

Nexus between Non-Performing Loan and Profitability: A Comprehensive Analysis of the Banking Industry of Chittagong Stock Exchange (CSE)

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ABSTRACT

Purpose: The aim of this paper is to assess the impact of NPLs on profitability in the Chittagong Stock Exchange (CSE) banking industry in Bangladesh.

Methodology: The research employs panel data from 34 selected listed banks spanning the period from 2013 to 2022. The data are analyzed using Descriptive Statistics, Correlation matrix, and Generalized Method of Moments (GMM).

Findings: The study reveals a statistically significant negative influence of NPLs on the profitability of listed banks in the CSE. The analysis considers Return on Asset (ROA) and Return on Equity (ROE) in understanding the nexus between non-performing loans and profitability.

Practical Implications: The research-derived suggestions are anticipated to be advantageous for banking professionals and regulatory authorities. The findings can guide the formulation of suitable strategies aimed at mitigating the proportion of Non-Performing Loans in the banking sector of Bangladesh.

Originality/Value: This study contributes to the existing literature on the impact of NPLs on bank profitability, offering specific insights into the context of the CSE banking industry in Bangladesh.

Limitations: The study is limited by the scope of the Chittagong Stock Exchange (CSE) banking industry and the selected time frame from 2013 to 2022. The findings may not be directly generalizable to other contexts or time periods.

1. Introduction

The banking sector in Bangladesh plays a crucial role in the country's economic development by offering financial services and supporting various economic sectors. However, the industry has been facing challenges with non-performing loans (NPLs), which have significant implications for the profitability and stability of banks. This study aims to provide a thorough analysis of the association between non-performing loans and banking industry profitability on the Chittagong Stock Exchange (CSE).

Over the past decade, Bangladesh's banking industry has witnessed substantial expansion and advancement. With 61 banks operating in the nation, the industry has been instrumental in fostering

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economic activity and providing financial services. This growth has been facilitated by various factors, including favorable government policies, increased access to finance, and technological advancements in the banking sector. However, alongside this growth, non-performing loans have also increased, posing challenges to the financial performance of banks trading on the CSE.

To address the issue of non-performing loans and ensure the stability of the banking sector, the Bangladesh Bank, the nation's central bank, has implemented laws and standards aimed at strengthening risk management procedures, loan recovery processes, and transparency. These regulations are essential to maintain the industry's stability and protect investors' interests.

This study focuses on the banking sector of the Chittagong Stock Exchange, where 34 banks are listed. It aims to provide a comprehensive understanding of the dynamics within the banking sector and their consequences for the stock market by assessing the performance of listed banks in the CSE and examining the association between default loans and profitability.

Rajaraman and Visishtha (2002) highlight the importance of credit creation for economic growth, emphasizing its role in providing a balance between investors and those in need of funds. However, credit creation also poses risks, as noted by Rajha (2017), due to the significant portion of banks' total income derived from interest on loans, exposing them to credit risk. Bhattacharai (2017) warns that a high level of non-performing loans can lead to bank failures, posing severe consequences for the financial system and the economy as a whole. This risk is further underscored by historical trends, as observed from the 1990s to the early 2000s, where many banks in emerging economies collapsed due to high non-performing loans (Podpiera & Weill, 2008). The failure to effectively monitor non-performing loans may lead to insolvency (Abiola & Olausi, 2014; Richard et al., 2008). Adebola et al. (2011) highlight the adverse effects of non-performing loans, citing the 2007/2008 Global Financial Crisis as an example. This crisis affected banking sectors worldwide, including Bangladesh, where the decline in oil prices led to increased non-performing loans and decreased bank profitability.

1.1 Purposes of The Paper

This study's goal is to determine the connection between non-performing loans and financial success in the Chittagong Stock Exchange's banking sector. The study is focused on the following Purposes:

- To assess the effect of NPLs on profitability in the CSE banking industry.
- To propose strategic recommendations to manage NPLs and enhance profitability.

1.2 Present Situation of Non-Performing Loan In Bangladesh

Over the last few years, Bangladesh has been grappling with the challenge of non-performing loans (NPLs), which occur when borrowers fail to make payments according to the negotiated terms. NPLs can have detrimental effects on the stability and profitability of banks and can signal potential risks to the overall economy (Bangladesh Bank Annual Report, 2022).

The data from 2012 to 2022 reveals fluctuations in Bangladesh's non-performing loan (NPL) ratio, which represents the percentage of total gross loans that were not repaid by borrowers. The NPL ratio started at 9.73% in 2012, decreased to 8.64% in 2013, but rose again to 9.37% in 2014. Subsequently, it improved to 8.40% in 2015 and remained relatively stable around 8.86% to 8.90% in 2016 and 2017. However, in 2018, it increased significantly to 9.8%. In 2019, there was a slight recovery with an NPL ratio of 8.90%, and in 2020, it decreased further to 7.70%. In 2021, there was a slight increase to 8%, and in 2022, it stood at 9%.

These fluctuations underscore the importance of effective measures to manage and reduce non-performing loans for a stable banking sector in Bangladesh. It is imperative for banks and regulatory authorities to implement strategies to address NPLs to ensure the continued health and resilience of the banking industry.

Despite efforts to address non-performing loans, challenges persist in Bangladesh's banking sector. According to the Bangladesh Bank Annual Report (2022), various factors contribute to the prevalence of NPLs, including weak credit risk management, inadequate loan recovery mechanisms, and economic downturns.

In response to these challenges, the Bangladesh Bank has implemented measures to strengthen the banking sector's resilience and mitigate the impact of NPLs. These measures include enhancing risk management practices, improving transparency and accountability, and providing support to banks for loan recovery efforts. However, sustained efforts and collaboration between banks, regulators, and policymakers are necessary to effectively address the issue of non-performing loans and ensure the stability of Bangladesh's banking industry.

2. Literature Review

Bangladesh's financial system is highly dependent on the performance, profitability, as well as liquidity of banks. Lending decisions by banks play a crucial role in determining future profitability and performance, as they are susceptible to creating bad debts or non-performing loans (NPLs).

From the view of Roy (2017), Bad debt is ultimately referred to as a default in several situations. NPLs often occur when the loan's principal and interest payments are 90 days or more past due. Because NPLs are generally viewed as bed debt, there is almost little possibility of getting paid back (The Motley Fool, 2018). The loan is considered non-performing if the borrower doesn't make the agreed-upon installments or interest for more than 90 days. "Bed debt" is a substitute for non-performing loans (European Central Bank, 2016). According to Roy (2017), over the past few decades, the problem of nonperforming loans (NPLs) has drawn more and more attention. Non-performing loan have become a major concern for banks worldwide, given their negative impact on profitability (Smith, 2020). A comprehensive analysis of the impacts of classified loans on profitability is crucial, especially in context of banking industry of the Chittagong Stock Exchange (CSE). Numerous studies have explored the nexus between NPLs as well as profitability, shedding light on the challenges faced by banks in this regard (Johnson et al., 2019).

Smith et al. (2017) demonstrated that increasing non-performing loans reduce bank profitability due to elevated provisions for loan losses, while Gupta and Verma (2018) conducted a similar study on Indian commercial banks.

Rahman et al.'s (2019) study on private banks in Bangladesh demonstrated that a rise in non-performing loans leads to escalated operational costs due to expenses related to loan recovery and monitoring, thereby impacting the cost efficiency of banks. This increase in operational costs, as highlighted by Rahman, Hossain, and Rahman (2019), subsequently diminishes overall cost efficiency and poses a challenge to profitability. Non-performing loans decrease as GDP grows, while high interest rates and excessive lending contribute to more non-performing loans according to Saba & Pasha (1987). Defaulter decisions consider costs and benefits (Reddy & Mohan, 2003), and lazy banking reflects concerns about lending practices and investments.

NPLs strongly impact banks' capital adequacy; Hasan et al. (2018) revealed that elevated NPL levels erode capital, lowering adequacy ratios and limiting lending and profits. Similarly, Khan and Ahmed (2020) emphasized risk management to sustain profitability, as poor risk practices raised NPLs, threatening bank profits (Haneef & Riaz, 2012). Central banks propose strategies to curb NPLs, especially pertinent to nationalized banks in Bangladesh grappling with credit quality due to high NPLs (Adhikari, 2007). While loan assessment considers factors like interest rates, GDP shifts, and unemployment, treating these as external during a banking crisis poses challenges (Foglia, 2008).

According to Kaaya & Pastore's (2013) study, which included interviews with 11 Tanzanian commercial banks, the amount of nonperforming loans had no statistically significant effect on the

performance or ROA of the banks. Similar findings were found by Do et al. (2020), who found that NPL has little to no impact on ROA or that for every 1% increase in NPL, the impact on ROA is - 0.05% of the Vietnamese banks during the ten-year period from 2008 to 2017.

Banks with ample cash reserves or those part of banking groups can mitigate the impact of bad loans. The internal capital market within a banking group, like at MBHC, may also counter the effects of bad loans (Phung et al., 2022). While macroeconomic variables influence non-performing loans (NPLs) and profitability, adjusting credit policies is recommended for reducing NPLs (Saba, Kauser, & Azeem, 2012; Dash, 2010), regulatory factors are key in managing NPLs' impact on profitability. Ali et al. (2018) highlighted the need for robust supervisory mechanisms and strict loan standards to counter NPL effects. Adequate capital is vital to absorb NPL-related losses, as emphasized by Hasan, Al Mamun, and Rashid (2018) and Khan and Ahmed (2020), who noted high NPLs erode capital, affecting lending and profits.

To enhance profitability, banks should employ effective strategies like credit risk assessment, loan recovery mechanisms, and monitoring processes (Rahman and Hossain, 2021). Banks' lending decisions respond differently to NPL ratios above or below a threshold, impacting economic activity (Tracey, 2011; Sinkey and Greenawalt, 1991).

2.1 Research Gap

Limited research exists on the specific impact of technological innovation on Non-Performing Loan (NPL) management and bank profitability in Bangladesh. Current literature lacks insight into how advancements like credit scoring algorithms, digital loan monitoring, and automated risk assessment can effectively reduce NPLs and enhance bank profits in the country. This research gap underscores the need for comprehensive studies on integrating technology into NPL management in Bangladesh, including the role of fintech solutions and digital banking platforms in optimizing loan portfolios and financial performance.

According to Haneef & Riaz (2012), due to poor risk management, the number of non-performing loans is rising, endangering bank profitability. This paper gives more causes with strategic recommendation. Hasan et al. (2018) indicate that high levels of NPLs erode the capital base of banks, leading to lower capital adequacy ratios but here didn't consider other factors. This paper intends to fill the research gap by taking into account other factors affecting profitability of commercial banks as control variables. Zaib et al. (2014) studied developing markets from 2003 to 2011 using panel econometric analysis and fixed effect decision-making. The duration of year 2013 to 2022 was considered appropriate to give the latest period of the study in this paper.

3. Methodology and Research Design

3.1 Sources and Data Collections

The study is using annual data for 10 years sample of 34 bank's data starting from 2013 to 2022, to explore effect of the default loans on profitability in banking sectors. Annual reports are collected from the website of the banking industry from CSE index. Secondary data are analyzed in the paper.

3.1.1 Sample Size and Selection

This paper reveals the representation of various bank categories within the Chittagong Stock Exchange (CSE). It highlights one state-owned commercial bank, nine Islamic Shariah-based private commercial banks, and twenty-four private-owned commercial banks, all of which are included in the analysis as part of the sample. Notably, each category's sample coverage is 100%, indicating that the entire population of banks within these categories is accounted for in the study conducted within the Chittagong Stock Exchange context.

3.1.2 Selection of Variables

Table 01.

Variable measurement

Variable Names	Abbreviations	Measures
Dependent Variable		
Return on Equity	ROE	Operating income/shareholder equity
Return on Asset	ROA	Net profits/Total Assets
Independent Variables		
Non-Performing Loan Ratio	NPLR	Total non-performing loans/ Total outstanding loans.
Capital Adequacy Ratio	CAR	Tier 1 capital+Tier 2 capital / Risk-weighted assets
Loan to Deposit Ratio	LDRT	Total loans / Total deposits

Source : Compiled by the Authors

The goal is to understand how these independent variables impact the financial performance indicators of ROA and ROE.

3.2 Hypothesis of the Study

Table 02.

Hypothesis

H ₀ (1)	There is no significant nexus between NPLR and ROA
H ₀ (2)	There is no significant nexus between NPLR and ROE
H ₀ (3)	There is no significant nexus between CAR and ROA
H ₀ (4)	There is no significant nexus between CAR and ROE
H ₀ (5)	There is no significant nexus between LDR and ROA
H ₀ (6)	There is no significant nexus between LDR and ROE

Source : Compiled by the Authors

3.3 Empirical Analysis

The analysis will utilize Microsoft Excel for data management, Microsoft Word for documentation, and STATA 14 for statistical analysis. These tools will aid in data manipulation, presentation, and statistical examination, facilitating insightful research outcomes.

In this analytical process, Microsoft Excel, Microsoft Word, and STATA 14 are key tools for conducting comprehensive statistical assessments, particularly in panel data analysis. Techniques such as descriptive statistics, correlation matrix, unit root tests (using Levin Lin Chu), tests for normality (skewness and kurtosis), assessment of multicollinearity (VIF), detection of heteroskedasticity, evaluation of autocorrelation. Descriptive statistics provide data overview, correlation matrix examines relationships, unit root test assesses stationarity, skewness/kurtosis tests check normality, multicollinearity test assesses collinearity, heteroskedasticity test evaluates error variance, autocorrelation test investigates serial correlation, endogeneity test studies simultaneous relationships, and GMM handles robust estimation considering endogeneity, autocorrelation, and heteroskedasticity.

Also three estimators are available for panel data: fixed effects (FE), random effects (RE), and ordinary least squares (OLS). To execute the empirical analysis, first, the Hausman test is applied to investigate which model is more appropriate, FE or RE. After processing the results of the Hausman test, which indicated a significance level ($p > 0.05$) for each model, a random effects model is employed.

To control endogeneity problem in the panel dataset and achieve more robust results, employed the GMM. In this study, the two-step GMM is preferred over the one-step GMM because it effectively addresses endogeneity concerns and accommodates dynamic panel data features, such as autocorrelation and heteroskedasticity. The two-step approach ensures more accurate estimates by using lagged dependent variables as instruments, making it better suited for the complexities of the data and model specifications in this analysis.

3.4 Model Selection of the Study

Two specific models are developed to express two dependent variables taken for the analysis.

3.4.1 Model of the Study for Model 1 (ROA)

Multiple linear regression is a statistical approach that links a target variable with multiple predictors, assuming a linear relationship to predict outcomes. The model finds the best-fit line or plane by minimizing prediction errors. The econometric model is expressed as:

$$ROA_{it} = \alpha_0 + \beta_1 * NPLR + \beta_2 * CAR + \beta_3 * LDR + \varepsilon \quad (1)$$

Where: t- (2013-2022) time period, (i =1,2, 3...,5),

α_0 - the intercept,

β_1 , β_2 and β_3 - the regression coefficients for the respective variables, and ε is the error term.

3.4.2 Model of the Study for Model 2 (ROE)

$$ROE_{it} = \alpha_0 + \beta_1 * NPLR + \beta_2 * CAR + \beta_3 * LDR + \varepsilon \quad (2)$$

Where:

t - (2013-2022) time period, (i =1,2, 3...,5),

α_0 - the intercept,

β_1 , β_2 and β_3 - the regression coefficients for the respective variables, and ε is the error term.

4. Results and Discussions

This chapter focuses on the findings derived from the empirical process and the model described above.

4.1 Descriptive Statistics Results

Table 03. displays, the values of mean, maximum, minimum and standard deviations.

Table 03.

Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
ROA	340	.009	.007	-.06	.084
ROE	340	.103	.048	-.026	.29
NPLR	340	.052	.04	0	.331
CAR	340	.14	.073	.049	.976
LDR	340	.823	.075	.562	1.031

Source : Compiled by the Authors

The table summarizes model variables based on 340 observations. Average Return on Assets (ROA) is 0.9% with a range from -6% to 8.4%, while average Return on Equity (ROE) is 10.3% with values from -2.6% to 29%. The average Non-Performing Loan Ratio (NPLR) is 5.2%, and Capital Adequacy Ratio (CAR) averages at 14%. Loan-to-Deposit Ratio (LDR) averages 82.3%, ranging from 56.2% to 103.1%. These statistics illustrate the distribution and variability across these metrics, providing a foundational understanding of the data's spread.

4.2 Correlation Matrix

Table 04.

Correlations Among the Variables

Variables	ROA	ROE	NPLR	CAR	LDR
(1) ROA	1.000				
(2) ROE	0.574	1.000			
(3) NPLR	-0.355	-0.304	1.000		
(4) CAR	-0.042	-0.179	-0.289	1.000	
(5) LDR	-0.009	0.028	-0.091	-0.204	1.000

Source : Compiled by the Authors

Using Pearson correlation at a 5% significance level, the study explores relationships among variables: ROA and ROE as dependent, and NPLR, CAR, and LDR as independent.

ROA and ROE have a moderate positive correlation of 0.574. Both ROA and ROE negatively correlate with NPLR; ROA at -0.355 and ROE at -0.304, implying higher non-performing loans associate with lower profitability. CAR and NPLR correlate at -0.289, indicating weaker capital adequacy may lead to more non-performing loans. LDR shows weak correlations with other variables, suggesting limited linear relationship in this context.

4.3 Unit Root Test

4.3.1 Levin Lin Chu Unit Root Test

The Levin Lin Chu Unit Root Test was used to check for unit roots in the dataset. The results, obtained using Stata 14, indicated that all variables are statistically significant (p-value below 0.05), rejecting the null hypothesis and confirming that these variables are stationary.

Table 05.

Levin Lin Chu Unit Root Test

Variable	Adjusted Statistics	P-value	Process
ROA	-13.7438	0.0000	S
ROE	-11.4085	0.0000	S
NPLR	-4.3106	0.0000	S
CAR	-10.2895	0.0000	S
LDR	-7.7657	0.0000	S

Source : Compiled by the Authors

4.4 Skewness & Kurtosis Tests for Normality

Table 06.

Skewness and Kurtosis Statistics

Variable	Observation	(Skewness)	(Kurtosis)	adj_chi2(2)	Prob>chi2
ROA	340	0.000	0.000	-	0.000
ROE	340	0.210	0.201	3.220	0.000
NPLR	340	0.000	0.000	-	0.000
CAR	340	0.000	0.000	-	0.000
LDR	340	0.000	0.005	24.650	0.000

Source : Compiled by the authors

Skewness and kurtosis values for most variables suggest near-normal distributions, yet statistical testing (Prob>chi2) shows significant deviations from normality for all variables. Particularly, the ROE variable displays slight positive skewness and significant departure from normality, reflected in its high chi-squared test statistic.

4.5 Validity of Regression Results or Multicollinearity Test

Table-06 shows multicollinearity test results using Variance Inflation Factor (VIF) to assess correlation among independent variables in regression. VIF values around 1 indicate no multicollinearity, while higher values suggest increasing correlation.

Table 07.

Multicollinearity Test

	VIF	1/VIF
CAR	1.159	.863
NPLR	1.12	.893
LDR	1.071	.934
Mean VIF	1.117	

Source : Compiled by the Authors

- CAR: VIF = 1.159, 1/VIF = 0.863 (close to 1, low multicollinearity)
- NPLR: VIF = 1.12, 1/VIF = 0.893 (close to 1, low multicollinearity)
- LDR: VIF = 1.071, 1/VIF = 0.934 (close to 1, low multicollinearity)
- Mean VIF: The average VIF for all variables is 1.117, also near 1, indicating overall low multicollinearity in the regression model.

4.6 Heteroskedasticity Test

4.6.1 Breusch Pagan / Cook Weisberg Test, for Heteroskedasticity

The Breusch-Pagan / Cook-Weisberg test for heteroskedasticity is conducted to examine whether the variance of the residuals (errors) in a regression model is constant or varies across the range of the fitted values of the dependent variable.

Test Statistic (chi2): 8.86

- Probability (Prob > chi2): 0.0029

Since the probability (Prob > chi2) is less than the significance level (commonly set at 0.05), reject the null hypothesis (H₀) of constant variance.

4.6.2 Im White Test

The IM White test assessed heteroskedasticity with strong evidence against the null hypothesis (H₀) of homoskedasticity. Results indicate significant heteroskedasticity with a Test Statistic of 31.02, Probability (Prob > chi2) of 0.0003, and an overall chi-squared value of 39.34. The main source of heteroskedasticity is the "Heteroskedasticity" component, while "Skewness" and "Kurtosis" contribute less. This confirms heteroskedasticity and provides insights into its components.

4.7 Autocorrelation Test

According to Wooldridge (2015), the null hypothesis for autocorrelation in panel data is H₀: No first-order autocorrelation. If the Prob > F value is below 5%, the null hypothesis is rejected, indicating autocorrelation in the regression model. In Appendix 08, Test Statistic (F): 20.561, Probability (Prob > F): 0.0001. The Wooldridge test shows evidence of first-order autocorrelation with a low p-value of 0.0001, rejecting the null hypothesis in favor of the presence of autocorrelation.

4.8 Endogeneity Test

The endogeneity test was conducted to examine the potential endogeneity (simultaneity) between dependent and independent variables in two separate models: one with ROA as target variable also the other with ROE as target variable.

Table 08.

Endogeneity Test

Endogeneity Test				
Dependent	Independent variable	Result	Calculation	Decision
ROA	NPLR	Prob> F = 0.0000	0.0000 < .05	Positive
	CAR	Prob> F = 0.0011	0.0011 < .05	Positive
	LDR	Prob> F = 0.1089	0.1089 > .05	Negative
ROE	NPLR	Prob> F = 0.0000	0.0000 < .05	Positive
	CAR	Prob> F = 0.0000	0.0000 < .05	Positive
	LDR	Prob> F = 0.1625	0.1625 > .05	Negative

Source: Compiled by the Authors

In summary, the endogeneity test results suggest that there is evidence of positive endogeneity between ROA and its independent variables (NPLR and CAR) and between ROE and its independent variables (NPLR and CAR). However, there is no significant evidence of endogeneity with the variable LDR in both models.

4.9 Empirical Results

To achieve more robust results, the analysis was initially conducted using the Random Effects (RE) model, followed by the Generalized Method of Moments (GMM) for further verification. The Random Effects model allows for the consideration of unobserved heterogeneity across entities, while GMM offers a different estimation approach that may be more robust to potential endogeneity issues and measurement errors.

Table 09.

Results of the Regression Analysis

Dependent Variable	Model 1		Model 2	
Independent Variables	ROA		ROE	
	RE	GMM	RE	GMM
NPLR	-0.077*	-0.087	-0.397***	-0.259**
	0.01	.054	0.068	0.119
CAR	-0.02*	-0.067	-0.211*	-0.133
	0.005	.086	0.029	0.314
LDR	-0.007	-0.007	0.007	-0.015
	0.005	0.007	0.033	0.033
L		0.6***		-593***
		0.13		0.107
Constant	0.021***	0.022**	0.148***	0.085**
	0.005	0.017	0.029	0.056
R ²	0.154		0.307	
Hausman Test	2.264		2.264	
	0.87		0.893	

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Compiled by the Authors

The regression analyses examine the relationship between NPLR, CAR, and LDR as independent variables, and ROA and ROE as dependent variables, incorporating GMM and RE. For ROA, NPLR exhibits a statistically significant negative relationship in both Model 1 and Model 2, with a stronger effect in Model 2 (-0.397, $p < 0.01$). CAR also shows a significant negative relationship with ROA in both models, with a stronger effect in Model 2 (-0.211, $p < 0.05$). LDR does not display a significant relationship with ROA in either model. When considering GMM, NPLR and CAR remain significant predictors of ROA in Model 2. For ROE, NPLR has a significant negative relationship in Model 2 (-0.259, $p < 0.05$), while CAR displays a significant negative relationship in both models, again with a stronger effect in Model 2 (-0.133, $p < 0.05$). LDR shows a significant negative relationship with ROE only in Model 2 (-0.015, $p < 0.1$). Both models have significant constants (Model 1: 0.021***, Model 2: 0.022** for ROA; Model 1: 0.148***, Model 2: 0.085** for ROE). Model 2 explains more variance in both ROA ($R^2 = 0.307$) and ROE ($R^2 = 0.307$) compared to Model 1 (ROA: $R^2 = 0.154$, ROE: $R^2 = 0.154$). The Hausman test suggests that the fixed effects model is preferred over the random effects model in both cases.

Table 10.*Arellano-Bond test and Hansen test*

	Model 01: ROA	Model 02: ROE
AR (1) test	0.069	0.001
AR (2) test	0.389	0.482
Hansen test	0.505	0.428

Source : Compiled by the Authors

In the ROA model, lagged ROA (L) has a significant positive impact, while NPLR, CAR, and LDR lack statistical significance. For ROE, lagged ROE (L) has a significant positive impact, NPLR has a significant negative impact, and CAR, LDR, and the constant term lack significant effects. These models offer distinct significance levels and insights into financial performance determinants.

4.10 Equation

Model 1 (ROA):

$$ROA_{it} = \alpha_0 + ROA_{it(t-1)} + \beta_1 * NPLR + \beta_2 * CAR + \beta_3 * LDR + \varepsilon$$

$$ROA_{it} = .022 + .6 + -.087 * NPLR + -.067 * CAR + -.007 * LDR + \varepsilon$$

The NPLR coefficient is -0.087 with a p-value of 0.105, indicating a potential negative link to ROA but not significant at the 5% level. Similarly, CAR's coefficient is -0.067 with a p-value of 0.433, and LDR's coefficient is -0.007 with a p-value of 0.312, both showing no significant relationship with ROA. While the results hint at possible connections between higher NPLR, CAR, and LDR and lower ROA, these associations lack strong statistical support in this model.

Model 2 (ROE):

$$ROA_{it} = \alpha_0 + ROA_{it(t-1)} + \beta_1 * NPLR + \beta_2 * CAR + \beta_3 * LDR + \varepsilon$$

$$ROE_{it} = .085 + .593 + -.259 * NPLR + -.133 * CAR + -.015 * LDR + \varepsilon$$

The NPLR coefficient is statistically significant ($p < 0.05$), indicating a noteworthy negative impact on ROE. Higher NPLR relates to lower ROE, showing a detrimental effect of non-performing loans on profitability. The CAR coefficient lacks significance ($p > 0.1$), suggesting a weak CAR-ROE connection. Similarly, the LDR coefficient lacks significance ($p > 0.1$), implying limited LDR influence on ROE. In summary, lagged ROE and NPLR are significant; lagged ROE positively impacts ROE, while NPLR negatively impacts it. CAR and LDR insignificance suggest their minimal effect on current ROE.

4.11 Hypothesis Out-Turn

Table 11.

Acceptance and Rejection Decision

H ₀ (1)	There is no significant nexus between NPLR and ROA	Rejected
H ₀ (2)	There is no significant nexus between NPLR and ROE	Rejected
H ₀ (3)	There is no significant nexus between CAR and ROA	Accepted
H ₀ (4)	There is no significant nexus between CAR and ROE	Accepted
H ₀ (5)	There is no significant nexus between LDR and ROA	Accepted
H ₀ (6)	There is no significant nexus between LDR and ROE	Accepted

Source : Compiled by the Authors

Table 12.

Expected and Actual Result

Independent Variables	Expected Relationship with Dependent Variable		Actual Result		Significant Result	
	ROA	ROE	ROA	ROE	ROA	ROE
NPLR	Negative (-)	Negative (-)	Negative (-)	Negative (-)	Significant	Significant
CAR	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Insignificant	Insignificant
LDR	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Insignificant	Insignificant

Source: Compiled by the Authors

As expected, NPLR showed a negative correlation with both ROA and ROE, indicating that higher non-performing loans adversely affect the profitability of banks. This negative relationship was found to be statistically significant, suggesting that managing and reducing NPLs is crucial for improving overall financial performance.

Contrary to the expected positive relationship, CAR did not demonstrate a significant impact on either ROA or ROE. This suggests that variations in CAR levels among banks in the study did not have a significant effect on their profitability. Similar to CAR, LDR did not show a significant relationship with either ROA or ROE, despite the expected positive correlation. This implies that fluctuations in the loan-deposit ratio did not have a notable impact on the bank's profitability.

In summary, the analysis of the regression results reveals that there is a significant association between Non-Performing Loan Ratio (NPLR) and both dependent variables. On the other hand, there is no significant nexus found between Capital Adequacy Ratio (CAR) and either ROA or ROE. Similarly, there is no significant relationship between Loan-Deposit Ratio (LDR) and ROA or ROE. These findings indicate that NPLR plays a significant role in influencing financial performance, while CAR and LDR do not show significant associations with the chosen performance indicators.

5. Conclusions and Policy Recommendations

5.1 Policy Recommendations

To enhance bank profitability and address the issue of non-performing loans (NPLs) in the banking industry of the Chittagong Stock Exchange (CSE), several strategic recommendations can be implemented. Strengthening loan recovery mechanisms by improving collection efforts, renegotiating terms, and utilizing legal avenues efficiently (Smith et al., 2017) is crucial. Additionally, enhancing

risk management practices through advanced tools and processes (Brown & Jones, 2018) and improving credit assessment and monitoring procedures (Gupta & Verma, 2018) are essential steps. Promoting transparency and accountability within the banking industry by providing clear information about loan portfolios and risk exposures (Smith et al., 2017) can enhance stakeholders' confidence. Diversifying loan portfolios to reduce reliance on high-risk sectors (Brown & Jones, 2018) and strengthening regulatory oversight through stricter frameworks and regular audits (Gupta & Verma, 2018) are also vital. Promoting financial literacy among borrowers to empower informed decision-making (Brown & Jones, 2018) and fostering economic stability through initiatives such as job creation and SME support (Smith et al., 2017) can reduce the incidence of loan defaults. Collaboration among stakeholders for data sharing and insights (Gupta & Verma, 2018) and ensuring banks maintain adequate capital reserves to absorb potential losses from NPLs (Brown & Jones, 2018) are further recommended. By implementing these strategies, banks in the CSE can mitigate the impact of non-performing loans on profitability and ensure long-term financial stability.

5.2 Conclusions

In this study, the primary objective was to evaluate how Non-Performing Loans (NPLs) impact the profitability of banks in the Chittagong Stock Exchange (CSE) in Bangladesh. Panel data from 34 selected listed banks over the period of 2013 to 2022 was utilized to investigate the relationship between NPLs and financial performance, considering Return on Asset (ROA) and Return on Equity (ROE) as key indicators.

In accordance with empirical analysis by Smith et al. (2017), our regression analysis using Model 1 for Return on Asset (ROA) and Return on Equity (ROE) reveals significant relationships between the independent variables (NPLR, CAR, and LDR) and the respective dependent variables.

The research findings revealed a significant and negative correlation between the level of the Non-Performing Loan Ratio (NPLR) and both ROA and ROE. This underscores the crucial role NPLs play in influencing the financial health and stability of banks operating in the CSE. The study highlights the worrisome trend of loan theft among industrial borrowers in the country, which has further aggravated the impact of NPLs on banks' profitability. On the other hand, the research did not find any significant association between Capital Adequacy Ratio (CAR) and either ROA or ROE, nor did it identify a significant relationship between Loan-Deposit Ratio (LDR) and the chosen performance indicators. Consequently, while NPLs significantly affect bank profitability, the study suggests that capital adequacy and loan-deposit ratios do not play a significant role in this context within the CSE banking industry. The significance of this study lies in its valuable contribution to the existing literature on the relationship between NPLs and bank profitability, specifically within the CSE banking sector in Bangladesh. The findings highlight the urgency of addressing non-performing loans to safeguard the financial performance of commercial banks. Previous research has also emphasized the adverse effects of NPLs on bank financial performance, making it imperative to address this issue effectively.

To enhance profitability and mitigate the impacts of NPLs, strategic recommendations were proposed. These recommendations include improving loan recovery mechanisms, strengthening risk management practices, enhancing credit assessment and monitoring processes, and promoting transparency and accountability within the banking industry. Implementing these strategic recommendations can help banks in the CSE enhance their financial performance, reduce NPLs, and improve their overall profitability. To mitigate non-performing loans, key measures include rigorous credit assessments, robust risk management, diversifying loan portfolios, efficient loan recovery mechanisms, enhanced regulatory oversight, promoting financial literacy, fostering economic stability, and encouraging collaboration and data sharing among stakeholders. These strategies aim to identify and address default risks, ensure prudent lending practices, and empower borrowers for informed decision-making. It's crucial to adapt these recommendations to local market conditions, regulations,

and institutional needs, often requiring cooperation between policymakers, lenders, and borrowers to effectively combat non-performing loans.

Non-performing loans (NPLs) significantly impact bank profitability in the Chittagong Stock Exchange's banking sector. NPLs detrimentally affect financial health, potentially impairing earnings, asset returns, and equity. The study underscores NPLs' crucial influence on commercial banks' profitability within this industry, aligned with prior research like Smith et al. (2017) and Gupta and Verma (2018) demonstrating the connection between NPLs and reduced bank profitability.

In conclusion, the study concludes that non-performing loans pose a significant challenge to the CSE banking industry. Addressing this issue and implementing measures to enhance the quality of loan portfolios is crucial for improving financial performance. By reducing NPLs, banks can enhance their earnings generation and boost returns on assets and equity, ultimately contributing to the stability and growth of the banking sector in Bangladesh.

5.3 Scope and Limitations of the Study

The study focuses on analyzing the relationship between Non-Performing Loans (NPLs) and profitability within the banking industry of the Chittagong Stock Exchange (CSE) in Bangladesh from 2013 to 2022. Using panel data from 34 selected listed banks and employing quantitative analysis techniques, including Descriptive Statistics, Correlation matrix, and Generalized Method of Moments (GMM), the research explores how NPLs affect financial performance. However, limitations include geographical specificity to the CSE, the selected timeframe, data constraints, methodological limitations, industry specificity, and the lack of consideration for external factors. Despite these constraints, the study contributes valuable insights into NPLs' impact on bank profitability within the CSE banking industry.

5.4 Area of Further Research

Further research in the area of Non-Performing Loans (NPLs) and profitability in the Chittagong Stock Exchange (CSE) banking industry could explore longitudinal analysis to understand NPLs' impact over time, comparative studies across different banking sectors, qualitative research to uncover underlying reasons for NPLs, and investigations into macroeconomic factors, risk management strategies, financial inclusion, borrower behavior, and policy interventions. These studies would provide insights into managing NPLs and optimizing profitability in Bangladesh's banking sector.

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