Factors influencing commercial bank profitability in Bangladesh: a panel data approach

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Abstract

This research is one of the few studies that examine the association of bank-specific determinants and macroeconomic factors with profitability in the banking industry of a developing country. This paper evaluates how bank-specific factors and macroeconomic determinants affect the profitability of commercial banks in Bangladesh. This study demonstrates that bank-specific factors and macroeconomic determinants are crucial catalysts in ensuring financial institutions' continuity and stable performance. The paper uses return on assets (ROA) as a proxy of bank profitability. The study also employs a group of explanatory variables, such as bank-specific determinants, which include capital adequacy (CAD), bank branches, asset management, deposit (DEP), and assets quality. The paper also considers gross domestic product, inflation rate (IF), exchange rate (EXR), and stock traded as macroeconomic variables. Pooled, fixed, and random effects models and unit root tests are employed on panel data for 24 commercial banks listed in Dhaka stock exchange from 2014 to 2020. The study results indicate that all bank-specific factors except CAD and DEP affect ROA statistically significantly. The paper also shows that among the macroeconomic determinants, IF has a significant and positive effect on ROA, while EXRTE significantly negatively impacts bank profitability. The findings of this paper are limited to the banking industry in Bangladesh, and it will provide valuable insights for future studies.

Keywords Bank, Macroeconomic, ROA, Panel data, Bangladesh
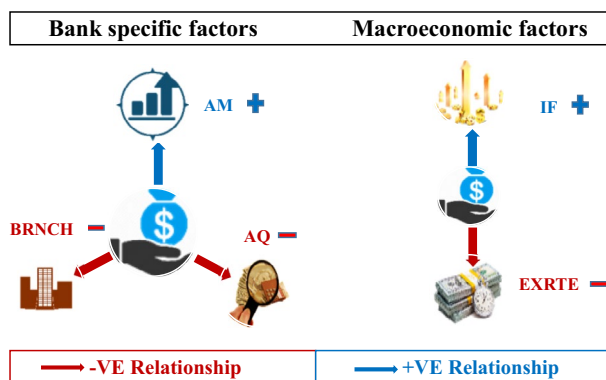
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Graphical abstract

Introduction

Bangladesh is one of the fastest-growing economies in South Asia, with its expanding financial system distinguished by a diverse array of financial institutions [82]. According to Bangladesh Bank (Central Bank of Bangladesh), there are four types of scheduled banks in Bangladesh (61 banks in total) depending on the ownership structure in the Fiscal Year 2021 (FY21). They are State-owned Commercial Banks (SCBs), Specialized Banks (SBs), Private Commercial Banks (PCBs), and Foreign Commercial Banks (FCBs). In December 2019, the number of branches of the bank was 10,578, which increased to 10,752 in December 2020. Moreover, banking sector deposits were BDT 12145.3 billion in 2019, which increased by 13.6% to BDT 13797.93 billion in 2020.

The operational performance of a nation's banking industry determines how the economy flourishes [67]. A credible and effective banking system must accomplish three things: it must generate an adequate profit, offer clients top-notch services, and keep enough cash on hand to lend to borrowers. At the micro-level, profit is a decision factor and essential for any competitive financial institution. Every bank aims to earn adequate revenue to remain in operation, especially given the intensifying competition in the financial markets. A robust banking system should withstand adverse shocks from outside sources and maintain the stability of the bank's performance on a larger scale [65].

Although research on factors affecting bank profitability is several in advanced economies, there needs to be more research in emerging economies [4]. Knowing the factors that affect bank profitability is crucial and fundamental for policymakers since the banking sector's stability is essential to the economy's survival as a whole [52]. As a result, researchers used a variety of criteria to assess the significant factors that influence the continuity and steady performance of financial institutions. For instance, Abbas et al. [2] and Wang et al. [120] identified technology, information exchange, and innovation processes as essential components of the organization's performance.

As a result, policymakers and finance academics should be more interested in examining the performance of commercial banks in Bangladesh in this environment. Therefore, this study aims to examine how macroeconomic determinants and bank-specific factors influence the performance of commercial banks in Bangladesh. The study is unique in particular for two distinctive features: first, this paper employs some new variables that have never been used in the context of Bangladesh to assess their relationship with the performance of the banks, for example, stocks traded (turnover ratio of domestic shares) and the number of the branches of commercial banks. Second, this is the first study to examine the effects of internal and external factors on bank profitability following the two most discussed events in the banking history of Bangladesh, the Basic Bank and Farmers Bank loan scams.

Between 2009 and 2013, when Sheikh Abdul Hye Bachchu was the bank's chairman, the Bangladesh Bank assessed that Basic Bank had defrauded it of 45 billion BDT through loan forgeries. Following the Basic Bank loan scandals, the banking industry has considerably boosted the voluntary disclosure of details financial information to reclaim its credibility, which may have influenced commercial banks' profitability [112]. Moreover, the latest generation private sector bank, Farmers Bank, posted a net loss of BDT 530 million in 2016 because of the default loan, posing a systemic risk to the banking industry. As a result, Bangladesh

Bank has taken several steps to prevent this occurrence from happening again [9]. However, several macroeconomic problems, such as inflation and exchange rates, are also significantly impacting the banking sector. For these reasons, this study emphasizes how important it is for policymakers and academics to focus on bank-specific factors and macroeconomic determinants that would have impacted Bangladesh's commercial banks' profitability. Future studies could extend this research contribution by integrating other macroeconomic and bank-specific variables.

The current study has several sections. The introduction is given in the paper's first section, and the literature review's analysis, including its summary, is given in the second section. The determinants of profitability of commercial banks in Bangladesh are discussed in chapter three, along with the Framework of the study. Chapter four's main topics are the hypothesis and methodology, which include samples, data collection, model specification, and econometric tools. The data analysis and results are discussed in chapter five regarding the study objectives and research questions outlined in the introduction section. The results of model discussions concerning the acceptance of the stated hypotheses are explained in chapter six. The study's implications are presented in section seven. The key conclusions are shown in section eight. The limitations and future research directions are discussed in the final part.

Literature review

The factors affecting a bank's profitability have been the subject of a few studies in numerous countries and areas worldwide. Three types of previous research on factors that impact bank profitability exist. First, studies that empirically investigated using a sample of many nations in a single study, for instance, Perera and Wickramanayake [88], analyzed 122 nations, and Masood and Ashraf [75], studied 14 nations. Second, studies in a particular region, for example, Sultana [116], examined the GCC countries, Petria et al. [91] evaluated the EU 27 countries, and Menicucci and Paolucci [77] examined Europe. Finally, researchers have just examined one nation, such as Abid et al. [6] and Bougatef [32] analyzed Tunisia, Tan [117] and Tan et al. [118] examined China, Almaqtari et al. [17], Bose et al. [31], Robin et al. [101] and Singh and Sharma [110] studied Bangladesh, and Bouzgarrou et al. [34] analyzed France (see Table 1).

Although the factors that impact the performance of commercial banks in Bangladesh have been the subject of a few studies such as [4, 104], the current study is the first one to consider stocks traded (turnover ratio of domestic shares) and the number of branches of banks as the independent variables, as well as, examines the substantial factors following the two most discussed events in the banking history of Bangladesh, the Basic Bank and Farmers Bank loan scams.

Although other factors can be used as proxies for bank performance, most experts consider ROA as the most influential variable [12, 98, 110]. However, previous studies have examined various macroeconomic (external) and bank-specific (internal) factors of bank performance and found mixed results [71, 110].

CAD and bank profitability

According to the capital structures, a company needs sufficient current assets to meet its financial obligations, which leads to stable performance that enhance overall company value [51]. It is a crucial ratio for determining capital strength [5, 75, 84]. To examine the relationship between CAD and bank profitability, O'Connell [83] studied CAD and Bank performance in the UK, employing the panel data regression, and the study demonstrated a positive and significant relationship. Similarly, Siddique et al. [109] found a significant positive relationship between these two variables in South Asian countries; also, the results are consistent with the findings of [42, 84]. In contrast, Ref. [126] determined a negative relationship between CAD and firm profitability in Jordan, similar to the findings of [44, 55, 96, 101, 103]. Moreover, Al-Taani [15] and El-Sayed Ebaid [45] showed an insignificant relationship between CAD and firm profitability in Jordan and Egypt.

Deposits and bank profitability

According to economic theory, profitability and risks are positively correlated. Moreover, sufficient deposits are essential to ensure long-term sustainability in the contemporary competitive environment. So, one of the often vital factors used to determine bank profitability in this context is deposits. Several researchers studied the impact of DEP on bank profitability [77, 125]. For example, Godswill et al. [47] conducted a study to examine the relationship between DEP and bank profitability in Nigeria. Employing the panel data regression, the study reported a significant positive relationship between DEP and bank profitability. Similarly, Hirindukawshala and Kushanipanditharathna [54] and Munyambonera [81] showed a significant positive relationship, while O'Connell [83] determined an insignificant relationship in the UK. However, Gul et al. [49] stated a significant negative relationship between the DEP and the profitability of commercial banks in Pakistan.

Table 1 Summary of literature review

	References	Variables/models	Sample	Study period	Country/region	Analysis methods
1	[7]	Return on asset (ROA), return on equity (ROE), capital adequacy, bank size, financial leverage, credit risk, operating efficiency, inflation, gross domestic products (GDP) growth	6	2013–2019	Bahrain	Regression and unit root test
2	[77]	ROE, NPL, GDP, solvency ratio, inflation (INF), interest rates	28	2006–2015	Europe	Regression
3	[16]	ROA, ROE, non-performing loans to total gross loans, regulatory capital to risk-weighted assets, liquid assets to total assets, non-interest expenses to gross income, interest margin to gross income		2005–2013	Chile, Columbia, Honduras, Mexico, Paraguay, El Salvador	Regression
4	[52]	ROA, ROE, net interest margin (NIM), bank size, capital to risk assets ratio, liquidity, non-performing investment, operating efficiency, GDP growth, inflation	8	2010–2017	Bangladesh	Regression
5	[119]	ROA, ROE, NIM, credit-to deposits ratio, NPL, non-interest income share, banking crisis, capital share, bank concentration, stock market capitalization, Lerner index, GDP growth, inflation, trade	–	1996–2017	Central European Countries	Regression
6	[11]	ROA, ROE, NIM, market concentration, inflation rate, liquidity risk, real GDP growth rate, CRIS is credit risk, business mix indicator, capital adequacy and efficiency ratio	25	2001–2015	Nigeria	Ordinary least square, panel unit root test and GMM
7	[60]	ROA, total asset, total equity to total asset, total loans to total asset, deposits to total assets	10	2004–2008	Pakistan	Pooled ordinary least square (POLS)
8	[111]	ROA, NIM, NPL, capital adequacy ratio (CAR), operational cost to revenue, total asset, exchange rate, oil price, consumption of cement and fed rate	26	2007–2018	Indonesia	Regression
9	[26]	ROA, EOE, bank size, capital adequacy, bank risk, operating expenses, profit per employee, inflation, GDP growth	35	2006–2014	Vietnam	Regression and GMM
10	[41]	ROA, liquid assets/total assets, total loans/total deposits, GDP growth, INF	26	2013–2018	Vietnam	Regression and GMM
11	[58]	ROA, ROE, NIM, bank size, equity to total assets, credit risk, liquidity ratio, total loans/assets, GDP growth, INF, interest rate, unemployment, regulatory quality, political instability, government effectiveness	18	2005–2017	Iraq	Regression
12	[19]	ROE, INF, GDP growth, non-interest income/interest income, size square logarithm of total assets, liquidity ratio, loans/deposits ratio, NPL, and CAR	103	2008–2016	MENA	Regression
13	[95]	ROA, NIM, ROE, capital, risk, bank size, ownership structure, non-interest income to total assets, cost/income ratio, off-balance sheet items/total assets, GDP growth and inflation	25	2006–2013	Bangladesh	Regression
14	[104]	ROA, ROE, liquidity risk, credit risk/credit quality, bank operational efficiency, capital efficiency, bank size, GDP, INF	42	2009–2010	Bangladesh	Regression
15	[57]	ROA, ROE, NIM, total interest income, non-interest income, operating expenditure, total deposits, capital, liquidity, GDP growth, INF, interest rate	23	2013–2017	Bangladesh	Regression

Source: Developed by author

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AQ and bank profitability

Although loans enhance a bank's profitability, there are two risks associated with them: credit risk and liquidity risk. Therefore, risk management is crucial to banking operations because of its impact on the banking industry's operational effectiveness [14]. Many researchers employed AQ and bank profitability and demonstrated mixed findings. For example, Doğan and Yildiz [42] studied employing the panel data regression and found a significant positive relationship in Turkey. The result is similar to the findings of [5, 85], who also found a significant positive relationship, whereas Rani et al. [97] reported a significant negative relationship in Ethiopia. However, Al-Matari [14] and Sarkar and Rakshit [106] showed an insignificant relationship between AQ and bank profitability in India and the GCC countries.

AM and bank profitability

The effective control of bank costs demonstrates the effectiveness of bank management. Efficiency in operations refers to the capacity of a bank to make the best use of its resources, provide beneficial results, and monitor its profitability. Asset management assesses how well a bank controls and uses its assets and liabilities. To determine the relationship between the AM and bank profitability, Al-Matari [14] used ordinary least squares (OLS) regression. The study found a significant positive relationship between AM and commercial bank profitability in GCC countries. With similar objectives, Almaqtari et al. [17], Masood and Ashraf [75] and Ongore and Kusa [85] conducted the studies and interpreted the same findings. Moreover, Abbas et al. [1, 3] stated the significant importance of asset management to ensure the stable return of an organization. In comparison, Sarkar and Rakshit [106] showed a significant negative relationship between AM and commercial banks' profitability in India.

Bank branches and bank profitability

According to economic theory, economies or diseconomies of scale may impact bank profitability [87]. The internal variable, like the number of bank branches or size, determines whether there are scale economies or diseconomies [80]. Al-Homaidi et al. [13] examined the relationship between bank branches and bank performance in India. The study demonstrated the significant and positive relationship between the number of branches and bank performance. However, using the linear regression model on 37 commercial banks in Bangladesh [115] showed mixed results, such as a positive relationship between bank size with ROA but an opposite relationship with ROE. Similarly, Gupta and Mahakud [50] reported a significant and negative relationship between the number of branches and bank profitability in India.

GDP and bank profitability

To explain the relationship between GDP growth and bank profitability, we can employ the wealth effect, which states that a gain in GDP denotes economic growth and causes higher aggregate demands and more investments [70]. When investment boosts, businesses borrow money from banks to finance some of their investments, which helps the banking sector expand [70]. Empirical studies found mixed results on the relationship between GDP and bank performance. For example, Sarkar and Rakshit [106] identified a significant positive relationship between gross domestic product (GDP) and bank profitability. Similarly, Adewole et al. [8], Doğan and Yildiz [42] and Olalere et al. [84] revealed a significant positive relationship between GDP and bank performance. While Almaqtari et al. [17] reported negative and significant relationships, Sufian and Habibullah [115] demonstrated an insignificant relationship between GDP and commercial banks' profitability in Bangladesh.

Inflation rate and bank profitability

According to the quantity theory of money, the government's excessive amount relative to the nation's productivity is inflation. Because of this, more people have extra money, which drives up the price of products and services hence production. Previous analyses of banks' profitability have often employed the IF and concluded mixed results [59, 98, 99]. To evaluate the relationship between IF and bank profitability in GCC countries, Rashid and Jabeen [98] used dynamic GMM estimation and showed a significant negative relationship; the results were similar to the findings of [106]. On the contrary, Sufian and Habibullah [115] reported the opposite findings in Bangladesh. Similarly, Almaqtari et al. [17], Doğan and Yildiz [42], O'Connell [83] and Souad [113] indicated a positive and significant relationship. However, Ongore and Kusa [85] implied an insignificant relationship between IF and the profitability of commercial banks in Kenya.

Exchange rate and bank profitability

The International Fisher Effect theory is relevant for this study as it explains the purchasing power of each currency and captures the IF across countries [102]. According to this theory, relatively high nominal interest rates in foreign currencies tend to lose value due to the anticipated IF they cause [73]. For example, Rashid and Jabeen [98] used a dynamic GMM approach to identify the relationship between exchange rate and bank profitability. The author showed that foreign exchange rates significantly impacted commercial banks' profitability in GCC

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countries. Similarly, Elisa and Guido [46] found the foreign exchange rate as a significant positive determinant of European banks' profitability, whereas Al-Homaidi et al. [13] and Keshtgar and Pahlavani [63] reported a significant negative relationship between exchange rates and bank performance in India and Iran.

The turnover of stocks traded and bank profitability

According to the law and finance theory, the effectiveness of compliance influences the degree of appropriation. As a result, the confidence with which people buy securities and participate in financial markets increases the turnover ratio of stocks traded and market capitalization, which positively impacts bank performance [20]. For instance, Milošević-Avdalović [78] studied to measure the relationship between the turnover of stocks traded and the performance of financial institutions in Belgrade and demonstrated a significant positive relationship. Identically, Sausan et al. [107] determined a significant positive relationship in Indonesia, while Mirzaei et al. [79], Ben Naceur and Ghazouani [29] and Warrad [121] reported an insignificant relationship between the turnover of stocks traded and the performance of firms. Similarly, Prochniak and Wasiak [92] revealed an insignificant relationship between the turnover ratio of stocks traded and economic acceleration in EU and OECD countries. However, the study determined a long-run relationship between these two variables.

From the above literature, it can be summarized that researchers are still determining the mixed results on bank-specific and macroeconomic factors that impact bank performance. So more research is therefore required to contribute to the literature and help generate conclusions regarding the true nature of the relationship. Moreover, we have selected branches of banks and turnover of stocks traded as independent variables employed in a few studies. Furthermore, there needs to be a study conducted on the factors that impact the banking industry in Bangladesh by considering the timeline of Farmers Bank scandals and Basic Bank loan scams. As a result, we have conducted this study. The latest study also analyzes data using the most appropriate econometric methodologies that derive more reliable results.

However, this study has some limitations, including a relatively small sample size caused by problems with data accessibility. Based on the information availability of the listed commercial banks, the study selects 24 (72.73%) of the 33 commercial banks listed in DSE. So, the future study can include other (non-listed) commercial banks in Bangladesh to expand the number of observations. Another direction for future study is that this model employs panel data regression analysis for information collection and research conduction. Future studies may use time-series regression to test this suggested model and study approach. Thus, time-series regression can contribute to the scholarly literature on the factors influencing bank profitability in this case. Moreover, the Bangladeshi environment was used to test this study's hypothesis. To strengthen the significance of the findings, the researchers may also repeat this proposed study framework in future studies using new samples from different cultures and nations.

Determinants of profitability of commercial banks in Bangladesh

Dependent variable

This study uses ROA as a proxy for bank profitability. A year's net profit ratio to all its assets is known as the return on assets (ROA) (Table 2). To analyze the profitability of the financial industry, many researchers used ROA as a dependent variable [13, 17, 43, 110, 124].

Independent variables

Explanatory variables are divided into two groups: (1) bank-specific factors and (2) macroeconomic determinants. Bank-specific factors include capital adequacy (CAD), bank branches (BRNCH), asset management (AM), deposit (DEP), and assets quality (AQ). The paper also considers gross domestic product (GDP), inflation rate (IF), exchange rate (EXR), and stock traded (ST) as macroeconomic variables that may affect banks' profitability. An explanation of each of the two groups of independent variables is provided below.

Bank-specific factors

Capital adequacy (CAD)

The equity-to-total assets ratio serves as a capital adequacy measurement. According to the capital structures, a company needs sufficient current assets to meet its financial obligations, which leads to stable performance that enhance overall company value [69]. It is a crucial ratio for determining capital strength [5, 75, 84]. Existing empirical studies found a mixed relationship between CAD and firm profitability; for instance, Doğan and Yildiz [42], O'Connell [83], Olalere et al. [84], and Siddique et al. [109] stated a significant positive relationship between CAD and firm profitability. In contrast, Edi et al. [44], Hussain [55], Ramadan et al. [96], Salim and Yadav [103] and Ref. [126] determined a significant negative relationship, whereas Al-Taani [15] and El-Sayed Ebaid [45] showed an insignificant relationship between CAD and firm profitability.

Assets quality (AQ)

Although loans enhance a bank's profitability, there are two risks associated with them: credit risk and liquidity

Table 2 Definition and measurement of variables

Variable	Acronym	Measure	Expected effect	Empirical evidence
Dependent variable				
Bank profitability	ROA	$ROA = \frac{Net\ profit_{it}}{Total\ asset_{it}}$		[36, 97]
Independent variable: bank-specific factors				
Capital adequacy	CAD	$CAD = \frac{Equity_{it}}{Total\ asset_{it}}$	+	[32, 40, 91, 100]
Branches	BRNCH	Number of branches	+	[17]
Asset management	AM	$AM = \frac{Operating\ income_{it}}{Total\ asset_{it}}$	+	[122]
Deposit	DEP	$DEP = \frac{Deposits_{it}}{Total\ asset_{it}}$	−	[77, 110, 125]
Asset quality	AQ	$AQ = \frac{Loan_{it}}{Total\ asset_{it}}$	−	[61, 85, 100]
Independent variable: macroeconomic factors				
Economic activity	GDP	Annual real GDP growth rate	±	[37, 81, 85, 125]
Inflation	IF	Annual inflation rate (IF)	±	[38, 59, 87, 105]
Exchange rate	EXR	Average exchange rate in a year	+	[61, 97, 100]
Stock traded	ST	Stocks traded, turnover ratio of domestic shares (%)—Bangladesh	+	[29, 79, 121]

Source: Developed by author

risk. Therefore, risk management is crucial to banking operations because of its impact on the banking industry's operational effectiveness [14]. Accordingly, Athanasoglou et al. [21] argued that higher management decides to diversify their portfolio and increase their liquid holdings to limit the risk because increasing risk puts pressure on management. Many researchers employed AQ and bank profitability and demonstrated mixed findings. For example, Abel and Le Roux [5], Doğan and Yildiz [42] and Ongore and Kusa [85] found a significant positive relationship between AQ and bank profitability, whereas Rani et al. [97] reported a significant negative relationship. However, Al-Matari [14] and Sarkar and Rakshit [106] showed an insignificant positive relationship between AQ and bank profitability.

Deposits
Higher deposits provide liquidity to the bank that reduces risk and enhances profitability. According to economic theory, profitability and risks are positively correlated. Moreover, sufficient deposits are essential to ensure long-term sustainability in the contemporary competitive environment. So, one of the often vital factors used to determine bank profitability in this context is deposits. Elisa and Guido [46] state that businesses with greater DEP levels are secure and exhibit excellent financial stability. Besides this, the increased DEP level improves bank loans and raises operational and financial profitability. Many researchers, like Menicucci and Paolucci [77] and Zampara et al. [125], studied the impact of DEP on bank performance, whereas Godswill et al. [47], Hirindukawshala and Kushanipanditharathna

[54], and Munyambonera [81] showed a significant positive relationship, but O'Connell [83] determined an insignificant relationship in the UK. However, Gul et al. [49] found a negative relationship between the DEP and the performance of commercial banks.

Asset management (AM)
According to the existing literature, banking costs play a significant role in determining profitability. The effective control of bank costs demonstrates the effectiveness of bank management. Efficiency in operations refers to the capacity of a bank to make the best use of its resources, provide beneficial results, and monitor its profitability. Asset management assesses how well a bank controls and uses its assets and liabilities. According to Molyneux and Thornton [80] and BP [33], effective management boosts bank profitability. These findings were identical to those of [14, 17, 75, 85], who stated the significant positive relationship between AM and commercial bank profitability. In opposition, Sarkar and Rakshit [106] showed a significant negative relationship between AM and commercial bank profitability in India.

Branches (BRNCH)
The total number of physical locations of a bank can identify branches. It conveys the bank's regional spread and market share [13]. According to economic theory, economies or diseconomies of scale may impact bank profitability [87]. The internal variable, like the number of bank branches or size, determines whether there are scale economies or diseconomies [80]. Due to various structural changes over the past two decades, this feature is

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intriguing for the case of the Bangladeshi banking industry [114]. Previous studies employed bank branches multiple times and suggested contradictory findings, such as Almaqtari et al. [17] demonstrated a significant and positive relationship between the number of branches and bank performance. However, Sufian and Habibullah [115] showed opposite findings. Moreover, Al-Homaidi et al. [13] reported an insignificant and positive relationship between the number of branches and bank performance in India.

Macroeconomic factors

Economic activity (GDP)

The gross domestic product (GDP) is a macroeconomic factor frequently used to measure economic development [97, 105, 110]. To explain the relationship between GDP growth and bank profitability, we can employ the wealth effect, which states that a gain in GDP denotes economic growth and causes higher aggregate demands and more investments [70, 120]. When investment boosts, businesses borrow money from banks to finance some of their investments, which helps the banking sector expand [70]. Empirical studies found mixed results on the relationship between GDP and bank performance; for example, Adewole et al. [8], Doğan and Yildiz [42] and Sarkar and Rakshit [106] disclosed a significant positive relationship, while Almaqtari et al. [17] reported a negative and significant relationship. However, Sufian and Habibullah [115] demonstrated an insignificant relationship between GDP and commercial banks' profitability.

Inflation rate

Inflation depicts the upward trend in the average level of prices for goods and services. It exhibits a currency's purchasing power [110]. Regarding the actual effects of IF, Bradley [35] provided an informal argument. He makes two points overall. According to the first point of his theory, an increase in inflation may cause the monetary authority to respond to it with uneven policies, creating uncertainty over the IF going forward. According to the second component of the Friedman Hypothesis, rising inflationary uncertainty undermines the price mechanism's ability to allocate resources effectively, which has a detrimental impact on output. However, according to the quantity theory of money, the government's excessive amount relative to the nation's productivity is inflation. Because of this, more people have extra money, which drives up the price of products and services hence production. Previous analyses of banks' profitability have often employed the IF and concluded mixed results [59, 98, 99]. For example, Al-Homaidi et al. [13], Doğan and Yildiz [42], O'Connell [83], Souad [113] and Sufian and

Habibullah [115] [13, 42, 83, 113, 115] indicated a positive and significant relationship. Whereas Sarkar and Rakshit [106] determined a significant negative relationship, Ongore and Kusa [85] implied an insignificant relationship between IF and the profitability of commercial banks.

Exchange rate

The exchange rate is measured using the average rate throughout a fiscal year. In order to ensure that at equilibrium exchange rates, the basket of goods and services purchased by one unit of a country's currency equals those purchased in another country, the International Fisher Effect theory is relevant for this study as it explains the purchasing power of each currency and captures the IF across countries [102]. According to this theory, relatively high nominal interest rates in foreign currencies tend to lose value due to the anticipated IF [73]. Despite the theory's shortcomings in predicting exchange rate fluctuations in the short term, it helps comprehend the precise connections between IF, interest rates, and bank performance. Prior studies used exchange rates frequently as a determinant of bank performance; for instance, Elisa and Guido [46] and Rashid and Jabeen [98] found the foreign exchange rate as a significant positive determinant of banks' profitability, while Almaqtari et al. [17] reported a significant negative relationship between exchange rate and bank performance.

The turnover of stocks traded

According to the law and finance theory, the effectiveness of compliance influences the degree of appropriation. As a result, the confidence with which people buy securities and participate in financial markets increases the turnover ratio of stocks traded and market capitalization, which positively impacts bank performance [20], although Prochniak and Wasiak [92] revealed an insignificant relationship between the turnover ratio of stocks traded and economic acceleration in EU and OECD countries. However, they determined a long-run relationship between these two variables. Moreover, Sausan et al. [107] and Milošević-Avdalović [78] found a significant positive relationship between return on assets (ROA) and stock traded turnover. In comparison, Mirzaei et al. [79], Ben Naceur and Ghazouani [29] and Warrad [121] reported an insignificant relationship between the turnover of stocks traded and the performance of commercial banks.

From the above theoretical and empirical evidence on the selected variables and bank profitability, it is clear that researchers are still determining mixed results. So, we have selected these variables to contribute more
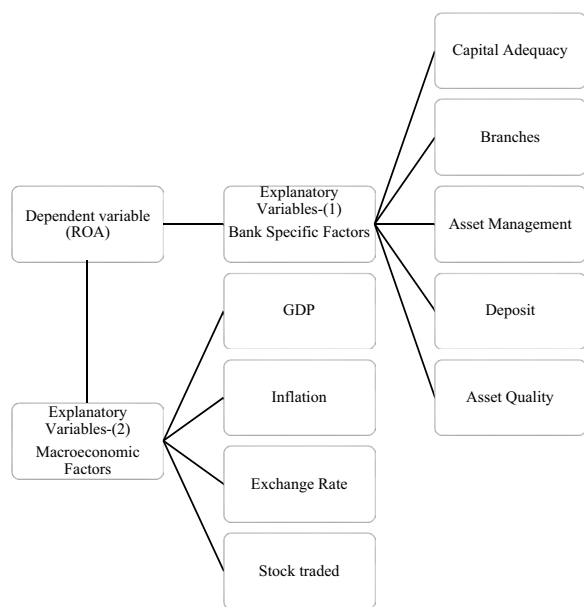
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Fig. 1 Framework of the study. *Source:* Developed by author

findings from the perspective of commercial banks in Bangladesh.

Hypotheses and methodology

The two following hypotheses are being tested in the current study:

H_0: Commercial bank profitability in Bangladesh is not influenced by bank-specific factors and macroeconomic determinants.

H_1: Bank-specific factors and macroeconomic determinants influence commercial bank profitability in Bangladesh.

The hypotheses are developed based on the study framework shown in Fig. 1.

Sampling and data collection

The Dhaka Stock Exchange and the World Bank database served as the primary sources of the data. Because of the missing data, we considered collecting our sample from 2014 and adopted data up to 2020. The significant growth of the banking sector in Bangladesh was one of the factors that led to our decision to select that country. Banks with missing values were eliminated in this study. As a result, we retained a sample of 24 companies that spanned a 7-year research period (Additional file 1).

Model specification and econometric tools
Panel data regression techniques

This paper employs panel data regression analysis to evaluate the impact of bank-specific factors and

macroeconomic determinants on the profitability of commercial banks in Bangladesh.

This study considers the following panel data models with unobserved effects of bank profitability in light of the literature and hypotheses previously mentioned.

The panel data equation model for bank-related factors:

$$\begin{aligned} \text{ROA}_{it} = {} & \beta_0 + \beta_1\text{CAD}_{it} + \beta_2\text{DEP}_{it} + \beta_3\text{AQ}_{it} \\ & + \beta_4\text{BRNCH}_{it} + \beta_5\text{AM}_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

The panel data equation model for macroeconomic factors:

$$\begin{aligned} \text{ROA}_{it} = {} & \beta_0 + \beta_1\text{GDP}_{it} + \beta_2\text{IF}_{it} \\ & + \beta_3\text{EXR}_{it} + \beta_4\text{ST}_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

where β_0=intercept, β_1, β_2, β_3, β_4, β_5=Variables' coefficients, ε=error term, Subscript i=ROA of individual bank, Subscript t=year.

All variables are described in Table 2. These two models are created to investigate the factors affecting the profitability of commercial banks in Bangladesh.

These panel data are frequently employed because they provide more insightful information since they incorporate time-series and cross-sectional data, reflecting constant modification and individual variance. Additionally, after controlling for bank-specific specifications, it enables the analysis of the effects of macroeconomic factors on banking sector profitability with reduced collinearity between variables and a higher degree of adaptability and effectiveness. The common effect model, the fixed effect model (FEM), and the random effect model (REM) are a few techniques that may be used to estimate the panel data regression model [93].

The Hausman test detects the endogeneity within explanatory variables and determines which model (FEM or REM) is more suited. The null hypothesis (H_0) states that REM is the suitable model if there is no association between independent variables and error terms in the panel data model. The alternative hypothesis (H_1) assumes that FEM is the suitable model when the explanatory variables and the error term are statistically significantly correlated in panel data [28, 108]. The computed Hausman statistical analysis is compared with the critical values for the X^2 distribution for k-degrees of freedom. The null hypothesis is rejected if the value of the Hausman test is greater than their critical value, or if the p value is less than 0.05.

Cross-sectional dependence, unit root, and cointegration tests

The cross-sectional dependency (CSD) test was initially employed in this study to examine the potential for an

Table 3 Descriptive statistical analysis results

Variables	Mean	Median	Maximum	Minimum	S.D	Obs
Bank performance: dependent variable						
ROA	0.008943	0.008550	0.023600	− 0.001000	0.004118	168
Bank-related factors: independent variable						
CAD	0.113338	0.119400	0.155200	− 0.000763	0.030472	168
BRNCH	0.775225	0.790680	0.898067	0.080945	0.092562	168
AM	0.681582	0.691930	0.824378	0.070185	0.082782	168
DEP	173.1012	133.0000	583.0000	76.00000	116.7145	168
AQ	0.014260	0.008914	0.129000	− 0.003767	0.023677	168
Macroeconomic factors: independent variable						
GDP	0.084743	0.073000	0.140200	0.034000	0.034764	168
INF	0.058857	0.057000	0.070000	0.055000	0.005070	168
EXR	81.04143	80.44000	84.87000	77.64000	2.943172	168
ST	0.220571	0.209000	0.308000	0.166000	0.040305	168

Source: EViews results (2022)

impact that spills over since Bangladesh might possess similar macroeconomic and microeconomic traits due to globalization. Baydoun and Aga [27] and Li et al. [68] all discussed the advantages of the CD test over other tests. Moreover, the study uses unit root tests of the [56, 66] and Fisher-ADF to test the stationarity among the variables since time-series or panel data may be affected by unit roots, which may impact final results.

This paper employs the panel cointegration test (Kao test) as a required criterion to examine the long-run relationship between the variables. The null hypothesis of no cointegration in panel data is tested by Kao [62] using the Dickey–Fuller (DF) and augmented Dickey–Fuller (ADF)-type tests in the distinctive scenario where the cointegration vectors are homogeneous among individuals (different intercepts, common slopes). These tests cannot be used on a bivariate system (where just a single regressor exists in the cointegration relationship), and they restrict heterogeneity under alternative hypotheses.

Robustness and multicollinearity test

The panel data for commercial banks in Bangladesh are examined to test the robustness and potential multicollinearity before conducting the regression analysis. The correlation between the independent variables is examined through the correlation matrix. Multicollinearity is shown when the correlation coefficient between two variables is close to 1. The study also uses the variance inflation factor (VIF), which compares the value of independent variables with the benchmark of five. If the number exceeds five, the variables are multicollinear;

therefore, one independent variable must be dropped out of the model.

Data analysis and results
Descriptive statistical analysis

Descriptive statistical analysis for the variables used in the present study is presented in Table 3. Data for each variable are shown in the table as maximum, minimum, mean, median, and standard deviation.

According to Table 3, the mean values for ROA, CAD, BRNCH, AM, DEP, and AQ are 0.008943, 0.113338, 0.775225, 0.681582, 173.1012, and 0.014260 with a standard deviation of 0.004118, 0.030472, 0.092562, 0.082782, 116.7145, and 0.023677, respectively. Moreover, the mean values for GDP, INF, EXR, and ST from the macroeconomic factors are 0.084743, 0.058857, 81.04143, and 0.220571, respectively, with standard deviations of 0.034764, 0.005070, 2.943172, and 0.040305.

Furthermore, Table 3 demonstrates that the mean and median values for each variable in the model are consistent for both bank-related and macroeconomic factors. As a result, we can assume that the model's variables follow a normal distribution.

Correlation and multicollinearity analysis

The Pearson correlation coefficient is a performance indicator [30]. The correlation coefficient is used in research to establish the random relationship between selected variables. Although Il Pak and Oh [86] concluded that correlation and regression studies do not infer causation, extra analyses are necessary to create a causal inference.

Table 4 demonstrates the relationships between each variable. For bank-related factors, the table shows that

Table 4 Correlation analysis results

	ROA	CAR	DEP	AQ	BRNCH	AM
Bank-related factors						
ROA	1	0.237	− 0.224	− 0.026	− 0.503	0.029
CAD	0.237	1	− 0.055	0.24624611	− 0.619	− 0.659
DEP	− 0.224	− 0.055	1	0.459	0.128	− 0.007
AQ	− 0.026	0.246	0.459	1	− 0.353	− 0.010
BRNCH	− 0.503	− 0.619	0.128	− 0.353	1	0.4010
AM	0.028	− 0.659	− 0.007	− 0.010	0.401	1
Multicollinearity test						
VIF		2.426639	1.463588	1.651748	1.911063	1.80731
Coefficient variance		0.000171	0.007412	0.010646	0.000056	0.00075

	ROA	GDP	INF	EXRTE	ST
Macroeconomic factors					
ROA	1	− 0.051	0.303	− 0.405	0.115
GDP	− 0.0513	1	− 0.230	0.067	0.724
INF	0.303	− 0.230	1	− 0.605	0.083
EXRTE	− 0.405	0.067	− 0.605	1	− 0.407
ST	0.115	0.724	0.083	− 0.407	1
Multicollinearity test					
VIF		3.160116	1.676788	2.444987	3.744911
Coefficient variance		0.000225	0.005612	0.000815	0.000198

Source: EViews results (2022)

DEP (− 0.224), AQ (− 0.026), and BRNCH (− 0.503) have a negative relationship with ROA, whereas CAD (0.237) and AM (0.028) have a positive relationship with ROA.

For macroeconomic factors, the table shows that GDP (− 0.0513) and EXRTE (− 0.405) have a negative relationship with ROA, while INF (0.303) and ST (0.115) have a positive relationship with ROA. Moreover, the multicollinearity test shows the highest VIF score is 3.744911, and the lowest coefficient variance is 0.000225, which means there is no multicollinearity in the independent variables.

Model test results
Table 5 displays the findings of the estimations for the models described in Eqs. (1–2). Three estimates for each model are reported in the results. The three estimates come from fixed, random, and pooled OLS models. The findings offer an estimation divided into bank-specific and macroeconomic factors that might have impacted the bank's profitability. The table shows that the adjusted *R*-squared value for the banks-specific model is 0.6785. It means 67.85% of the ROA variable can be explained by the selected bank-specific variables, and the remaining 32.15% is explained by other variables not found in the equation. For the macroeconomic model, it is 0.5402, which means macroeconomic factors can explain 54.02%

of the ROA variable. The remaining 45.98% is explained by other variables that not included in the equation.

The results from the Hausman test imply that the probability value is less than 5% (0.0000 < 0.05) for both models, which means the fixed effect model is the suitable model for this study.

Residual diagnostic test
Residual cross-section dependence test
In a panel data analysis, cross-sectional dependency is one of the most crucial diagnostics researchers should look into [39]. The LM tests from [64], the scaled LM test and the CD test from [89], and the bias-corrected scaled LM test from [72] are all used in this study.

The results in Table 6 show that, even at the 1% significance level, the null hypothesis of "no cross-sectional dependency" is not supported. That means there is cross-section dependence (correlation) in residuals. As a result, we must go forward with estimate methods and tests that can account for cross-sectional dependency [7].

Panel unit root test
As shown by the findings in Table 6, cross-section dependency tests do not accurately reflect the proper

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Table 5 Summary of common effect, fixed effect, and random effect models

Variable	Common effect model		Fixed effect model		Random effect model	
	Coeff	Prob	Coeff	Prob	Coefficient	Prob
Bank-specific factors						
C	0.019108	0.0000***	0.025163	0.0000***	0.019484	0.0000***
CAD	0.016099	0.2201	0.008740	0.5860	0.025776	0.0514*
BRNCH	−0.015363	0.0000***	−0.05283	0.0000***	−0.020618	0.0000***
AM	0.059592	0.0001***	0.028626	0.0000***	0.112309	0.0000***
DEP	−0.001031	0.7583	−0.00016	0.9569	0.003451	0.1955
AQ	−0.011863	0.0033***	−0.01115	0.0066***	−0.018248	0.0000***
R-squared	0.375704		0.732413		0.358966	
Adjusted *R*-squared	0.355404		0.678511		0.339181	
Log likelihood	724.2821		795.5797			
F-statistic	19.41544		13.58778		18.14332	
Prob (*F*-statistic)	0.000000		0.000000		0.000000	
Hausman test				0.0000***		
Macroeconomic factors						
C	0.052537	0.0019	0.052537	0.0000	0.052537	0.0000
GDP	0.009119	0.5440	0.009119	0.4106	0.009119	0.4104
INF	0.069293	0.3563	0.006929	0.0211**	0.069293	0.2111
EXRTE	−0.000566	0.0004	−0.000566	0.0000***	−0.000566	0.0000
ST	−0.011510	0.4149	−0.011510	0.2691	−0.011510	0.2689
R-squared	0.173101		0.614541		0.278349	
Adjusted *R*-squared	0.152809		0.540202		0.260640	
Log likelihood	700.8077		764.9204			
F-statistic	8.530521		8.266780		15.71773	
Prob (*F*-statistic)	0.000000		0.000000		0.000000	
Hausman test				0.0000***		

Source: EViews results (2022)

*, **, ***indicate level of significance at 10%, 5% and 1% respectively

Table 6 Residual cross-section dependence test results

Test	Statistic	d.f.	Prob
Bank-related factors			
Breusch–Pagan LM	427.2742	276	0.0000***
Pesaran-scaled LM	6.438658		0.0000***
Bias-corrected scaled LM	4.438658		0.0000***
Pesaran CD	−1.301965		0.1929
Macroeconomic factors			
Breusch–Pagan LM	518.8265	276	0.0000***
Pesaran-scaled LM	10.33538		0.0000***
Bias-corrected scaled LM	8.335382		0.0000***
Pesaran CD	−0.663996		0.5067

Source: EViews results (2022)

Cross-section effects were removed during estimation

*, **, ***indicate level of significance at 10%, 5%, and 1%, respectively

time-series properties of the underlying series. In order to account for the cross-sectional dependency, this study employs [90], ADF-Fisher Chi-square, and PP-Fisher Chi-square [24] panel unit root test [53].

Panel cointegration test

The long-run relationship between non-stationary variables can only exist if variables are co-integrated [23]. The table presents Kao's [24] residual cointegration test.

Results of model discussions

Stationarity tests result

The correlation analysis in Table 4 shows that the independent variables are not perfectly correlated. Additionally, the variance inflation factor (VIF) value between independent variables is not greater than five. Therefore, the coefficient of variables is not affected by collinearity. Let us discuss the study's findings in greater detail.

Bank-related factors

Bank-related factors are demonstrated in Eq. (1). According to the findings of Table 5, all bank-specific factors except CAD and DEP have a statistically significant impact on commercial bank profitability measured by ROA. The positive coefficient of the AM shows that every percent increase in AM will lead to a profitability increase of 0.0286%. That is similar to the findings of [13, 14, 75, 85], who stated that banks with higher AM result in higher profitability. However, the result conflicts with the findings of Sarkar and Rakshit [106], who reported a significant negative relationship between AM and the performance of commercial banks. This study also shows that BRNCH significantly negatively impacts the ROA with a parameter coefficient of -0.05283. If BRNCH increases by one unit, ROA will decrease by 0.05283%. Also, the negative coefficient of AQ means that Asset Quality significantly negatively influences ROA, and every unit increase of AQ will decrease ROA by 0.01115%. The results are consistent with the findings of [97, 115], who stated that banks with higher BRNCH and AQ result in lower profitability. However, the findings contradict the findings of [5, 13, 42, 85], who argued that asset quality and branches would significantly impact banks' profitability.

Table 7 states that in the case of bank-specific determinants, the dependent variable (ROA) and independent variables (AM, AQ, and DEP) are stationary with a level difference, while CAD and BRNCH are non-stationary. However, CAD and BRNCH are stationary in the first difference. As ROA is significant in the level difference, we can conclude that the panel is stationary for the first model, so the study can consider the model to be statistically significant.

Table 8 shows that the null hypothesis is strongly not supported by the Kao test, which means bank-specific variables have a significant relationship in the long run that is similar to the findings of [74, 94, 109].

Macroeconomic factors

Macroeconomic factors are stated in Eq. (2). Table 5 determines that IF has a significant and positive impact, while EXRTE has a significant negative impact on bank performance in Bangladesh. The positive coefficient of the IF demonstrates that every percent increase in IF will lead to a profitability increase by 0.006929%. Moreover, EXRTE significantly negatively impacts the ROA with a coefficient of −0.000566, which means if the exchange rate increases by one unit, the ROA will decrease by 0.000566%.

The study results are consistent with [13, 42, 83, 113, 115], who showed the positive impact of IF on bank performance. However, the findings contradict the findings of Sarkar and Rakshit [106], who determined a significant negative relationship between IF and bank performance. In the case of the exchange rate, the result is consistent with the findings of [13, 98], who found a significant and negative impact of the exchange rate on bank performance. However, the findings conflict with the report of [105], who argued that the exchange rate significantly and positively impacts bank performance.

Table 7 shows that ROA is not stationary in the level difference for macroeconomic variables, which means there is a unit root in this series. However, it is stationary in the first difference. GDP, IF, and EXR are stationary in the level difference for independent variables. Only ST is non-stationary in the level difference. Moreover, it is stationary in the first difference. As the dependent variable (ROA) is significant in the level difference, we cautiously conclude that the panel is non-stationary for the second model, so we cannot consider the model to be statistically significant.

Table 8 shows that the null hypothesis is strongly not supported by the Kao test, which means macroeconomic variables significantly impact bank profitability in the long run, similar to the findings of [74, 109].

Implications

This study contributed several contributions to the literature concerning the components that affect commercial bank profitability. This study examined the effects of macroeconomic factors and bank-specific indicators on the performance of the banks; in contrast, most of the earlier studies explained only the impact of bank-specific factors and their association with banks' profitability [10, 18, 22, 25, 48, 76]. The number of branches of commercial banks listed on the DSE, and the stocks traded (turnover ratio of domestic shares), these two factors are introduced in this study. The other variables used for this study show a distinct rationale for the conflicting findings from earlier research. For instance, AM shows a significant impact on bank profitability. That is similar to the findings of [13, 14, 75, 85], who stated that banks with higher AM result in the higher profitability. Because efficient AM ensures efficient operating activities that lead to the stable profit of the financial institutions; as a result, commercial banks should prioritize AM in their performance indicators.

The current study determines that CAD has an insignificant impact on bank profitability in Bangladesh. That is similar to the findings of Al-Taani [15] and El-Sayed Ebaid [45], who showed insignificant impact of CAD on bank profitability. However, the findings conflict with the results of Doğan and Yildiz [42], O'Connell [83], Olalere et al. [84] and Siddique et al. [109], who stated that CAD significantly positively impacts firm profitability.

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Table 7 Unit root test results

Variables	Tests	Level difference-statistics (Prob.)	First difference-statistics (Prob.)	Second difference-statistics (Prob.)
Bank-related factors				
ROA	Im, Pesaran and Shin W-stat	− 3.88884 (0.0001)***		
	ADF-Fisher Chi-Square	79.6257 (0.0028)***		
	PP-Fisher Chi-Square	86.7020 (0.0005)***		
CAD	Im, Pesaran and Shin W-stat	1.82537 (0.9660)	− 7.05257 (0.0000)***	
	ADF-Fisher Chi-Square	31.5478 (0.9680)	139.778 (0.0000)***	
	PP-Fisher Chi-Square	35.5593(0.9082)	187.459 (0.0000)***	
BRNCH	Im, Pesaran and Shin W-stat	− 0.65399 (0.2566)	− 3.09090 (0.0010)***	
	ADF-Fisher Chi-Square	57.3147 (0.1679)	95.5433 (0.0001)***	
	PP-Fisher Chi-Square	104.618 (0.0000)***	127.117 (0.0000)***	
AM	Im, Pesaran and Shin W-stat	− 1.75248 (0.0398)**		
	ADF-Fisher Chi-Square	71.5464 (0.0154)**		
	PP-Fisher Chi-Square	94.4217 (0.0001)***		
DEP	Im, Pesaran and Shin W-stat	− 14.3030 (0.0000)***		
	ADF-Fisher Chi-Square	73.5965 (0.0102)**		
	PP-Fisher Chi-Square	81.1654 (0.0020)***		
AQ	Im, Pesaran and Shin W-stat	− 9.84979 (0.0000)***		
	ADF-Fisher Chi-Square	68.9401 (0.0254)**		
	PP-Fisher Chi-Square	83.5259 (0.0011)***		
Macroeconomic factors				
ROA	Im, Pesaran and Shin W-stat	− 0.96677 (0.1668)	− 2.92953 (0.0017)***	
	ADF-Fisher Chi-Square	58.6172 (0.1402)	87.4896 (0.0004)***	
	PP-Fisher Chi-Square	86.7020 (0.0005)***	110.681 (0.0000)***	
GDP	Im, Pesaran and Shin W-stat	− 4.43174 (0.0000)***		
	ADF-Fisher Chi-Square	112.250 (0.0000)***		
	PP-Fisher Chi-Square	113.152 (0.0000)***		
IF	Im, Pesaran and Shin W-stat	− 9.59850 (0.0000)***		
	ADF-Fisher Chi-Square	194.367 (0.0000)***		
	PP-Fisher Chi-Square	194.367 (0.0000)***		
EXR	Im, Pesaran and Shin W-stat	− 4.50809 (0.0000)***		
	ADF-Fisher Chi-Square	76.7563 (0.0000)***		
	PP-Fisher Chi-Square	79.7856 (0.0000)***		
ST	Im, Pesaran and Shin W-stat	− 0.50613 (0.3064)	− 3.31034 (0.0005)***	
	ADF-Fisher Chi-Square	46.0881 (0.0.5515)	94.6131 (0.0001)***	
	PP-Fisher Chi-Square	43.0978 (0.6736)	99.1269 (0.0000)***	

Source: EViews results (2022)

*, **, ***indicate level of significance at 10%, 5% and 1% respectively

However, Edi et al. [44], Hussain [55], Ramadan et al. [96], Salim and Yadav [103] and Ref. [126] determined a significant negative impact of CAD on bank profitability. Since results vary nationwide, bank management should rely on the regional study's findings.

Similarly, our study demonstrates the insignificant impact of DEP on bank performance. The result is similar to the findings of [83], who also determined the insignificant impact of DEP on bank profitability in the UK.

In contrast, Elisa and Guido [46] stated that businesses with greater DEP levels are secure and exhibit excellent financial stability. Besides this, the increased DEP level improves bank loans and raises operational and financial profitability. As a result, the bank management should depend on their domestic findings because the result varies from country to country.

However, the current study shows a significant negative impact of BRNCH and AQ on bank profitability.

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Table 8 Panel cointegration test results

	t Statistic	Prob
Bank-related factors		
ADF	− 4.522407	0.0000***
Residual variance	0.0133108	
HAC variance	0.0105842	
Macroeconomic factors		
ADF	− 2.704492	0.0034***
Residual variance	0.018070	
HAC variance	0.016236	

Source: EViews results (2022)

The automatic lag length selection based on Schwarz Bayesian information criteria (SIC) with a max log of 1. Newey West automatic bandwidth selection and Bartlett kernel

*, **, *** indicate level of significance at 10%, 5%, and 1%, respectively

Commercial banks should prioritize online banking over growing their physical branch network to grab the benefit of technology, and the loan quality could be more satisfactory for commercial banks in Bangladesh. In order to decrease the amount of non-performing loans (NPL), the credit risk of the borrowers should be carefully taken into account using modern credit risk management techniques. The results are consistent with the findings of [97, 115], who stated that banks with higher BRNCH and AQ result in lower profitability. However, the findings contradict the findings of [5, 13, 42, 85], who argued that BRNCH and AQ would significantly impact banks' profitability.

Among the macroeconomic variables, IF significantly and positively impacts profitability. As a result, commercial banks should rely on more sophisticated forecasting models to predict future IF. The results are incorporated with the findings [59, 98, 99]. Al-Homaidi et al. [13], Doğan and Yildiz [42], O'Connell [83], Souad [113] and Sufian and Habibullah [115] indicated a positive and significant impact of IF on bank performance. In contrast, Sarkar and Rakshit [106] determined a significant negative impact, whereas Ongore and Kusa [85] implied an insignificant impact of IF on the profitability of commercial banks. As a result, the bank management should depend on domestic research findings because the result varies from country to country. However, the current study indicates that GDP has an insignificant impact on commercial bank performance, so commercial banks should not consider GDP whenever the investment strategy develops, similar to the finding of [115, 123]. Although this finding is contradictory with [8, 42, 106], who disclosed a significant positive impact, Almaqtari et al. [17] reported a negative and significant impact of GDP on the bank performance. As a result, since results

differ from nation to nation, bank management should rely on domestic research findings.

Moreover, this current study determines the insignificant impact of stocks traded (turnover ratio of domestic shares) on the performance of commercial banks. So, commercial banks should refrain from taking the stock market's performance into their account while operating the banking business in Bangladesh. Finally, this study shows a significant negative impact of exchange rates on bank profitability. The finding is incorporated with the results of [17], who also reported a significant and negative impact. In contrast, Elisa and Guido [46] and Rashid and Jabeen [98] found a significant positive impact of foreign exchange rates on banks' profitability. So, Bangladeshi policymakers should recognize that improving banks' profitability is associated with the foreign exchange rate. The exchange rate should be managed favorably for the banking sector's growth.

Conclusions

This study has addressed a gap in the factors that affect bank profitability through an extensive literature analysis. We tested this model and looked at how macroeconomic determinants and bank-specific factors affected bank profitability. Commercial banks need to perform at satisfactory levels, as was previously addressed in the introduction portion of this study, and the findings demonstrated an unstable situation. In addition, the collection of existing literature acknowledged that effective, dependable, and dynamic banks contribute to sustainable economic development. Giving banks a competitive edge in a challenging business environment generates necessary improvement. This research study uses the panel data regression method to investigate how the macroeconomic determinants and bank-specific factors affect commercial banks' profitability. Since EViwes (2022) defines panel structures with essentially no limit on the number of cross-sections or groups or the number of periods or observations in a group, this study employed an advanced method through its application. The EViews framework naturally handles panel data sets with regular or irregular consistency, balanced or unbalanced, and dated or undated [112]. The study's findings offered fascinating significant information to bank managers, policymakers, and owners of commercial banks.

To evaluate the macroeconomic and bank-specific factors that affect banks' profitability in Bangladesh, the return on asset (ROA) metric of bank profitability was regressed on 09 macroeconomic and bank-specific variables of 24 private commercial banks listed in the Dhaka Stock Exchange (DSE) from 2014 to 2020. The results of the fixed effect model indicate that all

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bank-specific factors, except CAD and DEP, significantly impact the profitability measured as ROA. Asset management (AM) significantly impacts bank profitability at a 99% ($\alpha = 0.01$) confidence level. That is similar to the findings of [13, 14, 75, 85], who stated that banks with higher AM result in the higher profitability. The current study model shows that capital adequacy (CAD) has an insignificant impact on bank profitability in Bangladesh. That is similar to the findings of Al-Taani [15] and El-Sayed Ebaid [45], who showed an insignificant impact of CAD on bank profitability. However, the findings conflict with the results of Doğan and Yildiz [42], O'Connell [83], Olalere et al. [84] and Siddique et al. [109], who stated that CAD significantly impacts firm profitability. However, Edi et al. [44], Hussain [55], Ramadan et al. [96], Salim and Yadav [103] and Ref. [126] determined a significant negative impact of CAD on bank profitability.

Similarly, our study demonstrates the insignificant impact of DEP on bank performance. The result is similar to the findings of [83], who also determined the insignificant impact of DEP on bank profitability in the UK. In contrast, Elisa and Guido [46] stated that businesses with greater DEP levels would have secured and exhibited excellent financial stability. However, the current study shows a negative impact of BRNCH and AQ on bank profitability at a 99% ($\alpha = 0.01$) confidence level. The results are consistent with the findings of [97, 115], who stated that banks with higher BRNCH and AQ result in lower profitability. However, the findings contradict the findings of [5, 13, 42, 85], who argued that BRNCH and AQ would significantly impact banks' profitability.

Among the macroeconomic variables, this study finds IF significantly and positively impacts profitability at a confidence level of 95% ($\alpha = 0.05$). The results are incorporated with the findings [59, 98, 99]. Similarly, Al-Homaidi et al. [13], Doğan and Yildiz [42], O'Connell [83], Souad [113] and Sufian and Habibullah [115] indicated a positive and significant impact of IF on bank performance. In contrast, Sarkar and Rakshit [106] determined a significant negative impact, whereas Ongore and Kusa [85] implied an insignificant impact of IF on commercial bank profitability. However, the current study indicates that GDP has an insignificant impact on commercial bank performance, similar to the finding of [115]. Although this finding is contradictory to the findings of [8, 42, 106], who disclosed a significant positive impact, Almaqtari et al. [17] reported a negative and significant impact of GDP on the bank performance.

Moreover, this current study determines the insignificant impact of stocks traded (turnover ratio of domestic shares) on the performance of commercial banks in Bangladesh. Finally, this study shows a significant negative impact of exchange rate on bank profitability at a 99% ($\alpha = 0.01$) confidence level. The finding is incorporated with the results of [17], who reported a significant negative impact. In contrast, Elisa and Guido [46] and Rashid and Jabeen [98] found a significant positive impact of foreign exchange rates on banks' profitability.

The findings of this study offered a significant contribution to the existing literature. It has examined the short-term and long-term influence of the macroeconomic factors and bank-specific variables on the profitability of commercial banks operating in Bangladesh.

Limitations and future research

Only the commercial banks in Bangladesh listed on the DSE were used for the empirical findings of this study. In order to increase the number of observations, the future study could also include other (non-listed) commercial banks in Bangladesh. The analysis tools examined the impact of macroeconomic and bank-specific variables on the profitability of commercial banks. Although empirical results have contributed to the present and earlier literature, it is still restricted to banks alone. This particular research model is favorable and helpful for numerous sectors in generalizing study findings to improve their business performance concerning future research directions. In addition, the study selected nine variables to evaluate the profitability of commercial banks in Bangladesh. So, future studies could examine this subject by integrating other macroeconomic and bank-specific variables.

Another direction for future study is that this model employs panel data regression analysis for information collection and research conduction. Future studies may use time-series regression to test this suggested model and study approach. Thus, time-series regression can contribute to the scholarly literature on the factors influencing bank profitability in this case. Moreover, the Bangladeshi environment was used to test this study's hypothesis. To strengthen the significance of the findings, the researchers may also repeat this proposed study framework in future studies using new samples from different cultures and nations.

Abbreviations

ROA	Return on assets
CAD	Capital adequacy
BRNCH	Bank branches
AM	Asset management
DEP	Deposit
AQ	Assets quality
GDP	Gross domestic product
IF	Inflation rate
EXR	Exchange rate
ST	Stock traded
NPL	Non-performing loans

ROE	Return on equity
NIM	Net interest margin
ADF	Augmented Dickey–Fuller
LM	Lagrange multiplier
SIC	Schwarz Bayesian information criteria
DSE	Dhaka stock exchange

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43093-023-00247-8.

Additional file 1: Sample data.

Declarations

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The corresponding author declares that there is no conflict of interest on behalf of all authors.

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