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BANKS AND CREDIT RISK MANAGEMENT IN NIGERIA

TIJANI, Julius O.
Department of Economics, University of Ilorin, Ilorin, Nigeria
juliustijani@yahoo.com

ABDULLAHI, Maikano S.
Department of Accounting & Finance, ESFAM University, Porto-Novo, Benin Republic
asturaki@gmail.com

Abstract

Despite the contributions of Nigeria banks to the growth of its economy, there are indications and evidences which suggest that some of these banks might be suffering from financial crunch as well as having performance problem. The unimpressive states of capital adequacy ratio, non-performing loans rate, liquidity rate and so on are signs of poor management of credit risk. This study therefore examined the relationship between credit risk management and banks' performance in Nigeria. Capital adequacy ratio was used as proxy of banks' performance, while non-performing loan rate, liquidity rate and loan-deposit ratio were used as proxies of credit risk management. The study employed both descriptive and panel regression analyses for ten commercial and microfinance banks between 2008 and 2017. Hausman test and Random effect model were employed. The study found direct relationships between capital adequacy ratio (banks' performance) and liquidity rate, loan-deposit ratio (credit risk management) and return on asset. It concluded that credit risk management had significant impact on banks' performance in Nigeria and that most banks understudy were fairly managing their credit risks.

Keywords: Credit Risk Management, Capital Adequacy Ratio, Bank Performance, Non Performing Loan, Liquidity Rate

INTRODUCTION

Banks like every other financial institution are faced with challenges of risks and its management. Since risks seem inevitable for organisations that desire to grow, management of risk definitely has to be one of the major priorities of any contemporary business organisations. Fadun (2013) regarded risk to be a major part of business that firms or businesses can not do without in their operations. In recent time, increase in diversification of banks asset portfolios has significantly intensified the risk faced by banks. Their operational activities have had to be rapidly expanded to accommodate flexible risk exposure in response to the globalisation of financial markets (Okere, Isiaka & Ogunlowore, 2018).

Most Nigerian banks are characterised by poor risk management. They are often time exposed to a large range of systematic and unsystematic risks while performing their commercial activities. Separate studies by Ogbulu and Eze (2016), Kolapo, Ayeni, and Oke (2012), Ahmad and Ariff (2007), and Gil-Diaz (1994) blamed banks failures in some emerging market economies, including Nigeria, on improper lending practices, insufficient organisational and informational systems, and lack of expertise to adequately assess credit risk in the dwindling economy. Similarly, empirical evidence shows that banks performed poorly, as evidenced by the bank performance and credit risk management indicators such as; poor loan quality, high credit risk, high liquidity risk, limited and/or inadequate capitalisation, operational inefficiencies, and higher proportion of high non-performing loans, among others (Ogbulu et al., 2016).

Many Nigerian banks were drastically undercapitalised in the late 1980s and early 1990s, owing mostly to non-performing loans, which greatly contributed to the banking system's financial hardship (Kayode, Obamuyi, Owoputi & Adeyefa, 2015). According to CBN 2005, the ratio of non-performing loans to total loans in the banking industry was 21.5 percent in 2000 and had improved to 16.9 percent by the end of 2001. By 2004, the percentage has steadily declined to 23.8 percent (CBN, 2005). By 2006, after first major phase of banking reform in 2004 in which several banks' operating licenses were revoked due to non-compliance with minimum re-capitalisation requirements, a large number of them had non-performing credit ratios of up to 80% (Kayode et al., 2015). This resulted in rebasing of commercial banks from N2 billion to N25 billion, while the then 89 commercial banks were acquired and merged to become twenty five. Consequently, in 2007, there was a significant recovery to 18.1 percent, which was again reduced to 6.3 percent in 2008 (CBN, 2010; Kayode et al., 2015).

Remarkably, the Credit Risk Management System (CRMS) or Credit Bureau and the Basel Accord I and II, implemented by CBN to enhance banks' credit assessment methods as well as the second phase of banking reform of 2009 in which the Asset Management Corporation of Nigeria (AMCON) established in 2010 to absorb and mop up non-performing loans in the system was able to absorb around 95% of the non-performing loans (Basel Committee on Banking Supervision, 2001; CBN, 2005; Onaolapo, 2012). The launch of the Nigerian Banking Consolidation Programme also brought higher competitiveness within the financial sector, encouraging banks to dispense large amounts of credit. Each bank also launched various tactics such as credit derivatives, credit securitization etc. The consequences of these changes were evident in various important performance metrics in the banking sector. For example, the capital adequacy ratio increased to 65 percent, earnings increased by 150 percent, liquidity increased by 120 percent, and asset quality increased to 75 percent (CBN, 2005; Onaolapo, 2012; Onaolapo and Oyedele, 2015).

Unfortunately, the effects of these initiatives did not endure long, since the majority of banks began to exhibit distress symptoms, poor credit risk management and unimpressed financial metrics which include; high rates of non-performing loans, low capital adequacy ratio, low liquidity rate among others. The circular from the CBN to microfinance banks in 2018 regarding the upward review of their minimum capital base requirements and other policies were as a result of several challenges confronting the banking system, such as weak corporate governance, insufficient capital base, and, most importantly, ineffective credit risk management practices (CBN, 2018).

From the preceding, it is obvious that poor credit risk management may have severe impact on banks' financial standings. Hence, it is critical to evaluate credit risk management of Nigeria banks and their performance. The objective of this study is to examine the relationship between credit risk management and banks' performance in Nigeria. The research will also try to provide answers to questions such as; what are the causes of poor credit risk management in Nigeria's banks? To what extent has poor credit risk management affected banks' performance? Are Nigeria's banks effectively managing their credit risk?. The null hypothesis (H_0) will be tested to see if there is no significant relationship between credit risk management and the performance of banks in Nigeria. Section I already contained introduction, section II discussed issues around literature review. Section III presented sample, model specification and techniques of analysis. Section IV had data presentation and discussion of findings, while Section V contained conclusion of the study.

LITERATURE REVIEW

Risk has been conceptualised extensively in literature, and are mostly hinged on expectation from an action. According to Nzotta (2002) and Owualla (2000), risk is seen as the exposure to loss resulting from the disparity between expected outcome and actual outcome from an investment. Fadun (2013) viewed risk as a major part of business, that no firm or business can do without in its operations and is often not unconnected with uncertainty since the event may occur or not occur which could either be in form of negative (threat) or positive (opportunity) or both. Soludo (2007), beliefs risk is not bad on itself, but risk that is mismanaged, misunderstood, mispriced or unintended is what is actually bad.

Credit risk is when a debtor defaults and refuses to honor his/her obligation debt servicing or fails to make timely payment of his/her debt servicing (Taiwo, Ucheaga, Achugamonu, Adetiloye, Okoye & Agwu, 2017; Coyle 2000). Credit risk occurs when an obligor cannot meet its commitments under a trade or lending contract, or when impairment develops that prevents him/her from executing such responsibilities, resulting in an economic loss to the bank (CBN, 2000). Boland (2012) further emphasised on how severe a slight default could cause, that is, a default of a very few customers could cause banks huge loss as a result of shortage of funds and lead to distress if not thoroughly managed.

Credit risk, liquidity risk, non-performing loan, loan to deposit rate are all critical to banking operations. They are banking operations metrics that are influenced by the effectiveness of the credit risk management. Credit risk management is thus of utmost concern to bank authorities and regulators due to the high levels of perceived risk that frequently result from the characteristics of some banks' customers and their business environment. Poor credit risk management leads to the buildup of non-performing loans, low capital adequacy which limits banks' liquidity and credit expansion, exposes institutions to distress, slows investment development, and has a direct impact on the banking system and the economy as a whole. Related to credit risk is liquidity risk which arises from the fact that the bank may find it difficult to generate substantial amount of funds in order to meet the short-term financial obligations. It is mostly seen as a sudden liability short fall that is associated with a deposit withdrawal or with a decline in borrowing capacity.

Like return on asset and return on equity, capital adequacy rate is a measure of the financial soundness of a bank, the higher the capital adequacy rate of a bank, the more likely for the bank to withstand a financial downturn or other unforeseen losses. It has been used to assess bank performance in literature, for instance, Dao and Nguyen (2016; 2020), Al-Tanimi and Fakhri (2013), Olanrewaju and Akande (2016) among others used capital related components to measure profitability and performance. Evidences from their studies suggest it’s a good measure of banks’ financial soundness, profitability and performance.

Ayodele and Alabi (2014) broadly explained the term risk management in relation to a mechanism which embraces planning, organising and controlling resources and operational activities of business for effective reduction of risk, correcting its adverse effects and consequences. Risk management does not necessary mean total minimisation of risk, but to optimise risk-reward trade off (Ayodele et al., 2014). Soludo (2007) referred risk management as involving identification, measurement, monitoring and controlling risks. Lindergren (1987) pointed out major principles in credit risk management process to include; the establishing of a clear structure, prioritising processes, allocation of responsibility and disciplined, communication of clear and definite responsibilities and accountability assigned.

Most banks in Nigeria strategically carry out CRM systems internally and these CRM systems fall within the purview of the CBN CRM framework guidelines, which are; "i) Limiting credit risk to certain industries, market or individuals (over- concentration) ii) Ensures adequacy of asset classification (asset classification rule) iii) Loan loss provisioning (prudential codes) iv) Stipulates borrower's key performance indexes (conditionality rule) v) Undertakes pre-lending assessment and post lending audit/monitoring." (Onaolapo 2012:42). A review of literature suggests that sources and determinants of poor credit risk management are universal, although they vary from one country to another depending on the level of growth and development of the country's economy, technology, human capacity and banking and financial sectors. However, some of the determinants and sources of poor credit risk management in Nigeria banks are similar to those identified by Kithinji (2010); Bidani, Mitra and Praniod (2004); Chen, Cheng and Wu (2005) and Onaolapo (2012). They include; i) limited institutional capacity and poor management, ii) inappropriate credit and lending policies, iii) volatile interest rates, low capital and liquidity levels, iv) inadequate supervision by the central bank and massive licensing of banks, v) government interference, vi) laxity in credit appraisal process due to corruption or ineptitude, vii) high credit concentration, viii) mismatch between credit monitoring system and external operating environment.

Gatuhu (2013); Ogbulu et al. (2016); Kargi (2011); Mwangi (2014); Kayode et al. (2015); Ayodele et al. (2014); Taiwo et al. (2017) and Okere et al. (2018) have reported significant relationship between banks' performance and credit risk management. While some reported positive significant relationship which is in tandem with the apriori or theoretical expectations, few of the studies reported negative and significant relationship. However, Onaolapo (2012); Taiwo et al. (2017), reported insignificant relationship between credit risk management and performance (growth of total loans and advances) of deposit money banks in Nigeria.

Gatuhu (2013) established strong and positive nexus between credit risk management and bank's financial performance employing survey design with sample of 59 microfinance institutions in Kenya. The study reported significant relationship between banks' performance and credit risk management. Kargi (2011) sampled selected banks in Nigeria from 2004 and 2008 using descriptive, correlation and regression techniques, with the view to evaluate the impact of credit risk on the profitability of Nigerian banks, Ogbulu et al. (2016) did similar but comprehensive study for deposit money banks in Nigeria from 1989 to 2013, and employed a more reliable quantitative technique known as the Error Correction Mechanism (ECM) and Granger causality techniques. Both studies results showed that credit risk management indicators understudied significantly impacted on the performance of deposit money banks in Nigeria.

Mwangi (2014) established a significant but negative relationship between liquidity and credit risk management and financial performance, after sampling 43 listed Banks in Kenya between the spaces of three years from 2010 to 2013 with the use of descriptive analysis. His findings corroborated the submission of Kargi (2011) and Ogbulu et al. (2016) that the levels of loans and advances, non-performing loans and deposits affected banks' profitability inversely. Kayode et al. (2015) affirmed to the submission that an extensive exposure to credit risk might reduce bank profitability in their study. They agreed that credit risk was negatively linked to bank performance in Nigeria. Ayodele et al. (2014) revealed that banking operations were majorly affected by credit risk and operational risk while examining the risk management in First bank of Nigeria PLC. They found risks such as, fraud and forgery, operational risk, market risk and system risk thrived in banking operations, exhibiting the characteristics of underdeveloped economy with developing banking system.

In spite of the inverse relationship between credit risk management and bank's performance enumerated above, Ogunlade and Oseni (2018) reported significant and positive relationship between credit management and financial performance of First bank Nigeria Plc.. Taiwo et al. (2017) found that sound credit management strategies boosted investors and increased customers' confidence in banks, which resulted into growth of funds for loans and advances and eventually led to increase in bank's profitability. Okere et al. (2018) employed panel data analysis and other econometric techniques to explore the impact of risk management (credit and liquidity) on financial performance of money deposit banks in Nigeria. Positive relationship was established between risk management and financial performance of money deposit banks.

However, Taiwo et al. (2017) further revealed that credit risk management insignificantly impacted on the growth of total loans and advances of deposit money banks in Nigeria. Onaolapo (2012) analyzed the efficiency of credit risk management and financial health in some banks in Nigeria. Found (minimal) insignificant relationship between credit risk management and performance. Kolapo et al. (2012) studied the effect of credit risk on the performance of five commercial banks in Nigeria from 2000 to 2010 using panel model analysis. The study concluded that the effect of credit risk on bank performance measured by the return on assets of banks was cross-sectional invariant, that is, the effect was minimally similar across banks sampled.

METHODOLOGY

This study examined the relationship between credit risk management and banks' performance in Nigeria. It covered the period of 10 years (2008-2017). The choice of this period is to capture developments under the discourse, since series of banking reforms have been carried out during this time period. The data used in this study was gathered from the annual financial statement of all the banks understudy for the period under consideration. A total number of ten (10) banks were selected across major types of banks in the country. The sample comprised of five (5) commercial banks, and five (5) microfinance banks presently operating in the country. The five commercial banks are classified as tier 1 banks in terms of their market share and raising of capital. They include; Access Bank Plc., First bank of Nigeria Plc., Guaranty Trust Bank Plc., United Bank for Africa Plc., and Zenith Bank Plc. The five (5) sampled microfinance banks are; AB microfinance bank, LAPO microfinance bank, Accion Microfinance bank, Mainstreet microfinance bank, Mutual Trust microfinance bank.

This study is mirrored after the model of Dao et al. (2016) and the capital adequacy equation of Dao et al., (2020), which established the relationship between capital adequacy ratio and return on asset, market value divided by asset replacement cost; credit growth; GDP growth; Equity to Deposit ratio; loan to deposit ratio; cost to income ratio; inflation rate and total asset. The model is of the form:

$$CAR_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 TOBINQ_{it} + \beta_3 LCREDITG_{it} + \beta_4 GDPGR_{it} + \beta_5 ETD_{it} + \beta_6 LTD_{it} + \beta_7 CTI_{it} + \beta_8 INF_{it} + \beta_9 TA_{it} + \mu_{it} \quad (1)$$

Where: CAR is capital adequacy rate; TOBINQ is market value divided by asset replacement cost; CREDITG is credit growth; GDPGR is GDP growth; ETD is Equity to Deposit ratio; LTD is loan to deposit ratio; CTI is cost to income ratio; INF is inflation rate; TA is total asset.

The model above was modified and then transformed by dropping and including some variables to become the form below; bearing in mind that the variable credit risk management

CRM is decomposed and measured by liquidity rate, non-performing loan rate and loan to deposit rate, while return on asset ROA is used as a control variable in the model.

$CAR_{it} = \beta 1 CMR_{it} + \beta 2 ROA_{it} + \mu_{it}$ (2)

$CRM_{it} = \beta 1 NPL\_LA_{it} + \beta 2 LQD_{it} + \beta 3 LA\_TD_{it} + \mu_{it}$ (3)

The modified model to be used in this study is specified below in equation 4.

$CAR_{it} = \beta_0 + \beta_1 NPL\_LA_{it} + \beta_2 LQD_{it} + \beta_3 LA\_TD_{it} + \beta_4 ROA_{it} + \mu_{it}$ (4)

Where; CAR is Capital Adequacy Ratio; NPL_LA is Ratio of Non-Performing Loan on Loan Advance; LQD is Liquidity ratio; LA_TD is Ratio of Loan and Advances on Total Deposit; ROA is Return on Assets; μ = Stochastic variable; i = cross sectional indicator; t = time series indicator; β1, β2, β3, β4: Parameters

The apriori expectations of the parameter are as thus; $\beta 1 < 0$; $\beta 2 > 0$; $\beta 3 < 0$ or $\beta 3 > 0$; $\beta 4 > 0$.

The estimation technique used was panel data regression analysis. It was estimated with the aid of STATA statistical package. The panel data estimation technique combines both the time series and cross sectional data to give more reliable and valid conclusion. This is because it gives adequate informative data, more variability, less co-linearity among the variables, more degree of freedom and more efficiency (Gujarati, 2004:637). Further econometric diagnostic tests such as Husman test, Breusch and Pagan Lagrangian multiplier test and random effect test were also carried out to examine the validity of the result.

FINDINGS

We start with descriptive analysis in this section, which involves the examination of the mean value of the data, standard deviation, minimum, maximum, skewness and kurtosis. From table 1 below, which showed the summary results of the descriptive statistics of the study, it revealed that for all the sampled banks in Nigeria, the overall average value for return on asset was 3.91, the standard deviation was 4.19, the minimum value was -6.1 and maximum value was 20.2, while skewness was 1.50 and kurtosis was 6.32. Also, the overall average value for non-performing loan was 4.53, the standard deviation was 4.33, skewness and kurtosis were 2.29 and 9.23 respectively, while the maximum value was 24.4. Similarly, the overall average value for liquidity rate was 43.81, the standard deviation was 19.47, skewness was -1.134, kurtosis was 3.48 and the maximum value was 69.7. The overall average value for loan-deposit rate was 67.99, the standard deviation was 37.83, skewness and kurtosis were 0.08 and 2.82 respectively, while the maximum value was 146. Lastly, the overall average value for capital adequacy rate was 25.16, the standard deviation was 13.22, skewness was -0.15, kurtosis was 2.79 and the maximum value was 55.6.

Table 1 Summary Results of Descriptive Statistics for all Sampled Banks

Variables		Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Return on Asset	overall	3.9064	4.194453	-6.1	20.2	1.503027	6.319062
	between		2.72676	.802	8.98		
	within		3.291527	-5.0736	17.6864		
Non-performing Loans	overall	4.5258	4.332424	0	24.4	2.2852	9.2286
	between		2.029726	2.3	9.62		
	within		3.876162	-3.6942	19.3058		
Liquidity Rate	overall	43.8106	19.47166	0	69.7	-1.13396	3.47916
	between		13.51316	21.3	62.22		
	within		14.59933	-6.0894	84.5106		
Loan-Deposit Ratio	overall	67.9845	37.83255	0	146	0.079914	2.81938
	between		31.04699	15.38	125.08		
	within		23.55876	-35.4855	110.5145		
Capital Adequacy Ratio	overall	25.1577	13.22103	0	55.6	-0.1457	2.79298
	between		7.019395	19.93	41.55		
	within		11.40189	-8.1323	60.3767		

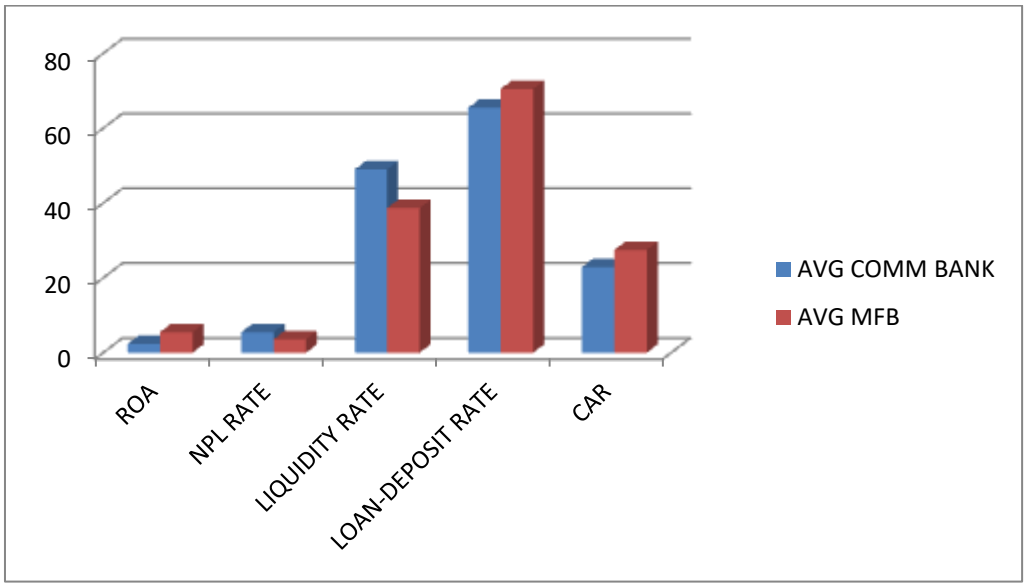
There was need to examine the average value of all the variables for the various banks classification sampled in the study. Table 2 showed clearly the mean value of all categories of banks for the variables.

Table 2 Summary Results of Average Value for Various Banks Classification

Variables	Commercial Banks	Microfinance Banks
Return on Asset Rate	2.33	5.49
Non-Performing Loan Rate	5.47	3.59
Liquidity Ratio	48.97	38.65
Loan-Deposit Ratio	65.47	70.5
Capital Adequacy Ratio	22.85	27.46

The above table 2 was further presented in bar chat in figure 1 to succinctly show the relationship as well as interactions between the mean values at a glance.

Figure 1 Average Value for Various Banks Classification



The above figure 1 reiterated the fact that loan-deposit ratio has the highest mean value followed by liquidity ratio, capital adequacy ratio, non-performing loan rate and return on asset rate for both bank classification. It revealed that microfinance banks had the highest mean value for loan-deposit rate, capital adequacy ratio and return on asset, while commercial banks had the highest mean value for non-performing loan and liquidity ratio.

Regression Analysis

In quantitative analysis, prior to any estimation techniques, there is the need for verification of the characteristics of the variables in the model by conducting the stationarity or unit root tests. This study therefore employed the Levin-Lin-Chu unit-root test, in order to determine if the variables have trend or not, as well as knowing the order of integration of the variables. Thus, the summaries of results of the Levin-Lin-Chu unit-root test for all the variables are presented in Table 3 below.

Table 3 Levin-Lin-Chu Unit-Root Test Results

Variables	P-value	Order of Integration	Remark
Return on Asset (ROA)	0.000	I(0) @ 1%	Stationary at Level
Non-Performing Loan (NPL_LA)	0.000	I(0) @1%	Stationary at Level
Liquidity Rate (LQD)	0.000	I(0) @ 1%	Stationary at Level
Loan-Deposit Rate	0.000	I(0) @1%	Stationary at Level
Capital Adequacy Ratio (CAR)	0.000	I(0) @1%	Stationary at Level

The Levin-Lin-Chu unit-root test in table 3 revealed that all the variables were at level, that is, order of degree zero I(0) at 1% significant levels. Thus, Levin-Lin-Chu unit-root test affirmed that all the series were integrated order of zero.

Hausman Test

The Hausman test is a model selection estimation technique which helps in selecting which model is suitable to accept between the Random effect model and Fixed effect model. Fixed effect model allows for heterogeneity or individuality among sampled banks by allowing having its own intercept value. The term fixed effect is due to the fact that the intercept may differ across sampled banks classification, but intercept does not vary overtime, that is, it is time invariant. Random effect model on the other hand is when all the sampled banks have a common mean value for the intercept. The null hypothesis (H_0) of Hausman test is; fixed effect is not appropriate or random effect is appropriate, while the alternative hypothesis (H_1) is; fixed effect is appropriate. The decision rule is that if the chi-square probability value of Hausman test is significant at 1%, 5% and 10%, the null hypothesis (H_0) should be rejected, otherwise it should be accepted.

Table 4 Hausman Model Selection Estimation Test Result

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Non-performing Loan	0.1577134	.1157625	.0419509	.0498132
Liquidity Rate	0.3043498	.3192169	-.0148671	.0338472
Loan-Deposit Rate	0.1062534	.0945488	.0117046	.018119
Return on Asset	1.345863	1.345707	.0001553	.1270189

chi2(4) = 2.62 Prob>chi2 = 0.6240

The Hausman model selection estimation test result above in table 4 revealed that the Chi-square probability value of 0.62 was insignificant at 10% significant level, suggesting the acceptance of null hypothesis (H_0) that, fixed effect model is not appropriate but random effect model is appropriate. Hence this study adopted the random effect model as suggested by the Hausman model selection estimation test.

Random Effect Model

As earlier mentioned, random effect assumed common mean value for the intercepts of all group of observations. It assumed that since the intercept may vary across group, in this case banks classification, it will be better if a common average value of such variance in intercept be obtained. The result in table 5 below is the random effect model which revealed that the Overall R-square value of the model was 0.81, the Within R-square was 0.82 and the Between R-square was 0.80 indicating that the explanatory variables; non-performing loan rate, liquidity rate, loan-deposit rate, return on asset jointly explained 82 percent variations within, 80 percent variation between and 81 percent variation overall in capital adequacy ratio in Nigeria banking system, which are very good fit, while other factors not captured in this model explained 8 percent variation within, 10 percent variation between and 9 percent variation overall in the model. The model possesses overall statistically significance at 1 and 5 percent significant levels since the probability value of chi-square of 0.000 is less than 0.05. Similarly, the value of the Wald test of 413.15 is an indication that there exists a long run equilibrium relationship between dependent variable; capital adequacy ratio and the independent variables; non-performing loan rate, liquidity rate, loan-deposit rate, return on asset in Nigeria banking system for this study.

Table 5 Random Effect Estimation Result

R-sq: within = 0.8151			Obs per group: min = 10			
between = 0.7973			avg = 10.0			
overall = 0.8086			max = 10			
Random effects u_i ~ Gaussian			Wald chi2(4) = 413.15			
corr(u_i, X) = 0 (assumed)			Prob > chi2 = 0.0000			
Capital Adequacy Rate	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Non-Performing Loan	.1157625	.1424016	0.81	0.416	-.1633396	.3948646
Liquidity Rate	.3192169	.0483283	6.61	0.000	.2244952	.4139386
Loan-Deposit Rate	.0945488	.0268857	3.52	0.000	.0418538	.1472439
Return on Asset	1.345707	.1803906	7.46	0.000	.9921482	1.699267
Constant	-1.036028	1.878083	-0.55	0.581	-4.717003	2.644948

Post Estimation Diagnostic Test

Despite the existence of long-run equilibrium relationship in the model as revealed by the Random effect estimation model, there is need to subject the model to diagnostic test to avoid either type one or type two error, so as not to lead to invalid conclusion. Such post estimation diagnostic tests include Breusch and Pagan Lagrangian multiplier test and serial correlation test.

Breusch and Pagan Lagrangian Multiplier Test

This test is retesting estimation technique that validates if the random effect model is an appropriate model for this study. From the result in table 6 below, that showed the Breusch and Pagan Lagrangian multiplier test result for random effects. The probability value of chi-square of 0.0002 suggested that random effect model was the appropriate model for this study.

Table 6 Breusch and Pagan Lagrangian multiplier test for random effects

Var	sd = sqrt(Var)	
Capital Adequacy Rate	174.7957	13.22103
e	27.5985	5.253427
u	8.869891	2.978236
chi2(1) = 14.13	Prob > chi2 =	0.0002

Serial Correlation Test

The serial correlation test was also estimated to establish if there was serial dependence in the model. The result showed that the P-value of F-statistic was not significant at 1% and 5% significance level, thus we do not reject the null hypothesis of no serial correlation and concluding that there was no serial correlation in the model.

DISCUSSION OF RESULTS

From the results in the descriptive analysis, the average value of return on asset indicated a significant improvement in performance of the banking system in Nigeria during the period understudy, thus, suggesting relatively high profitability margin for the banks. The mean value of the non-performing loan rate of 4.53 percent for the ten years period reported in this

study is lesser than the maximum benchmark of 10% set by CBN. This suggests that the Nigeria banks are still within the safety margin of non-performing loan and might not witness any threat or risk to credit so quickly, however the rate is still high and effort should be channeled towards reducing it.

Similarly, the mean value for liquidity rate of 43.8 percent is higher than the minimum benchmark of 30% set by the CBN for the period understudy. This is an indication that the Nigeria banks have low liquidity problems of converting short term assets into cash. Although, this rate is somewhat low compare to other developed economies, it suggests that the Nigeria banking sector is still developing. The mean value of 68 percent for loan-deposit rate for the ten years understudy is lesser than the maximum benchmark of 80% loan-deposit ratio set by the CBN, although seems close. This means that the banks in Nigeria still fall within acceptable margin, however, it suggests that the customers deposit to banks is still very low, thereby reflecting the low financial literacy level, as well as low financial inclusion in the country. The mean value of capital adequacy rate of 22.96 percent during the ten years period understudy exceeded the 10% minimum benchmark set by CBN. This means that the banks in Nigeria are adequately capitalized, although, the rate is not that high.

In an effort, to examine the average value of all variables for various banks' classification that was sampled in this study. Table 2 and figure 1 showed clearly the interaction and relation of mean values for both categories of banks for the variables in the study. Figure 1 revealed that microfinance banks have the highest mean value for loan-deposit rate, capital adequacy ratio and return on asset. The reasons for this are not farfetched since they specialise in short term loan which are relatively easily accessible to micro and small business owners, although, with double digit interest rate. Microfinance banks often times use third party collaterals in form of association or group to ameliorate non-performing loans, which could be a pointer to why they have the least mean value for non-performing loan rate. However, commercial banks have the highest mean value for non-performing loan and liquidity ratio, suggesting a fairly regulated credit risk by the deposit money banks (DMB). Although, deposit by customers to DMB seemed low from the loan-deposit ratio reported and the need for concern with respect to non-performing loan rate, however, the liquidity rate is still somewhat not too low, allaying the fear of liquidity shortage of deposit money banks.

For the regression analysis, the pre-estimating test of Levin-Lin-Chu unit-root test in table 3 revealed that all the variables were at level, that is, order of degree zero I(0). The results obtained from Hausman model selection estimation technique in table 4 revealed that the null hypothesis that random effect was appropriate was not rejected. Similarly, the Breusch and Pagan Lagrangian multiplier test result for random effects in table 6 confirmed that the random

effect model was appropriate. Post estimation test of serial correlation so as to know if there was serial dependence in the residual of the model, showed that there was no serial dependence in the model. The random effect model result presented in table 5 further showed that all the variables conformed to apriori expectations, that is, they all have the expected sign, except for the non-performing loan which failed to show up as expected and failed to be significant at 10% significant levels.

The findings revealed that the coefficient of non-performing loan rate of 0.116, suggests that a unit increase in non-performing loan ratio will result into 0.12 unit increase in capital adequacy rate. This suggests that capital adequacy rate increases when the rate of non-performing loan is high. Of course, this is contrary to apriori expectation and findings from Gatuhu (2013); Ogbulu et al. (2016); Kargi (2011); Kayode et al. (2015); Ogunlade et al. (2018) that the levels of non-performing loans inversely affect banks' profitability and financial soundness.

The coefficient of return on asset of 1.35 which also came up as expected and is statistically significant, thereby showing that a unit increase in return on asset will cause capital adequacy ratio to increase by 1.35 unit. This means that higher adequacy ratio (that is, performance) of banks, is as a result of higher return on asset rate of the banks. This finding is in line with the submission of Al-Tanimi et al. (2013); Dao et al., (2016); Kolapo et al. (2012); Okere et al. (2018); Iwedi and Onuegbu (2014); Ogunlade et al., (2018); Kargi (2011) that positive relationship exists between capital adequacy ratio and return on asset.

The coefficient of liquidity rate of 0.319, conformed to apriori expectation and significant at 1 percent significant level, shows that a unit increase in liquidity rate will cause capital adequacy ratio (proxy of bank's performance) to increase by 0.32 units. This suggests that higher liquidity ratio improves banks' financial soundness and shows higher safety margin a bank possesses to cover it debts, thereby increasing its profitability and performance. This finding corroborates the findings of Ogunlade et al. (2018), Dao et al. (2020) and Okere et al. (2018), that liquidity rate positively determines the performance of banks. However, some studies reported slightly different findings, Mwangi (2014), reported negative relationship between liquidity and banks' performance.

The coefficient of loan to deposit ratio of 0.095, is significant at 1 percent significant level, and conformed to apriori expectation. This shows that a unit increase in loan to deposit ratio will cause capital adequacy ratio to increase by 0.10 units. That is, higher loan to deposit ratio would increase banks profitability, although a very high loan to deposit ratio could expose bank to high credit risk, as established by Dao et al. (2020) when loan-deposit rate inversely affected capital adequacy ratio in Vietnam' banks. However, the result of loan to deposit ratio

reported in this study is reinforced by the findings of Kargi (2011) that the levels of loans and advances affected banks' profitability significantly. Other studies with similar findings include; Taiwo et al. (2017); Onaolapo (2012) in which they all also reported that loan to deposit ratio have significant impact on financial soundness and profitability of banks in Nigeria.

CONCLUSION

The survival of any bank is hinged on how effective such bank manages its credit risk. This study has examined the relationship between credit risk management and banks' performance in Nigeria. The study employed the use of longitudinal data. The variables used for the empirical analysis in this study include; capital adequacy ratio (a proxy of banks' performance or financial soundness) and non-performing loan rate, liquidity rate, loan-deposit ratio (as proxies of credit risk management), return on asset as control variable. Both the descriptive analysis and econometric techniques were employed.

The findings from this study revealed that liquidity rate, loan-deposit rate, non-performing loan rate (credit risk management) and return on asset all have positive relationship with capital adequacy ratio (banks' performance). It also established that all the proxies of credit risk management; non performing loan, loan-deposit ratio and liquidity ratio have values that fell within the stipulated benchmark set by CBN, thus, concluding that credit risk management does not only have significant impact on banks' performance in Nigeria, banks in Nigeria are still within the safety margin set by CBN for credit risk, and that microfinance and commercial banks understudy were fairly managing their credit risks and are relatively performing better. From all indications, sound and effective credit risk management strategies will translate into reduction in rate of non performance loan as well as increase liquidity and capital adequacy which eventually engender sustainable and development of the banking system and thus should be given paramount attention by both bank managements and financial institutions regulator.

All banks must continuously comply with relevant provisions of the banks and other Financial Institutions Acts, both within and outside the country. The banks should also continuously maintain strict adherence to CBN benchmark and guidelines on CRM as well as improve their respective credit risk strategies, appraisals and analysis. Financial literacy awareness and financial inclusiveness among the populace should be intensified, especially in the rural areas to increase demand and savings deposits of banks. Banks should always ensure proper credit evaluation of potential borrowers before funds is allocated to prime borrowers. This should be done by collaborating with top quality credit rating firms. Lastly, debt regulatory and procurement agencies like AMCOM should be proactive in its intervention.

There is need for further expansion of the scope of this discourse; hence, future research should endeavour to increase the scope of this discourse beyond what was done by this study in terms of the number of years understudied, inclusion of other variables that were not taken into consideration in this study, employ other sampling and estimation techniques other than those employed in this study and finally give consideration to other banks classifications such as mortgage and merchant that were not captured in this study.

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APPENDICES

i. Random Effect Regression Estimate

```
Random-effects GLS regression                   Number of obs      =       100
Group variable: idcode                          Number of groups   =        10

R-sq:  within  = 0.8151                         Obs per group: min =        10
       between = 0.7973                                        avg =      10.0
       overall = 0.8086                                        max =        10

Random effects u_i ~ Gaussian                   Wald chi2(4)       =    413.15
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000
```

carrate	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
nplrate	.1157625	.1424016	0.81	0.416	-.1633396	.3948646
liquidityr~e	.3192169	.0483283	6.61	0.000	.2244952	.4139386
loandeposi~e	.0945488	.0268857	3.52	0.000	.0418538	.1472439
roa	1.345707	.1803906	7.46	0.000	.9921482	1.699267
_cons	-1.036028	1.878083	-0.55	0.581	-4.717003	2.644948
sigma_u	2.9782362					
sigma_e	5.2534271					
rho	.24322136	(fraction of variance due to u_i)				

ii. Hausman Estimation Test

```
. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
nplrate	.1577134	.1157625	.0419509	.0498132
liquidityr~e	.3043498	.3192169	-.0148671	.0338472
loandeposi~e	.1062534	.0945488	.0117046	.018119
roa	1.345863	1.345707	.0001553	.1270189

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 2.62
Prob>chi2 = 0.6240

iii. Post Estimation Test

Breusch and Pagan Lagrangian multiplier test for random effects

carrate[idcode,t] = Xb + u[idcode] + e[idcode,t]

Estimated results:

	Var	sd = sqrt(Var)
carrate	174.7957	13.22103
e	27.5985	5.253427
u	8.869891	2.978236

Test: Var(u) = 0
chi2(1) = 14.13
Prob > chi2 = 0.0002

iv. Descriptive Statistics Results

```
. xtsum
```

Variable		Mean	Std. Dev.	Min	Max	Observations
idcode	overall	5.5	2.886751	1	10	N = 100
	between		3.02765	1	10	n = 10
	within		0	5.5	5.5	T = 10
year	overall	2012.5	2.886751	2008	2017	N = 100
	between		0	2012.5	2012.5	n = 10
	within		2.886751	2008	2017	T = 10
roa	overall	3.9064	4.194453	-6.1	20.2	N = 100
	between		2.72676	.802	8.98	n = 10
	within		3.291527	-5.0736	17.6864	T = 10
nplrate	overall	4.5258	4.332424	0	24.4	N = 100
	between		2.029726	2.3	9.62	n = 10
	within		3.876162	-3.6942	19.3058	T = 10
liquid~e	overall	43.8106	19.47166	0	69.7	N = 100
	between		13.51316	21.3	62.22	n = 10
	within		14.59933	-6.0894	84.5106	T = 10
loande~e	overall	67.9845	37.83255	0	146	N = 100
	between		31.04699	15.38	125.08	n = 10
	within		23.55876	-35.4855	110.5145	T = 10
carrate	overall	25.1577	13.22103	0	55.6	N = 100
	between		7.019395	19.93	41.55	n = 10
	within		11.40189	-8.1323	60.3767	T = 10
roas	overall	390.64	419.4453	-610	2020	N = 100
	between		272.676	80.2	898	n = 10
	within		329.1527	-507.36	1768.64	T = 10

v. Unit Root or Stationarity Test

```
Levin-Lin-Chu unit-root test for roa
-------------------------------------

Ho: Panels contain unit roots               Number of panels  =     10
Ha: Panels are stationary                   Number of periods =     10

AR parameter: Common                        Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t       -26.1462
 Adjusted t*        -26.3236        0.0000
------------------------------------------------------------------------------

. xtunitroot llc nplrate

Levin-Lin-Chu unit-root test for nplrate
-----------------------------------------

Ho: Panels contain unit roots               Number of panels  =     10
Ha: Panels are stationary                   Number of periods =     10

AR parameter: Common                        Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t       -15.7009
 Adjusted t*        -14.2877        0.0000
------------------------------------------------------------------------------

. xtunitroot llc liquidityrate

Levin-Lin-Chu unit-root test for liquidityrate
-----------------------------------------------

Ho: Panels contain unit roots               Number of panels  =     10
Ha: Panels are stationary                   Number of periods =     10

AR parameter: Common                        Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t       -35.8471
 Adjusted t*        -37.0193        0.0000
------------------------------------------------------------------------------

. xtunitroot llc loandepositrate

Levin-Lin-Chu unit-root test for loandepositrate
-------------------------------------------------

Ho: Panels contain unit roots               Number of panels  =     10
Ha: Panels are stationary                   Number of periods =     10

AR parameter: Common                        Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t       -18.2650
 Adjusted t*        -17.1529        0.0000
------------------------------------------------------------------------------

. xtunitroot llc carrate

Levin-Lin-Chu unit-root test for carrate
-----------------------------------------

Ho: Panels contain unit roots               Number of panels  =     10
Ha: Panels are stationary                   Number of periods =     10

AR parameter: Common                        Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t       -26.1259
 Adjusted t*        -26.2215        0.0000
------------------------------------------------------------------------------
```