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EFFECT OF CREDIT RISK MANAGEMENT ON THE FINANCIAL PERFORMANCE OF BANKING SECTOR OF BANGLADESH: A STUDY ON GENERATION-BASED SELECTED LISTED COMMERCIAL BANKS

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Abstract:
The financial sector of the country is mostly comprised of banking institutions; those are leading the economy with great exposure with the contribution to the development process. However, the banking sector of Bangladesh is disturbed by the large-scale amount of non-performing loans while has become an essential part of the finance of the industries. As part of the measurement of credit risk and macro factors average lending rate, inflation, NPL size, capital adequacy ratio, liquidity ratio have been selected to test the influence on the financial performance found through the return on asset of the selected banks. To conduct the study 9 banks of three generations have been selected for the period of 2016 to 2022. Robust least square method of regression and error correction term have been run to oversee the real impact on financial performance while endogenity and random walk in the values are being considered to overcome through a dynamic regression model. NPL has a negative impact on the performance and average lending rate, inflation, liquidity ratio and capital adequacy ratio bring a positive impact on the financial performance of the banks. Breusch-Pagan LM test confirms that cross-sectional dependency exists and VAR serial correlation test finds autocorrelation in the data set. The policy implication of this study suggests that the high NPL ratio must be reduced and CAR and LR must be improved to get the desired results of the performance. Strong

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fiscal and banking regulation should implement so that governance can be ensured to create responsibility and financial strength.

JEL: E4, D81, E33, E44

Keywords: credit risk, financial performance, NPL, capital adequacy ratio, return on assets, robust least square, cointegration

1. Introduction

The banking sector of Bangladesh is facing a large-scale non-performing loan and liquidity problem. Around 61 banks are providing financial services to the economy. Listed banks of the stock market are disclosing sensitive information from which investors in this industry is making decision. Credit and liquidity management of the banks are playing a key role in the governance and financial stability of the market. Disruption in the fund flow and excessive bad loans are frequently hampering the investment and market development of the country. Bangladeshi government banks are responsible for more than 65% of the total bad loans while other private commercial banks are slightly making non-performing loans in the competitive environment in the banking industry. Liquidity crisis and lending rate volatility are the facts of instability of performance. The inflation rate is often taken and altered by the central bank with the policy rate changes that significantly affect the loan size. The amount of bad loans is on the trend of being increased with time. The comparative economic growth rate and bad loan rate picture are depicted below:

Figure 1: GDP Growth Rate and NPL

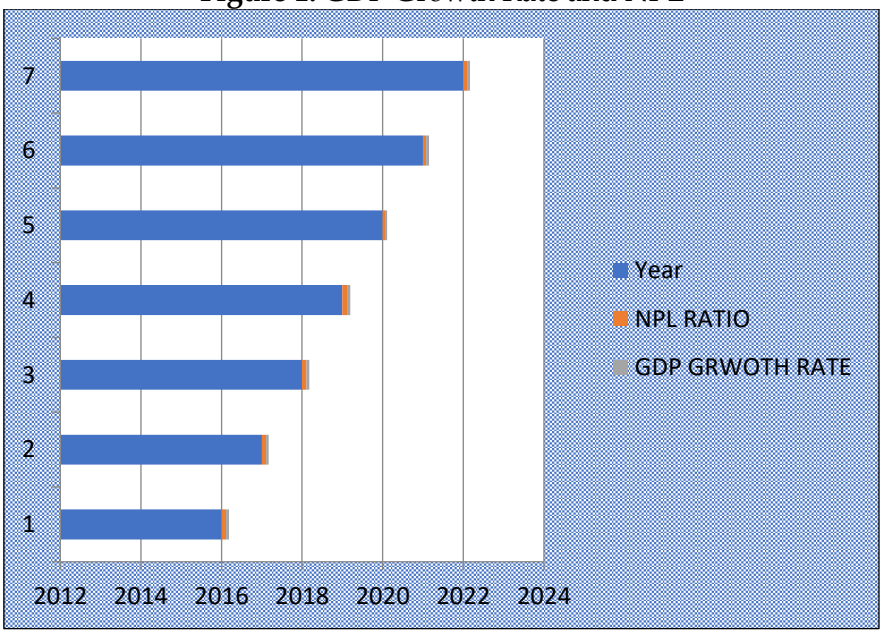
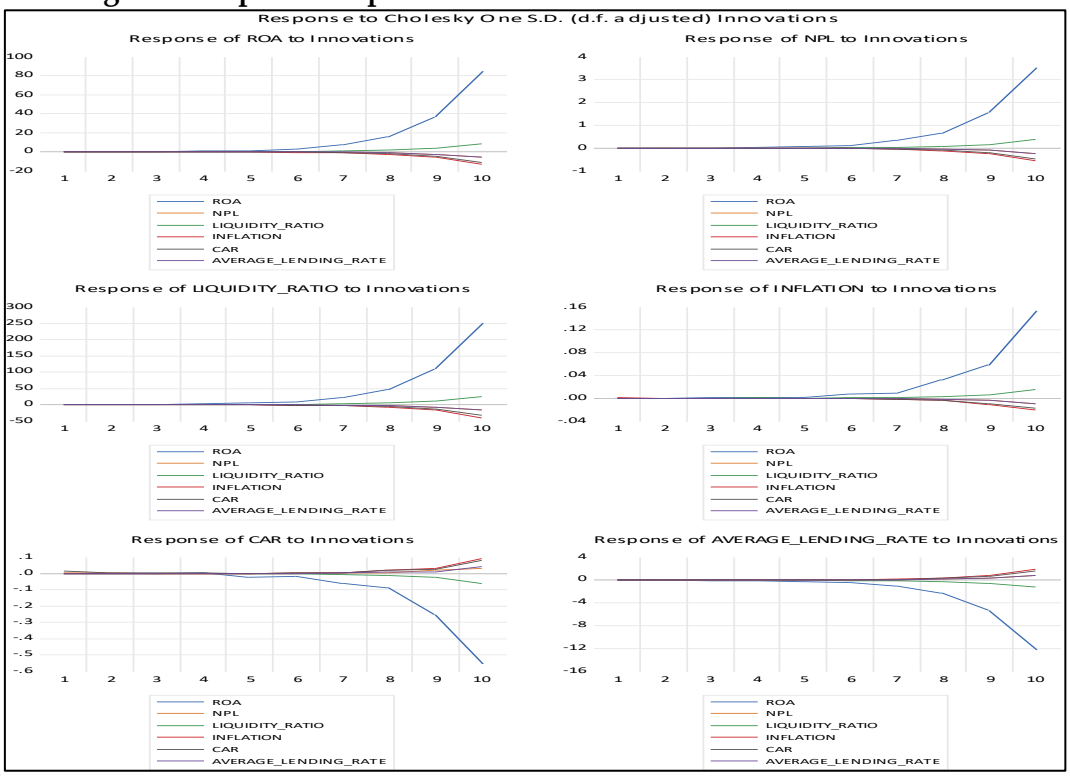


Figure 2: Impulse Response to Different Variables with Innovations



From the analysis, it is notified that the size of the non-performing loan is closely related to the GDP growth rate. During COVID-19 the economic growth rate measured by GDP growth rate has declined and in response to that rate of non-performing loans had also abated. Under the impulse response scenario, it is found that for one unit shock arises in the endogenous variable and makes changes in the other explanatory variables which reveals the impact of bank-specific and macro factors on the growth or performance of the banks in the industry. The impact of the innovations derived from the shocks on the variables. Response of return on assets, NPL is mostly negatively influenced by the variables in the presence of shock except for the liquidity ratio. Response of capital adequacy ratio, average lending rate with the negative shock is positively related to the inflation, non-performing loan and liquidity ratio. Under the robust least square analysis and error correction term estimation, the real influence and needed policy implementation action will be important to destine the future growth and stability in the financial banking sector.

2. Literature Review

The literature review of this paper has brought up different findings related to Financial Performance (FP) that have been explained by different credit risk and bank-specific factors. In the hypothesis, Return on Assets (RoA) of the commercial banks has been taken into consideration as an indicator of FP of the commercial banks. Several empirical researches have been conducted to understand the effect of credit risk management on

the FP of the banks. Hakim, S. and Neaime, S., 2001, tried to investigate the impact of variables like liquidity, credit and capital on the bank's profitability of Egypt and Lebanon. The study found that there is a significant impact on the rules and laws of the bank due to sound risk management actions and applications.

Hosna, A., Manzura, B. and Juanjuan, S., 2009 on their study found that financial performance as measured by RoE has been affected more by Non-performing Loan (NPL), rather than capital adequacy ratio. They also found that the effect of credit risk management on the profitability of the banks wasn't similar for all. Njanike, K., 2009., found that the banking crisis happened due to the absence of effective credit risk management and the financial crisis was led by the inadequate risk management system. Kithinji, A.M., 2010 found that the bank's profitability was guided by other variables than credit and non-performing loans.

Aduda, J. and Gitonga, J., 2011 found in their study that credit risk management has a reasonable effect on profitability. Aruwa, S.A. and Musa, A.O., 2014 on their study investigated the impact of credit risk management and other risk components on the financial performance of banks. From their study, they found that there is a strong relationship between risk components and the financial performance of the banks. Boahene, S.H., Dasah, J. and Agyei, S.K., 2012 investigated the relationship between the profitability of the banks and credit risk. They found a positive relationship between these two.

San, O.T. and Heng, T.B., 2013 in their study investigated the factors affecting the profitability of Malaysian commercial banks. They used ROA, ROE, and NIM as a substitute for profitability and used different bank-specific factors and macroeconomic variables. The study concluded that macroeconomic variables have a positive impact on the profitability of the banks. Bank-specific factors like liquidity and bank size have a positive impact on profitability while capitalization has a negative impact on it.

Poudel, R.P.S., 2012 investigated among different factors of credit risk management with the profitability of the banks. The study concluded that the default rate has the most impact on the bank's financial performance. Musyoki, D. and Kadubo, A.S., 2012 used different variables related to credit risk management to assess the bank's performance. They concluded all the variables have a negative impact on the financial performance of the bank. It was also concluded that the default rate has the most significant impact among other variables on the financial performance of the banks. Kaaya, I. and Pastory, D., 2013 found that credit risk indicators affect negatively on the financial performance of banks. Ogboi, C. and Unuafe, O.K., 2013 on their study concluded that sound credit risk management and capital adequacy affect the financial performance of the banks. Abiola, I. and Olausi, A.S., 2014 found that bank's profitability is affected by credit risk management. Kurawa, J.M. and Garba, S., 2014 on their study found that different credit risk management factors like default rate (DR), cost per loan asset (CLA), and capital adequacy ratio (CAR) have an effect on the bank's profitability. Alshatti, A.S., 2015 in their research found that credit risk management indicators have a significant effect on the financial performance of commercial banks.

3. Material and Methods

The dependent variable for our study is financial performance as measured by Return on Assets (ROA) and the key regressors for the model are credit risk and bank-specific variables. Non-performing loans (NPL) and Capital Adequacy Ratio (CAR) are taken as measures of credit risk while Average Lending Rate (ALR) and Liquidity Ratio (LR) are the bank-specific variables.

Several studies have found that a few micro and macro variables may have an impact on financial performance and hence, must be controlled. Inflation is one such macroeconomic variable that was taken as a control variable for the purpose of this paper. We have collected panel data on financial performance from 9 prominent banks in Bangladesh. The data was collected from the audited financial statements of the respective banks for the period spanning 2016 to 2022. A total of 63 observations were taken for the analysis of this paper.

Table 1: Variables Used in the Study with Measurements

		Variable	Symbol	Measurement
Dependent Variable	Financial Performance	Return on Asset	ROA	Net Income/ Total Assets
Independent Variables	Credit Risk	Non-Performing Loans	NPL	Total nonperforming loan/ Total loans
		Capital Adequacy Ratio	CAR	Risk weighted assets/ Total equity
	Bank Specific Factors	Average Lending Rate	ALR	Net interest income/ Total assets
		Liquidity Ratio	LR	Total loans/ Total deposits
Control Variable		Inflation Rate	IR	Annual inflation rate declared by Bangladesh Bank

Model specification:

$$ROA_{it} = \gamma_0 + \gamma_1 NPL_{it} + \gamma_2 CAR_{it} + \gamma_3 ALR_{it} + \gamma_4 LR_{it} + \gamma_5 IR_{it} + \epsilon_{it}$$

where,
γ_0 = intercept;
γ_1 - γ_5 = coefficients of independent and control variables; and
ε_{it} = residuals.

Error Correction Term for the Long Run Causality:

D(NPL) = C(9)*(ROA(-1) + 0.51793951745*NPL(-1) + 0.0996059648549 *LIQUIDITY_RATIO(-1) - 126.380363887*INFLATION(-1) - 0.20595641977*CAR(-1) + 0.219747659803*AVERAGE_LENDING_RATE(-1) + 6.98443992616) + C(10)*D(ROA(-1))

+ C(11)*D(NPL(-1)) + C(12)*D(LIQUIDITY_RATIO(-1)) + C(13)*D(INFLATION(-1)) + C(14)*D(CAR(-1)) + C(15)*D(AVERAGE_LENDING_RATE(-1)) + C(16)

To test the methodology, unit root test, serial correlation test, cross-sectional dependence test, error correction model will be conducted. The robust least square analysis will be brought to reach the expected results of the model. A diagnostic test will be conducted to ensure the normality of the values of the model.

4. Results and Discussion

4.1 Diagnostic Test Results

The data analysis part of the study mainly concerns with the movement of the major bank-specific and macro factorial influence on the financial performance that needs to ensure the stability and normality of the values of explanatory variables. To check the originality and the identity of the data descriptive analysis is given below:

Table 2: Descriptive Analysis

Variables	Mean	Maximum	Minimum	Standard Deviation	Skewness
ROA	0.03	0.68	0.00	0.10	5.42
NPL	0.05	0.09	0.02	0.02	0.73
Liquidity Ratio	0.86	1.06	0.06	0.19	-2.93
Inflation	0.06	0.07	0.06	0.02	2.01
CAR	0.14	0.19	0.08	0.01	-0.06
Average Lending Rate	0.02	0.07	0.00	0.00	1.49

Note: Descriptive Statistics.

Capital Adequacy Ratio and Non-Performing Loan values are close to normally distributed whereas Return on Asset, Liquidity Ratio, and Inflation brings skewness of more than 2 which shows data are not normally distributed. Time variant skewness of the explanatory variables exposes random moves in the model derived.

4.2 Cross-Sectional Dependence Test

Table 3: Cross-Sectional Dependence Test

Test Name	Statistic	P- Value
Breusch- Pagan LM	72.53	0.00*
Pesaran Scaled	4.30	0.00*

Note: Cross-Sectional Dependence Test Results. Significance is denoted by the probability of 5% with * sign.

Under cross-sectional dependency check, Average Lending Rate, Liquidity Ratio, Inflation, and Bad Loans can interchangeably influence one another. It stands that a change in one of the explanatory variables can make a change in all other or some of the instrumental variables of the model analyzed. Breusch Pagan LM test confirms that

dependency exists in the model that jointly requires overseeing all the policy rates over time so that control in the market can be feasible.

4.3 Panel Unit Root Test

Panel unit root test brings the stability of the values in the set of the model. This is stated below:

Table 4: Panel Unit Root Test

Name of Variable	ADF Fisher Chi Square Value	Levin, Lin & Chu t*	Stationary at First Difference Level
ROA	63.73 (0.00)*	-33.76 (0.00)	Stationary
NPL	13.14 (0.78)	1.39 (0.92)	-2.27 (0.02)*
Liquidity Ratio	34.66 (0.01)*	-167 (0.04)*	Stationary
Inflation	40.35 (0.00)*	39.36 (1.00)	-10.99 (0.00)
CAR	25.12 (0.12)	-8.33 (0.00)*	Stationary
Average Lending Rate	11.52 (0.87)	-0.78 (0.22)	-6.32 (0.00)*

Note: Levin, Lin & Chu t stat value is significant and stationary at 5% level denoted by * and first difference level statistic value is presented with the corresponding probability value in parenthesis.

Under the unit root test, the stationary position of the variables is confirmed so that the expected outcome may not lead to misleading direction. Returns on Assets, Liquidity Ratio, Capital Adequacy Ratio are stationary at the prime stage. But NPL, Inflation, and Average Lending Rate are stationary the first difference that resolves the random walk or uncertain volatility in the values of the data. It is mandatory to make sure that our data are free from biasness and volatility to get the real picture of the study.

4.4 Cointegration Test

Long-run associationship among the explanatory variables is checked through this cointegration test. Fluctuations in the policy rates or macro factors should be traced to correct as quick as possible. It disturbs the favorable outcome. The results of KAO residual co-integration test is depicted below:

Table 4: Cointegration Test

Test	T-statistic	P-Value
Augmented Dicky Fuller	0.99	0.16
Residual variance	0.0009	

Note: R^2 for co integration test is 32%. P value is significant at 5% level. Durbin Watson stat is 2.02.

From the analysis of the cointegration test, it is observed that no cointegration exists among the Non-Performing Loan, Liquidity Ratio, Inflation, and Average Lending Rate. Any disturbance in any one of the variables will not directly influence the others. Long-run cointegration is absent and dynamic change in the performance of the company will not result overnight due to change in one factor overnight. A single factor such as Inflation itself can impact the Return on Assets in the short and long run.

4.5 Serial Correlation LM Test

From 2016 to 2022 all the values of the past period can be interrelated and can disturb the expected outcome. Autocorrelation in the Inflation, Liquidity Ratio, Average Lending Rate, NPL will create instability and it will take time to make corrections of the term to come back to equilibrium. During the volatile period, company performance might be affected in the industry. Under Lag 2 and 3 outcome of LM test is given.

Table 5: Serial Correlation LM Test

Lag Value	LRE* stat	Rao- F-Stat
2	53.80 (0.03)	1.63 (0.3)
3	107.55 (0.00)	4.26 (0.00)

Note: The probability value is in the parenthesis and significant at the 5% level.

From vector autoregression LM test of autocorrelation, the values of the inflation, lending rate, NPL are serially correlated and residuals of the model can extort the relationship among the forecasting in the short run. A number of banks in the industry belong to three different generations and the activities are almost in the same race. In the absence of large magnitudes and operational change, the regular results of the performance of the banks are highly correlated with itself. Strong serial correlation in the weak form of the financial market creates volatility.

4.6 Panel Least Square of Vector Error Correction Estimates

Table 6: Panel Least Square of Vector Error Correction Estimates

Co-integration Term	Coefficient	P-value
C(11)	-0.45	0.00*
C(13)	-0.25	0.20
C(14)	0.12	0.15
C(16)	-0.004	0.02*

Note: Probability is denoted by * and significant at a 5% level.

Error correction term here expresses that the value of the coefficient is negative and significant at 5% level and long-run causality exists between NPL and Inflation. Short-run causality exists in the Capital Adequacy Ratio. Economic growth and other variables can be unstable and it will come back to the equilibrium by 51% as quickly as it happens

in the performance of the banks. Any shortfall or uncertainty in the return will make a correction to return back to the balance condition within half of its non-volatility period. However, in the interim period of the anarchy, gain from the market can distort the return.

4.7 Robust Least Square Analysis and Implication

Table 4: Robust Least Square Analysis

Variable	Values
NPL	-0.06 (0.01)*
Inflation	0.10 (0.03)*
Liquidity Ratio	0.00 (0.04)*
CAR	0.02 (0.87)
Average Lending Rate	0.16 (0.00)*

Note: Adjusted R^2 for regression is 54%. P-Value is in the parenthesis and 5% significance is denoted by *. Akaike info criterion is 92.49 in this result.

The robust least square analysis shows that banking performance is influenced by the variation in the explanatory variables. A non-performing loan is increasing over time. Due to this reason each hundred percent increase in the NPL return on asset is decreased by 6% and this is significant to express this impact. Inflation positively interrupts the banking performance by 10% for each hundred percent which is valid at a 3% significant level. Liquidity positively influences the return of the banks. Improving the liquidity condition intensifies the deposit condition of the banks and it results in the smooth rise in the profitability of the banks. The capital adequacy ratio is the measurement of the bank's strength and market position. Under Basel III criteria capital adequacy ratio should be maintained at 12% around. Sustenance in the CAR can motivate banking performance. CAR can positively change the return level of the banks but this is less important to interact in the overall performance. The Average Lending Rate has a positive impact on the return of the banks. Banking performance relies on the lending rate as the fund flows vary on the basis of the changes in the policy rate (Adebayo et al., 2011). Each 16% increase in the lending rate creates a 100% return for the banks. The significant impact on the return of the banks as a matter of positive move in the lending rate is at the 5% level. Moreover, positive change in the performance must be realized by the changes in the values of the factors as it is expected in the economy in which it operates.

5. Recommendations & Conclusions

As a developing country, Bangladesh is deliberately trying to extend its economic performance and growth in the world. The banking sector of the country is troubled by multiple micro and macro factors. Inflation, Average Lending Rate, Liquidity Ratio, CAR brings a positive influence on the performance of the banks in the economy whereas NPL generates a negative impact on the return of the banks (Masood and Ashraf, 2012). However, the expected impact on the performance of the bank from NPL rising is negative and it is reliable. Other variables of the study are also true as positive changes in the bank-specific and macroeconomic factors of the study might influence the profitability and performance. In the analysis of the results of the robust least square, the problems of the values of the factors are automatically corrected and it provides a reliable outcome. It can be said that NPL must be reduced to sustain the positive return over time. Facing the challenges in the competitive market, macro and other policy-related factors must be complied with in such a way that will create stability. Any fluctuation in the level of the market economy, adaptation of new guides on the derivation of the policy and internal governance regarding the interest rate, CAR will help to return to a stable situation (Blum and Hellwig, 1995). The management of the banks must take strategies to control the rate of NPL. In the same race, the authority must implement a global banking strategy and guidelines on governance so that the economic return of each bank can be achieved. In order to survive the rising pressure in the banking industry, a high liquidity position and CAR ratio must be needed (Hamza, 2017). The findings of the study are based on the selected banks only. This model can be used further for more specific other objective-based research on the same ground. The selection of variables and analysis of this study are trustworthy as it matches with the previous findings. Policymakers might not avoid the necessity of adopting time and environment-sensitive decisions so that anomalies in the market can be removed. Financial distortion in the policy rates and macro factors should be handled with a prudent hand that will create trust and confidence in the economy and removes unhealthy race at all. The lending rate that has a positive impact on performance must be checked of (Chimkono et al., 2016). All these factors of credit risk management can influence the profit in different dimensions so based on their level of impact accurate action for market adjustment is will be needed.

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Conflict of Interest Statement
The authors declare no conflicts of interest.

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Appendix

a. Panel Least Square

Dependent Variable: D(NPL)
Method: Panel Least Squares
Date: 06/15/23 Time: 19:15
Sample (adjusted): 2018 2022
Periods included: 5
Cross-sections included: 9
Total panel (balanced) observations: 45
D(NPL) = C(9)*(ROA(-1) + 0.51793951745*NPL(-1) + 0.0996059648549 *LIQUIDITY_RATIO(-1) - 126.380363887*INFLATION(-1) - 0.20595641977*CAR(-1) + 0.219747659803*AVERAGE_LENDING_RATE(-1) + 6.98443992616) + C(10)*D(ROA(-1)) + C(11)*D(NPL(-1)) + C(12)*D(LIQUIDITY_RATIO(-1)) + C(13)*D(INFLATION(-1)) + C(14) *D(CAR(-1)) + C(15)*D(AVERAGE_LENDING_RATE(-1)) + C(16)

	Coefficient	Std. Error	t-Statistic	Prob.
C(9)	0.005430	0.022563	0.240652	0.8112
C(10)	0.004269	0.026691	0.159960	0.8738
C(11)	-0.454119	0.141890	-3.200505	0.0028
C(12)	0.001445	0.008929	0.161867	0.8723
C(13)	-0.255090	0.196710	-1.296785	0.2027
C(14)	0.124842	0.084863	1.471098	0.1497
C(15)	-0.020012	0.165937	-0.120600	0.9047
C(16)	-0.004303	0.001758	-2.447548	0.0192

R-squared	0.264299	Mean dependent var	-0.002034
Adjusted R-squared	0.125112	S.D. dependent var	0.009827
S.E. of regression	0.009192	Akaike info criterion	-6.381247
Sum squared resid	0.003126	Schwarz criterion	-6.060062
Log likelihood	151.5781	Hannan-Quinn criter.	-6.261512
F-statistic	1.898881	Durbin-Watson stat	1.788665
Prob(F-statistic)	0.097650		

b. Robust Least Square

Dependent Variable: ROA
Method: Robust Least Squares
Date: 06/15/23 Time: 19:57
Sample: 2016 2022
Included observations: 63
Method: M-estimation
M settings: weight=Bisquare, tuning=4.685, scale=MAD (median centered)
Huber Type I Standard Errors & Covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
NPL	-0.059988	0.023588	-2.543151	0.0110
INFLATION	0.108837	0.049626	2.193139	0.0283
LIQUIDITY_RATIO	0.004238	0.002032	2.085217	0.0370
CAR	0.002949	0.019313	0.152671	0.8787
AVERAGE_LENDING_RATE	0.161728	0.033763	4.790070	0.0000
C	-0.002497	0.005145	-0.485242	0.6275

Robust Statistics

R-squared	0.286912	Adjusted R-squared	0.224360
Rw-squared	0.537096	Adjust Rw-squared	0.537096
Akaike info criterion	92.49582	Schwarz criterion	108.2942
Deviance	0.000522	Scale	0.002501
Rn-squared statistic	49.30325	Prob(Rn-squared stat.)	0.000000

Non-robust Statistics

Mean dependent var	0.029329	S.D. dependent var	0.105648
S.E. of regression	0.112605	Sum squared resid	0.722752