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THE DYNAMICS OF NON-PERFORMING LOANS IN THE ISLAMIC BANKING SECTOR OF BANGLADESH: A QUANTITATIVE ANALYSIS

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Abstract: Non-Performing Loans (NPLs) is a critical issue that affects the performance of Islamic banking in Bangladesh. This study aims to investigate the determinants of NPLs in the Islamic banking sector of Bangladesh, considering both bank-specific and macroeconomic factors. Data were collected from annual reports and World Development Indicators from 2007 to 2018. Regression analyses and diagnostic tests were conducted to analyze the data. The results indicate that loan growth, loan-to-asset ratio, and net interest margin are significant factors that reduce NPLs, while capital adequacy ratio has a positive but insignificant impact. Macroeconomic factors such as GDP growth and inflation also significantly influence NPLs. The study suggests that reducing NPLs is crucial for the management and regulatory bodies of the banking industry, and strategies need to be developed to address the identified factors. The study contributes to the existing literature by considering a long-period database and examining both bank-specific and country-specific variables.

Keywords: Non-Performing Loans, Islamic banking, Bangladesh, Bank-specific factors, Macroeconomic factors, Loan growth, Loan-to-asset ratio, Net interest margin, GDP growth, Inflation.

INTRODUCTION

Non-performing loans (NPLs), also known as irregular loans and indicates the credit risk of the banking industry, have been considered a significant issue in recent times. This is because of the increasing awareness for getting a clear idea about the factors liable for financial susceptibility in the banking sector, as well as the country. NPL is such a variable that is strongly related to a flaw in the financial arrangement of a state. The well-built association can establish this observed among the rush in NPLs and the incident of banking disasters. Indeed, Reinhart and Rogoff (2011) mentioned that the NPL growth can be used to

highlight the move up of the banking crisis, whereas Sorge (2004) proposed NPLs can be used to check the susceptibility of the financial system.

Non-performing loans (NPLs) refer to portions of loans that have either defaulted or are at risk of default. When a bank is unable to collect the interest or principal payments on credit, that loan is considered to be an NPL (Chowdhury, 2018). Most of the loans are considered unsuccessful after 90 days of delay in payment, but this may depend on the terms of the contract (Sarker, 2017). Also, the IMF, identified NPL as "a loan is non-performing when payments of interest and principal are past due by 90 days or more, or at least 90 days of interest payments have been capitalized, refinanced or delayed by agreement, or refunds are less than 90 days overdue, but there are other good reasons to doubt that payments will be made in full". Brownbridge et al. (1998) mentioned that the causes of bank failures are non-performing loans. The moral danger, the negative inducements for the owners of the bank to take imprudent strategies for lending, in particular, loans in the homeland, and loans in the highest interest charges for borrowers in the uncertain parts of the credit markets were attributable to bad debts. Recently, the issue of non-performing loans has become a major concern in Bangladesh, as it is impacting the country's banking industry.

We consider NPL as it is the major issue in the banking sector of any country, including Bangladesh. According to the statistics of Bangladesh bank, the NPL ratio has increased from 7.3 to 10.41, from 2010 to 2018. In the currency amount in 2010, NPL was 227.1 (billion BDT), and in 2018 it was 893.4 (billion BDT). Figure 01 shows the relation between aggregate NPL and total loans from 1990 to June 2017. Data were obtained from Bangladesh Bank's annual reports. Steady growth was found in the ratio of NPLs to total loans from 26.09% in 1990 to 41.1% in 1999. From 2000 to 2011, there was a sharp decline in the NPL ratio, which was 34.9% to 6.1%. At the end of 2012, it suddenly increases to 10%, and it was 10.10% in late June 2017. The above scenario indicates that NPL is very alarming for the Bangladeshi banking industry and needs to investigate the probable reasons for growing NPLs.

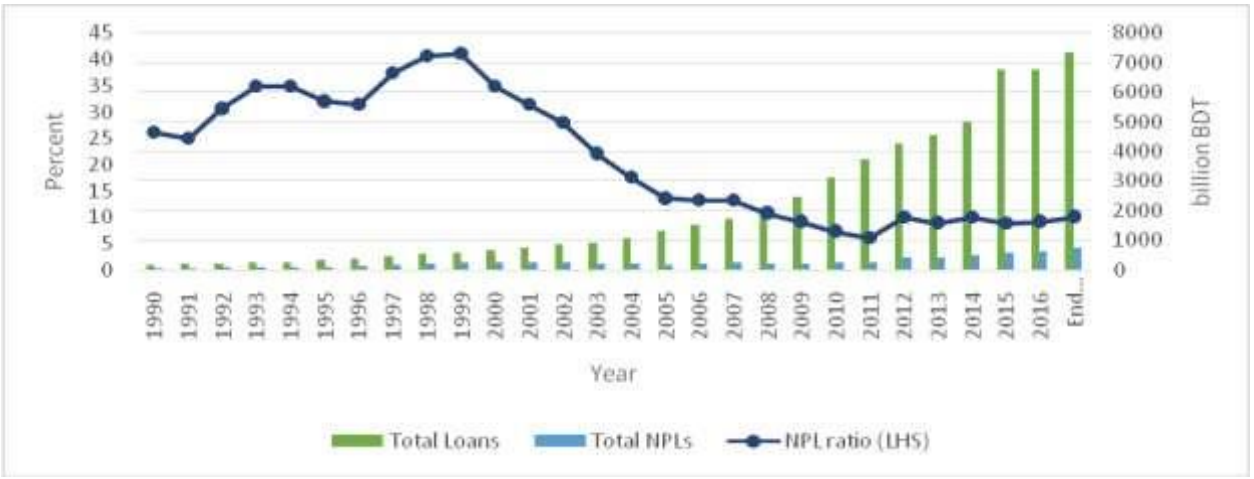

Figure 1. Trends of NPLs to total loans
Source: Bangladesh bank

There are two types of the banking system in Bangladesh, conventional and Islamic; we select the Islamic banking sector, as it is a growing part of the Bangladeshi banking industry. According to the articulation of the Bangladesh Bank, "the Islamic banks have continued to show strong growth since its inception, as reflected by the increasing market share of Islamic banking in terms of assets, financing, and deposits of the total banking system." Islami Bank Bangladesh Ltd. (IBBL) was the first Islamic bank in Bangladesh according to Islamic principles, established in 1983. In the recent few years, it is the number one Islamic bank according to annual performance. Currently, there are 10 fully operating Islamic banks

(Bangladesh Bank, 2022). In response to the success of the Islamic banking industry, 9 conventional banks have launched Islamic banking through 41 branches, and 13 conventional banks are conducting Islamic banking through 434 windows.

Sincethe share of Islamic banks is increasing over the period, factors influencing Islamic banks to manage the NPL needs to be investigated **(**Ahmad & Hassan, 2007). Salas and Saurina (2002) mention that not only the bank-specific variables but also the macroeconomic variables impact the determination of NPL.They merge macroeconomic and microeconomic predictors to clarify aggregate NPLs to the Spanish banking sector from 1985 to 1997, highlight the NPL's determinants and discover that bank-specific predictors can provide prior caution signs for potential variation in NPLs. Other studies of this kind evaluate macroeconomic and banking variables determining non-performing loans (Clair, 1992;
Espinoza & Prasad, 2010; González-Hermosillo, Pazarbaşioğlu, & Billings, 1997). They find an adverse link between the NPLs and the actual GDP (except for the oil sector), the global financial market conditions also affect the NPL ratio, and the relationship exists between the bank's efficiency, and NPL's rate is favorable. The association here between NPLs and the level of capitalization is negative, illustrating that capital growth is interpreted in the lower NPL ratio.

The purpose of the paper is to pursue factors specific to banks and the macroeconomy influencing the NPL of the Islamic Banking sector of Bangladesh. We considered two separate groups of factors such as bank-specific variables which are: growth in gross loans (LOAN), net interest margin (NIM), capital adequacy ratio (CAR), loan to asset ratio (LOTA), and the macroeconomic variables are: GDP growth, inflation rate (INFLA). We utilize 2007-2018 Islamic banking sector data; in the final full sample. Regression outputs from different models confirm the negative and significant impact of three bank-specific variables, namely LOAN, LOTA, and NIM; however, CAR shows a positive but insignificant impact on NPL. On the other hand, macroeconomic variables, GDP growth and INFLA show positive and negative impacts on NPLs, respectively, and both are significant. For robustness, we divide the total sample according to the characteristics and period. The findings are not entirely consistent in all sub-sample analyses, like in the most recent period of 2015-2018, we do not find any significant relationship between our predictors with NPLs. Our results are similar to some previous studies, such as Cucinelli (2015); Ghosh (2015); Dewartpoint andTirole (1994); Hayek (1940); Salas and Saurina (2002); Bangia et al.; Klein (2013); Washington (2014) and show that our selected bank-specific and macroeconomic variables LOAN, LOTA, NIM, GDP growth, and INFLA can interpret the NPL.

This study has been conducted to contribute to the existing NPLs literature in the following ways. Firstly, this paper deals with the Bangladeshi Islamic banking industry. This is because of the recent economic development of Bangladesh and the growing NPLs problem in the banking sector. Moreover, the Islamic banks of Bangladesh are one of the prime and well-established divisions of the related industry. Secondly, it considers a long-period database with the recent one. Most of the previous studies considered five years or lower periods of data to show the impact of the multiple variables on NPL. Thirdly, in this study, we examine the impact of both bank-specific and country-specific variables under different time horizons.

The remaining paper has been structured as follows; section 2 shows the literature review of the bank-specific and macro-economic determinants that can influence the Islamic banking sector. Section 3 depicts the materials and methods part of the study. Section 4 incorporates the analysis of the results and discussion. Section 5 concludes the discussion.

LITERATURE REVIEW

NPL is a burning concern that can affect the stability of the economy. Many researchers have examined the connections between NPLs and various factors within the banking industry and the broader economy. Keeton and Morris (1987) suggest that banks can experience significant losses due to chance, poor credit management, specialization, and economic conditions. Most of the studies examined the determinants of the NPL by either the macroeconomic system or the bankrelated factors utilized as illustrative predictors. However, some studies like Salas and Saurina (2002) merge macroeconomic and microeconomic predictors to clarify aggregate NPLs in the Spanish banking sector from 1985 to 1997. They highlight the NPL's determinants and discover that bank-specific predictors can provide prior caution signs for potential variation in NPLs. The researchers discover a genuinely adverse link between the NPLs and the actual GDP.

Some empirical studies scrutinize the impact of macroeconomic predictors on NPLs. In 2006 another group of researchers examines NPLs of households from different countries in Europe and offer experimental confirmation that monetary conditions, unemployment, and disposable income have a substantial influence on NPLs of the banking sector (Rinaldi & Sanchis-Arellano, 2006). In 2007, another study presents that irregular loans are incredibly susceptible to unemployment and the real rate of interest for most of the banking systems of Nordic over the epoch 1993-2005 (Berge & Boye, 2007).

Li et al. (2007) explore the positive influence of incentive contracts on the efforts of the management to decrease NPL in the Chinese banking industry. Alexandri and Santoso (2015) show the relationship between NPL with the Capital Adequacy Ratio in their paper. They notify the variable CAR has a positive sign of estimates of the coefficient. CAR variable's coefficient is positive because the banks have to maintain a minimum amount of reserve of capital to cover the risk of loan or credit so that high reserves of money are followed by high NPL. The other study in India also describes that both GDP and CAR have an adverse impact on the NPL (Bahmani-Oskooee& Wang, 2007).

Determinants of NPL

NPL has been considered the dependent variable in our study. When a loan is unsuccessful, the probability of repayment is considerably lower; it is judged as NPLs. The independent variables include bank-specific variables, namely loan growth, loan-to-asset ratio, net interest margin, and capital adequacy ratio, and besides the macroeconomic variables, including inflation, and GDP growth. However, researchers find that the factors affecting the performance of Islamic and conventional banks are different (Malim & Azizan, 2020). Table 1 shows the expected effect of both bank-specific and macroeconomic variables and their measurements. In this section, we discuss all the variables used in our study.

NPL for Islamic Banks

Non-performing loans (NPLs) are a prevalent concern that can affect economic stability. Researchers have examined the connections between NPLs and various bank-specific and macroeconomic factors. Research has explored the impact of credit growth on loan quality, evaluating loan quality using ratios such as credit loss to total loans and NPL to total loan ratio (Clair & Tucker, 1993).

Bank Specific Variables

- Growth in gross investment (LOAN): Researchers find a significant relationship between NPL and the total investment of Italian banks (Cucinelli, 2015). He finds that there is a negative relation between NPL and loans, and mentions that this is because bank managers want to decrease the load distribution to reduce the present NPL.
- Loan to asset ratio (LOTA): This is the ratio between total loans and total assets. This ratio also indicates the liquidity risk of the banks, as loans are more illiquid compared to other financial assets (Klein,

2013). Another researcher finds that an increase in the LOTA ratio can significantly and positively affect the NPLs; this happens when banks offer flexible interest rates and reduce the credit standard (Ghosh, 2015).

- Net interest margin (NIM): NIM is the net interest income over the total asset and represents a significant portion of most banks' operating income. Dewartpoint and Tirole (1994), showed in their paper the negative relation between NIM and NPL, which summarizes that when net interest income decreases, banks try to take more risk to earn more profit.
- Capital Adequacy Ratio (CAR): A bank's solvency ratio, measured by CAR, is associated with the NPL. Equity is a safeguard to soak up losses from different hazards. A higher amount of CAR will be able to finance the assets of the bank, which are risky, so in that case, banks can eliminate the push for taking more risks, leading to a reduction in the NPL level. Some studies show that the adequacy of capital is adversely linked to the NPL (Berger & DeYoung, 1997; Dhar & Bakshi, 2015; Makri, Tsagkanos, & Bellas, 2014). The more the level of solvency ratio,

the lower the level of NPL, as banks having a top CAR have a high-risk financing ability to prevent NPL. However, some studies suggest that CAR and NPL are positively connected, such as Karim et al. (2014) mention that the adequacy of bank capital has a significant impact on banking actions. They also find a very significant correlation between capital requirements with deposit and loan growth.

Macro-Economic Variables

- GDP growth (GDP): GDP is one of the important drivers of NPL ratio (Beck, Jakubik, &Piloiu, 2015). They find that GDP growth has a significant negative effect on NPL. However, they also find that the credit quality of the banks goes down due to the loss of credit quality during the boom period. Nkusu (2011) finds that lagged GDP growth has negative relation with NPL.
- Inflation (INFLA): Inflation is one of the leading causes of the growing loss of commercial bank funds; this leads to a higher risk of credit loss (Klein, 2013; Mpofu & Nikolaidou, 2018). High inflation leads to a higher level of prices and may also lead to an increase in interest rates, making the repayment capacity of the borrower more difficult.

Table 1. Summary of The Variables and Their expected Relationships with The Dependent Variable with Sources.

Variables	**Measurement**	**Notation**	**Expected Effect**
Dependent variables			
Non-performing loan	NPL of each year/total loan outstanding of that year	NPL	
Independent Variables (Bank specific variables)			
Growth in gross loan	LOAN= (present year-previous year total loan)/previous year gross loan	LOAN	Negative
Loan-to-asset ratio	LOTA= Total Loan/Total Asset	LOTA	Negative
Net interest margin	NIM= Net Interest Income/Total Assets	NIM	Negative
Capital adequacy ratio	CAR = (Tier 1 Capital + Tier 2 Capital) / RiskWeighted Assets.	CAR	Negative
Independent Variables (Macro-economic variables)			
GDP growth	GDP growth (annual)	GDP	Negative
Inflation Rate	Inflation, GDP deflator	INFLA	Positive

MATERIALS AND METHODS

In this study, we employ a multidimensional approach in the methodology to examine the elements of NPL. For a robustness check, we divide the total period into three sub-period and all variables into two groups; in most cases, findings are consistent with the total period. In this section, we discuss the data collection and model development procedures.

Data

At present, 10 Islamic banks are operating in Bangladesh, with 1679 branches (Bangladesh Bank, 2022). Among them, 3 newly established banks, started operation after 2013, so for the lack of available data, those have been excluded from the sample. Another Islami bank, ICBI bank, presently facing huge non-performing loans that stand for 81% of their total loans in 2018 (as per the annual report of ICBI bank), and the last few years' negative loan growth was also found. While testing the normality of the data, considering these banks, the result indicates that the data is not distributed normally. To make the distribution normal, we have excluded this bank from the total sample. Considering the data availability finally we use yearly panel data of 6 Islamic Banks of Bangladesh for the period 2007-2018, which are listed in Dhaka Stock Exchange

(DSE). Overall data are collected from the bank's annual reports and also from different publications of the Central bank.

Model Specification and Hypothesis Development

Specification of the Base Model

To estimate the determinants of NPL can be formulated by the general regression equation given below:

$$NPL_{it} = \beta_0 + \beta_1 LOAN_{it} + \beta_2 LOTA_{it} + \beta_3 NIM_{it} + \beta_4 CAR_{it} + \beta_5 GDPgrowth_{it} + \beta_6 INFLA_{it} + \in_{it} (1)$$

Where β_1, β_2, β_3, β_4, β_5, β_6, are coefficients of the determinant variables, β_0 is the intercept. Here, t and i represent period and bank, respectively. The descriptions of the variables are given in table 1. This data comprised six private Islamic commercial banks in Bangladesh and spread over twelve years (2007-2018). To estimate equation 1, we employ OLS, robust regression, fixed effects, and random effects regression. Firstly, we use OLS, however, Arellano and Bond (1981) mention that OLS could be biased with small t and large n. In our study, t is greater than n. Secondly, we use a robust standard error estimation method to resolve the heteroscedasticity problem following the work of White (1980) and Hausman (1978). Thirdly, we employ the fixed effects that allow unattended heterogeneity control across banks (Judson & Owen, 1999). Fourthly, we use a random effect, to evaluate non-independent, pooled data resulting from observations made from different or linked units (Laird & Ware, 1982; Walker, Hall, &Basáñez, 2013). To check the robustness and check the results from a multidimensional point of view, we divided the models into 7 different models, with details of each model mentioned later.

Hypothesis Development

In our study, the following hypothesis has been developed to test the impact of bank-specific and macroeconomic variables on NPL.

H_1: Growth in the gross loan (LOAN) has a negative relationship with NPL's ratio.

H_2: An increase in the loan-to-asset ratio (LOTA) leads to a decrease in the ratio of non-performing loans (NPLs).

H_3: An increase in the net interest margin (NIM) results in a decrease in the ratio of non-performing loans (NPLs).

H4: An increase in Capital Adequacy Ratio (CAR) decreases the NPL's ratio. **H_5:** The NPL ratio is negatively correlated with GDP growth. **H_6:** The NPL ratio increases as inflation increases.

RESULTS

We divide this section into five specific parts: descriptive statistics, correlation analysis, multicollinearity test, heteroscedasticity test, and regression analysis.

Descriptive Statistics

The descriptive statistics include the data from 2007-2018 for the selected six Islamic banks are represented in Table 2. In this section, we also analyze the normality of data and other statistical measures. The approximate mean-median ratio is 1 for all, which indicates variables are normally distributed. However, considering the data of ICBI Islami bank, it has been found that all the data are not distributed normally due to the extreme values of this bank. ICBI Islami bank facing a huge NPL for several years, we drop this bank from our final sample.

Table 2. Descriptive statistics of the variables

Name	NPL	LOAN	LOTA	NIM	CAR	GDP growth	INFLA
mean	0.0359	0.2423	0.7458	0.0329	0.1208	0.0649	0.0680
p50	0.0363	0.2176	0.7455	0.0313	0.1168	0.0649	0.0673
max	0.0823	0.5967	0.8375	0.0588	0.1649	0.0813	0.0816
min	0.0043	-0.1040	0.6421	0.0021	0.0900	0.0505	0.0560
sd	0.0170	0.1242	0.0438	0.0096	0.0170	0.0080	0.0084
Obs.	72	72	72	72	72	72	72

Source: Author's calculation in STATA16

NPL represents an average of 3.5% of the gross investment, where it was 16.55%, including ICB Islami bank. One of the previous studies on these six Islamic banks in Bangladesh also found NPL around 3% from 2006 to 2010 (Suzuki & Uddin, 2016). The growth of the loan is 24.23%, the same study shows that the loan growth of Islamic banks was 5.13% in 1997, which was 19.66% at the end of 2011. Concerning the total asset, the net income margin is 3.2%. The risk of the entire asset portfolio (LOTA) of banks is 74.57% on average, suggesting that banks come out to be risky in lending; CAR is 12.07% on average, the growth of GDP is 6.49% on average, where inflation is 6.79%. From table 2, we can confirm that the data are normalized and can be considered for further analysis. These findings infer that we can use parametric tests for this data set (Elliott & Woodward, 2007).

Correlation Analysis

The correlation test checks whether co-linearity exists among variables and shows the extent of the fluctuations among the variables. 'Correlation matrix' of table 3, specifies the relation between the independent and dependent variables. Multi colinearity is a statistical concept in which independent variables correlate strongly among them. Severe multi co-linearity undermines statistical significance, and small changes in input data may result in more significant changes to the overall model.

Table 3. Correlation matrix of the variables

Name	NPL	LOAN	LOTA	NIM	CAR	GDP growth	INFLA
NPL	1						
LOAN	-0.5565	1					
LOTA	-0.2577	0.0301	1				

NIM	-0.1245	-0.0457	-0.1526	1			
CAR	0.1523	-0.1387	-0.198	0.2435	1		
GDP growth	0.4417	-0.3278	0.1938	-0.0685	0.0560	1	
INFLA	-0.473	0.4066	-0.0958	0.1337	-0.1366	-0.4009	1

The table reports the correlation analysis results of all dependent and independent variables, also defined in Table 1—source: author's calculation in STATA 16.

The above table shows no high-level multi-co-linearity among the independent variables. The correlation coefficient is the simplest way to calculate co-linearity**.** When there is a high correlation found between two variables, this means that there is high collinearity between those two variables. Generally, if the value is more than 0.8 or 0.9, then it means there is co-linearity. However, this method cannot generate a degree of co-linearity (El-Dereny & Rashwan, 2011).

Multicollinearity Test: Variance Inflation Factor

To quantify the multi-collinearity, we need to test VIF. (Variance Inflation Factor). If the VIF score is more than 5 or 10, then it indicates that there is multi-collinearity, which is a sign of sparse estimation of the factors (Montgomery, Peck, & Vining, 2021). Table 4 shows VIF scores, where it is clear that no variable has a multi-collinearity problem as the score is all the scores are below 5.

Table 4. Variance Inflation Factor

Variable	VIF	1/VIF
INFLA	1.38	0.722867
GDP growth	1.29	0.777043
LOAN	1.28	0.782012
CAR	1.14	0.877161
NIM	1.11	0.898053
LOTA	1.11	0.90237
Mean VIF	1.22	

Source: author's calculation in STATA 16

Heteroscedasticity Test

In regression analysis, heteroscedasticity is a major concern. For making the estimators BLUE, there must be no heteroscedasticity problem. We have conducted the heteroscedasticity test on multiple models, and the findings are summarized in table 5. The test result of model 1 has been summarized in table 6, where it has been found that all are homogeneous except the CAR variable. It has been found that all models have homoscedasticity whereas models 5, and 6 have heteroscedasticity problems. To get a more accurate result, we use a white robust standard error correction test for models 5 and 6.

Table 5. Heteroscedasticity test results summary

Category	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
chi2(1)	0.20	0.78	2.01	9.92	18.54	1.19
Prob > chi2	0.9371	0.4609	0.1558	0.0016	0.0000	0.2754
Heteroskedasticity	No	No	No	Yes	Yes	No

Source: Author's calculation in STATA 16

Regression Analysis

To present an accurate scenario of the impact of bank-specific and country-specific variables on NPL**,** we have executed OLS, GLS, FE, and RE under multiple dimensions. Table 6 shows the results of Model 1, and the results of Models 2-7 are shown in Table 7.

Model 1: Impact of the independent variable on NPL (individual effect)

In the first model, we examine the impact of each independent variable (both bank-specific and country-specific) separately on NPL from 2007 to 2018.

Table 6. The impact of independent variables on NPL

Variables	**Bank specific variables**				**Macro-economic variables**	**(country-specific)**
	LOAN	LOTA	NIM	CAR	GDP growth	INFLA
NPL Coefficient	-0.076(0.014)***	-0.100 (0.045)**	-0.219 (0.209)	0.152 (0.118)	0.935 (0.227)***	-0.960 (0.214)***
Constant	0.054(0.004)***	0.111(0.034)***	0.0431(0.007)***	0.0185 (0.014)	-0.025 (0.015)*	0.101(0.015)***
Observations	72	72	72	72	72	72
R-squared	0.310	0.066	0.016	0.023	0.195	0.224
chi2(1)	0.92	0.16	0.25	4.85	0.61	1.20
Prob > chi2	0.3368	0.6855	0.6148	0.0277	0.4343	0.2731

This table presents the relationship between all individual variables and NPL from Univariate regression analysis, where standard errors are in parentheses and *** p<0.01, ** p<0.05, * p<0.1. Source: author's calculation in STATA 16.

Here it has been found that LOAN, CAR, GDP, and INFLA have a positive and significant impact on NPL from 2007 to 2018 while LOTA and NIM have a negative and significant impact on NPL over the same period.

Model 2: Impact of Bank-Specific Determinants on NPL

In the second model, we regress the NPL (dependent variable) with bank-specific variables. In table 7, the R-squared indicates that 40.86% of variations in NPL have been illustrated by the determinants used in the model. The value of Fstatistics is 11.57% with $p< .05$, which specifies that the model fits well with the data.

The loan variable has a negative indication of the estimated coefficient following the initial hypothesis sign. The LOTA variable has a negative coefficient as per the initial study hypothesis. NIM is negatively related to NPL.CAR variable shows a positive relationship with the NPL. All the results are showing a significant association between dependent and independent bank-specific variables, except the CAR variable.

Model 3: Impact of Country-Specific Determinants on NPL

In the third model, we regress NPL with macroeconomic variables, to show the impact of the macroeconomic variables on the NPL independently and the data observed from 2007 to 2018. In table 5, R-squared defined all variables that include in this analysis make 0.2995 indicating that 29.95% of variations in NPL have been illustrated by the determinants used in the model. The value of F-statistics is 14.74% with $p< .05$, which specifies that the model fits well with the data.

The GDP growth variable has a positive indication of the estimated coefficient, not following the initial hypothesis

sign. INFLA variable has a negative coefficient as per the initial study hypothesis. All the results are showing a significant link between the dependent and independent macroeconomic variables.

Model 4: During the Global Financial Crisis Period (From 2007 to 2010)

Model 4 examines the impact of all the selected variables on NPL from 2007 to 2010. Findings confirm that 65.11% of variations in NPL have been illustrated by the determinants used in the model with a difference of only 1.01% between actual and predicted values. The value of F-statistics is 5.28% with $p < .05$, which specifies that the model fits well with the data.

The loan variable has a negative sign of the estimated coefficient following the initial hypothesis sign; however, the result is not significant. The LOTA variable has a negative coefficient as per the initial study hypothesis and is significant. NIM is negatively related to NPL, and their regression shows significance. CAR has a negative and significant influence on NPL. Both GDP growth and INFLA variables have a positive sign of the estimated coefficient; however, these are not significant.

Model 5: During 2011 to 2014

Model 5 examines the impact of all the selected variables on NPL from 2011 to 2014. Findings confirm that 83.99% of variations in NPL have been illustrated by the determinants used in the model with a difference of only 0.74% between actual and predicted values. The value of F-statistics is 14.86% with $p < .05$, which specifies that the model fits well with the data.

The loan and LOTA variable has a negative sign of the estimated coefficient following the initial hypothesis sign,

and both are significant. NIM is negatively related to NPL; however, their regression shows insignificant. CAR has a positive and significant impact on NPL. GDP growth is positively associated with NPL, where it is not significant. INFLA variable has a negative sign of the estimated coefficient, and it is significant. Since this model has a heteroscedasticity problem, we run the robust standard error correction regression to find a more accurate result. The result shows that LOAN, LOTA, NIM, and INFLA have a negative and significant impact on NPL. However, other variables have no significant relation with NPL.

Model 6: ***During 2015 to 2018***

Model 6 examines the impact of all the selected variables on NPL from 2011 to 2014. Outcomes of the regression analysis confirm that 35.27% of variations in NPL have been illustrated by the determinants used in the model with a difference of only 0.1321% between actual and predicted values. The value of F-statistics is 1.54% with $p > .05$, which specifies that the model fits well with the data.

Loan and LOTA variables have a negative sign of the estimated coefficient following the initial hypothesis sign. All other variables have positive coefficients. Moreover, no variable is showing a significant impact on the NPL.

Since this model has a heteroscedasticity problem, we run the robust standard error correction regression to find a more accurate result. However, all the variables show an insignificant impact on NPL. Moreover, this model still does not fit as the p-value of the model is more than .005.

Model 7: During the entire period (from 2007 to 2018)

Model 7 examines the impact of all the selected variables on NPL over the entire selected period. Results demonstrate that 54.49% of variations in NPL have been illustrated by the determinants used in the model with a difference of only 1.19% between actual and predicted values. The value of F-statistics is 12.97% with $p < .05$, which specifies that the model fits well with the data. The complete sample analysis confirms that three bank-specific variables LOAN, LOTA, and NIM have a significant negative relation with NPL, whereas CAR has a positive but insignificant relationship. Two macroeconomic indicators, GDP growth, have positive, and INFLA has negative; however, both have a significant relationship with NPL. To get a robust output from the model, we run F.E. and R.E. on this model. Under the fixed-effect model, LOAN

(negative), NIM (negative), GDP growth (positive), and INFLA (negative) have a significant impact on NPL.

In contrast, LOTA and CAR variable has no significant impact on NPL. Under the random effect model, LOAN, LOTA, NIM, and INFLA have a negative and significant impact on NPL, while GDP growth has a positive and significant impact. On the other hand, CAR has no significant impact on NPL. We also run the Hausman (1978) specification test to check which model is best, and it is found that the Random effect model will be more acceptable than the Fixed effect model as the p-value is .043 (less than .05).

Table 7. The impact of independent variables on NPL

Model Variable	**M-02**	**M-03**	**M-04**	**M-05**	**M-05 (Robust)**	**M-06**	**M-06 (Robust)**	**M-07**	**M-07 (F.E.)**	**M-07 (R.E.)**
LOAN	-0.075 (0.0130)***		-0.031(0.021)	-0.068 (0.014)***	-0.0678*** (0.0163)	-0.023(0.0579)	-0.0229 (0.0325)	-0.050 (0.013)***	-0.0589*** (0.0136)	-0.0502*** (0.0129)
LOTA	-0.100 (0.038)***		-0.117 (0.045)**	-0.240 (0.043)***	-0.240*** (0.0362)	-0.210 (0.177)	-0.210 (0.156)	-0.133 (0.034)***	-0.0550 (0.0414)	-0.133*** (0.0342)
NIM	-0.365 (0.172)**		-0.686 (0.211)***	-0.299 (0.183)	-0.299** (0.117)	0.113 (0.578)	0.113 (0.634)	-0.265(0.156)*	-0.401** (0.197)	-0.265* (0.156)
CAR	0.076 (0.099)		-0.275 (0.103)**	0.275 (0.142)*	0.275 (0.172)	0.197 (0.352)	0.197 (0.401)	0.025 (0.090)	0.0434 (0.0933)	0.0247 (0.0894)
GDP growth		0.636 (0.233)***	0.161(0.305)	2.467 (1.269)*	2.467 (1.470)	1.515 (1.024)	1.515 (1.004)	0.611(0.201)***	0.503** (0.195)	0.611*** (0.201)
INFLA		-0.716 (0.223)***	0.251(0.420)	-0.617 (0.261)**	-0.617** (0.230)	-0.0783 (0.865)	-0.0783 (0.654)	-0.441(0.200)**	-0.365* (0.193)	-0.441** (0.200)
Constant	0.132 (0.033)***	0.043 (0.025)*	0.150 (0.053)**	0.091(0.071)	0.0909 (0.103)	0.077 (0.135)	0.0772 (0.110)	0.143(0.036)***	0.0913** (0.0376)	0.143*** (0.0356)
Observations	72	72	24	24	24	24	24	72	72	72
R-squared	0.409	0.299	0.651	0.840	0.840	0.353	0.3527	0.545	0.562	
Prob > F			0.0031	0.000	0.000	0.2238	0.0998	0.000	0.0441	0.000

The table shows results from multivariate regressions of NPL on predictor variables. Different regression models are constructed for proper validation and more specific findings. The standard errors are in parentheses and *** p<0.01, ** p<0.05, * p<0.1. Source: author's calculation in STATA 16

We Can Summarize the Results in the Followings

The LOAN variable shows a negative and significant relationship with the NPL. Islamic banks follow a conservative approach to credit management, where they reduce the current level of loan growth when expecting an increase in the NPL. Most of the dimensions of the test have proven this relationship. Results confirm the initial expectation and match with some other researchers such as Ozili (2015); Keeton (1999); Cucinelli (2015).

The LOTA variable also shows a negative relation with the NPL, and this relation is also significant in maximum dimensions. It means that when the amount of loan in their total asset portfolio increases, they can reduce the NPL. This suggests that Islamic banks are managing their risky assets efficiently to reduce NPL. This also confirms the initially expected sign and matches others' findings, such as Ozili (2015) and Klein, (2013).

In all the dimensions, NIM is showing a negative relationship with NPL. Most of cases, this is significant. When NIM increases, the default loan ratio decreases. The possible explanation is that as the NIM increases, the rate of return charged on loans will also increase, and this will demotivate weak borrowers to take loans from banks. It confirms the expected sign as per the initial hypothesis and matches with some previous findings such as Dhar and Bakshi (2015) and (Dewartpoint&Tirole (1994).

CAR variable shows a positive relationship in most of the cases; however, this relationship is not significant. Only in Model 4 (2007 to 2010) it has been found that CAR has a negative impact on NPL and this output matches with the findings by previous researchers such as Messai and Jouini (2013) and Louzis et al. (2012). However, Model 5 (2011 to 2014) finds that CAR is positively connected with NPL, and this also matches with some other studies such as Dhar and Bakshi (2015) and Makri et al. (2014).

GDP growth variable shows a positive and significant relationship with NPL in all the dimensions; however, out of 11 models (including sub-models), 4 show insignificant relation. This indicates that an increase in the GDP causes subsequent growth in the NPL ratio. These outputs do not match with the initial hypothesis but match with some other researchers' findings such as those and Salas and Saurina (2002). As per central banking theories, GDP increases with the rise in loans at a lower interest rate (Semuel& Nurina, 2014). Moreover, the percentage of GDP calculation in Bangladesh is governed by the industry of agriculture, which includes forestry, plantations, agriculture, and fisheries. The low proportion of construction and real estate sectors in calculations of GDP, therefore, has less of an impact on the NPL of the banks.

Inflation shows a negative and significant link with NPL in most of the models. This means when inflation decreases, there is a chance of an increase in the NPL ratio. This macroeconomic variable also not confirms the initial hypothesis; however, it matches most of the previous studies, such as Ekanayake and Azeez (2015), and Warue (2013).

CONCLUSIONS

This study evaluates the impact of both bank-specific and macroeconomic variables on the NPL of Islamic banks in Bangladesh. Being a Muslim-majority country necessity of Islamic banking in Bangladesh is increasing day by day. This confirms by the participation of Islamic banks and the recent government decision to increase the number of Islamic banks to ten. We employ OLS on all the models, robust regression on models 5 and 6, fixed effect, and random effect on model 7. Among the bank-specific variables, LOAN, LOTA, and NIM variables are showing negative and significant impacts whereas CAR shows positive relation with NPL. On the other hand, GDP is showing positive relation whereas INFLA is showing negative relation with NPL.

The increasing trend of NPL is a severe issue so the bank can improve its NPL situation through active management, monitoring, and control systems. Authorities should require the bank's managerial performance to prevent probable rises in non-performing loans. Also, to avoid future financial instability, risk management systems and bank procedures should be taken into account. Therefore, the national authorities (Bangladesh Bank), who are obliged by the Bangladeshi banks to provide an overwhelming non-performance loan rate, recommend implementing a strict governance policy. Change in the gross loan is

sensitive to credit risk requirements; therefore, banks should decrease investment growth when the quantity of NPL increases. Negatively relevant to the NPL ratio, the loan-to-asset ratio suggests that an increase in the loan-to-asset ratio can result in a drop in the NPL ratio. In such a situation, managers should increase the loan amount by maintaining enough assets against the loan. The higher level of net interest (investment in Islamic banking perspective) margins will determine a lower NPL ratio. So, the managers should be efficient, targeting the improvement of NIM, which will result in a decrease in the NPL. Although the bank must maintain its capital adequacy ratio, its impact on the NPL is not significant. So, additional information like a reserve for NPL can identify the effect of CAR on NPL. When GDP is increasing trend, it shows that NPL will reduce. The banker can take into consideration the growth of the GDP when they want to improve the NPL situation since a positive sign in GDP can ensure the repayment of the loan on due time. An increase in the price level, i.e., the inflation rate, can also provide the repayment of the loan, as it may increase the earnings of the businesses.

Considering the religious belief of the majority of people in Bangladesh, only the Islamic banking sector has been

focused on in this research, it may not reflect the overall situation of the non-performing loans in Bangladesh. Considering this limitation, more research is needed in the field of NPL of both conventional and Islamic banks in Bangladesh, for getting more deep information. Board structure, change in ownership formation, and political influences would be interesting to find out essential information.

Moreover, bank-specific variables like ROA, ROE, and degree of diversification (non-interest income to total income) can be added. Besides, other macroeconomic variables like lending rate, unemployment rate, and national debt growth can include in further modeling. Cross-country comparison can also help determine the factors affecting the NPL of Islamic banking in Bangladesh as Bangladesh still now doing Islamic banking on a small scale.

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