variables on banks' profitability was assessed along with these three omitted variables.

$ROA_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + \beta_{11}$ Liquidity $proxy_{i,t} + \beta_{12}$ Managerial efficiency $proxy_{i,t} + \beta_{13}$ Labor market $proxy_{i,t} + a_i + \Delta_t + \varepsilon_{i,t}$

$Economic\ Profit_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + \beta_{11}$ Liquidity $proxy_{i,t} + \beta_{12}$ Managerial efficiency $proxy_{i,t} + \beta_{13}$ Labor market $proxy_{i,t} + a_i + \Delta_t + \varepsilon_{i,t}$

$CAPE_{i,t} = \alpha + \sum_{i=1}^{6} \beta_i$ Firm-specific $factors_{i,t} + \beta_7$ Industry-specific factor $+ \sum_{j=1}^{3} \beta_j$ Macro-economic $factors_t + \beta_{11}$ Liquidity $proxy_{i,t} + \beta_{12}$ Managerial efficiency $proxy_{i,t} + \beta_{13}$ Labor market $proxy_{i,t} + a_i + \Delta_t + \varepsilon_{i,t}$

Case of all the baseline regression models, once the omitted variables were introduced into the models. It was also evident that capital adequacy and banks' performance is negatively related and the regression coefficient is significant in case of all the baseline regression models, once the omitted variables were

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introduced in the models. It is worth mentioning that the overall baseline models are statistically significant.

Table 4: Omitted variable bias

VARIABLES	Model 1	Model 2	Model 3
	ROA	Economic profit	CAPE
Size	0.0089	0.00583	2.74838
	2.95867	0.6572	0.95106
Capital Adequacy	-1.03832***	-6.18**	-3.82651**
	-1.6592	-2.714	-1.2811
Activity Mix	0.020735	1.34E+09	13.4537
	2.89861	3.01252	2.26892
Asset Quality	3.025**	4.989*	6.13362**
	.79794	.25334	.51876
NIM	0.87373	3.22E+09	1.36996
	2.4131	1.62498	0.39431
HHI	-0.25311	-8.43E+10	-3.096
	-0.56914	-3.05068	-0.36156
Cost Management	0.006249	2.302	3.31299
	2.69555	0.16006	1.72789
Interest Rate	-0.26026	-2.61E+10	-0.126
	-0.60632	-0.97944	-0.42313
Inflation	-0.01101	-4.89E+08	-5.04612
	-1.58873	-1.13526	-0.88032
GDP Growth Rate	0.127699	4.63E+09	2.4532
	1.85614	.08438	-.50042
Liquidity	-.564764	-3.005	-2.06048
	-1.31571	-2.12538	-0.2031
Managerial efficiency	0.02389	0.987	2.42214
	3.44754	2.46351	0.42255
Labor efficiency	0.277107	0.009	3.65754
	4.02782	2.3531	0.2402
Constant	-2.098	-3.989	-3.02
	0	0	0
Observations	298	298	298
R-squared	0.342	0.319	0.311
Number of Firm Code	23	23	23
Firm FE	Yes	Yes	Yes
Firm Cluster	No	No	No
seasonal adjustment	No	No	No
R2 within	0.017	0.052	0.034
R2 overall	0.086	0.015	0.032
R2 between	0.231	0.256	0.312
F-stat	1.860	1.045	2.067
Prob > F	0.003	0.012	0.032
t-statistics in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Complied by: The researcher

The individual, factor-specific test of hypothesis was conducted by t-test. The null hypothesis [Ho: $\beta_1 = 0$] is rejected at 5% level of significance. It was evident that asset quality and banks' performance is positively related and the regression coefficient is significant in

VII. FINDS AND CONCLUSION

Commercial banks play a pivotal role in driving a nation's economic growth by financing productive investments. In the face of intensifying competition, heightened risk exposure, and rapid technological advancements, these institutions must enhance their operational efficiency to remain resilient and effective. This study examines key bank-specific factors and reveals that these internal dynamics significantly influence the profitability of commercial banks.

The study has designed three determinant models for Bangladesh based commercial bank's profitability. It was evident in the regression results that a number of bank-specific, macro-economic and industry-specific variables influence commercial banks' profitability.

The substantial features and contribution of this research are provided below:
Based on the PCA results, it was concluded that 'dimension reduction' would not be an appropriate approach to understanding the profitability determinants of Bangladesh-based commercial banks since the first two principal components can together explain only 45% of the total variation.
The researcher designed three regression models for the profitability of Bangladesh-based commercial banks. The profitability of commercial banks was defined through three perspectives: accounting profit (measured through ROA), economic profit (measured through residual income), and the market's perception of profit (measured through CAPE). It was evident that several bank-specific, macroeconomic, and industry-specific variables influence commercial banks' profitability.
The regression results showed that factors such as business size, activity mix, cost management, interest rate, GDP growth rate, asset quality, and net interest margin positively impacted commercial banks' accounting profitability. Conversely, capital adequacy and inflation rate were found to negatively affect accounting profitability.

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It was documented that factors such as business size, activity mix, cost management, interest rates, GDP growth rate, asset quality, and net interest margin had a positive impact on the economic profitability of commercial banks. In addition, capital adequacy and the inflation rate were found to negatively impact economic profitability.

Similarly, business size, activity mix, cost management, interest rates, GDP growth rate, asset quality, and net interest margin were also observed to positively influence market-based profitability measures for commercial banks, while capital adequacy and inflation rate had a negative effect.

It was observed that the estimated effects are robust to model preference as the regression sign does not flip and the level of significance does not change when the researcher uses a random effects model. Likewise, similar types of results can be extracted if MLE or GMM estimation techniques are introduced instead of the OLS framework. The study documented that the estimated effects are robust to out-of-the-sample contexts [using a 70%-30% training-testing split]. The results showed that asset quality remained positively correlated with bank performance, and capital adequacy remained negatively correlated, with both coefficients remaining significant across all baseline models when the alternative definitions were applied. The researcher did not observe any signs of cross-sectional heterogeneity in the estimated effects.

LIST OF ACRONYMS

Acronym	Full Form
AQ	Asset Quality
BB	Bangladesh Bank
CA	Capital Adequacy
CAPE	Cyclically-Adjusted Price to Earnings
CAR	Capital Adequacy Ratio
EP	Economic Profit
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
HHI	Herfindahl-Hirschman index
MLE	Maximum Likelihood Estimation
NIM	Net Interest Margin
NPL	Non-Performing Loan
OLS	Ordinary Least Square
PFP	Partial Factor Productivity
ROA	Return on Asset
ROE	Return on Equity

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