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THE EFFECT OF CAPITAL STRUCTURE ON BANGLADESH'S COMMERCIAL BANK'S PROFITABILITY

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Abstract

The purpose of the paper is to explore how capital structure affects the profitability of Bangladeshi commercial banks. A balanced panel data set of ten listed commercial banks of Bangladesh has been selected over the period of 2011 to 2022. The analysis is performed using OLS regression model. The study found that debt to assets ratio and current liabilities to assets ratio have significant positive impact on ROE of commercial banks of Bangladesh. The study also found that debt to equity ratio is significantly and negatively correlated to the return on the assets of the commercial banks. Assets size and assets quality have significant negative influence on net interest margin of the commercial banks. The study also found that assets quality & assets size are significantly and negatively correlated to return on the equity & return on the assets of the commercial banks. Current liabilities to assets ratio has positive impact on return on equity of the banks. Capital adequacy ratio has positive impact on the profitability of the commercial banks of Bangladesh.

Keywords: Capital structure, Profitability, Net interest margin, ROE, ROA & Bangladesh.

1. Introduction

Capital structure refers to the combination of various types of internal and external funds which is used to finance a business. Capital structure is the aggregation of equity and debt where equity includes common stock, preferred stock, or retained earnings and debt includes issuing bond, subordinate bond, bank loans, commercial loan and short-term debt (Tuovila, 2021). Now capital structure decisions are one of the crucial phenomena among the financial decision of the commercial banks. The overwhelming majority of studies have found that capital structure decisions have significant effect on variables including stock market return, industry leverage, profitability, firm size, and growth prospects. Capital structure decisions are also directly associated with the cost of capital.

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The key factor of capital structure decision is to figure out the optimal capital combination which is the level of capital that maximizes a company's market value and profitability while minimizing its cost of capital (Addae *et al.,* 2013). The innovators in the field of capital structure research in finance are Modigliani and Miller (Musha, 2017). They argued that when taxes, transaction costs, and symmetric information are not present, the choice of capital structure has no positive impact on the worth of the firm. Modern finance has developed some theories like trade-off, pecking order and agency theories for the search of optimal capital structure (Buferna, 2005).

Profitability is the measure of the capacity to make profit that leads a firm to wealth creation for shareholders. A firm's profitability can be identified by different ways but Net interest margin (NIM), return on equity (ROE) and return on assets (ROA) etc. are used world widely as the proxy of profitability. According to the behavior finance, profitable firms are more attractive for investor and more beneficial for shareholders than loss bearing firms. Shareholder's value change when firm's value changes. According to Ross *et al.* (2009), Manager should take the level of capital structure that will make highest firm's value as well as shareholder's value.

Today Banks are one of the major components of any financial systems in the world. According to Bangladesh bank (2022), Bangladesh has 61 scheduled banks. 6 government owned commercial banks,43 private commercial banks, 9 foreign commercial banks and 3 specialized banks conducting their banking activities under the supervision of Bangladesh Bank contributing to the country's prosperity. Commercial banks are crucial elements of the financial systems in Bangladesh. The study aims to uncover the impact of capital structure on the profitability of commercial banks of the country. So, the investigation attempts to elucidate the capital structure of banks that significantly influence their profitability.

2. Objectives of the study

The principal objective of the research is to explore how capital structure affects the profitability of Bangladeshi commercial banks. Moreover, the specific objectives are as follows:

a) To evaluate the impact of capital structure on the net interest margin of commercial banks in Bangladesh.
b) To assess the effect of capital structure on the return on equity of commercial banks in Bangladesh.
c) To evaluate the determinants of capital structure on the return on assets of commercial banks in Bangladesh.
d) To identify most sensitive factors that increase commercial banks' profitability.

To evaluate the objectives of the study, the paper is structured as follows: Sections 2 and 3 cover literature & theoretical framework, while Section 4 presents statistical results and their interpretations. Data accuracy check, findings & recommendations and conclusion are highlighted in section 5 and 6 respectively.

2.1 Research questions

a) Does the combination of capital structure have any significant influence on the profitability of the banks?

b) What are the most sensitive factors of capital structure that significantly influence commercial banks' profitability?

2. Literature Review

The theoretical background of the investigation is illustrated in this section. Previous scholars from across the world have conducted studies to ascertain the influence of capital structure on the profitability of financial organizations. While Most researchers analyse the banking industry, only a few focuses on specific banks.

2.1 Modigliani-Miller Theorem (M&M)

Franco Modigliani and Merton Miller developed the theorem in 1958. The theorem describe that the value of an organization is unaffected by its capital structure, when in the absence of taxes, agency costs, bankruptcy costs, asymmetric information, and in an efficient market (Modigliani & Miller, The cost of capital ,corporation finance and the theory of investments, 1958). Two propositions that constitute the theorem are as follows:

2.2 Proposition I

If there are no taxes, Proposition I still applies. According to the proposition the enterprise value of a firm is independent to its capital structure. Despite the sources of finance used, the value of two identical enterprises would remain the same. Future earnings predictions affect a company's value, but capital structure decisions do not affect it.

2.3 Proposition II

Proposition II assumes that tax information is available. According to this proposition II, the financial leverage enhances the firm value and reduces the weighted average cost of capital (WACC). The financial leverage ratios measure capital structure.

2.4 Pecking Order Theory

The theory was introduced by Stewart Myers and Nicolas Majluf in 1984. It based on the concept of asymmetric information, where one party has better information than another. According to this theory, managers prioritize different sources of financing in a hierarchy. The idea states that internal finance, or retained earnings, is the manager's first choice since it is the cheapest and most practical source of funding because there is less knowledge asymmetry. Managers prefer debt over equity when external funding is required since debt has a lower cost compared to equity (Myers & Majluf, 1984).

2.5 Empirical study

Gadabui & Amoah (2016) examined the influence of bank capital on the profitability of selected banks in Ghana. The investigation utilized fourteen banks of Ghana as a sample during the period 2005-2015. The paper employed purposive sampling approach to select the fourteen banks & conducted a panel dataset to examine how bank capital affects profitability in Ghana. The research used random effects GLS

regression (Generalized Least Square) to show the effects of capital structure. The paper found that equity is positively and significantly correlated with Return on Equity (ROE) and Net Interest Margin (NIM). The study revealed that bank size has a significantly negative impact on ROE but an insignificantly positive impact on NIM. Badawy (2020) investigate the effect of Covid 19 crisis on the capital structure & liquidity of the banking industry in Egypt. The study employed nine listed banks on the EGX (Egyptian Stock Exchange) during the period of 2019-2020. The paper measured liquidity by cash flows from operations and measured capital structure by the leverage level. The investigation found that the Covid-19 pandemic has no statistically significant dominant on the liquidity of the Egyptian banks. However, the empirical result showed that Covid-19 pandemic had a significant influence on the capital elements of the listed banks. Research results suggest that the strategies of the Central Bank of Egypt (CBE) are highly effective in absorbing the negative effects of Covid-19 pandemic on banks. Guoxiang (2014) investigated the competition and sustainable bank capital regulation in commercial banks in US during the period of 1934 to 2011. The paper developed a set of equations to investigate banks' capital structure and these equations yielded similar to Modigliani Miller theory as well as the Capital Asset Pricing Model (CAPM). The empirical results supported this inference and identified that bank capital regulation contributes to sustainable economic growth in the US.

Musah (2018) analyzed the effect of capital structure on profitability of Ghana's commercial banks. Short-term, long-term, and total debt ratios were applied in this study to gauge capital structure. Return on assets (ROA) and return on equity (ROE) were measurements for profitability. The paper taken twenty-three banks as a sample during the period of 2010 to 2015. The examination was carried out utilizing statistical tools such panel data regression analysis, correlation metrics analysis, and descriptive statistics. According to the descriptive statistics most of the banks are highly leveraged, almost 84% of total capital being debt capital. The empirical result found that short term debt & long term debt ratios are negatively associated with bank's profitability. But total debt ratio has positive impact on the profitability of banks. The research also found that firm size, foreign ownership and operating time of the bank has positive impact on the profitability but customers' deposits growth rate has a negative correlation with banks' profitability. The study's findings imply that the best mix of short and long-term debt will increase bank profitability. Fatima & Bashir (2021) assess the moderating impact of business size on the relationship between capital structure and performance of the Pakistani textile sector. From 2010 to 2017, the study gathered information from secondary sources such as the annual reports of listed businesses at the Pakistan Stock Exchange (PSE). The research applied panel data of a generalized least square (GLS) regression model. According to research survey, debt accounts for 65% of the assets of Pakistani textile enterprises. Given that the average value is close to 65%, companies' overall debt ratios are somewhat heavily leveraged. Skopljak & Luo (2012) explore at the connection between Australian financial sector firm performance and capital structure. The study demonstrated a solid quadratic link between Australian firm performance and capital structure that is statistically significant. According to the study's findings, relatively low levels of leverage boost bank performance's earnings

quality while relatively high levels of leverage diminish it. Erhomosele (2021) looked into the relationship between capital structure and firm performance in Nigeria. While profit margin and return on equity (ROE) are employed as proxies for company performance, leverage indicates capital structure. The effect of capital structure on performance is assessed using a balanced panel of data from eleven samples. The empirical finding revealed a non-monotonic linkage between bank performance and capital structure.

Adesina *et al.* (2015) investigated the impact of capital structure on Nigerian firm's financial performance during the period of 2005 - 2012. Profit before tax is considered as a dependent variable and equity & debt are representing the independent variables as a proxy of capital structure. The paper took ten samples of Nigerian banks. Secondary data & Ordinary least square (OLS) regression analysis are used as statistical instruments. According to the research, the capital structure of Nigerian banks significantly improves their financial performance. The analysis also shows that the management of Nigerian banks uses equity and debt capital in financing to steadily increase profitability. An analysis of the effects of capital structure, working capital, and governance quality on the financial performance of SME in Taiwan was conducted by Thi & Phung (2021). The investigation used 24 years' data for more than 2000 firms of Taiwan during the period of 1995–2018. Depending on the findings, a firm's debt level has a considerable negative influence on both return on assets (ROA) and return on equity (ROE). Governance quality has diverse effects and the cash conversion cycle (CCC) has adverse effects. The capital structure and profitability of Pakistan's Islamic and conventional banks was evaluated in Zaman & Ali, (2019) research. The paper examined 250 observations from 2006 to 2016 of the Karachi Stock Exchange listed bank. The study discovered that, while there is no discernible connection between debt-to-equity (D/E) ratio and return on equity (ROE) in Islamic banks, there is a significant association in conventional banks. Modaraba-based deposit accounts are considered as equity of Islamic banks. The paper suggests that Islamic banks are able to increase their savings deposits since they have no risk & have equity-like features. Anand *et al.* (2006) examined the factors that determine the optimal capital structure and credit rating for Pakistani banks during the recent seven years. Credit rating and a company's appropriate capital structure are closely tied. High crediting rating firms tend to use more debt financing. The paper used firm's size, liquidity, profitability and leverage factors to define crediting rating score of firms. The top twenty banks of Pakistan are the sample of the study. The paper found that size & leverage significantly impact credit rating positively while profitability & liquidity have negative impacts on credit rating of Pakistani banks.

3. Research Methods

This section describes the data sources, sample size, data grouping method, variables, and data analysis methodologies used in the research that demonstrates how the capital structure of the banks affects bank's profitability.

3.1 Data Source, Sample Size and Variables

Data are collected from secondary sources. The study randomly selected ten DSE listed commercial banks over the period of 2011-2022. The study grouped the entire

dataset into one category, resulting in a balanced panel dataset of commercial banks in Bangladesh. Six independent variables and three dependent variables were selected, with two independent variables serving as the study's control variables while the other four independent variables act as proxies for capital structure. The study utilized an ordinary least square (OLS) regression model to examine the effect of capital structure on the profitability of Bangladesh's commercial banks. Both dependent and independent variables will be used in the investigation. The following dependent variables and the independent factors will be considered to accomplish the study's objectives:

3.1.1 Dependent Variables

1. Net Interest Margin (NIM): The profitability metric known as NIM is calculated by dividing net interest income by total assets. The difference between interest income and interest expense is referred to as net interest income. It is a significant measure of a financial institution's profitability, due to the fact given their heavy focus on interest-generating activities.

2. Return on Equity (ROE): The profitability indicator termed as return on equity (ROE) is derived by dividing net income (net profit after tax) by shareholder equity.

3. Return on Assets (ROA): Another measurement of profitability is return on assets (ROA), which is determined by dividing net income (net profit after tax) by total assets.

3.1.2 Independent variables

1. Debt to Equity Ratio (DTE): In Finance, debt to equity ratio is a measure of a firm's financial leverage representing the proportion of shareholders' equity and debt used to finance corporate resources. In this study, the financial leverage ratio is calculated by dividing total interest bearing long term debt by total shareholders' equity. According to finance theory, Optimum debt equity ratio maximize profit for banks, thus, positively impacting their profitability.

2. Debt to Assets Ratio (DTA): The ratio indicates the proportion of debt a firm holds in relation of its total assets. The ratio also demonstrates the firm's capacity to repay long-term debt using its own resources. In this study, the ratio of debt to assets is determined by dividing total interest-bearing long-term debt by total assets. The ratio is expected to impact negatively on the profitability of banks.

3. Current Liabilities to Assets (CTL): CTL ratio is another proxy of capital structure in this study. The CTL ratio indicates the proportion of total current liabilities and total assets of the bank, implying the ability of the firm to repay current liabilities using its own assets. In this study, total current liabilities divided by total assets generates the CTL ratio. It is anticipated to have positive impact on the profitability of banks.

4. Capital Adequacy (CAR): The capital adequacy ratio is expressed as total equity divided by total assets. The capital adequacy ratio is an indicator of a firm's capital strength. Most finance research indicates that a higher ratio signifies less reliance on outside funding, thereby reducing the risk of bankruptcy and lowering the company's cost of capital.

5. Asset Quality (ATQ): The ratio of loans to total assets (ATQ) gauges a bank's asset quality. Although asset quality is not a component of capital structure, this study examines its impact on profitability and uses it as a control variable. A higher ratio of loan to total assets in generally expected to positively affect profitability, indicating a bank's income stream. However, it also suggests higher level and lower liquidity, which may increase the risk of defaults.

6. Assets Size (ATS): In finance term, Asset size represents total assets of banks. The banks' combined assets are utilized as a stand-in for the banks' size. By using the natural logarithm of the total asset (log A), banks size is computed. Therefore, it is anticipated that the size of the bank would have a positive impact on profitability. But in this study, asset size is employed as a control variable.

3.2 Econometrics Model

The data is processed & analyzed using Eviews software. The following technical tools and models have been taken into consideration when conducting the study:

1. The mean, standard deviation, minimum, and maximum are all reported in descriptive statistics.
2. Simple correlation has been done to demonstrate correlations among independent variables.
3. The study used Levin-Li-Chu for the Unit Root test and found that panels are stationary.
4. The Coefficients, Standard Error, T Ratio, and P Value are determined using the OLS model.

Panel data have been taken into consideration in this study. Cross sectional and time series data are both included in panel data. When using panel data analysis, the data set consists of n cross sectional units I = 1..., N) which been observed during T distinct periods of time (t = 1,...., T). The data set has n x T observations. The following regression model highlights the key context for the panel data:

$$Y_{it} = a + b_i x_i + u_{it}$$

In this context, Y_{it} is the dependent variable, a is the coefficient or slope term, b_i is the coefficient or parameter, x_i is the set of given observations or samples, and u_{it} is the residual.

5. The study used Breusch-Pagan-Godfrey test for heteroscedasticity. Heteroscedasticity testing is a form of post-test used to assess the variance errors within the model, which are dependent on the values of the independent variables.
6. The Breusch-Godfrey test is employed to assess the model's autocorrelation issues. First order autocorrelation is employed to identify issues that arise when inaccuracies from one time period correlate with errors from a particular interval of time.
7. The paper used normality test to determine if the selected data set is well-modeled by a normal distribution.

8. The investigation used variance inflation factor (VIF) to detect multi-collinearity problem among the independent variables of the selected model.

3.3 Hypothesis

Followings are the hypothesis developed to find out the impact of capital structure on the profitability of commercial banks in Bangladesh:

***H_1**: Net Interest Margin (NIM) being profitability of commercial banks is not significantly affected by selected independent variables such as Debt to equity ratio (DTE), Debt to assets ratio (DTA), Current liabilities to assets (CTL), Capital adequacy (CAR), Asset Quality (ATQ) and Assets Size (ATS) ratio.*

***H_2**: Net Interest Margin (NIM) being profitability of commercial banks is significantly affected by selected independent variables such as Debt to equity ratio (DTE), Debt to assets ratio (DTA), Current liabilities to assets (CTL), Capital adequacy (CAR), Asset Quality (ATQ) and Assets Size (ATS) ratio.*

***H_3**: Return on Equity (ROE) being profitability of commercial banks is not significantly affected by selected independent variables such as Debt to equity ratio (DTE), Debt to assets ratio (DTA), Current liabilities to assets (CTL), Capital adequacy (CAR), Asset Quality (ATQ) and Assets Size (ATS) ratio.*

***H_4**: Return on Equity (ROE) being profitability of commercial banks is significantly affected by selected independent variables such as Debt to equity ratio (DTE), Debt to assets ratio (DTA), Current liabilities to assets (CTL), Capital adequacy (CAR), Asset Quality (ATQ) and Assets Size (ATS) ratio.*

***H_5**: Return on Assets (ROA) being profitability of commercial banks is not significantly affected by selected independent variables such as Debt to equity ratio (DTE), Debt to assets ratio (DTA), Current liabilities to assets (CTL), Capital adequacy (CAR), Asset Quality (ATQ) and Assets Size (ATS) ratio.*

***H_6**: Return on Assets (ROA) being profitability of commercial banks is significantly affected by selected independent variables such as Debt to equity ratio (DTE), Debt to assets ratio (DTA), Current liabilities to assets (CTL), Capital adequacy (CAR), Asset Quality (ATQ) and Assets Size (ATS) ratio.*

4. Statistical Results and Interpretations

This section presents the details analysis and interprets the finding fact from the investigation, focusing on descriptive statistics, correlation matrix for commercial banks of Bangladesh. The approach indicates an empirical evaluation of Bangladeshi commercial banks to demonstrate how the capital structure affects profitability.

4.1 Descriptive Statistics

In Table 1, descriptive statistics of mean, minimum and maximum values and standard deviation for a number of selected variables of Bangladeshi commercial banks are presented. According to the table, average return on equity (ROE) is 11.34%. The minimum and maximum values of return on equity (ROE) are 0.17% and 24.13% respectively. With a standard deviation of roughly 4.71%, the return on equity (ROE) fluctuates greatly.

T**able 1:** Descriptive Statistics for all Variables of Commercial Banks

	Mean	Std. Deviation	Minimum	Maximum
ROE	0.1134	0.0471	0.0017	0.2413
ROA	0.0092	0.0044	0.0001	0.0214
NIM	0.0213	0.0129	0.0000	0.0456
ATS	11.3774	0.2220	10.8302	12.0000
ATQ	0.6488	0.0976	0.1445	0.7767
CAR	0.0799	0.0191	0.0173	0.1543
CTL	0.1654	0.0841	0.0269	0.7430
DTA	0.0159	0.0111	0.0000	0.0426
DTE	0.2175	0.1597	0.0000	0.6814

Source: Author's estimate based on 12 years' data of commercial banks of Bangladesh.

The mean & standard deviation of return on assets (ROA) are 0.92% and 0.44% respectively. Compared to return on equity (ROE), commercial banks' average return on assets (ROA) and net interest margin (NIM) are lower. The mean of assets size (ATS), assets quality (ATQ) and current liabilities to asset ratio (CTL) are 11.37, 0.6488 and 0.1654 respectively as well as their standard deviations are 0.2220, 0.0976 and 0.0841 respectively. Standard deviation of the debt to assets ratio (DTA) is 1.11%. The mean of debt to assets ratio (DTA) is 1.59% and its dispersion is 0.0% to 4.26%. Average debt to equity (DTE) is 21.75% and it varies from 0.0% to 68.14% during the period of 2011-2022. The average debt to assets ratio (DTA), as depicted in the following table, is about 20 times lower than the average debt to equity ratio (DTE). This lower debt to assets ratio and higher debt to equity ratio reveal that commercial banks in Bangladesh have more debt and other liabilities as a proportion of their total assets.

4.2 Correlation Matrix

Table 2 presents correlation matrix of commercial banks of Bangladesh, illustrating the correlation between independent variables. There have some negative and positive correlations between independent variables. Where all the independent variables are positively correlated with assets size (ATS) except assets quality (ATQ) and capital adequacy ratio (CAR). Assets size (ATS) is negatively associated with assets quality (ATQ) but all other independent variables are positively correlated with assets quality ratio (ATQ). Capital adequacy (CAR) ratio is negatively associated with all the independent variables.

Table 2: Correlation Matrix for Independent Variables of Commercial Banks

	ATS	ATQ	CAR	CTL	DTA	DTE
ATS	1					
ATQ	-0.04	1.00				

CAR	-0.35	-0.05	1.00			
CTL	0.11	0.10	-0.17	1.00		
DTA	0.26	0.19	-0.37	0.27	1.00	
DTE	0.33	0.22	-0.49	0.26	0.97	1.00

Source: Author's estimate based on 12 years' data of commercial banks of Bangladesh.

With the exception of capital adequacy (CAR), the current liabilities to assets ratio (CTL) shows positive correlation with all other factors. Apart from capital adequacy ratio, all identified independent variables and the debt to equity ratio (DTE) exhibit positive correlations. Debt to assets (DTA) is negatively associated with capital adequacy (CAR) but positively correlated with all independent variables. Evidence suggests minimal correlation among independent variables, except for the debt to equity ratio (DTE) against debt to assets ratio (DTA).

4.3 Regression Analysis

To determine the appropriate econometric technique, the Breusch and Pagan Lagrangian Multiplier (LM) test *(shown in appendix C)* was first conducted to assess the necessity of a panel data approach over pooled OLS. The LM test results yielded statistically significant chi-bar² values for all three dependent variables—ROA (24.60), ROE (40.72), and NIM (66.87)—with p-values less than 0.01, indicating the presence of substantial individual effects across the panel. These results justify the rejection of the pooled OLS model in favor of panel estimation techniques. Subsequently, the Hausman specification test *(shown in appendix D)* was employed to guide the choice between random effects and fixed effects models. The test statistics for ROA ($\chi^2 = 3.156$, $p = 0.789$) and ROE ($\chi^2 = 3.771$, $p = 0.708$) were statistically insignificant, supporting the use of the random effects model for these variables. However, the Hausman test for NIM ($\chi^2 = 28.168$, $p = 0.000$) revealed a significant difference between the estimators, necessitating the use of the fixed effects model for this outcome.

Table 3: Determinants of Net Interest Margin (NIM), ROE and ROA: Commercial banks

	Return on Assets (ROA)		**Return on Equity (ROE)**		**Net Interest Margin (NIM)**	
Variables	**Coefficient**	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
ATS	-.007	**.000*** **	-.082	**.000*** **	-.044	**.000*** **
ATQ	-.011	**.001*** **	-.11	**.006*** **	-.014	.162
CAR	.076	**.000*** **	-.234	.357	-.081	.203
CTL	0	.916	.017	.694	.045	**.000*** **
DTA	.425	**.000*** **	5.258	**.000*** **	.338	.342
DTE	-.026	**.003*** **	-.335	**.002*** **	-.017	.517
Constant	.09	**.000*** **	1.127	**.000*** **	.523	**.000*** **

***, ** & * Indicates significant level 1%, 5% & 10% respectively.

Source: Author's estimate base on 10 banks.

In the random effects model for ROA, assets size (ATS) and asset quality (ATQ) were found to have negative and highly significant coefficients ($p < 0.01$), suggesting that increase in assets size and asset quality reduce returns on assets. The capital adequacy ratio (CAR) and debt to total assets (DTA) demonstrated positive and statistically significant associations ($p < 0.01$), indicating that higher capital against risk-weighted assets and leverage through total assets are linked with improved profitability. Conversely, the debt to equity ratio (DTE) exhibited a significant negative relationship with ROA, highlighting the adverse effect of high financial leverage on asset-based returns. The random effects model for ROE yielded similar patterns. ATS, ATQ, and DTE were negatively and significantly associated with ROE, reaffirming the negative influence of assets size and high leverage on equity performance. DTA showed a strong positive impact on ROE ($p < 0.01$), emphasizing the role of debt in enhancing shareholder returns when managed efficiently, while CAR and current liabilities to assets (CTL) were statistically insignificant.

For NIM, the fixed effects model was used, and the results revealed that ATS continued to exert a strong negative and significant influence ($p < 0.01$). Among all variables, current liabilities to assets (CTL) had a significant positive impact on NIM ($p < 0.01$), suggesting that a positive changes in CTL leads to a positive change in NIM. Other variables, including ATQ, CAR, DTA, and DTE, did not show significant effects on NIM under the fixed effects framework.

The explanatory power of the models, as indicated by the R-squared values, further supports the robustness of the findings. The ROA model achieved an R-squared of 0.533, implying that 53.3% of the variation in ROA is accounted for by the model. The ROE model, with an R-squared of 0.319, suggests a more modest explanatory capacity. The NIM model under the fixed effects specification showed the strongest explanatory power, with an R-squared of 0.564, indicating that over half the variation in net interest margin is explained by the included variables. Collectively, these results underscore the significance of asset management and capital structure in influencing bank performance.

5. Data Accuracy Check for the Model

This section shows the statistical parameter to check the model. The study has three dependent variables but in this section show the result of data accuracy check for one dependent variables Net interest margin. Other segment and dependent variables have given relatively same result. Heteroscedasticity test, autocorrelation test, normality test and multi-collinearity test results are representing here.

5.1 White's test for heteroscedasticity

The table 4 represents Breusch-Pagan-Godfrey test for heteroscedasticity. By analyzing the heteroscedasticity (Breusch-Pagan-Godfrey test) test result, the study found that p value is 0.6932. The calculated p value 0.6932 is higher than 0.05. According to Breusch-Pagan-Godfrey test, the variance of residual is homoscedasticity. Therefore, the model does not have a heteroscedasticity problem.

Table 4: Test for Heteroscedasticity, Autocorrelation & Normality

Name of the Test	R -squared	F-statistics	P-value	Comment
Heteroscedasticity	3.877651	0.316680	0.6932	✔
Serial Correlation	9.942219	86.03370	0.0760	✔
Normality	Jarque-Bera	(1.0296)	0.5976	✔

Source: Author's estimate base on 10 banks.

5.2 Test for Autocorrelation

The table 4 shows autocorrelation test statistics such as R squared, F statistics and p value. By interpreting the Breusch-Godfrey's autocorrelation test result, the study showed from the above table that p value is 0.0760. The calculated p value 0.0760 is higher than 0.05. According to Breusch-Godfrey's autocorrelation test, no autocorrelation (serial correlation) is found in residuals. As a result, the econometric model has no autocorrelation issues.

5.3 Normality Test

Normality test's result is shown on the table 4. Normality test determines if the selected data set is well-modeled by a normal distribution. By analyzing the normality test result, the analysis found that p value is 0.5976. The calculated p value 0.5976 is higher than 0.05. According to normality test statistics, the data set are normally distributed in this model.

5.4 Multi Collinearity Test

The table 5 represents multi collinearity test for the independent variables in this study. The investigation used variance inflation factor (VIF) to detect multi-collinearity problem among the predictor factors of the selected model. The corresponding table shows that VIF of all selected independent variable is less than 10. The econometric model has no multi-collinearity issues, as per the guidelines of the variance inflation factor (VIF).

Table 5: Multi collinearity Test for the Variables

Variables Name	ATQ	ATS	CAR	CTL	DTA	DTE
VIF	3.93696	2.54618	5.30262	1.40593	7.75290	8.27328

Source: Author's estimate base on 10 banks

6. Findings and Recommendations

6.1 Findings

Descriptive statistics, the correlation matrix, and the regression analysis of the study have uncovered a number of significant findings.

This study found that Bangladeshi commercial banks effectively utilize their equity to generate net profits of 11.34%. Additionally, banks' average net profits are 0.92 percent of their total assets. Notably, average ROE exceeds average ROA, indicating efficient equity utilizing. The examination uncovers that the average difference

between the interest income and interest expense (NIM) is 2.13%. This demonstrates that commercial banks in Bangladesh can effectively convert deposits into loans.

The average debt to assets ratio (DTA) is almost 20 times smaller than the average debt to equity ratio (DTE). Consequently, Bangladeshi commercial banks appear to have more debt and other obligations as a percentage of their overall assets. The study also found that the average current liability is 16.54% on their total assets of the banks. The current liability to assets ratio is positively associated with debt to equity ratio, debt to assets ratio, assets quality ratio and assets size ratio except capital adequacy. Debt to equity ratio is positively correlated with all selected independent variables (Current liability to assets ratio, debt to assets ratio, assets quality ratio and assets size ratio) except capital adequacy ratio. Debt to assets (DTA) is negatively correlated with capital adequacy (CAR) but positively correlated with all other independent variables (Current liability to assets ratio, debt to equity ratio, assets quality ratio and assets size ratio).

The study found that Bangladeshi commercial banks' current liabilities to assets ratio (CTL) significantly boosts their profitability (NIM). This indicates that when the current liabilities to assets ratio (CTL) rises or falls by one unit; the commercial banks' net interest margin also rises or falls by 0.045. The study also showed that the profitability of Bangladeshi commercial banks is significantly adversely affected by the assets size (ATS). According to the findings, banks' net interest margins (NIM) fluctuate at a rate of 0.044 for per unit change whether their assets size (ATS) rises or falls.

The study found that Bangladeshi commercial banks' debt to assets ratio (DTA) significantly boosts their profitability (ROE). This indicates that when the debt to assets ratio rises or falls by a unit; the commercial banks' ROE also rises or falls by 5.258. Assets quality (ATQ) & Assets size (ATS) have significant adverse impact on the profitability (return on the equity) of the Bangladeshi commercial banks. Return on equity and the debt-to-equity ratio (DTE) exhibit significant negative correlation, indicates that the DTE has an adverse effect on the profitability of commercial banks. The study also revealed that the return on assets (ROA) is significantly and adversely connected with both asset quality (ATQ) and asset size (ATS). This inverse association highlights that assets' quantity and assets size both adversely affect the profitability of commercial banks. Capital adequacy ratio is consistently and positively connected with return on assets (ROA), indicating a favorable effect on the profitability of Bangladeshi commercial banks. Finally, the study found that debt to assets ratio (DTA) boosts their profitability (ROA) significantly at a rate of 0.425 in a positive manner while debt to equity ratio (DTE) deteriorates commercial banks' profitability (ROA) significantly at a rate of 0.026.

6.2 Recommendations

The recommendations given below are suggestions to improve the performance to enhance customer satisfaction and encourage clients to prefer banks, but they are not final decisions.

i. The paper indicates that debt to assets ratio (DTA) has significant positive impact on return on equity (ROE) and return on assets (ROA) of Bangladeshi commercial banks. This impact suggests that capital structure of commercial banks has positively affect the profitability. According to finance theory, an optimum level of debt equity ratio provides highest level of profit. However, higher level of debt may sometimes burden the banks, leading to lower profitability. So, the authorities of commercial banks tactfully consider their debt assets ratio to increase their net interest margin.

ii. Debt to equity ratio (DTE) has significant negative impact on return on assets at 10% significant level but it has insignificant impact on net interest margin and return on equity of commercial banks of Bangladesh. As return on equity is the proxy of profitability, debt to equity ratio has significant negative impact on profitability. So, bank management should consider debt to asset quality ratio to enhance profitability.

iii. The study highlights that current liabilities to assets ratio (CTL) is also highly significant and positively associated with return on equity and net interest margin of commercial banks of Bangladesh. Capital adequacy ratio (CAR) is also highly significant and positively associated with return on assets and net interest margin (NIM) of the banks. Both ratios are the proxy of capital structure of the banks. Consequently, authorities of commercial banks can increase their net interest margin and return on assets by carefully increasing current liabilities to assets ratio and capital adequacy ratio.

iv. Assets size (ATS) and assets quality (ATQ) have significant negative influence on among net interest margin, return on equity and return on assets of Bangladeshi commercial banks. Assets size is the exogenous variable or control variable of the study. So, bank management should consider assets size to increase the profitability.

v. The paper also found that capital adequacy ratio is significantly and positively correlated to return on the assets and net interest margin (NIM) of the commercial banks of Bangladesh. So, the authorities of all the banks should consider the mention ratio to increase their profitability.

7. Conclusion

This research paper explores the effect of capital structure on the profitability of Bangladeshi commercial banks. In today's context, banking sector is an important source of financing in Bangladesh. Therefore, the research hypothesis is developed and implemented to investigate how fund structure effect on the profitability of Bangladeshi commercial banks. The paper identifies six independent variables with four variables serving as proxies of capital structure and two as control parameters that may influence on the profitability of the commercial banks in Bangladesh. The study grouped the whole data into one category such as the commercial banks of Bangladesh and selects a balanced panel data set of commercial banks in Bangladesh covering the period from 2011 to 2022. The impact of capital structure on

profitability is examined using fixed effects model for NIM and random effects model for ROA, and ROE. The study found that the debt to assets ratio has a substantial impact and is positively correlated with both the return on equity and return on assets of Bangladeshi commercial banks. Assets size, assets quality, and debt-to-equity ratio are very significant and negatively associated with the same. However, unlike return on equity, return on assets is significantly and favorably associated with banks' performance. For net interest margin, assets size and current liability to assets ratios are found to have significant association: negative with assets size, and positive with current liabilities to assets ratio.

The research holds substantial relevance for stakeholders, including bank management, policymakers, and loan applicants. The discerned insights serve as a pivotal resource for shaping precise policies and facilitating judicious decisions related to market access for loans. Anticipating promising future prospects by expanding the research horizon through the inclusion of new explanatory variables, employing advanced econometric methodologies, extending the data duration, and conducting a comprehensive cross-country analysis.

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Appendics

Appendix A: Breusch-Pagan-Godfrey Heteroscedasticity Test

F-statistic	0.316680	Prob. F(6,3)	0.8927
Obs*R-squared	3.877651	Prob. Chi-Square(6)	0.6932
Scaled explained SS	0.175838	Prob. Chi-Square(6)	0.9999
R-squared	0.387765	Mean dependent var	4.35E-07
Adjusted R-squared	-0.836705	S.D. dependent var	4.61E-07

Source: Author's estimate base on Net interest margin (NIM)

Appendix B: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test (NIM)			
F-statistic	86.03370	Prob. F(2,1)	0.0760
Obs*R-squared	9.942219	Prob. Chi-Square(2)	0.0069
R-squared	0.994222	Mean dependent var	3.47E-18
Adjusted R-squared	0.947997	S.D. dependent var	0.000695
S.E. of regression	0.000159	Akaike info criterion	-15.16324
Sum squared resid	2.51E-08	Schwarz criterion	-14.89091
Log likelihood	84.81619	Hannan-Quinn criter.	-15.46198
F-statistic	21.50842	Durbin-Watson stat	2.482362
Prob(F-statistic)	0.165323		

Source: Author's estimate base on Net interest margin (NIM)

Appendix C: Breusch and Pagan Lagrangian Multiplier Test for Random Effects

Breusch and Pagan Lagrangian multiplier test for random effects Null Hypothesis: Random Effects are insignificant			
	ROE	**ROA**	**NIM**
Chibar^2(01)	40.72	24.60	66.87
Chibar^2	**.000***	**.000***	**.000***

Source: Author's estimate

Appendix D: Hausman (1978) Specification Test

Hausman (1978) specification test [H_0: Random Effect (RE) is appropriate model]

	ROA	ROE	NIM
Chi-square test value	3.156	3.771	28.168
P-value	.789	.708	.000

Source: Author's estimate

Levin-Lin-Chu unit-root test for ROE

	Statistic	p-value
Unadjusted t	-7.2141	
Adjusted t*	-3.8434	0.0001

Levin-Lin-Chu unit-root test for ROA

	Statistic	p-value
Unadjusted t	-6.6042	
Adjusted t*	-2.5966	0.0047

Levin-Lin-Chu unit-root test for NIM

	Statistic	p-value
Unadjusted t	-2.1859	
Adjusted t*	-1.7237	0.0424