



## CAPITAL REGULATORY POLICY AND NON PERFORMING LOANS OF COMMERCIAL BANKS IN NIGERIA

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**ABSTRACT:** *An efficient and sound financial system is crucial to enhancing sustainable economic growth in any country, as it provides a balance between those who have funds to invest and those in need of these funds. The creation of credit is a source of revenue for banks just as it makes up the majority of bank's assets. This is however a very risky outcome, as there is the risk of insolvency if less return is earned from its credit portfolio. The interest gotten from risk assets contributes significantly to interest income of banks, and about 85% of banks total income, thus exposing banking business to credit risk. When banks are exposed to high credit risk, it could lead to loans becoming non-performing and putting banks at high risk. Thus, regulatory policies are established to enable banks and other financial institutions have enough protection when carrying out their functions. In lieu of these, this study is carried out to examine the effect of capital regulatory policies on non-performing loans of commercial banks in Nigeria. Data on a sample of 15 commercial banks quoted on the Nigerian Exchange Group as at 31<sup>st</sup> December 2021 were analyzed using the panel regression models. The results showed a positive and significant effect between capital regulatory policies and non-performing loans of commercial banks. The study also showed that banks in Nigeria were able to survive high rate of non-performing loans because they were able to take the policies set out by the regulatory bodies into consideration. Based on the findings, the study advised the need for commercial banks to strictly adhere to the capital regulatory policies of government to be able to operate efficiently and effectively in a harsh economy like Nigeria.*

**KEYWORDS:** Capital regulatory policy, Non-performing loans, Operational and market risk, Basel 1 Basel 2 Basel 3



## INTRODUCTION

The nature of the banking sector regulation determines the magnitude, and extent of its economic challenges/crisis. It is therefore very pertinent to take note of the fact that the financial system continues to play vital roles in its effort to particularly achieve financial stability and economic growth in general. It is believed that the banking sector could be a catalyst of economic growth and development if it is well regulated (Iwedi, 2017). Over the years, the banking industry in Nigeria has gone through changes and these ranges from managements, the ownership structure, and the number of institutions that are found therein (CBN, 2010). Before the 2005 banking system consolidation in Nigeria, about 89 banks existed under a universal banking system- a framework that did not place any restriction in banks' share capital investments in other financial sectors (Atoi, 2018). Before the 2004 and 2005 recapitalization exercise took place in the Nigerian banking sector, it was considered to be highly oligopolistic with some features of market concentration and leadership. Under this exercise, every licensed bank was expected to meet up with the new capital requirement of ₦25 billion either as a single bank in operation or acquiring other banks assets and liabilities of other smaller banks that were not able to meet up with this requirement. This process brought about a massive reduction in the number of banks operating in the country to 24.

However, the reports of the special examination team carried out by CBN/NDIC revealed that about 9 out of the 24 banks in operation in 2010 were in a serious situation that needed the immediate intervention of the Central Bank (Sanusi, 2010). Furthermore, that report revealed that non-performing loans in 10 banks totaled ₦1,696 billion, representing 44.38% of the total loans while the Capital Adequacy Ratio in the 10 banks stood between -1.01% and 7.41% which were all below the minimum capital ratio of 10% that was set by the regulatory body. Banks remain a crucial part of the financial system. They operate the payments system, supply credit, and serve as agents and catalysts for a wide range of other financial transactions. As a result, their well-being remains a key concern. A resilient banking system is, above all, one that has sufficient capital to weather the loan defaults and declines in asset values that will inevitably come (Dimitrios, Helen and Mike, 2016).

In this sense, it is important to note that bank capital plays a crucial role in making sure that there is safety and soundness of the banking system. The riskiness of a bank loan depends on the capital structure of the firm to which it is made. Bank equity acts as a buffer which absorbs shocks and prevents costly financial distress (Allen & Gale 2007). A highly leveraged bank is more likely to experience a financial crisis, other things being equal, than a bank with low leverage. The more capital there is in a bank the 'safer' the lending to that firm will be. Hence, we will say that the 'safety and soundness' of banks depends on if the bank is well capital structured. Evidence has shown in recent times that non-performing loans have been trending and becoming a cause of concern for banks stability in the face of reeling economic downturns. No doubt banks are contracted with numerous challenges in the business of creating money and they are well known for their risk-taking behavior (Iwedi & Onuegbu, 2014 and Iwedi, 2017), which include credit risk. Credit extended to businesses and other economic agents are assets to the banks and the interest bank received on these assets forms a key component of income. The risk of the loan not being paid back is the main risk faced by banks. Thus, the higher this credit risk, the lower the quality of the loan. However, despite the non-performing loan portfolio has been trending downwards in recent times, dropping to 4.8% below the 5% approved regulatory limit. Statistics from the Central Bank of Nigeria between January and December, 2021 shows that total credit to the private



sector rose to ₦35.11 trillion representing ₦5.16 trillion net new loans (CBN, 2021). This development exposed the banking industry to high credit risk. From the light of the above, there is a need to constantly evaluate the effect of capital regulatory policy on non-performing loans in Nigeria.

## LITERATURE REVIEW

### Theoretical Framework

#### Modigliani and Miller (M&M) Theory of Capital Structure

The Modigliani and Miller approach to capital theory, devised in the 1950s, advocates the capital structure irrelevance theory. This suggests that the valuation of a firm is irrelevant to a company's capital structure. Whether a firm is high on leverage or has a lower debt component has no bearing on its market value; instead, the market value of a firm is solely dependent on the operating profits of the company. A company's capital structure is the way a company finances its assets. A company can finance its operations by either equity or different combinations of a debt and equity. A company's capital structure can have a majority of the debt component or majority of equity or an even mix of debt and equity. Each approach has its own set of advantages and disadvantages. The fundamentals of the Modigliani and Miller approach resemble that of the net operating income approach. Modigliani and Miller further states that the operating income affects the firm's market value, apart from the risk involved in the investment. The theory states that the firm's value is not dependent on the choice of capital structure or financing decisions of the firm.

#### Asset-Liability Management Theory

Asset-liability management is a forward-looking process involving the joint and simultaneous management of assets and liabilities to measure, and control the effect of changing interest rates on income, asset values, liquidity, and regulatory capital. According to a definition provided by Greuning and Iqbal, (2008) Asset-liability management consists of practices and approaches used by banks to determine and control all aspects related to the assets and liabilities (volume, structure, maturity etc.). It aims to provide the optimal structure of assets and liabilities and therefore ensures high-quality, stable, and growing flows and income. Liquidity risk is the bank's ability to cover the need for liquidity available. It consists of balancing the demand for liquidity on the asset value. Asset-liability management risk arises from the difference in maturity terms and conditions on a bank's assets and liabilities. The concept of assets-liability management focuses on the timing of cash flows because company managers must plan for the payment of liabilities. The process must ensure that assets are available to pay debts as they come due and that assets or earnings can be converted into cash. An important ratio used in managing assets and liabilities is the asset coverage ratio which computes the value of assets available to pay a firm's debts. It is calculated as follows:

$$\text{Asset Coverage Ratio} = \frac{(\text{BVTA} - \text{IA}) - (\text{CL} - \text{STDO})}{\text{Total Debt Outstanding}}$$

**Where:**

BVT A = Book value of Total Assets

IA = Intangible Assets

CL = Current Liabilities

STDO = Short-term Debt Obligation

**Empirical Review**

Abdelkader, Neila & Sana, (2009) empirically analyze the cross-countries determinants of non-performing loans (NPLs), the potential impact of supervisory devices, and institutional environment on credit risk exposure. The study employed aggregate banking, financial, economic, and legal environment data for a panel of 59 countries over the period of 2002-2006. It developed a comprehensive model to explain differences in the level of NPLs between countries. The results indicate that higher capital adequacy ratio (CAR) and prudent provisioning policy seems to reduce the level of problem loans.

In a bid to examine the pro-cyclical effect of bank capital regulation, Repullo & Suarez, (2013) developed and calibrated a dynamic equilibrium model of relationship lending in which banks are unable to access the equity markets every period and the business cycle is a Markov process that determines loans' probabilities of default. The study found that banks anticipate that shocks to their earnings and the possibility of capital requirements over the cycle can impair the future lending capacity and, as a precaution, hold capital buffers. They compared the relative performance of several capital regulation regimes, including one that maximizes a measure of social welfare. They also went further to show that Basel II is significantly more pro-cyclical than Basel I, but makes banks safer. In trying to detect the determinants of non-performing loans, Ahlem & Fathi, (2013) took a sample of 85 banks in three countries (Italy, Greece and Spain) for the period of 2004-2008. The study found that the problem loans vary negatively with the growth rate of GDP, the profitability of banks' assets and positively with the unemployment rate, the loan loss reserves to total loans and the real interest rate.

Shelkhar, Charles & Tomasz, (2015) in their study on bank capital regulation opined that minimum equity ratio requirements promote bank stability, but compliance must be measured credibly and requirements must be commensurate with risk. A mix of higher capital requirements, carefully designed regulatory requirements, and other measures would address prudential objectives better than book capital requirements alone. The research went further to state that a system of credible, incentive-robust rules that combine valid concepts with objective market -based information into a simplified and credible regulatory process should replace Basel 3's ill-defined liquidity ratios, book capital ratios and internal models of risk. Raising minimum capital requirements will not be socially cost-less, bank profitability, share prices, loan supply is likely to suffer.

To examine the effect of a full set of bank capital regulations (capital stringency) on loan growth, Yota & Hasan, (2017) found out that overall capital stringency only has a weak negative effect on loan growth. The effect is completely offset if banks hold moderately high levels of capital. They opined that the components of capital stringency that have the



strongest negative effect on loan growth are those related to the prevention of banks to use as capital borrowed funds and assets other than cash or government securities. In contrast, compliance with Basel guidelines in using Basel and credit-risk weights has a much less potent effect on loan growth.

Ngozi, (2018) conducted a study on non-performing loans and its effects on banking stability and revealed in her study that drivers of non-performing loans vary across the two categories of banks, but weighted average lending rate is a vital macroeconomic driver of NPLs for both. The results also confirm the moral hazard hypothesis and risk-return trade-off of efficient market theory. In a bid to study the bank specific factors affecting non-performing loans in developing countries, a case study of Indonesia, Rathria, Yohanes & Kevin, (2018) analyzed that banks with higher profitability are proven to have lower NPLs because they can afford adequate credit management practices. Likewise, banks with higher credit growth evidently have lower NPLs in the sense that they demonstrate more specialized lending activity and thus have better credit management systems. The findings imply that, in order to lower loan defaults that can deteriorate banks' asset quality, banks should maintain their level of profitability and increase rather than decrease their credit supply to debtors. Ronald, Peter, Arvind & Selvin, (2018) results show that the following indicators have negative association with NPL and are statistically significant with the conventional levels: return on equity, capital adequacy requirement, and market share based on assets, unemployment and time. On the other hand, the net interest margin has a positive and statistically significant association with NPL.

Nwosu, Okedigba & Anih, (2020) results revealed a negative, and statistically significant impact of non-performing loans on banks' profitability. Their study went further to explain that lower bank profitability can be explained by higher volume of non-performing loan, increased liquidity ratio and inflation, while higher profitability could be as a result of increase in bank size and capital adequacy ratio. John & Caterina, (2021) examine whether the effect of NPLs on bank credit growth differs depending upon the level of bank capital and profitability in a panel of up to 521 banks from 28 European countries. Their main findings are that there are significant positive interaction effects of NPLs and bank capital and NPLs and profitability on the supply of bank credit. Thus, whether NPLs impede the monetary policy transmission depends substantially on whether or not banks are sufficiently capitalized and profitable. Policy actions aimed at reducing NPLs to sustain bank credit should protect bank capital and profitability if they aim at returning NPLs to good standing. Furthermore, Ni Kadek & Ni Ketut, (2021) analyze the effect of non-performing loans on return on assets with a capital adequacy ratio as a mediator. The research was conducted at banking companies listed on the Indonesia stock exchange with a total sample of 24 banks. They collected data observing the company's financial statements. The results show that there is a negative and significant relationship between non-performing loans and capital adequacy ratio. However, the capital adequacy ratio has a positive and significant relationship with return on assets. Non-performing loans has a negative and significant relationship with return on assets. Based on the research results, it was proven that the capital adequacy ratio mediates the effect of non-performing loans on return on assets. By applying GMM on the data of US commercial banks from 2002 to 2018, Faisal & Zahid, (2021) investigated the influence of bank capital, risk-based capital and bank capital buffers on the behavior of banks risk-taking. The findings show that bank capital has a positive influence on total risk. However, risk-based capital and capital buffer have a negative impact on total risk. In addition, the results showed that the



relationship between bank asset risk and bank capital, risk-based capital and a capital buffer is negative in pre, amid and post-crisis periods. Their findings also reveal that the result of bank capital, risk-based capital and a capital buffer is not similar in case of well, adequately under, significantly under, and critically under-capitalized banks.

Onah, Iwedi, & Leera (2022) investigates the causal effects of asset quality shocks on the profitability of Nigeria banking industry for a period of 11 years ranging from 2008 to 2021. Time series data were sourced from the Nigeria deposit insurance corporation annual reports and accounts, CBN financial stability report and CBN statistically bulletin for various years. The granger causality framework was employed in analyzing the time series data. The result shows evidence of causality between asset quality and return on asset of commercial banks in Nigeria.

## METHODOLOGY

The population of the study consists of 22 quoted commercial banks on the Nigerian Exchange Group as at August 2022. The judgmental sampling technique was used to select 15 quoted commercial banks. The essence is because the researcher has access to information about the selected banks. The data for analysis were collected from the Nigerian exchange group fact sheet for 2021 for 15 commercial banks under study. The data collected were analyzed using the descriptive analytical technique and econometrics analytical technique.

Descriptive analysis is employed in the presentation and preliminary analysis of the data section. Among others, the study utilizes such measures as the mean, median, standard deviation, skewness and kurtosis and the jarque-bera statistics. The skewness, for instance, is a measure of asymmetry of the distribution of the series around its mean. The econometric analysis is used to determine the relationship between the variables implicated in the associated models resulting into sets of estimable equations, appropriate levels of analysis are conducted in each case ranging from the global analysis to analysis of relative statistics that test the hypothesis. In order to test of the data, a functional relationship in form of multiple linear regression models are presented as follows:

### Pooled Effect Model Specification

$$NPLs = \beta_0 + \beta_1 OMR + \beta_2 B1TR1 + \beta_3 B2MTR2 + \beta_4 B3CBTL + \mu \quad (1)$$

### Fixed Effect Model Specification

$$NPLs = \alpha_0 + \alpha_1 OMR + \alpha_2 B1TR1 + \alpha_3 B2MTR2 + \alpha_4 B3CBTL + \sum_{i=1}^a I_{\alpha_i} dum \in 1 \quad (2)$$

### Random Effect Model Specification

$$NPLs = \alpha_0 + \alpha_1 OMR + \alpha_2 B1TR1 + \alpha_3 B2MTR2 + \alpha_4 B3CBTL + \mu_i + \epsilon_{it} \quad (3)$$

### Where

NPLs = Non-Performing Loans

OMR = Operational and Market Risk



B1TR1 = Basel 1 Tier 1 Capital

B2MTR2 = Basel 2 Minimum Tier 2

B3CBTL = Basel 3 Capital Buffer to Loan

$\epsilon_1$  = Stochastic or disturbance/ Error term

t = Time dimension of the variables

$\alpha_0$  = Constant or intercept

## RESULTS AND DISCUSSIONS

### Descriptive Analysis

**Table 4.1 Descriptive Analysis**

	NPLS	OMR	B1TR1	B2MTR2	B3CBTL
Mean	0.291333	0.314974	0.325333	0.343641	0.194769
Median	0.110000	0.400000	0.260000	0.300000	0.100000
Maximum	0.590000	0.590000	0.590000	0.590000	0.590000
Minimum	0.060000	0.060000	0.130000	0.200000	0.050000
Std. Dev.	0.216874	0.190283	0.129508	0.113012	0.161566
Skewness	0.230420	-0.028639	0.499998	0.625742	1.064716
Kurtosis	1.162553	1.246804	1.801889	2.039895	2.492660
Jarque-Bera	29.15725	25.00044	19.78811	20.21513	38.93396
Probability	0.000000	0.000004	0.000050	0.000041	0.000000
Sum	56.81000	61.42000	63.44000	67.01000	37.98000
Sum Sq. Dev.	9.124653	7.024275	3.253853	2.477715	5.064065
Observations	195	195	195	195	195

*Source: Extract from E-Views 9.0 Results, 2022.*

From table 4.1 above non-performing loans (NPLs), Operational and market risk (OMR), Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), and Basel 3 capital buffer to loan (B3CBTL) recorded a mean of 0.291333, 0.314974, 0.325333, 0.343641 and 0.194769 with a maximum value of 0.590000 for all the variables, and a standard deviation of 0.216874, 0.190283, 0.129508, 0.113012 and 0.161566. The computed Jarque-Bera of 29.15725, 25.00044, 19.78811, 20.21513, and 38.93396 with various probability values of less than 0.05 suggest that at 95% confidence interval the distribution of the population of non-performing loans (NPLs), Operational and market risk (OMR), Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), and Basel 3 capital buffer to loan (B3CBTL) are not normally distributed.



## Correlation Matrix Results

**Table 4.2 Capital Regulatory Policy and Non-Performing Loan**

Correlation Probability	NPLS	OMR	B1TR1	B2MTR2	B3CBTL
NPLS	1.000000				
	-----				
OMR	0.799813	1.000000			
	0.0000	-----			
B1TR1	0.872439	0.740783	1.000000		
	0.0000	0.0000	-----		
B2MTR2	0.641613	0.560107	0.578651	1.000000	
	0.0000	0.0000	0.0000	-----	
B3CBTL	0.502801	0.350170	0.423337	0.367147	1.000000
	0.0000	0.0000	0.0000	0.0000	-----

Source: Extract from E-Views 9.0 Results, 2022.

Person correlation analysis was conducted to examine the nature of relationship between the variables. The analysis was carried out at 5% level of significance. The correlation coefficient  $r$  may assume any value from  $-1$  to  $1$  (i.e.,  $-1 \leq r \leq 1$ ) depending on the direction and strength of the relationship. Positive values of  $r$  i.e. ( $0 < r \leq 1$ ) indicate a positive linear relationship, while negative values of  $r$  i.e. ( $-1 \leq r < 0$ ) indicate a negative linear relationship. If  $r = 0$ , then there is no linear relationship (zero correlation). The correlation results above shows the relationship between non-performing loans (NPLs), Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), Basel 3 capital buffer to loan (B3CBTL), and Operational and market risk (OMR). The results from the table above suggest that Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), Basel 3 capital buffer to loan (B3CBTL), and Operational and market risk (OMR) all have positive and significant relationship with non-performing loans (NPLs) with the respective p-values  $r < 0.05$ . The results also suggest that Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2) and Operational and market risk (OMR) have a strong correlation with non-performing loans (NPLs) with coefficient of correlation values  $r = 0.872439, 0.641613$  and  $0.799813$  for Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2) and Operational and market risk (OMR) respectively. The strength of relationship between Basel 3 capital buffer to loan (B3CBTL) and non-performance loan was found to be medium with a correlation coefficient value  $r = 0.502801$  for Basel 3 capital buffer to loan (B3CBTL).





## Panel Unit Root Test

**Table 4.3 Capital Regulatory Policy and Non-Performing Loan**

Variables	Level	1 <sup>st</sup> Difference	2 <sup>nd</sup> Difference	Decision	Conclusion
NPLs	0.22152 (0.4123)	3.88606 (0.0001)	9.61339 (0.0000)	Stationary at First Difference	I(I)
OMR	2.79107 (0.0026)	6.75519 (0.0000)	11.5432 (0.0000)	Stationary at Level	I(0)
B1TR1	5.60670 (0.0000)	7.39891 (0.0000)	7.13545 (0.0000)	Stationary at Level	I(0)
B2MTR2	4.45592 (0.0000)	8.14858 (0.0000)	9.71119 (0.0000)	Stationary at Level	I(0)
B3CBTL	132.850 (0.0000)	94.0391 (0.4282)	29.0575 (0.0000)	Stationary at Level	I(0)

Source: Extract from E-Views 9.0 Results, 2022.

To check the stationarity of our data we use the two types of panel unit root tests. As common unit root process we use Levin, Lin and Chu panel unit root test and for individual unit root process we use three type of panel unit root tests, first one is Im, Pesaran and Shin panel unit root test, second is Fisher type test, the ADF-Fisher chi-square test and last one is also a fisher type test, the PP-Fisher Chi square panel unit root test. From the results in table 4.3 above, all the variables are found to be stationary at level that is to say that they are co integrated at order zero I(0) except non-performing loan (NPLs) which is stationary at first differenced that is co integrated at order one I(I). This result suggests that the statistical properties of the variables are constant over time. Again, this result presented in table 4.3 enables us to present our regression results as formulated in chapter three of this study.

## Panel Regression Results

**Table 4.4 Relationship between Capital Regulatory Policy and Non-Performing Loan**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
<b>Pooled Effects Results</b>				
OMR	0.334654	0.050630	6.609726	0.0000
B1TR1	0.884089	0.077266	11.44215	0.0000
B2MTR2	0.237024	0.071066	3.335260	0.0010
B3CBTL	0.176032	0.043521	4.044782	0.0001
C	-0.217434	0.021530	-10.09916	0.0000
R-squared	0.840624	Mean dependent var		0.291333
Adjusted R-squared	0.837269	S.D. dependent var		0.216874
S.E. of regression	0.087487	Akaike info criterion		-2.009350
Sum squared resid	1.454250	Schwarz criterion		-1.925427
Log likelihood	200.9116	Hannan-Quinn criter.		-1.975370
F-statistic	250.5374	Durbin-Watson stat		1.591535
Prob(F-statistic)	0.000000			



Variable	Coefficient	Std. Error	t-Statistic	Prob.
OMR	-0.008437	0.033051	-0.255262	0.7988
B1TR1	0.064268	0.058379	1.100860	0.2725
B2MTR2	0.079205	0.048652	1.627990	0.1053
B3CBTL	0.051312	0.029551	1.736410	0.0842
C	0.235870	0.027291	8.642632	0.0000
<b>Effects Specification</b>				
Cross-section fixed (dummy variables)				
R-squared	0.957539	Mean dependent var		0.291333
Adjusted R-squared	0.953196	S.D. dependent var		0.216874
S.E. of regression	0.046919	Akaike info criterion		-3.188430
Sum squared resid	0.387446	Schwarz criterion		-2.869522
Log likelihood	329.8719	Hannan-Quinn criter.		-3.059308
F-statistic	220.4965	Durbin-Watson stat		1.894409
Prob(F-statistic)	0.000000			
<b>Random Effect Results</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
OMR	0.214538	0.029941	7.165487	0.0000
B1TR1	0.601505	0.048429	12.42023	0.0000
B2MTR2	0.259506	0.044621	5.815819	0.0000
B3CBTL	0.146057	0.027468	5.317328	0.0000
C	-0.089555	0.019205	-4.663122	0.0000
<b>Effects Specification</b>				
			S.D.	Rho
Cross-section random			0.025095	0.2224
Idiosyncratic random			0.046919	0.7776
<b>Weighted Statistics</b>				
R-squared	0.541761	Mean dependent var		0.134110
Adjusted R-squared	0.532114	S.D. dependent var		0.107721
S.E. of regression	0.073684	Sum squared resid		1.031567
F-statistic	56.15770	Durbin-Watson stat		1.408983
Prob(F-statistic)	0.000000			

Source: Extract from E-Views 9.0 Results, 2022.

From the pooled effect results the independent variables explained 83 percent variations in non-performing loan for the period under study. The model is statistically significant when judged from the f-statistic and probability while the Durbin Watson statistic proves that the variables have no serial autocorrelations. The beta coefficients of the variable show that Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), Basel 3 capital buffer to loan (B3CBTL), and Operational and market risk (OMR) shows a positive and significant relationship with non-performing loans (NPLs).

From the fixed effect results we found that the independent variables explained 95 percent changes in the dependent variable. However, the beta coefficients of the variables suggest that Operational and market risk (OMR) has a negative effect on non-performing loan; the negative effect was found not be significant. Again, the beta coefficients of Basel 1 tier 1



capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), and Basel 3 capital buffer to loan (B3CBTL) suggests a positive relationship with non-performing loans (NPLs) however the relationship was significant. The Durbin Watson statistics of 1.89 suggest the absence of autocorrelation since the value is closer to 2 than it is to zero.

From the random effect model 53 percent of the variations in the dependent variable can be explained by the independent variables. The model is statistically significant when judged from the f-statistic and probability while the Durbin Watson statistic proves that the variables have no serial autocorrelations. The beta coefficients of the variable show that Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2), Basel 3 capital buffer to loan (B3CBTL), and Operational and market risk (OMR) shows a positive and significant relationship with non-performing loans (NPLs). This result is consistent with our earlier findings in the pooled effect model and correlation matrix results. This result further suggests that there is no difference between the random and pool effect model for all the independent variables as tested on each of the model. The independent variables does not change across the section which suggest that irrespective of the model we choose between pooled and random effect there won't be any difference on measuring the impact of the independent variable

### Granger Causality

**Table 4.5 Effect of Capital Regulatory Policy on Non-Performing Loan**

Null Hypothesis:	Obs	F-Statistic	Prob.
OMR does not Granger Cause NPLS	165	1.16193	0.3155
NPLS does not Granger Cause OMR		23.1666	1.E-09
B1TR1 does not Granger Cause NPLS	165	5.28713	0.0060
NPLS does not Granger Cause B1TR1		32.3885	2.E-12
B2MTR2 does not Granger Cause NPLS	165	0.60313	0.5483
NPLS does not Granger Cause B2MTR2		5.68342	0.0041
B3CBTL does not Granger Cause NPLS	165	0.22732	0.7969
NPLS does not Granger Cause B3CBTL		11.9135	2.E-05
B1TR1 does not Granger Cause OMR	165	10.8350	4.E-05
OMR does not Granger Cause B1TR1		9.72848	0.0001
B2MTR2 does not Granger Cause OMR	165	2.99283	0.0530
OMR does not Granger Cause B2MTR2		1.51525	0.2229
B3CBTL does not Granger Cause OMR	165	4.52685	0.0122
OMR does not Granger Cause B3CBTL		7.28855	0.0009
B2MTR2 does not Granger Cause B1TR1	165	4.35302	0.0144
B1TR1 does not Granger Cause B2MTR2		8.81643	0.0002
B3CBTL does not Granger Cause B1TR1	165	2.26243	0.1074
B1TR1 does not Granger Cause B3CBTL		5.76165	0.0038
B3CBTL does not Granger Cause B2MTR2	165	1.99023	0.1400
B2MTR2 does not Granger Cause B3CBTL		6.48013	0.0020

Source: Extract from E-Views 9.0 Results, 2022.



From the results in table 4.5, there is no causal relationship from Operational and market risk (OMR) to non-performing loans (NPLs) value therefore accept null hypothesis, there is causal relationship from Operational and market risk (OMR) to non-performing loans (NPLs) therefore reject null hypothesis. The results suggest that there is a uni-directional relationship between that Basel 1 tier 1 capital (B1TR1), Basel 2 minimum tier 2 (B2TR2) and non-performing loan (NPLs), this suggest a long run relationship between these variables. There is no causal relationship between Basel 3 capital buffer to loan (B3CBTL) and non-performing loans (NPLs)

**Table 4.6 Pedroni Residual Cointegration Test**

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.214089	0.5848	-1.785321	0.9629
Panel rho-Statistic	1.108109	0.8661	1.626614	0.9481
Panel PP-Statistic	-3.165070	0.0008	-5.904867	0.0000
Panel ADF-Statistic	1.089572	0.8620	-2.487190	0.0064
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	3.025317	0.9988		
Group PP-Statistic	-6.909661	0.0000		
Group ADF-Statistic	-0.493991	0.3107		

Source: Extract from E-Views 9.0 Results, 2022.

For the analysis we use three types of panel co-integration test. One type of tests was introduced by Pedroni (1999) and a second type was introduced by Kao (1999) which is Engle Granger (1987) two step residual-based test, and a third type of tests was introduced by Fisher which is a combined Johansen test. Pedroni (1999) derives seven panel co-integration test statistics. Of these seven statistics, four are based on within dimension, and three are based on between dimension. From Table 4.6 in every case of opportunity cost except in panel v statistics long term and difference between long term and short term at 5% level of significance, accept the null hypothesis otherwise in all case at 5% level of significance we reject the null hypothesis of no co-integration. This means the variable has a long run relationship. Kao Residual Co-integration test also shows us for every case of opportunity cost at 5% level of significance we reject null hypothesis of no co-integration and every case pvalue 0.00 which is highly significance it gives a strong evidence that the variables has a long run relationship. From the results above Group PP-Statistic, Panel ADF-Statistic, and Panel PP-Statistic all confirm that there is a long run relationship but other test statistics gives a contrary result. For this reason, we proceed to the test the Kao residual co integration to validate or reject our earlier findings.

**Table 4.7 Kao Residual Cointegration Test**

Series: NPLS OMR B1TR1 B2MTR2 B3CBTL

	t-Statistic	Prob.
ADF	-2.650909	0.0040
Residual variance	0.003799	
HAC variance	0.001626	

*Source: Extract from E-Views 9.0 Results, 2022.*

From the results in able 4.7 above, we can conclude that there is a long run relationship between the variables under study. This result validates our findings from the pedroni cointegration results.

### Redundant Fixed Effects Tests: Capital Regulatory Policy and Non-Performing Loan

Redundant Fixed effect test is a statistical test to select whether the most appropriate fixed effect or random effect model is used. If Result:

H0: Select RE ( $p < 0.05$ )

H1: Select FE ( $p > 0.05$ )

**Table 4.8 Redundant Fixed Effects Tests**

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	34.614525	(14,176)	0.0000
Cross-section Chi-square	257.920571	14	0.0000

*Source: Extract from E-Views 9.0 Results, 2022*

In testing the validity of fixed and random effect model, the study adopted the Redundant Fixed effect test coefficient, from the table 4.8, the probability coefficient of Redundant Fixed effect of 0.0000 is less than the critical value of 0.05 therefore, the study accept that Random effect model is appropriate.

### Summary of Findings

**Table 4.9 Summary of Findings**

Hypothesis	Decision Rule	Findings
Basel 1 tier 1 capital has no significant effect on the non-performing loans of commercial banks in Nigeria.	Reject $H_0$ if P-value $< 0.05$	Significant
Basel 2 minimum tier 2 capital has no significant effect on the non-performing loans of commercial banks in Nigeria.	Reject $H_0$ if P-value $< 0.05$	Significant



Basel 3 capital buffer to loan has no significant effect on the non-performing loans of commercial banks in Nigeria.	Reject $H_0$ if P-value < 0.05	Significant
Operational and market risk has no significant effect on the non-performing loans of commercial banks in Nigeria.	Reject $H_0$ if P-value < 0.05	Significant

Source: Extract from *E-Views 9.0 Results*, 2022

## CONCLUSION

This research work has empirically analyzed the capital regulatory policy and non-performing loans of commercial banks in Nigeria using the multiple linear regression models. The empirical analysis started with the descriptive analysis which includes the mean, median, standard deviation, skewness, kurtosis and jarque-bera statistics. Thereafter, we proceeded to the correlation matrix to examine the relationship that exists between the dependent and independent variables. We also went further in our analysis using the econometric analysis by first conducting conventional stationarity test (panel root test), followed by the granger causality test, thereafter, the pedroni residual cointegration test, the kao residual cointegration test and the redundant fixed effects test. Additionally, diagnostics test was carried out to ensure a robust analysis. Applying the multiple linear regression techniques to 165 observations of a yearly data covering the periods of 2009 to 2021, the results show a good number of findings. According to the unit root test results, all the variables are found to be stationary at level that is to say that they are cointegrated at order 1(0) except non-performing loans (NPLs) which is cointegrated at order one 1(I). This of course suggests that the statistical properties of the variables are constant over time. Following the fact that the variables are cointegrated, the study went further to estimate the VAR model, the baseline result shows that there exist a positive and significant relationship with non-performing loans (NPLs). This implies that Basel1 tier 1 capital, Basel2 minimum tier 2 and Basel 3 capital buffer to loan plays a role in the level of non-performing loans of commercial banks. This further indicates that capital regulatory policy is relatively effective in commercial banks in Nigeria. Based on the findings of this research work, it can be concluded that capital regulatory policy is significant in the reduction of non-performing loans of commercial banks in Nigeria. This is not surprising outcome due to the fact that these policies significantly influence and make sure that there is a significant amount of risk assets that should be non-performing in banks. A proper understanding of these policies is key for financial institution and other firms to have proper banking system soundness.



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