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DETERMINANTS OF OPERATING EFFICIENCY OF NIGERIA'S  
BANKING SECTOR

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**ABSTRACT**

Few empirical types of research on determinants of operating efficiency of the Nigerian banking sector have constrained bank managers in reconstructing and formulating better policies and valuable management strategies to address recurring inefficiencies. As a concern, this study closes the gap by examining the determinants of operating efficiency of Nigeria's banking sector for the period 2002 to 2019. It employed the Data Envelopment Analysis (DEA) model and Tobit Regression model. Descriptive statistics were employed where the Jarque-Bera statistic was used to confirm normality and the Likelihood ratio to confirm the existence of no panel level effects. The relatively low robust standard errors confirmed no existence of heteroscedasticity problem. The results from the DEA for the dependent variable (operating efficiency) showed that the Nigerian banking sector was both efficient and inefficient during the period. The Tobit regression estimation results show that bank size and intermediation ratio were positive and significant in determining banking sector operating efficiency while overhead cost ratio, credit risk and inflation rate were negatively significant in determining operating efficiency. The study recommends that bank management should deploy creative strategies in cutting down overhead cost, engages in proper credit evaluation, ascertain customer creditworthiness before extending credit facilities, increase bank size as operating condition demands, strengthened intermediation activities and engage in proper forecasting of the inflation rate. The CBN on the other hand should develop adaptive policy measures to ensure sustained regulation, supervision and monitoring of banking activities.

**INTRODUCTION**

Operating efficiency in the banking sector has continued to attract increasing research attention given the importance the banking sector plays in an

economy. Efficient conduct of banking business is what banking regulation targets and seeks to achieve. Banking activities are vital not only in an economy but constitute key drivers that lead to the achievement of government monetary policies, financial policies and economic stability. This begets the question of why operating efficiency is of considerable concern to the government on the backdrop of its linkages to various sectors of an economy. Any sort of sustained inefficiency with the sector is injurious and capable of stimulating bank run with unpleasant consequences to depositors, creditors, investors and other key stakeholders in the economy. This reason is responsible why central banks of many countries place greater emphasis in the continued effort and determination to intensify the development of both regulatory and supervisory frameworks to deal with emerging systemic risks to forestall operating inefficiency. This more or less underscores how crucial the sector is, as a top priority in contemporary economic management for the much-desired growth, development and stability of a country's economy through apparatus of financial resource mobilization and allocation (Husain & Abdullah, 2008). The sector dominance both in national and international financial discourse cannot be discountenanced especially of its a contributory potential to national productivity, making an economy to be resilient and enduring to shocks that are either negative or external (Athanasoglou, Delis & Staikouras 2008).

Like every other form of business, banks should pay more vigilance on wise spending particularly when combinations of business circumstances arise to give impetus for serious need to achieve operating efficiency. Changes in the Nigerian business environment continue to throw up uncertainties that challenge banks operating budgets which call for identification and proper understanding. Firms need to continuously respond in a manner to navigate through successfully and justify their establishment. Ensuring better operating efficiency is an important strategic objective banks management should strive to attain in the face of changing **conditions**. This, however, puts exceptional pressure on their capability narrowing down net income margins and causing slow deposit growth rate.

The Nigeria banking sector continues to find itself in a precarious business environment. Inefficiencies have not ceased to become a constant feature in the industry undermining its capacity and service delivery potentials. The associated uncertainty has heightened fears among players and stakeholders, prompting the Nigerian government to respond appropriately in instituting several regulatory mechanisms implemented through the Central Bank on-site and off-site supervision, monitoring and oversight. Despite these laudable initiatives and committed effort, the sector operating efficiency has not improved either but on an intermittent plunge capable of causing bank distress, insolvency and foreclosure. The development has engaged the minds of researcher and attracted research inquiry in a significant number of ways. The literature exposition indicates that studies have examined the Nigerian banking sector; unfortunately, they focused attention more on causes of bank distress and banks' profitability at the exclusion of operating efficiency determinants.

The study believes that the paucity of studies in the area of operating efficiency may be the reason why the causes of the sector inefficiencies have not been fully diagnosed, identified and appropriate recommendations prescribed as solutions. It, however, notes that the few studies that explored determinants of bank operating efficiency in the country are the studies of Zhao & Murinde (2011) which looked at it from the deregulation perspective and Olarewaju & Obalade (2015) which investigated it from the cost operating standpoint. It is observed that the studies ignored key bank-specific, operational and macroeconomic factors which collectively can significantly affect operating efficiency. This research gap is capable of beclouding profound understanding of the diverse factors that determine banking sector operating efficiency. The recognition of this gap is the main motivation behind the study. In this regard, the study is poised to examine determinants of operating efficiency of the banking sector in Nigeria with particular emphasis on bank-specific, operational and macroeconomic factors. These perspectives make the study not unique alone but differentiate it from other existing studies.

The study main objective is to examine the determinants of commercial banking operating efficiency. The specific objectives are to examine whether overhead cost ratio, credit risk, bank size, intermediation ratio and inflation rate are determinants of commercial banking sector operating efficiency. In line with the research objectives, hypotheses were developed from the literature review and tested at 5% level of significance: The study is significant in several ways as it contributes to the theoretical and empirical studies conducted in Nigeria and at the global scene. It would provide bank managers with an understanding of the determinants of operating efficiency and how to ensure better deliver of efficiency; engage policymakers on how to develop commercial banking policies while ensuring attention directing to banking regulators and supervisors' in the development of appropriate regulatory and supervisory frameworks; researchers in academics and practice would find the research results useful in the furtherance and stimulation of more research inquest. The study is limited to the only commercial banking sector of the Nigerian banking sector excluding other specialized and development banks activities.

### ***Theoretical Framework***

This study is predicated on the intermediation theory since there is no inclusive theory on banking activities coupled with no precise consensus definition and measurement of banks' inputs and outputs. Against this backdrop, the intermediation theory appears to have some relevance near an inclusive theory on banking activities This is underscored by Berger & Humphrey (1997) who showed that the 'intermediation theory' is more suitable for assessing financial institutions simply because of inclusiveness of interest expenses, which is observed to be responsible for almost one-half to two-thirds of total costs. As such it is considered more appropriate for the assessment of financial institutions frontier efficiency. In this respect minimization of total costs include interest expenses, non-interest expenses and personnel expenses, which are not just production costs but are required to determine and maximise profits. This makes the theory more significant as it considers customers' deposits as inputs, and interest on deposits as an element

of total costs. The often use of intermediation theory in financial institutions explains the intermediary link between funds' supply and demand (Barry, **Lepetita** and Tarazia (2010). The foregoing made the intermediation theory find relevance in the study as the main theoretical underpinning

## **Review of Related Literature and Hypothesis Development**

### ***Concept of Operating Efficiency***

Operating efficiency measures banks' ability in transforming financial inputs into financial products and services at a lower cost relative to revenue generated from operations Olarewaju & Obalade (2015). It is concerned with the efficient utilization of human and material resources or the efficient use of people, machine tools and materials funds to increase product and services at a reduced cost (Chen, 2001). It is about tactical organizational planning geared to ensure the maintenance of a safe balance between cost and productivity. It focuses on the identification and removal of wasteful processes that contribute to loss of resources which invariably increases organizational profits. It is more or less about a maximum possible proportional reduction in input usage at a given output, or a maximum proportional increase in output at a given input (Coelli & Rao, 2005). The operating income to operating cost ratio is one of the many ratios often used to measure the level of business efficiency. A high ratio means better efficiency and profitability. It signifies inputs costs were properly **managed** and minimized to achieve a higher income which demonstrates efficiency in asset and liability management of banks (Buchory, 2014; Suryasa et al. 2019; Kustina et al., 2019)

### ***Overhead Cost Ratio and Banking Sector Operating Efficiency***

The overhead cost ratio according to Hasan & Marton (2003) represents a good measure for the average cost of non-financial inputs to a bank often used as a proxy for the price of labour which provides a snapshot of how efficient bank management has managed labour costs. A higher ratio is seen to be related to higher expenses and as such would hurt profitability (Athanasoglou, Brissimis & Delis, 2008). ). Isik & Hassan (2002) however, argued that small banks' overhead might be low because they operate fewer branches compared to larger banks; as such they have an operational advantage which may lead to higher efficiency. Larger banks' may also issue loans to several people in small amounts; this can increase servicing and monitoring costs. Kovner, Vickery & Zhou (2014) opined that an inverse relationship exists between overhead cost ratio and operating efficiency of banks. Mirzaei, Moore & Liu (2013) however, hypothesized that a negative relationship exists between operating cost ratio and efficiency; lower operating costs are seen as a source of scale economies for banks and other firms. Big firms can spread overheads on accounting, management, information technology and advertising over a revenue base or operating asset. From the empirical literature, Sharma, Gounder, & Xiang (2015) explored the determinants of banks' efficiency in the Pacific Island Country using the GMM model. The result from the analysis showed that overhead personal expense has a significant negative effect on bank efficiency. Tesfay (2016) applied the Tobit model to study the determinants of commercial Banks' efficiency for the period **ranging** from 2003–2012 and results indicate that overhead costs have an insignificant effect on bank efficiency. Thus it is hypothesized that:

**Ho<sub>1</sub>:** Overhead cost ratio does not significantly determine banking sector operating efficiency

### ***Credit Risk (Non-Performing Loans/Gross Loans) and Banking Sector Operating Efficiency***

The ratio of non-performing loans to total loans is one very good measure for bank credit risk and it reflects potential losses facing a bank. A non-performing loan has overdue payments of interest and principal which have remained unpaid after 90 days or more, capable of creating doubts as to whether the payments are likely to be made subsequently. A higher ratio suggests that a bank is risky, which invariably affect bank efficiency. Increases in the percentage of non-performing would increase monitoring cost, working out and selling off bad loan costs which invariably is expected to have a positive effect on cost inefficiency. In the empirical literature, Berger & DeYoung (1997), Altunbas, Liu, Molyneux, & Seth (2000), and Fries & Taci (2005) find a positive correlation between ratio of non-performing loans to total loans and bank cost inefficiency. Garza- Garcia (2009) deployed Data Envelopment Analysis and provided results that bank efficiency is impeded by non-performing loans. Armer, Mustapha & Eldomiaty (2011) study found that credit risk is a determinant of efficiency in highly competitive banks. Sharma, Gounder, & Xiang (2015) explored determinants of banks' efficiency in the Pacific Island Country using General Method of Moment (GMM). The results showed that credit risk from the macroeconomic, industry and bank-specific models has a significant positive effect on bank efficiency. Tadesse (2017) using the Tobit model showed that credit risk has a less positive significant effect on operational efficiency. Employing the Binary Logit technique, Adusei (2016) used the Binary Logit Technique and revealed that credit risk has a significant negative effect on technical efficiency. Thus it is hypothesized that:

Ho<sub>2</sub>: credit risk does not significantly determine the banking sector' operating efficiency

### ***Bank Size and Banking Sector Operating Efficiency***

Banking size measured by taking the logarithm of total bank assets has been seen to have a possible non-linear relationship with bank inefficiency. Bank size affects the cost and profit inefficiency negatively. This means that larger banks are expected to be more cost and profit efficient. Yildirim & Philippatos (2007) opine that with asset restrictions relaxed in the banking system, it would allow banks to grow and venture into several banking business practices, thereby creating some scale and scope economies. As such an expected positive relationship exists between bank size and efficiency which is attributed to larger banks' ability not only to attract but retain better bank managers Although positive relationship could be expected between bank size and efficiency, however, the relationship is usually negative( De Young & Nolle,1998). From the empirical literature, Sufian (2009) estimated banks' efficiency applying a Multivariate Tobit regression. The results show that banks' total assets have a significant positive effect on bank efficiency. Ahmad & Noor (2011) adopted the non-parametric Data Envelopment Analysis and found that bank size has a positive effect on bank efficiency. A similar result was reported by Kamarudaddin & Rohani (2013) and Banna, Ahmed & Koy

(2017). Studies that used Tobit model with the positive insignificant and significant result of bank size on operating efficiency are: Singh & Fida (2015) reported insignificant positive effect and Tadesse (2017) showed a less positive significant effect. On the contrary, employing the Binary Logit technique, Adusei (2016) indicated that bank size has a **significant** negative effect on technical efficiency while studies that applied Tobit model with similar results are Tesfay (2016); Alrafadi, Kamaruddin, & Yusuf (2014) and Sufian (2009). Thus it is hypothesized that:

**Ho<sub>3</sub>**: Bank size does not significantly determine banking sector operating efficiency

#### ***Intermediation Ratio and Banking Sector Operating Efficiency***

The intermediation ratio captures the overall depth of banking intermediation activity and shows banks' ability in converting deposits into loans. It is captured as the relation of total loans to total deposits. The variable negatively influences bank inefficiency because a higher intermediation ratio indicates that there are fewer deposits to produce expected loans, which in turn infers that production costs are lowered and therefore higher profits are expected. The works of Fries & Taci (2005), Kosak, Zajc & Zoric (2009), and Dietsch & Lozano-Vivas (2000) find that intermediation ratio has a negative relationship with bank cost inefficiency. Sharma, Raina & Singh (2012) using the stochastic frontier analysis reported that total deposits to total liabilities ratio was a major determinant of technical efficiency. Olarewaju & Obalade (2015) using panel data regression technique showed that total loan and total deposit negatively influenced banks operational efficiency. Applying the Tobit model, Tesfay (2016) **intermediation** ratio has a significant positive effect on bank efficiency. Thus it is hypothesized that:

**Ho<sub>4</sub>**: **Intermediation** ratio does not significantly determine banking sector operating efficiency

#### ***Inflation Rate and Banking Sector Operating Efficiency***

Inflation rate as a macroeconomic variable has been seen to have a potential effect on both bank profit and cost inefficiency. Grigorian & Manole (2002) argued that inflation has a positive correlation with bank inefficiency because excessive branch networks may be associated with a high inflationary environment. Hanson & Rocha (1986) argued that inflation may increase bank costs because large numbers of transactions are likely to be associated with higher labour costs which would cause a higher ratio of bank branches per capita. Increases in inflation rate may cause interest rates to increase which likely may lead to higher costs incurred by banks. Revell (1979) however, argue that the effect of inflation on bank costs and profits generally depends on the increasing rate of operating expenses as against the inflation rate. Athanasoglou, Delis. & Staikouras (2006) on the other hand suggest that inflation influence on bank profits depends on inflation forecastability of the bank and its management's capability to manage expenses and interest rates for profit generation. As such commercial banks are believed to have the ability to forecast inflation rate changes successfully, which positively affect the profitability of banks. From their study, they found no expected signs of inflation on either bank cost inefficiency or profit inefficiency from a sample of banks that operated in 27 countries. Similar results were reported by, Weill

(2003) and Grigorian & Manole (2002). Garza- Garcia (2009) deployed Data Envelopment Analysis, and provided results which showed that bank efficiency is impeded by inflation. On the contrary, studies that reported a significant positive effect of inflation on bank operating efficiency are Tomova (2005); Seelanatha (2012) and Endri & Divilestari (2014). Thus it is **hypothesized that:**

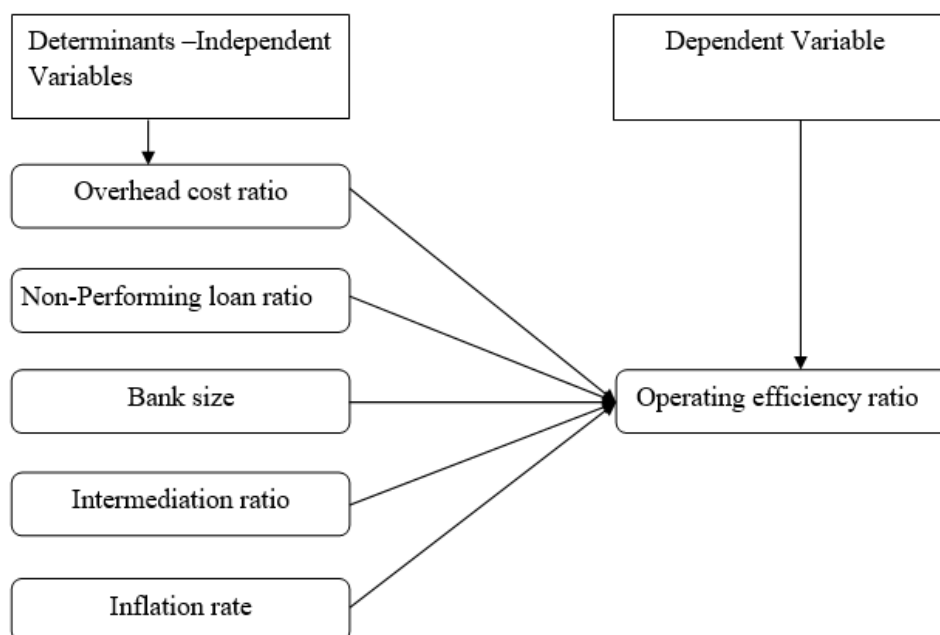
**Ho5:** Inflation rate does not significantly determine banking sector operating efficiency

## RESEARCH METHODOLOGY

The study adopted an ex-post research design. The choice was informed because the data for the dependent and independent variables were obtained from published financial reports on past economic events and transactions of the industry by credible secondary sources such as the CBN Statistical Bulletin and World Bank Financial indicators for countries. The study population is the entire commercial banking sector which comprised all the deposit money banks operating in Nigeria. The reason for this is not farfetched because there is the possibility of accessing the required data about the entire commercial banking sector than for each of the deposit money banks before aggregation. The sample size is therefore the entire commercial banking sector for the period spanning from 2002 to 2019. The study applied judgmental sampling because within this period government at regular intervals have intervened in the commercial banking subsector by way of reforms aimed strategically to reposition it for better service delivery and efficiency. Data collected was from a secondary source, specifically from CBN Statistical Bulletin and World Bank financial indicators. The variables selected for the estimated model was guided by relevant theories and existing empirical studies based on the research gap identified. This consist of banking industry-specific, operational and macroeconomic variables which relate to inputs, outputs and environment variables affecting commercial banking operating activities. They are operating efficiency ratio, overhead cost ratio, non-performing loan ratio, banking sector size, intermediation ratio and inflation. These variables for the sake of clarity and purpose of analysis are measured in Table 1 below.

**Table 1.** Variables, their Symbol and Measurements

Variable	Symbol	Name	Measurements
Dependent variable	OER	Operating efficiency ratio	Operating income/operating cost
Independent variables	OCR	Overhead cost ratio	Non-interest cost/ Total assets
	NPLR	Non-performing loan ratio	Non-performing loans/ total loans
	BSIZE	Banking sector size	Natural logarithm of banking sector assets
	INTM	Intermediation ratio	Total deposits / total loans
	INF	Inflation	Inflation rate



**Figure 1.** Conceptual Framework of the Model

### ***Model Specification***

Given the relation between operating efficiency and its determinants as observed in the literature informed the construction of the conceptual model above. However, the Battese and Coelli (1995) model were adopted in this study because of the methodological advantages it offers to our panel data efficiency study. According to the model, the efficiency term is assumed to be a function of a set of independent variables and a vector of unknown parameters to be estimated. Therefore, the model is specified as:

$$\mathbf{OER}_{it} = \alpha - \beta_1 \mathbf{OCR}_{it} - \beta_2 \mathbf{NPLR}_{it} + \beta_3 \mathbf{BSIZE}_{it} + \beta_4 \mathbf{INTM}_{it} - \beta_5 \mathbf{INF}_{it} + E_{it}$$

**Where:**

$\mathbf{OER}_{it}$  = Operating efficiency ratio int period

$B_1$  = Coefficient of overhead cost ratio

$\mathbf{OCR}_{it}$  = Overhead cost ratio (as an input measuring price of labour) for t period

$B_2$  = Coefficient of Non-performing loan ratio

$\mathbf{NPLR}_{it}$  = Non-performing loan ratio (as an output measuring price of output) for t period

$B_3$  = **Coefficient** of banking size

$\mathbf{BSIZE}_{it}$  = Banking size for t period

$B_4$  = **Coefficient** of intermediation ratio

$\mathbf{INTM}_{it}$  = Intermediation ratio for t period

$B_5$  = **Coefficient** of inflation

$\mathbf{INF}_{it}$  = **Inflation rate for t period**

$E$  = Stochastic error term for t period

A priori **expectations** are that  $B_3$ - $B_4$ =positive, while  $B_1$ ,  $B_2$ ,  $B_5$ =negative

The study adopts descriptive statistics like mean, standard deviation, minimum and maximum to describe variables in the DEA model and those in the Tobit regression model. The DEA was used to estimate the yearly operating efficiency score of the entire commercial bank sector for the period while the



Tobit model was used to examine the determinants of the efficiency score for the same period. Although the DEA has a major weakness as it does not assume random error (measurement error) (Raphael, 2012). However, it is preferred because it does not require a prior specification of the underlying technology but it can always accommodate multiple inputs and outputs (Raphael, 2013). It is a more preferred analytical tool to others when dealing with banks and financial institutions because it involves the use of linear programming to construct a non-parametric piece-wise frontier over the data (Řepkova, 2015)

### *Data Presentation and Analysis.*

**Table 2.** Efficiency Score generated by DEA Model from OER data for the period

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010
Eff.Score	1.00 0	0.98 7	0.97 9	0.89 9	1.00 0	0.98 5	0.99 1	0.824	0.979
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Eff.Score	1.00 0	1.00 0	0.99 8	1.00 0	1.00 0	0.76 2	0.78 6	0.835	0.953

Source: **Author** Data Envelopment Analysis, 2020

Table 2 shows the efficiency score under variable return scale (VRS) generated by the DEA based on the operating efficiency variable data (OER). The interpretation of the efficiency score is that **the** commercial banking sector is considered efficient when the score equals one (1) and inefficient when the score is less than one. Based on the scores one can see that in 2002, 2006, 2011, 2012, 2014, and 2015, the efficiency scores from the variable return scale were all 1. The indication is that for these years the entire commercial banking sector was efficient. However, in 2003, 2004, 2005, 2007, 2008, 2009, 2010, 2013 and 2013, the efficiency scores were all less than one (1), an indication that for these years, the entire commercial banking sector was inefficient.

**Table 3.** Descriptive Statistics for the Dependent Variable using DEA

Variables	Obs	Mean	Standard deviation	Minimum	Maximum	Jargue-Bera	Prob.
VRS for OER	18	0.9432	0.02566	0.7620	1.00000	1.0154	0.6019

Source: **Author** Data Envelopment Analysis, 2020

In Table 3, the mean for average efficiency score based on the variable return scale is 0.9873 with a standard deviation of 0.02566. The minimum and maximum values are 0.89900 and 1.00000. The Jargue-Bera statistic is 1.0154 with a probability value of 0.6019. Because the probability of the Jargue-Bera statistic is greater than 5%, it implies that the variable distribution appears to have a normal distribution. The operating efficiency scores generated from the DEA model lie between 0 and 1 with most observations distributed around the

upper boundary this **indicates** the preference for using Tobit model rather than the ordinary least square in estimating the determinants of efficiency. As such the Tobit model was applied and the results of the descriptive statistics displayed in the Table 4 below.

**Table 4.** Descriptive statistics of the determinants of efficiency in the Tobit model

Variables	Obs	Mean	Standard deviation	Minimum	Maximum	Jargu e-Bera	Probability
OCR	18	6.82470	1.8375	4.3400	10.0400	1.9818	0.6121
NPLR	18	13.4427	8.9062	3.0000	37.3000	1.8355	0.3994
Bsize	18	10.1507	0.4612	9.3000	11.1800	1.3498	0.8395
INTMR	18	12.0713	9.0746	9.2400	15.1100	1.0811	0.5824
INFLR	18	11.9893	4.4911	6.6000	23.8000	5.4178	0.0666

Source: Author Tobit model output, 2020.

In Table 4, the mean for the variables are as follows: overhead cost ratio 6.82470, non-performing loan ratio 13.4427, bank size 10.1507, intermediation ratio is 12.0713 and inflation rate 11.9893. Intermediation ratio has the highest volatility based on standard deviation value of 9.0746, followed by non-performing loan ratio with 8.9062 standard deviations, while the standard deviation for inflation, overhead cost ratio, bank size and variable return scale for operating efficiency are 4.4911, 1.8375, 0.4612 and 0.035 respectively, followed in that order. The Jargue-bera statistics for the variables were all greater than 1 and their respective probabilities were also greater than 5%, implying that the individual variable series appear to follow the normal distribution assumption.

**Table 5.** Tobit Model Estimation Results at 5% level of significance

Panel Tobit model under VRS				
Determinants	Coefficient	Robust Standard Error	t-stat	Prob.
Constant	0.268	0.472	0.5678	0.537
OCR	-0.953	0.470	-2.0277	0.032
NPLR	-0.853	0.340	-2.5088	0.007
Bsize	5.246	1.625	3.2283	0.000
INTMR	0.787	0.345	2.2812	0.002
INFLR	-0.542	0.232	-2.3362	0.001
$\delta_u$ constant	0.0262	0.0334		

$\delta_e$ constant	0.2578	0.016		
Prob.	0.0425	0.237		
Likelihood-ratio test of $\delta_u=0$ : $\chi^2$ (5%) =0.0425				

Source: **Author's** Tobit model output, 2020

Table 5 shows the Tobit model results derived by regressing the operating efficiency score obtained from the variable return scale analysis with the determinants ( independent) variables of overhead cost ratio, non-performing loans, bank size, and intermediation ratio and inflation rate for the period 2002 to 2019. To determine whether the Tobit model was appropriate to estimate the relationship between the dependent variable and the determinants, the likelihood ratio test statistic was relied upon. The likelihood ratio test is usually applied to check if there are panel level effects. Fortunately from the result, the likelihood ratio has a value of zero (0).which means the absence of panel-level effect, which confirmed reliance on the model. The robust standard errors for the determinants were relatively low and the low values indicate the absence of heteroscedasticity problem in the panel Tobit model, which further reinforced more reliance on the estimation results. The error constant ( $\delta_e$  constant) of .2578 captures other factors not considered in the model, meaning that such factors only accounted for 25.78 per cent variation in operating efficiency. This implies that the factors examined as determinants in the study were able to explain variations in banking sector operating efficiency to the extent of 74.22 per cent. Overall the model was statistically significant given the probability value of  $\chi^2$  to be 4.25% which is lesser than 5% level of significance

## DISCUSSION OF FINDINGS

The equation extracted from the Tobit model regression results shown on Table 5.4 is  $VRS \text{ OER} = 0.268 - 0.953OCR - 0.853NPLR + 5.246BSIZE + 0.787INTMR - 0.542INFLR$ . Based on the results it can be observed that overhead cost ratio, non-performing loan ratio, credit risk, banking **size**, intermediation ratio and inflation rate were found to be significant determinants of banking sector operating efficiency in Nigeria.

### Overhead Cost Ratio and Banking Sector Operating Efficiency

Overhead cost ratio coefficient was -0.953, the t-value 2.0277 and the probability 0.032 which indicate that the variable negatively and significantly a determinant of operating efficiency. A unit increases in overhead cost ratio would lead to 0.953 decreases in operating efficiency. In effect, it means the variable has a negative significant effect on the operating efficiency of the Nigerian banking sector. This finding is in agreement with the results of Athanasoglou et al (2008), Mirzaei et al (2013), Kovner et al (2014), Sharma, et al (2015) and Olarewaju & Obalade (2015) who found that overhead cost ratio negatively significantly influences banking operating efficiency.

### Credit Risk (Non-performing loan ratio) and Banking Sector Operating Efficiency

The coefficient of Credit risk (Non-performing loan ratio) was -0.853, the t-value -2.5088 and the probability 0.007 which infer that this variable,

negatively and significantly is a determinant of operating efficiency. A unit increase in credit risk will lead to 0.853 decreases in operating efficiency it connotes also that the variable has a negative significant effect on the operating efficiency of the Nigerian banking sector. The finding is at variance with the results of Tadesse (2017), Sharma et al (2015), Repkova (2015), Seelanatha (2012), Armer et al (2011), **Sufian** (2009) who found that credit risk positively significantly influences operating efficiency and in agreement with Adusei (2016), Sanchez et al (2013), Garza-Garcia (2009) who found that credit risk negatively significantly influence banking operating efficiency.

#### ***Bank Size and Banking Sector Operating Efficiency***

Bank size has a coefficient value of 5.246 with a t-value of 3.2283 and an associated probability of 0.0000. This implies that this variable positively and significantly is a determinant of operating efficiency. A unit increase in banking size will lead to 5.246 increases in operating efficiency the import suggests that the variable has a positive significant effect on the operating efficiency of the Nigerian banking sector. The finding corroborates the results of Tadesse (2017), Banna et al (2017), Sharma et al (2012), Ahmad & Noor (2011), Sufian (2009) who found that bank size positively significantly influences banking operating efficiency but contradicts the results of Adusei (2016), Singh & Fida (2015), Alrafadi et al (2014) who found that banking size negatively significantly influences banking operating efficiency.

#### ***Intermediation Ratio and Banking Sector Operating Efficiency***

Intermediation ratio coefficient was 0.787, its t-value is 2.2812 and the associated probability 0.002. The indication is that the variable has displayed that it is a positive and significant determinant of operating efficiency. A unit increase in intermediation ratio will lead to 0.787 increases in **operating** efficiency, In other words, it shows that the variable has a significant positive effect on the operating efficiency of the Nigerian banking sector. The finding is at variance with the results of Olarewaju & Obalade (2015) who found that intermediation ratio measured by total loan to total deposit negatively influence bank operating efficiency but in agreement with the results of Dietsch & Lozano-Viva(2000), Fries & Taci (2005) and Kosak et al (2009) who found a positive relationship between intermediation and operating efficiency.

#### ***Inflation Rate and Banking Sector Operating Efficiency***

The inflation rate has a coefficient of -0.542, its t-value -2.3362 and the associated probability 0.001. It indicates that the variable is negatively and significantly a determinant of operating efficiency. A unit increase in the inflation rate will lead to 0.542 decreases in operating efficiency. It translates by the interpretation that the variable has a significant **negative** effect on the operating efficiency of the Nigerian banking sector. The finding supports the results of Grigorian & Manole (2002), Hanson & Rocha (1986) who found that inflation rate has a negative influence on banking operating efficiency but disagree with the result of Tomova (2005) who found that inflation has a positive effect on banking operating efficiency.

## CONCLUSION AND RECOMMENDATION

The study examined the determinants of operating efficiency of the Nigerian banking sector and was able to provide some empirical evidence based on the use of Data Envelopment Analysis (DEA) method and Tobit estimation model. The study found that overhead cost ratio, credit risk and inflation negatively and significantly determine banking sector operating efficiency while banking size, and intermediation ratio positively and significantly determine banking sector operating efficiency in Nigeria. The empirical findings present considerable valuable lessons to learn from and policy implications for the Central bank and the managers of the deposit money banks in the country. The study recommends that bank management are advised to deploy creative strategies in cutting down overhead cost relating to staff and another aspect of operations by exercising good management control techniques and the use of cost-saving banking technologies. Bank management should engage in due diligence, proper loan evaluation and creditworthiness of customers before extending credit facilities. Creative loan recovery strategies should be developed and implemented with sustained vigour. Bank management should consolidate on the strategies to ensure the continued creation, management **and** control of quality assets to support their operations. Good use of deposits and other assets to create loans and advances should be encouraged through proper analysis while lending policies should be evaluated continuously in line with CBN and other supervisory agencies directives and policies. Bank management should develop more ability and capacity to forecast inflation and ways to ameliorate its effect on banking operation since inflation can increase the cost of operation. Scanning of the macroeconomic environment is one way of achieving inflation forecast objectives. Proper analysis of bank network growth, staff cost and operating costs is an ideal strategy to fall back on. Furthermore, the CBN, on the other hand, should develop adaptive policy measures for enhancement and sustained regulation, supervision and monitoring of banking activities

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