

The Macroeconomic Determinants of Non-Performing Loans in Bangladesh: An Empirical Analysis

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Abstract – Bank plays intermediary role which is very important for the development of any nation that can be affected by the non-performing loan. This study investigated the macroeconomic determinants of non-performing loans in Bangladesh using the time series data from 1990 to 2020 collected from Bangladesh Bank, Bangladesh bureau of statistics, World Bank, International Monetary Fund (IMF) data on World economic outlook and International Labour Organization (ILO) Statistics. The time series is chosen from 1990 to 2020 because of expansion of private commercial banks and availability of data of gross loans and amount of Non-performing loan amounts. The dependent variable considered in this study was percentage of non-performing loan to gross loan (NPL) and the independent variables were gross domestic product growth rate (GDPGR), inflation (INF), lending rate (LR), exchange rate (ER), money supply to gross domestic product (M2GDP) and unemployment rate (UR). NPL was positively influenced by GDPGR, LR and ER and negatively influenced by INF, M2GDP and UR. The government should direct its monetary and fiscal policies towards reducing Non-Performing Loans by creating an environment for business growth for the provision of social and infrastructural facilities.

Keywords – Non-performing Loans, Macroeconomic Factors, Credit, Banking System, Bangladesh

1 Introduction

1.1 Background of the Study

Bank plays intermediary role which is very important for the development of any nation that can be affected by the non-performing loan. This study investigated the macroeconomic determinants of non-performing loans in Bangladesh using the time series data from 1990 to 2020 collected from Bangladesh Bank, Bangladesh bureau of statistics, World Bank, International Monetary Fund (IMF) data on World economic outlook and International Labour Organization (ILO) Statistics. The time series is chosen from 1990 to 2020 because of expansion of private commercial banks and availability of

data of gross loans and amount of Non-performing loan amounts. The dependent variable considered in this study was percentage of non-performing loan to gross loan (NPL) and the independent variables were gross domestic product growth rate (GDPGR), inflation (INF), lending rate (LR), exchange rate (ER), money supply to gross domestic product (M2GDP) and unemployment rate (UR). Non-performing loans are those financial assets which do not generate profit or perform well. Choudhury et al. (2002: 21-54) state that the non-performing loan is not a “uniclass” but rather a “multiclass” concept. Non-performing loan can be classified into different categories based on the “length of overdue” of the said loan. To ensure financial sustainability, Banks and other financial institutions need to reduce the non-performing loans and develop sound lending policy. Increase of non-performing loans often justified by the credit policy but solely cannot be put on lending decisions. Some loans may have all the good criteria initially but turn into a non-performing loan over the time. External macro-economic factors may have significant impact on non-performing loans besides internal factors.

1.2 Problem Statement

The increasing volume of non-performing loans has always been a major concern for the bank’s management, regulator and policymaker due to its adverse impact on both bank and economy. Non-performing loans decreases bank’s earning capacity that leads to distress and financial crisis. Considering the data from 1990 to 2020, the level of NPL percentage was as high as 41% in 1999. NPL has become an important issue for the sustainability of the financial institution and for the overall economic growth of the country. These loans affect the private consumptions by reducing the loan disbursement which is also known as ‘credit crunch’ that leads to erosion of firm’s assets.

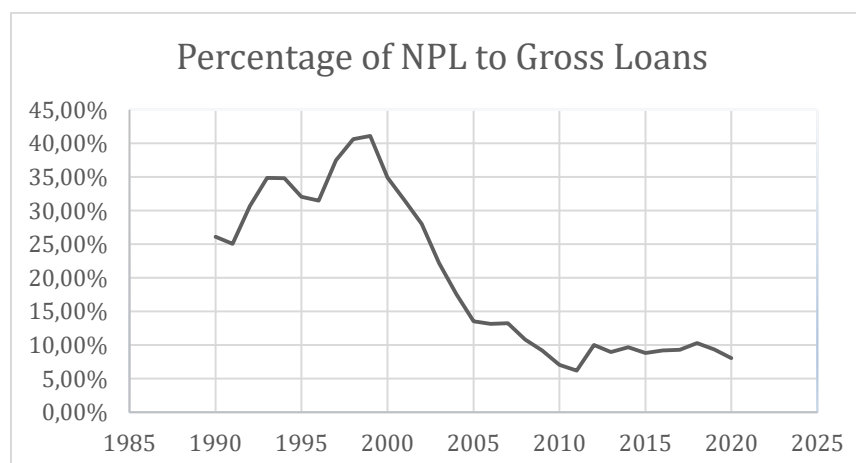


Figure 1: Percentage of Non-Performing Loans to Gross Loans from 1990 to 2020
(Source: Annual Report and Financial Stability Report of Bangladesh Bank)

1.3 Rationale of the study

The rising ratio of non-performing loans has been the effect of poor and ineffective credit administration, poor loan processing, undue influence in loan processing process and inadequate or lack of collateral (Umoh, 1994). This study was aimed to find out the macroeconomic determinants of non-performing loans in Bangladesh. This study is in demand to evaluate the determinants and their effect on NPL. With the help of the study the determinants can be controlled to reduce the NPL, which will lead to stronger financial base of the banks by enhancing profitability.

2 Literature Review and Hypothesis Development

The widely accepted definition of Non-performing loan was developed by International Monetary Fund (IMF) in the Financial Soundness Indicator (FSI) framework endorsed by IMF executive board. In March 2016, Financial Compilation Indicators stated that a loan to be defined non-performing if the principal and interest is not paid for more than three months or 90 days. Non-performing loans has always been an important issue for the researchers as it slow down the economic growth of the country. To find out the root cause of the non-performing loans researchers have considered different types of variables. Among them macroeconomic variables, bank specific variables and regulatory framework have been vastly studied and analyzed. This study, investigates the macroeconomic determinants of Non-Performing loans in Bangladesh based on the empirical analysis of time series data for last 31 years. In this chapter the previous literatures relating to determinants of non-performing loans will be reviewed and hypothesis will be developed to conduct the study to find out the macroeconomic determinants of non-performing loans in Bangladesh.

2.1 Literature Review

A loan is defined as non-performing if it is in arrear for a long time and does not perform well or generate income for the bank. Non-performing loans can be classified into different categories based on the length of overdue of the non-performing loans and the classification criteria differs based on the regulations of the country. In most cases, a loan is considered non-performing if the loan remains in arrear for at least 90 days. Henin (2003) defined non-performing loans are those which are not generating income. It was further supported by Fofack (2005) who defined a non-performing loan as those loan for which the principal as well as the interest was left unpaid for at least ninety days.

Beck, Jakubik and Piloiu (2012) showed that real GDP growth, share price, exchange rate and lending rate significantly affect rise of NPL ratio using panel data for 75 countries. Among them GDP was found to be most influential to NPL. Saba, Kausar and Azeem (2012) studied the data of US banking sector from 1985 to 2003 and conducted the correlation and regression test that showed real GDP per capita, inflation and total loan had signif-

ificant impact on non-performing loan ratio. Jimenez and Saurina (2005) analyzed Spanish banking data from 1984 to 2003 and found that GDP growth, high real interest rate and lenient credit term have significant impact on NPL. Louzis, Vouldis and Metaxas (2010) examined Greek banking sector by separating consumer loans, business loans and mortgage loans and the study showed except mortgage loans the NPL was highly responsive to macroeconomic variables like GDP, unemployment, interest rate and management quality. Keeton (1999) used vector auto-regression model with data from 1982 to 1996 and showed rapid credit growth compromising standard contributed to higher loan loss in the US. Using pseudo panel based model for sub Saharan African countries Fofack (2005) found a strong casualty between non-performing loans, economic growth, appreciation of real exchange rate, real interest rate, net interest margin and interbank loans. In Taiwan, there is a relationship between NPL ratio and ownership structure of commercial banks which was analyzed by Hu et al (2006) by using a panel data for the period of 1996-1999. The study also showed that bank size is inversely related to NPL. Rajan and Dhal (2003) used panel regression analysis to find out that credit term, size of the bank and macroeconomic conditions had significant impact on NPL in India.

Lower economic growth and higher interest rates had impact on NPL which was identified by Espinoza and Prasad (2010). Panel data of 80 banks of the Gulf Corporation Council countries from 1995 to 2008 was considered for this study. Nkusu (2011) found significant relationship between quality of bank's asset portfolio and micro-financial vulnerabilities. Rodolphe Blavy and Marcos Souto (2009) studied the banks in Mexico and found out that banking soundness depends on domestic and macro-financial variables and high external volatility and domestic interest rates were associated with high default probability. Jarmo Pesola (2005) analyzed panel data from 1980 to 2002 and the study showed advanced macroeconomic surprise shocks to income and real interest rates caused customer indebtedness.

The above review indicates that there has not been much studies on macroeconomic determinants of non-performing loans in Bangladesh. Banks of Bangladesh are facing tremendous pressure on profitability due to the rise of NPL in Bangladesh. Bangladesh Bank, Center for Policy Dialogue (CPD), Bangladesh Institute of Bank Management (BIBM) and few public and private organizations conduct discussion sessions, seminars in different occasions but there have no scientific empirical analysis on the rise of non-performing loans. This study attempt to verify macroeconomic variables like Gross Domestic Product Growth Rate (GDPGR), Inflation (INF), Lending Rate (LR), Exchange Rate (ER), Money Supply to Gross Domestic Product (M2GDP), Unemployment Rate (UR) and Percentage of Non-performing Loans to Gross Loans (NPL) of 58 banks of Bangladesh for the duration of 1990 to 2020. This research outcomes will benefit decision makers of commercial banks, government and regulatory authority to develop a regulatory framework to reinforce sustainability of banks by minimizing the NPL ratio.

2.2 Hypothesis Development

Primarily considered macroeconomic determinants are Gross Domestic Product Growth Rate (GDPGR), Inflation (INF), Lending Rate (LR), Exchange Rate (ER), Money Supply to Gross Domestic Product (M2GDP) and Unemployment Rate (UR) for rise of Percentage of Non-performing Loans to gross Loans (NPL) of Banks. The proposed framework for this study is as shown in Figure 2.

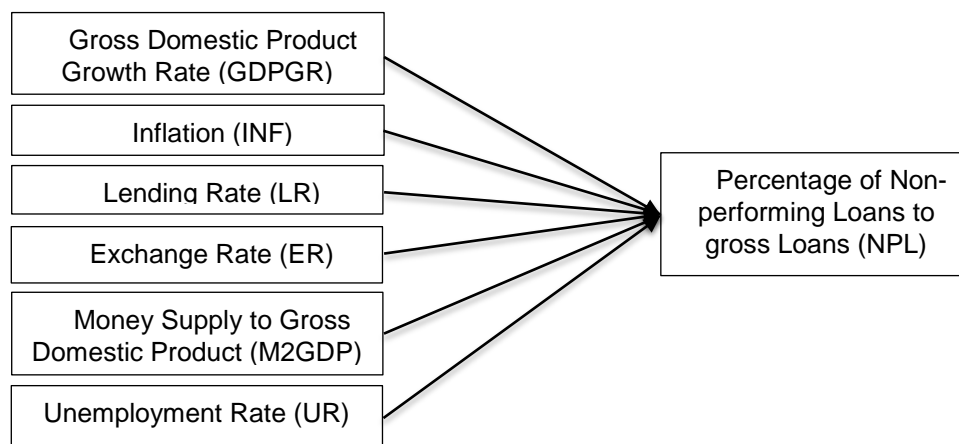


Figure 2: Framework for the study

Research Hypothesis is as follows:

- H₁: Gross Domestic Product Growth Rate (GDPGR) will have a direct significant influence on percentage of non-performing loans to gross loans (NPL)
- H₂: Rate of Inflation (INF) will have a direct significant influence on percentage of non-performing loans to gross loans (NPL)
- H₃: Lending Rate (LR) will have a direct significant influence on percentage of non-performing loans to gross loans (NPL)
- H₄: Exchange Rate (ER) will have a direct significant influence on percentage of non-performing loans to gross loans (NPL)
- H₅: Money Supply to Gross Domestic Product (M2GDP) will have a direct significant influence on percentage of non-performing loans to gross loans (NPL)
- H₆: Unemployment rate (UR) will have a direct significant influence on percentage of non-performing loans to gross loans (NPL)

The hypothesis was Gross Domestic Product Growth Rate (GDPGR), Rate of Inflation (INF), Lending Rate (LR), Exchange Rate (ER), Money Supply to Gross Domestic Product (M2GDP) and Unemployment Rate (UR) will have a direct influence on percentage of non-performing loans to gross loans (NPL).

3 Data and Methodology

3.1 Theoretical Background

Non-performing loans has been identified as the biggest threat to the profitability of the bank (Aremu, Suberu & Oke, 2010) and in some cases NPL is the reason for bank failure also (Brownbridge, 1998). Tracey and Leon (2011) mentioned that the decline in the quality of bank asset is one of the signs of bank failure in both developing and developed nation. According to International Monetary Fund (IMF), (2005), NPL refers to non-payment of principal and interest which was due by 90 days and more. NPL can be categorized into three categories in Bangladesh. Firstly, Sub-standard category of non-performing loan if a loan is due for more than three months but less than nine months. Secondly, Doubtful category if a loan is due for over nine months but less than twelve months. And finally, Bad and Loss category if the non-performing loan is overdue for more than twelve months. The portion of NPL is increasing for all types of banks for sanctioning loans without proper appraisal, interference of top management in loan processing, inappropriate asset valuation and irresponsibility of banker. Banks do not remove the classified loans for image crisis and legal complications. The study aims to evaluate the macroeconomic determinants that have an effect on the rise of the non-performing loans in Bangladesh. The time series data of 31 years are covered for the analysis.

3.2 Sources of Data and Study Period

For assessing the macroeconomic factors that determine the rise of non-performing loans in Bangladesh, time series data for the period 1990 to 2020 was collected from Annual Reports and Financial Stability Report of Bangladesh Bank, Time Series data of Bangladesh Bank, Bangladesh Bureau Of Statistics, Data bank of World Bank, World Economic Outlook of International Monetary fund (IMF) and Statistics of International Labour Organization (ILO). The choice of the time period was 1990 to 2020 was because the Bank Company Act was enacted in 1991 (Act 14 of 1991) and after that the expansion of Private Commercial Bank occurred. The variable used in this study was Percentage of non-performing loan to gross loan (NPL) as dependent variable, while gross domestic product growth rate (GDPGR), inflation (INF), lending rate (LR), exchange rate (ER), money supply to gross domestic product (M2GDP) and unemployment rate (UR) as independent variables (cf. Table 1).

Table 1: Data Description and Sources

Variables	Definition	Data Sources
Percentage of Non-Performing Loan to Gross Loan (NPL)	A loan is considered as non-performing loan when interest and principal are not paid for more than 90 days. The percentage of non-performing loan to gross loan (NPL) was considered as dependent variable.	Annual Reports and Financial Stability Reports of Bangladesh Bank
Gross Domestic Product Growth Rate (GDPGR)	This is the growth rate of Gross Domestic Product. It refers to how Bangladesh's gross domestic product has grown from one year to another.	Bangladesh Bureau of Statistics and collected from World Economic Outlook of International Monetary Fund (IMF)
Inflation (INF)	This refers to the increase in the price of goods and services due to excessive money circulation in the economy.	Bangladesh Bureau of Statistics and collected from World Economic Outlook of International Monetary Fund (IMF)
Lending Rate (LR)	This is the rate of interest for loans and advances sanctioned by the banks.	Time Series Data of Bangladesh Bank
Exchange Rate (ER)	This is the rate of exchange of US Dollars to Bangladeshi Taka	Time Series Data of Bangladesh Bank
Money Supply to Gross Domestic Product (M2GDP)	This is the amount of money supply to the gross domestic product or the broad money which generally denoted by M2.	Time Series Data of Bangladesh Bank
Unemployment Rate (UR)	This refers to the percentage of unemployed labour force of the total labour force.	Statistics of International Labour Organization (ILO)

3.3 Sampling Technique and Sample Size

Time series dataset of different macroeconomic factors was collected from different data source like Bangladesh Bank, Bangladesh Bureau of Statistics, International Monetary Fund, World Bank and International Labour Organization. The range of the population data was 1990 to 2020. The choice of the range was the availability of NPL data of that period and in 1991 Bank Company Act was enacted which helped in expansion of the private commercial banks in Bangladesh.

3.4 Measurement of Variables

Percentage of non-performing loans to gross loans (NPL) is the dependent variable and the data represented amount of non-performing loan to the

gross loan amount for the year 1990 to 2020 and are in percentage form. For the study the amount of gross loan and the amount of NPL were collected. The amount of Gross domestic product (GDP) was collected and the data was in billion taka and the growth rate of gross domestic product was also calculated and compared with the previous year GDP the values were presented in percentage of growth. The data related to inflation was collected from world economic outlook and the data were presented in percentage format, which represents the change of price of commodities from year to year. The lending rate represented the average interest rate of loans and advances of Bangladesh and the data were presented in percentage format. The data on exchange rate represented the average rate of USD to BDT for that year and the data represented the amount of BDT in exchange of 1 (one) USD. The data on money supply to gross domestic product were presented in billion taka and the M2GDP was calculated by adding up Currency outside Banks, Demand Deposits and Time Deposits. The data on unemployment rate were presented in percentage format and data were collected from ILO statistics. However the data of year 1991, 1996, 2000, 2003, 2005, 2006, 2009, 2010, 2013, 2016 and 2017 were available in ILO statistics and rest of the years were assumed based on the provided dataset. For example we had data of year 2010, 2013 and 2016. It was assumed the unemployment rate was unchanged on the year 2011, 2012, 2014 and 2015. So the UR of 2011 and 2012 were same as 2010 and the UR of 2014 and 2015 were same as 2013.

3.5 Analytical Techniques

The study accomplished multiple regression models of Ordinary Least Square to determine the macroeconomic determinant of non-performing loans in Bangladesh. Several analytical test had also been carried out. Such as, Normality test, Autocorrelation test, Heteroskedasticity test

3.6 Econometric Models

To examine and determine the macroeconomic determinant of non-performing loans in Bangladesh the model of the study is expressed as follows:

$$NPL = \int (GDPGR, INF, LR, ER, M2GDP, UR)$$

The econometric model of the study is expressed below:

$$NPL = \beta_0 + \beta_1GDPGR + \beta_2INF + \beta_3LR + \beta_4ER + \beta_5M2GDP + \beta_6UR + et$$

Where

- NPL = Percentage of Non-Performing Loan to Gross Loan
- GDPGR = Gross Domestic Product Growth Rate
- INF = Inflation
- LR = Lending Rate
- ER = Exchange rate to USD
- M2GDP = Money supply to Gross Domestic Product
- UR = Unemployment rate
- e_t = Error

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are respective co-efficients for the independent variables.

3.7 Stationary Test

Stationary test is also known as unit root test. The variables will be stationary if the variance and covariance remains constant in different situation. If there is no unit root in the data that means the data is stationary and the existence of unit root refers the data as not stationary. Both informal and formal tests are available to check unit root. The informal test is to generate the graph and the formal test to check whether the data is stationary or not is known as Dickey-Fuller test for unit root. If the t-statistics > T-critical value, the data is stationary or there is no unit root and vice versa.

When there is existence of unit root and the data is not stationary, 1st difference should be considered and then the stationary test is conducted again to check whether the variable become stationary or not.

4 Data Analysis and Findings

Firstly the stationary test will be conducted to check whether the variables are stationary or not. If it is found that the variable is not stationary, 1st difference will be considered to make the variable stationary and then several test like correlation, mean estimation, multiple regression analysis, normality test, autocorrelation test and heteroskedasticity test will be conducted. And the outcomes will be summarized as findings of the study.

4.1 Stationary test

Both formal and informal test of unit root or stationary will be conducted. For informal test the graph will be generated using line plots and the Dickey Fuller test will be conducted as formal test. If existence of unit root is found and the variable is not stationary, 1st difference will be considered and then line plot test and the Dickey-Fuller test will be conducted again for each variable.

Table 2: Dickey-Fuller test for unit root of variables

Variable	Test Stat.	Interpolated Dickey-Fuller			Approximate P-Value	Variable Status
		1% Critical Value	5% Critical Value	10% Critical Value		
LNPL	-2.976	-3.716	-2.986	-2.624	0.0372	Not Stationary
d.LNPL	-4.266	-3.723	-2.989	-2.625	0.0005	Stationary
LGDPGR	-3.098	-3.716	-2.986	-2.624	0.0267	Stationary
d.LGDPGR	-6.359	-3.723	-2.989	-2.625	0.0000	Stationary
LINF	-3.028	-3.716	-2.986	-2.624	0.0324	Stationary
d.LINF	-5.129	-3.723	-2.989	-2.625	0.0000	Stationary
LLR	0.155	-3.716	-2.986	-2.624	0.9696	Stationary
d.LLR	-3.084	-3.723	-2.989	-2.625	0.0278	Stationary
LER	-2.387	-3.716	-2.986	-2.624	0.1454	Not Stationary
d.LER	-3.738	-3.723	-2.989	-2.625	0.0036	Stationary
LM2GDP	0.578	-3.716	-2.986	-2.624	0.9871	Stationary
d.LM2GDP	-3.582	-3.723	-2.989	-2.625	0.0968	Stationary
LUR	-4.612	-3.716	-2.986	-2.624	0.0001	Stationary
d.LUR	-9.451	-3.723	-2.989	-2.625	0.0000	Stationary

After conducting the stationary test LNPL and LER was not stationary and the 1st difference was conducted for each variable and the new variables are d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP, d.LUR.

4.2 Summary Statistics, correlation matrix and mean estimation

The summary statistic of the data set is represented from the output of STATA. The variables can be described as follows:

Table 3: Summary Statistics of the data set

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
d.LNPL	30	0.0414702	0.1928952	-0.2672622	0.4780357
d.LGDPGR	30	-0.0175515	0.2329997	-0.8430548	0.4117348
d.LINF	30	-0.018312	0.3618542	-0.6701577	0.6085896
d.LLR	30	-0.0207827	0.0723408	-0.1865056	0.1017308
d.LER	30	0.0315331	0.0312033	-0.0280156	0.1056414
d.LM2GDP	30	0.1373603	0.031727	0.0791788	0.2024426
d.LUR	30	0.0528988	0.2056901	-0.3856626	0.8938179

The correlation coefficient between variables can be explained by the following correlation matrix which was the output of STATA:

Table 4: Correlation Matrix

	d.LNPL	d.LGDPGR	d.LINF	d.LLR	d.LER	d.LM2GDP	d.LUR
d.LNPL	1.0000						
d.LGDPGR	0.2583	1.0000					
d.LINF	- 0.3340	- 0.0201	1.0000				
d.LLR	0.4587	0.2877	- 0.0986	1.0000			
d.LER	0.6231	- 0.0036	- 0.2196	0.5502	1.0000		
d.LM2GDP	- 0.2859	0.1868	0.0597	0.1045	- 0.0486	1.0000	
d.LUR	- 0.1222	- 0.3795	- 0.0442	0.0747	0.1385	- 0.1705	1.0000

The estimated mean of d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR are 0.0415, -0.0176, -0.0183, -0.0208, 0.0315, 0.1374 and 0.0529 respectively. The Standard error of d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR are 0.0352, 0.0425, 0.0661, 0.0132, 0.0057, 0.0058 and 0.0376 respectively at 5% significance level.

Table 5: Mean Estimation of the variables

Variable	Mean	Std. Error	[95% Confidence Interval]	
d.LNPL	0.0414702	0.0352177	- 0.0305581	0.1134984
d.LGDPGR	-0.0175515	0.0425397	- 0.1045551	0.069452
d.LINF	-0.018312	0.0660652	- 0.1534306	0.1168066
d.LLR	-0.0207827	0.0132076	- 0.0477952	0.0062298
d.LER	0.0315331	0.0056969	0.0198816	0.0431846
d.LM2GDP	0.1373603	0.0057925	0.1255133	0.1492074
d.LUR	0.0528988	0.0375537	- 0.0239071	0.1297048

4.3 Multiple Regression Analysis

Multiple regression is the statistical technique which is used to find out the relationship between one dependent variable and several independent variables. In this study the dependent variable is the percentage of Non-Performing Loans to Gross Loan (NPL) and the independent variables are Gross Domestic Product Growth Rate (GDPGR), Inflation (INF), Lending Rate (LR), Exchange Rate (ER), Money Supply to Gross Domestic Product (M2GDP), Unemployment Rate (UR). Total number of observation is 30 and the data is a time series data. The variables were converted to natural logarithm and the stationary test was conducted. Log NPL and Log ER was not stationary so 1st difference was considered for each variables. The outcome of the multiple regression using the variables d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR in STATA is as follows:

Table 6: Multiple Regression Analysis

Source	SS	df	MS	No of Obs.		
Model	.671627129	6	.111937855	F(6,23)		6.32
Residual	.407421599	23	.017713983	Prob.>F		0.0005
Total	1.07904873	29	.037208577	R-squared		0.6224
				Adj. R-Squared		0.5239
				Root MSE		0.13309
d.LNPL	Coef.	Std. Err	t	P > t 	[95% Confidence Interval]	
d.LGDPGR	.1674552	.1243983	1.35	0.191	-.0898822	.4247926
d.LINF	-.1022167	.0701882	-1.46	0.159	-.2474122	.0429787
d.LLR	.4030464	.4446875	0.91	0.374	-.5168598	1.322952
d.LER	3.146086	.9926734	3.17	0.004	1.092584	5.199587
d.LM2GDP	-2.043894	.8047519	-2.54	0.018	-3.708651	-.3791383
d.LUR	-.1809807	.1338647	-1.35	0.190	-.457901	.0959396
_cons	.2420317	.1235142	1.96	0.062	-.0134768	.4975403

The multiple regression model considering d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR

$$d.LNPL = \beta_0 + \beta_1 d.LGDPGR + \beta_2 d.LINF + \beta_3 d.LLR + \beta_4 d.LER + \beta_5 d.LM2GDP + \beta_6 d.LUR + e_t$$

Where

- d.LNPL = 1st difference of Log of Percentage of Non-Performing Loan to Gross Loan
- d.LGDPGR = 1st difference of Log of Gross Domestic Product Growth Rated.LINF = 1st difference of Log of Inflation
- d.LLR = 1st difference of Log of Lending Rate
- d.LER = 1st difference of Log of Exchange rate to USD
- d.LM2GDP = 1st difference of Log of Money supply to Gross Domestic Product
- d.LUR = 1st difference of Log of Unemployment rate
- e_t = Error

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are respective co-efficient for the independent variables.

The multiple regression line considering d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR is $d.LNPL = 0.2420 + 0.1675 d.LGDPGR - 0.1022 d.LINF + 0.4030 d.LLR + 3.1461 d.LER - 2.0439 d.LM2GDP - 0.1810 d.LUR$.

1 Interpretation of economic and statistical significance

If the value of d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR is 0 then the value of NPL is 0.2420 unit. The result is statistically not significant at 5% significance level as the value of the probability of T statistics is not less than 0.05. Holding other variables constant or unchanged, if d.LGDPGR is increased by 1 (one) unit, the value of NPL increases by 0.1675 units or 16.75% of the gross loans. The result is statistically not significant at 5% significance level as the value of the probability of T statistics

is more than 0.05. Holding other variables constant or unchanged, if d.LINF is increased by 1 (one) unit, the value of NPL decreases by 0.1022 units or 10.22% of the gross loans. The result is statistically not significant at 5% significance level as the value of the probability of T statistics is not less than 0.05. Holding other variables constant or unchanged, if d.LLR is increased by 1 (one) unit, the value of NPL increased by 0.4030 units or 40.30% of the gross loans. The result is statistically not significant at 5% significance level as the value of the probability of T statistics is more than 0.05. Holding other variables constant or unchanged, if d.LER is increased by 1 (one) unit, the value of NPL increases by 3.1461 units. The result is statistically significant at 5% significance level as the value of the probability of T statistics is less than 0.05. Holding other variables constant or unchanged, if d.LM2GDP is increased by 1 (one) unit, the value of NPL decreases by 2.0439 units. The result is statistically significant at 5% significance level as the value of the probability of t statistics is less than 0.05. Holding other variables constant or unchanged, if LUR is increased by 1 (one) unit, the value of NPL decreases by 0.1810 units. The result is statistically not significant at 5% significance level as the value of the probability of T statistics is more than 0.05.

2 Validity and Goodness of fit of the Regression Model:

The Probability of the F statistics is 0.0005 which is less than 0.05, so the overall regression model is valid and statistically significant at 5% significance level. The goodness of fit is determined based on R^2 , Adjusted R^2 and regression standard error/ Root MSE. The study shows that $R^2 = 0.6224$ means that about 62.24% variation in d.LNPL can be explained by the combined variation in all independent variables like d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP, d.LUR. The study shows that Adjusted $R^2 = 0.5239$ means that about 52.39% of the variation in d.LNPL can be explained by the combined variation in all independent variables like d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP, d.LUR taking the number of independent variables in consideration. In this study Root MSE = 0.13309 means that the standard error of the residual is 0.13309 which is less than the simple regression model. So it is better fit than before.

3 Result of Hypothesis Testing

d.LGDPGR, d.LLR and d.LER have positive influence on d.LNPL and d.LINF, d.LM2GDP and d.LUR have negative influence on d.LNP so the hypothesis H_1 , H_2 , H_3 , H_4 , H_5 and H_6 cannot be rejected, so they are confirmed.

4 Normality, Autocorrelation and Heteroskedasticity Test

To check the dataset, whether it is normally distributed or not, a new variable was predicted "resid" representing residuals. The figure below shows the regression analysis, prediction of new variable 'resid' and the result obtained after performing the Skewness and Kurtosis test for normality in STATA.

Table 7: Skewness/Kurtosis test for Normality

Variable	Obs.	Pr (Skewness)	Pr (Kurtosis)	adj chi2 (2)	Prob > chi2
resid	30	0.7463	0.8112	0.16	0.9223

'Sktest' shows the probability of Skewness is 0.7463 > 0.05 and probability of Kurtosis is 0.8112 > 0.05 meaning that Skewness and kurtosis are asymptotically normally distributed. Finally, the chi (2) is 0.9223 which is greater than 0.05 referring its significance at 5% level. So the null hypothesis cannot be rejected and according to the Skewness and Kurtosis test of normality, residuals shows normal distribution.

To check the autocorrelation problem Breusch- Godfrey test for auto correlation was used in STATA and the outcome was as follows:

Table 8: Breusch-Godfrey LM test for autocorrelation

lags (p)	chi2	df	Prob > chi2
1	0.297	1	0.5858

Since from the above table it is observed that the probability is not less than 0.05 or 5%, the null hypothesis cannot be rejected. So, there is no serial correlation between the residuals in the model.

A Durbin-Watson Test for autocorrelation does not reveal autocorrelation issue.

Popular tests to detect the heteroskedasticity are Breusch Pagan Test and White Test. The outcome of the Breusch Pagan test for heteroskedasticity shows that the probability value of chi square is more than 0.05 or 5%. Therefore the null hypothesis of constant variance cannot be rejected at 5% significance level, meaning that there is no presence of heteroskedasticity in the residuals.

The output of the heteroskedasticity test using White Test in STATA is as follows:

Table 9: White's test for Heteroskedasticity

Source	chi2	df	p
Heteroskedasticity	27.98	27	0.4120
Skewness	5.92	6	0.4306
Kurtosis	1.08	1	0.2979
Total	35.00	34	0.4205

Similar to the outcome of Breusch Pagan test for heteroskedasticity the probability value for chi square is more than 0.05 or 5%. The null hypothesis of constant variance cannot be rejected at 5% significance level. So there is no heteroskedasticity in the residuals.

4.4 Findings

For the purpose of the study the data was collected from different sources and analyzed through STATA. Outcomes of different tests in STATA were explained and data presented in tables were presented and explained in different ways. The summary statistics presented the minimum value, maximum value, mean and standard deviation of the variables d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR. The correlation matrix table represented the coefficient of correlation among the variables. The multiple regression line considering d.LNPL, d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP and d.LUR is

$$\mathbf{d.LNPL = 0.2420 + 0.1675 d.LGDPGR - 0.1022 d.LINF + 0.4030 d.LLR + 3.1461 d.LER - 2.0439 d.LM2GDP - 0.1810 d.LUR}$$

It represents that NPL is positively influenced by GDPGR, LR, ER and negatively influenced by constant, INF, M2GDP and UR. From the regression analysis it was found out that the overall regression model is valid and statistically significant at 5% significance level and about 52.39% variation in d.LNPL can be explained by the combined variation in all independent variables like d.LGDPGR, d.LINF, d.LLR, d.LER, d.LM2GDP, d.LUR. According to the Skewness and Kurtosis test of normality, residuals shows normal distribution. After conducting the Durbin-Watson test, new DW statistics is 2.0664 which lies between 0 to dl meaning that there is no existence of positive serial correlation. For Heteroskedasticity test Breusch-Pagan test and White Test were conducted and the outcome of both the tests were similar. There was no homoscedasticity in the residuals of the model. In the stationary test it was found out that among the variables NPL and ER was not stationary and GDPGR, INF, LR, M2GDP and UR were stationary. 1st difference was considered for each variable and the variables turned stationary.

The dependent variable and another variable (ER) did not meet the stationary criteria, so 1st difference was considered for each variables to run the regression model. The correlation and the mean of the variables were calculated. In the regression analysis it was found out that the dependent variable NPL was positively influenced by GDPGR, LR and ER and negatively influenced by INF, M2GDP and UR. The regression model showed that only ER and M2GDP were economically and statistically significant at 5% significance level but other variables like GDPGR, INF, LR and UR were not economically or statistically significant. The F-test showed that the regression model was valid and 62.24% variance of NPL can be explained by the independent variables. Normality test showed that the distribution was asymptotically normally distributed, there was no serial correlation in the data set and the data set was free of heteroskedasticity problem. In the next chapter the study will be concluded with some recommendation for policy implementation and by identifying the scope of future research.

5 Conclusion and Policy Implications

5.1 Conclusion

Non-performing loans and bad loans have an adverse impact on the economy. That leads to a banking crisis and lead to septicity to other countries as well as the whole banking sector of the world. This study reconfirms macroeconomic linkage between real economy and banking sector. The ongoing discussion relating NPL in Bangladesh reveals that the banking sector of Bangladesh needs to get out of the mess for financial stability and sustainable development. The study attempt to determine the macroeconomic variables that influence the rise of NPL ration in Bangladesh using the time series data from 1990 to 2020. This study's empirical result supported that there is a significant positive relationship among Gross Domestic Product Growth Rate (GDPGR), Exchange Rate (ER) and Percentage of Non-Performing loan to Gross Loan (NPL) and there is an inverse relationship to Inflation (INF), Lending Rate (LR), Money Supply to Gross Domestic Product (M2GDP) and Unemployment Rate (UR).

More than 32 years have passed since the adoption of the prudential norms in banking sector in Bangladesh in 1990. Still Bangladesh is struggling with huge burden of NPL amount of 882.36 billion in 2020 which is approximately 8.05% of the total loan outstanding. Although Bangladesh has adopted different international standards, NPL management is still ineffective. NPL management should be multi-prolonged in different stage of credit sanctioning, monitoring and recovery of credit and of different types like prevention and resolution. For preventive measure of NPL management, credit screening, loan surveillance, loan review functions both at individual bank level and central bank level. Resolution measures may include but not limited to legal measures like improving legal systems and development and enforcement of out of court settlement process, such as compromised settlement schemes, incentive packages, formation of asset management companies, factoring, and asset securitization and so on.

5.2 Policy Implications

The findings of the study have some implications for the financial community mainly commercial banks, academicians like researchers, regulator Bangladesh Bank and policymakers of the country.

This study showed that there are six macroeconomics variables that influence the rise of NPL ratio and those are GDPGR, INF, LR, ER, M2GDP and UR.

GDP Growth Rate and Exchange Rate influence NPL ratio positively, whereas Inflation, Lending Rate, Broad Money and Unemployment rate influence negatively.

Commercial Banks will receive information about the study and they will adjust the lending rate to minimize the rise of NPL.

This study will also help the researcher to conduct further study as it combines the effect of macroeconomic determinants on NPL.

Bangladesh Bank can consider this study for regulatory purpose of maintaining the NPL ratio by minimizing the Exchange Rate.

Policymakers may use the findings of the study to maintain sustainable development of GDP Growth Rate and to adjust Money Supply to GDP and Unemployment Rate which will lower the NPL ratio at a tolerable rate.

5.3 Scope for Further Research

There is a scope of further research on the investigation of the factors of the non-performing loan and their relationship with the commercial banks. This research indicated that these six macroeconomic variables GDPGR, INF, LR, ER, M2GDP and UR affect NPL to various extents. Among six variables, two independent variables GDPGR and ER support the dependent variable NPL, whereas other four independent variables INF, LR, M2GDP and UR do not support dependent variable. For future research, it is advised that the sample size should be decreased due to the fact that the limited amount of sample can provide more accurate findings as there is a huge data value difference in 31 years and the economy of Bangladesh has developed tremendously. The future researcher can also use this research as a reliable and useful reference.

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