



## Credit Risk Management and Efficiency in the Banking Industry of an Emerging Economy in Africa: Evidence from Nigerian

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Received date: November 18, 2019; Accepted date: November 29, 2019; Published date: December 31, 2019

### Abstract

Credit risk management and efficiency of the banking industry remains a debated issue in literature. Our position on this subject matter is that credit risk affects banks' efficiency and distorts profitability with a resultant loss in banks' earnings. Momentous depreciation in banks' earnings would make shareholders not to have confidence in banking operations. This would affect banks' capacity to mobilize idle funds from the public which influences effective financial intermediation. A bank may go bankrupt and possibly into merger with another bank or have its licence revoke by regulatory authority (ies) owing to ineffective credit risk management practice. The finding from this study using data from 1999 to 2018 sourced from the Central Bank of Nigeria (CBN) and Nigeria Deposit Insurance Corporation (NDIC) revealed that credit risk management has significant effect on efficiency of the Nigeria banking industry. We suggest that banks should adhere strictly to the rules that guide given of loans and advances to customers. In addition, banks should abide by the credit risk management guidelines as spelt out in the prudential guideline of the Central Bank of Nigeria.

**Keywords:** Credit Risk Management; Banks' Efficiency

### 1. INTRODUCTION

The place of banks in the national economy is very significant. This is because banks act as prime movers of economic life of any nation. The stability of the banking industry enhances the stability of the economy. The stability of Nigerian banks would be under threat due to poor credit management. Credit mismanagement could be traced to a number of factors including high corporate profit appetite, extreme culture of disregard to or absence of professionalism and best banking practices as well as the corrupt attitude of Nigerians. The resultant effect of credit mismanagement is a huge pile-up of non-performing loans which led to high incidence of bad debts and increase in loan loss provisions. The high incidence of bad debts in banks has led to the withdrawal of some banks' license by the Central of Bank Nigeria (CBN): the apex regulator of the Nigerian financial system. Some of the toxic assets of banks were handed over to the Asset Management

Corporation of Nigerian (AMCON). Some banks were liquidated and others classified as distressed. These liquidated banks was afflicted by the problem of poor quality loans and advances and huge losses accumulated as a result of poor earnings on assets. Bad debts increases as a result of poor evaluation of credit due to corrupt tendencies of bank officials which often led them to accept unrealizable security as collaterals which in turn increases the volume of non-performing loans which deplete banks profit and erode bank capital.

Non-adherence to and poor implementation of CBN code of corporate governance due to high level of corruption in the country and huge corporate profit appetite give rise to reckless lending, most of which end up as bad and irrecoverable debts. Inability to implement banking rules also led to the problem of poor supervision by the supervisory authorities. The inability of CBN to prosecute and imprison loan defaulters and their accomplice in banks has also led to poor loan management which increases the incidence of nonperforming loans of banks. In a bid to avoid giving loans that will put them into trouble, many bank managers have become very risk averse. This attitude has created credit crunch in the mist of excess liquidity which affects development of the economy and impact negatively on bank profits as excess liquidity does not create profit. Credit mismanagement in bank could lead to erosion of public confidence in bank. Banks are businesses that thrive on public confidence and once such confidence is tampered with, depositors will begin to look for alternative ways of safeguarding their money and this leads to drop in total deposit liability which in turn reduces the loans and advances given out and inability to pay maturing obligations and the failure of banks. Hence, a study of the effects of credit management on the efficiency of commercial banks is therefore, necessary to evaluate aspects of credit management operations of bank that could promote or hinder the overall efficiency of banks in Nigeria.

Our study differs from most of the prior studies in emerging economies in two dimensions. First, we focused on efficiency of the banking industry which we consider unconventional rather than the orthodox financial performance/profitability measurements (return on assets, return on equity, net profit margin, gross revenue, etc.). To the best of our knowledge regarding empirical studies in this subject area, for instance, in the Nigeria economy, there is no study on credit risk management and efficiency of the banking system based on internet searches. The studies of [1-8] were on financial performance/profitability. This applies to some other emerging economies of the world such as Asllanaji [9] for Kosovo, Bhattari [10] for Nepal, Paulino, et al. [11] for Kenya, Noor [12] for Senegal, Ranasinghe, et al. [13] for Sri-Lanka [14] for Uganda [15], for Morrocco [16] for Iran [17] for Eritrea and [18] for Ethiopia. Secondly, our analysis build on the nation's banking industry as against sampled banks as in the case of the above enumerated empirical researches. This will allow us explore whether the efficiency of the banking industry depends on credit risk management or not.

With the concise introduction of the topic in section one, the rest of this paper is structured as follows: section two dwelt on review of relevant literatures; section three details the methodological approach; section four discussed the result of the analysis, while section five summarized and concluded the study.

## 2. REVIEW OF LITERATURE

Credit management according to Aremu, et al. [19] is a process of ensuring that individuals and companies, who borrow from the bank, can afford to do so and pay their debts on time. Usually banks lend to various borrowers since lending is the greatest source of their income. As a result of numerous loans and advances given out by bank to generate income, banks are deeply involved in credit portfolio management. Credit portfolio management is a necessary component of any business that deals with loans on a regular basis. Banks and other lenders often have a credit portfolio management. This is made up of team who oversees the entire loans issued out by the bank. Loan default poses serious problems to banks because they stand the chance of losing both the money lent and the interest accruing to such lending. Credit portfolio includes assessing the risk involved with each potential loan and analyzing the total amount of risk the portfolio incurs as a whole. Credit management therefore is of paramount importance not only because of the financial crisis that the world is experiencing nowadays but also in compliance to dictates of Basel II which according to Onalo [20] aims at ensuring that capital allocation is more risk sensitive, enhance disclosure requirements which allow market participants to assess the capital adequacy of an institution, and ensuring that credit risk, operational risk and market risk are qualified based on data and format techniques.

The devastating effect of non-performing loans and advances makes sound evaluation of credit request paramount in all our banks. The credit officers of bank need to properly evaluate and articulate the projects, the costumers and the prevailing economic situations. Central Bank of Nigeria (CBN) maintains that the credit frame work of loans should be designed to serve as a tool for monitoring and controlling risk inherent in individual credits. The apex emphasizes that risk ratings should be assigned at the inception of lending and retrieved at least half-yearly and when adverse events occur. However, whenever deterioration on risk is noted, score assigned to borrower facility should be immediately changed. Credit scoring helps to take a close look at risks. This concept is referred to as credit scoring. Credit scoring is a statistical method used to predicate the probability that a loan or an existing borrower will default or become delinquent [21]. Credit scoring assigns scores for potential borrower by estimating the probability of default of the loans borrowed and loan characteristic idea. Myra [22] reveals that information on the borrowers to be used are applicants monthly income, outstanding debt, financial assets, duration on the job, lending history of the customer, collateral owned, types of bank accounts among others. The above stated are potential factors that may relate to loan performance and they are to be used in the score card for credit scoring. Though credit scoring has been experiencing draw back in Nigeria due to non-establishment of a credit bureau. The account management structure and pricing of the advance must commensurate with the risk involved. There is going to be cut-off score or grade above which a loan request will be approved.

Theories such as commercial loan theory or real bills doctrine in accordance to [23], shift-ability theory, anticipated income theory, credit risk theory and liability management theory have been documented in literature to support the asserted interconnection between credit risk management and performance/efficiency in banks.

However, in this study, we limited our discussion to commercial loan theory and shift-ability theory. The commercial loan theory is of the standpoint that banks should extend credit to their clients/customers only on short term basis hence, discouraging medium and long term lending by banks. In this theory outlook, it is presumed that when clients/customers default on short term facility, banks would cushion the risk associated with non-payment/customers' cessation in contract obligation by borrowing from the Central Bank. This principle makes for appropriate degree of liquidity for each bank and appropriate money supply for the whole economy [1]. The shift-ability theory is assiduously on the instinct that loans should not be said to be the only appropriate asset of banks. This calls for shift in banks assets from loans to financial market instruments: government securities (treasury bills, bonds, etc.). The tenet of the shift-ability theory did not in any way contradict the hypothesis of the commercial loan theory rather, according to Taiwo et al. [23], it took a more general view of the banking business by broadening the list of assets deemed legitimate for bank ownership.

Empirical studies on the interconnection between credit risk management and banking system efficiency have mixed results [20], [25], [10], [26], [42], [28], [29], [17], [6], [8] and [30] have established the presence of a significant relationship between credit risk management and banks' performance. On the contrary, [1] refuted their claims by empirically showing that there is no significant relationship between credit risk management and banks' performance. With regard to effect of credit risk on performance of the banks, the research outputs of [31], [7], [2], [3], [9], [27], [4], [12], [5], [14] [32], [15], [33-37], Tassew [18] and Njoku et al.[38] support the significant effect of credit risk management on performance of banks. Conversely, [39], [40] and [23] have found no significant effect of credit risk management of performance of banks. The divergent findings perhaps depend on the methodological approach followed or measurement constructs.

## 3. MATHEMATICAL MODELLING

### Data Source and Description

In this study, we utilized annual time series data for the Nigerian banking industry as contained in the Central Bank of Nigeria (CBN) supervision reports and Nigeria Deposit Insurance Corporation (NDIC) annual reports from 1999 to 2018 for the variables which include non-performing loans to total assets ratio [1] [2] [3], total loans to total deposits ratio [9]; [27]; [31], capital adequacy ratio [14]; [32]; [15], banks size represented by natural log of total assets (as a control variable; see Oke and Wale-Awe[7] and efficiency ratio. This is against the orthodox practice of sampling some banks as in the works of Ndubuisi and Amedu [1-4], [23], [6], [8], Nwude and Okeke [5] and Njoku, et al. [38] among others works conducted in the Nigeria economy. The dependent variable is Bank Efficiency (BE), whereas Non-Performing Loans to Total Assets Ratio (NPLTAR), Total Loans to Total Deposits Ratio (TLTDR) and Capital Adequacy Ratio (CAR) and Natural Log of Total Assets (NLTA) are the independent variables. Table 1 summarizes how the variables were constructed/ measured.

Variables	Symbol	Description
Bank Efficiency Ratio	BER	Bank Efficiency ratio is the measure of total overhead expenses against operating income.

Non-Performing Loans to Total Assets Ratio	NPLTAR	Total non-performing loans of the banking industry divided by total assets
Total Loans to Total Deposits Ratio	TLTDR	Total loans of the banking industry divided by total deposits
Capital Adequacy Ratio	CAR	Shareholders fund of the banking industry divided by total assets
Natural Log of Total Assets	NLTA	Natural Log of total assets of the banking industry

Table 1: Data Measurement/Construct

### Model Specification

This present study is undertaken to estimate the effect of credit risk management on efficiency of the Nigeria banking industry with reliance on the Granger Causality approach. However, the relationship between the dependent and explanatory variable was analysed by means of the Autoregressive Distribute Lag (ARDL) model. Our model is a reminiscent of [1] who express bank performance (return on assets and return on equity) as a function of credit risk management (non-performing loans to total assets ratio, total loans to total deposits ratio and capital adequacy ratio). This current study removed return on assets and return on equity and introduced efficiency ratio. Furthermore, we included a control variable (bank size): natural log of total assets of the banking industry. We are of the opinion that size of banks can influence their efficiency. Our functional model with regard to the effect of credit risk management on efficiency of the banking industry is modelled in Equ. 1, where as the econometric transformation is inbuilt in Equ. 2.

$$BER = f(NPLTAR, TLTDR, CAR, NLTA) \quad \text{Equ.1}$$

$$BER_t = \beta_0 + \beta_1 NPLTAR_t + \beta_2 TLTDR_t + \beta_3 CAR_t + \beta_4 NLTA_t + \varepsilon_t$$

Equ.2

Where:

BER = Banking Industry Efficiency Ratio

NPLTAR = Non-Performing Loans to Total Assets Ratio

TLTDR = Total Loans to Total Deposits Ratio

CAR = Capital Adequacy Ratio

NLTA = Natural Log of Total Assets

$\beta_1$  and  $\beta_2$  are the coefficients of the regression equation  $\varepsilon$  = the error term  $t$  = the time trend

### Empirical Procedure

At first instance, we determined the descriptive statistics of the data as well as the correlation matrix to avoid the issue of multi-collinearity among the variables in the model. Second, we ascertained the stationarity properties of the data using the Augmented Dickey-Fuller (ADF) and Philip Peron (PP) tests. This is to ensure that the variables are free from stationarity defect that may likely lead to spurious regression result and justify our specified model. The unit root tests were performed at level and first difference in three sets: intercept; intercept & trend and none. Third, we estimated Equ. 1 using econometric techniques of Autoregressive Distribute Lag (ARDL) and Granger Causality test. Finally, we evaluated the robustness of our model by conducting diagnostic test of serial correlation LM test,

heteroscedasticity and Ramsey Reset Specification test to assess the residual and stability of the model.

## 4. RESULTS AND DISCUSSION

### Descriptive Properties

The descriptive statistics of the data from 2001 to 2018 are presented in Table 2. Panel A unveils the mean of efficiency ratio of the banking industry to be 85.77 with a dispersion of 57.77 from one year to another. This is an evidence that the average efficiency ratio of the banking system appreciated by 85.77%. The minimum and maximum values are 31.77 and 293.33 accordingly. Panel B reveals that the mean of the credit risk management variables: NPLTAR, TLTDR and CAR are 35.63, 62.43 and 14.36 respectively. From the standard deviation, there was a significant variation in TLTDR: 14.62% compared to 8.08% and 5.28% of NPLTAR and CAR respectively. The minimum and maximum values are 8.84 and 46.70 for NPLTAR, 15.58 and 87.63 for TLTDR and 4.32 and 22.60 for CAR. For the control variable in Panel C, the mean of the natural log of total assets of the banking industry is valued at 15.58 with a standard deviation of the 13.07, whereas the minimum and maximum values are depicted to be 13.98 and 17.56 respectively.

	Mean	Std. Dev.	Min.	Max.	Obs.
<b>Panel A: Bank Efficiency Variable</b>					
BER	85.77 25	57.7747 9	31. 77	293. 33	20
<b>Panel B: Credit Risk Variables</b>					
NPLTAR	35.63 05	8.08058 1	8.8 4	46.7	20
TLTDR	62.43 2	14.6215 8	15. 58	87.6 3	20
CAR	14.36 3	5.27619 2	4.3 2	22.6	20
<b>Panel C: Control Variable</b>					
NLTA	15.58 343	13.0763 7	13. 984 82	17.5 551	20

Table 2: Descriptive Properties of Data

Note: Mean = mean of the variables from 1999 to 2018; Std. Dev. = standard deviations of the variables; Min. & Max. =Minimum and

maximum values of the variable, whereas Obs. = number of observation of the variables

### Multi-collinearity/Correlation Analysis

The correlation level between the variables are detailed in Table 3. There is a significant (at 5% significance level) positive correlation between banking BER and NLTA on one hand, and a positive significant (at 5% significance level) correlation between NPLTAR and NLTA on the other hand. The analysis of the credit risk management variables shows that there is a significant positive correlation (0.7594) between NPLTAR and TLTDR at 1% level of significance. This suggests that NPLTAR can explain 75.94% of TLTDR and TLTDR can equally explain 75.94% of NPLTAR. Put differently, NPLTAR and TLTDR are dependent on each other. With this, we were convinced beyond reasonable doubt that there would be problem of multi-collinearity if NPLTAR and TLTDR are included in the same model. In view of this, we decided to remove TLTDR from the model estimation.

	BER	NPLTAR	TLTDR	CAR	NLTA
BER	1.000000				
NPLTAR	0.285354	1.000000			
TLTDR	0.289553	0.759437*	1.000000		
CAR	-0.060417	-0.227651	-0.338062	1.000000	
NLTA	0.555532**	0.460586**	0.252715	0.166636	1.000000

Table 3: Multi-collinearity Test

Note: \* and \*\* denote significance level at 1% and 5% respectively

### Stationarity Analysis

We carried out unit root test on the variables using the Augmented Dickey-Fuller (ADF) and Philip Peron (PP) tests and this was done in three sets: intercept, intercept & trend and none. From the unit root output in Tables 4 – 5, the variables were found to be stationarity thus devoid of stationarity defect that are typical of most time series data.

Variables	Intercept	Intercept & Trend	None	Remark
<b>Bank Efficiency</b>				
BER	-5.639497*	-5.973994*	-5.630365*	Stationary/1(1)
<b>Credit Risk</b>				
NPLTAR	-5.630365*	-4.525183*	-7.653720*	Stationary/1(0)
TLTDR	-3.508218*	-3.626209*	-7.446594*	Stationary/1(0)
CAR	-3.310229*	-4.361270*	-4.564187*	Stationary/1(1)
<b>Control Variable</b>				

NLTA	-3.445239*	-4.779604*	-1.908739**	Stationary/1(1)
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Table 4: ADF Test Result

Note: \* and \*\* denote significance level at 1% and 5% respectively, whereas 1(0) and 1(1) represent integration order at level and first difference accordingly

Variables	Intercept	Intercept & Trend	None	Remark
<b>Bank Efficiency</b>				
BER	-5.639497*	-5.973994*	-5.630365*	Stationary/1(1)
<b>Credit Risk</b>				
NPLTAR	-3.417767*	-4.525183*	-7.653720*	Stationary/1(0)
TLTDR	-3.508218*	-3.626209*	-7.446594*	Stationary/1(0)
CAR	-4.444330*	-4.361270*	-4.564187*	Stationary/1(1)
<b>Control Variable</b>				
NLTA	-3.445239*	-4.779604*	-1.908739**	Stationary/1(1)

Table 5: PP Test Result

Note: \* and \*\* denote significance level at 1% and 5% respectively, whereas 1(0) and 1(1) represent integration order at level and first difference accordingly

### Long Run Estimate

To confirm that the level of non-performing loans to total assets ratio, capital adequacy ratio controlled by bank size: natural log of total assets have a long run relationship with efficiency ratio of the banking industry, the long run estimate by way of Autoregressive Distribute Lag (ARDL) was performed. The ARDL output in Table 6 provides evidence that non-performing loans to total assets ratio, capital adequacy ratio controlled by bank size are related in the long run with efficiency ratio of the banking industry at 5% level of significance. The f-statistic of 6.49 is greater than the lower and critical values of 2.79 and 3.67 respectively.

T-Test	5% Critical Value Bound		Remark
F-Statistic	Lower Bound	Upper Bound	
6.496678	2.79	3.67	Null Hypothesis Rejected

Table 6: ARDL Long Run Estimate

### Short Run Estimate

In the short run estimate in Table 7, non-performing loans to total assets ratio has insignificant negative relationship with efficiency ratio but at lag one, it has a significant negative relationship with banking efficiency ratio. Similarly, capital adequacy ratio relates positively with efficiency ratio, but at lag one, capital adequacy ratio significantly and negatively relates with efficiency ratio of the banking industry. The size of the banks measured by natural log of total assets has positive but insignificant relationship with banking industry efficiency ratio. When non-performing loans to total assets ratio and capital adequacy ratio controlled by bank size are held constant, efficiency ratio would be valued at 302.28. A percentage increase in non-performing loans to total assets ratio and capital adequacy ratio at lag one significantly reduce efficiency ratio by a factor of 6.75 and 6.19 respectively. A unit increase in bank size would result in a factor of 4.85 appreciation in banking industry efficiency ratio. Adjusted R-square suggested that 99.44% changes in efficiency ratio was attributed to non-performing loans to total assets ratio and capital adequacy ratio controlled by bank size. This is statistically significant based on the f-statistic of 526.37 and p-value of 0.00. The Durbin Watson statistic of 1.66 does not suggest any element of autocorrelation.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BER(-1)	0.260687	0.370183	0.704212	0.4959
NPLTAR	-0.623346	1.294949	-0.481367	0.6397
NPLTAR(-1)	-6.757853	1.843113	-3.666544	0.0037
CAR	1.838216	2.204136	0.833985	0.422
CAR(-1)	-6.191573	2.149652	-2.880268	0.015
NLTA	4.85E-06	6.38E-06	0.7599	0.4633
NLTA(-1)	6.70E-07	6.77E-06	0.099042	0.9229
C	302.2806	78.22236	3.864376	0.0026
Adjusted R-squared	0.634547	Durbin-Watson stat		1.6601
F-statistic	5.464855	Prob (F-statistic)		0.0065

Table 7: Short Run Estimates

### Robustness of the Model

We went further to test the robustness of the estimated model by way of serial correlation LM test, heteroskedasticity Test and Ramsey Reset Specification and the output unveiled in Table 8. The serial correlation LM test shows that the variables in the model are not serially correlated (p-value: 0.3731 > 0.05). Similarly, heteroskedasticity issue was found not to exist in the model ((p-value: 0.3025 > 0.05). However, the Ramsey Reset Specification would not affirm the fitness of the model which is attributable to the exclusion of total loan to total deposit ratio in the model owing to the multi-collinearity issue

observed between non-performing loan to total assets ratio and total loan to total deposit ratio.

	F-statistic	Prob.
Serial Correlation LM Test	1.102109	0.3731
Heteroskedasticity Test	1.38319	0.3025
Ramsey Reset Specification TLTDR – EXC	10.46474	0.0104
Ramsey Reset Specification TLTDR – INC.	5.771446	0.0558

Table 8: Diagnostic Test

Note: TLTDR – EXC expresses the Ramsey Reset Specification result when total loan to total deposit ratio in removed from the model, while TLTDR – EXC discloses the Ramsey Reset Specification output when total loan to total deposit ratio was included in the model.

### Effect of Credit Risk Management on Efficiency of the Nigeria Banking Industry

The output in Table 9 reveals a unidirectional causal relationship between non-performing loans to total assets ratio and efficiency ratio at 5% significance level. Causality flows from non-performing loans to total assets ratio to efficiency ratio. This is an indication that non-performing loans to total assets ratio exerts significant effect on efficiency ratio. Similarly, the size of the banks was found to have significant effect on efficiency of the banking industry. We observe that there a causal relationship between natural log of total assets of banks and efficiency ratio. Here, causality runs from bank size to efficiency ratio at 5% significance level. Capital adequacy ratio was not seen to have significantly influenced efficiency ratio owing to absence of either a unidirectional or bidirectional causal relationship between capital adequacy ratio and efficiency ratio.

Null Hypothesis:	Obs	F-Statistic	Prob.	Remarks
NPLTAR does not Granger Cause BER	18	6.30631	0.0122	Causality
BER does not Granger Cause NPLTAR		0.82154	0.4613	No Causality
CAR does not Granger Cause BER	18	0.14205	0.8689	No Causality
BER does not Granger Cause CAR		1.8055	0.2033	No Causality
NLTA does not Granger Cause BER	18	3.84784	0.0487	Causality
BER does not Granger Cause NLTA		0.34228	0.7164	No Causality

Table 9: Granger Causality Test

### Our Major Finding

We observe with keen interest that this is the first study on the effect of credit risk management on efficiency of the banking industry in Nigeria thus relating our result with previous studies in the Nigeria environment was difficult due to unavailability of empirical literature

on the internet. That notwithstanding, we discovered that non-performing loans to total assets ratio – a major proxy for credit risk management has significant effect on the efficiency of the Nigeria banking industry. This envisages that effective credit risk management is critical to the survival of banks. This is why banks expend funds for effective credit risk management. Banks would be on the verge of financial difficulty consequent to ineffective credit risk management process – meeting the short term obligation of customers becomes arduous. This is in line with Ferhi and Chkoundali [41] that credit risk has a high impact on Islamic and conventional banks exposure to the financial crises. We found also that the size of the banks significantly affect efficiency. Banks with large branches are better off in diversifying risk compared to banks with relatively few branches [42-43].

## 5. Concluding Remark

We carried out a study on the effect of credit risk management on efficiency of the Nigeria banking industry. Our position on this subject matter is that credit risk affects banks' efficiency and distorts profitability with a resultant loss in banks' earnings. Momentous depreciation in banks' earnings would make shareholders not to have confidence in banking operations. This would affect banks' capacity to mobilize idle funds from the public which influences effective financial intermediation. A bank may go bankrupt and possibly into merger with another bank or have its license revoke by regulatory authority (ies) owing to ineffective credit risk management practice. The finding from this study is that credit risk management has significant effect on efficiency of the Nigeria banking industry. Consequently, we conclude that efficiency in banking operations would be sustained by effective and efficient credit risk management practice. We suggest that banks should adhere strictly to the rule that guide given of loans and advances to customers. In addition, banks should abide by the credit risk management guidelines as spelt out in the prudential guideline of the Central Bank of Nigeria.

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