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Cost Efficiency of Nigerian Banks an Empirical Analysis

[1]Oluitan Roseline PhD, [2]Bojerenu Michael & [3]Onyebuchi John
Department of Banking and Finance,
Lagos State University

Abstract
This study conducts a stochastic frontier analysis (SFA) analysis to examine the cost efficiency of Deposit Money Banks (DMBs) in Nigeria. The investigation covered fifteen DMBs during the sample period 2002-2013 and adopted the translog functional form for the model and halfnormal distribution of random inefficiency term. The result suggests that the efficiency of Nigerian DMBs varies within 0.97 and 0.99 with an average value of 0.98. Having checked a range of hypotheses, the study establishes that these banks are highly efficient with cost in determining their non-interest revenue at 99.9 percent which represents the highest level of cost efficiency attained during the period observed. From this, basic recommendations were advanced, one of which is to establish and maintain cost efficiency in the banking system.

Keywords: *Cost Efficiency, Nigerian banks, Deposit Money Banks (DMBs)*

Background to the Study

The performance of the banking system has been widely recognized theoretically and empirically as an important prerequisite for economic growth and for enhancing the financial system (Abdmoulah, 2012). In order to attain a required level of development of the economy, the financial system must be stable and efficient. It is worthy of note that banks, in their role as financial intermediaries contribute significantly to economic activity in a number of ways. Since the establishment of the first commercial bank in Nigeria (African Banking Corporation thereafter referred to as ABC in 1892), the industry has been facing several challenges coupled with implementation of reforms (consolidation). As a result,

research on the efficiency of banks has become prominent work embarked upon during the last few decades across the globe.

Efficiency in the operation of these institutions (banking) is required in order to stimulate the growth of the economy. Oluitan (2014) describe efficiency as "the ratio of output to the input of any system" which is also regarded as the production ratio. A brief investigation into the operations of banks from the pre-colonial era in Nigeria reveals that most banks failed due to undercapitalization; weakness in the regulatory and supervisory framework, inability to operate efficiently (Uchendu 2005) as cited by Adegbaju and Olokoyo (2008). As a result of the financial liberalization policies, many banks could not operate on the efficiency frontier. This is consistent with the report of Idialu, (2010). They postulate that as bank regulators open their financial industries for competition and liberalization, many banks operate at a level that is less efficient and profitable leading to unsoundness or distress in the industry.

Prior to the banking reform in 2004, there was proliferation of banks with a very low capital base, weak intermediation functions among others. As a result of the aforementioned, 36 banks were declared insolvent and consequently liquidated from 1994 to 2004. The reform (consolidation exercise) in 2004 increased the capital base of banks to N25 Billion and reduced the number of banks to 25 through merger and acquisition, revocation of licenses etc. However, the Central Bank of Nigeria (CBN) further reveals six distress banks which were taken over by the Asset Management Company of Nigeria (AMCON). This invariably x-ray the importance of frequent efficiency measurement of banks to both the management and the regulatory agencies (Nigerian Deposit Insurance Corporation NDIC, Central Bank of Nigeria CBN) in identifying inefficiency and corrective measures taken in order to ensure efficiency in their utilization of resources. Thus, it is imperative that frequent studies be carried out on the efficiency of their operation as they carry out their intermediation function.

There are a handful number of investigations on cost efficiency of Nigerian banks. However, some of these studies incorporates a wider number of countries and as such, are not country specific. For example, Oluitan (2014) examined the efficiency of the financial sector in African countries; Chen (2009) also investigated the bank efficiency in Sub-Saharan African Middle-Income Countries. Others that are country specific cover a small number of years. For example, Muhammad (2008) examined the Nigerian bank performance for the period of five years, Idialu (2007) measured the efficiency of Nigerian banks for the period 1999 to 2004 (7 years).This study is country specific and it examines the efficiency of Nigerian deposit money banks for twelve years covering year 2002 to 2013.

Objective of the Study

The aim of this study is to assess the efficiency of Nigerian banks for 12 years, 2002 2013.

Literature Review and Theoretical Framework

The efficient functioning of the banking system is an important prerequisite for economic growth and for enhancing the financial system. This statement is consistent with the postulations of Levine and Renelt (1992) and King and Levine (1993) that financial sector development impact positively on economic growth. Therefore, evaluating the efficiency in

their intermediation function is important to the shareholders, depositors, government, and regulatory authorities, academic and potential investors. It is therefore important that arguments and debates on the relative efficiency of industries and firms must be based on a well-defined measurement of the concept of efficiency.

The efficiency concept is used to characterize the utilization of resources to produce outputs. It describes the level of performance that uses the lowest amount of inputs to create the greatest amount of outputs. Discussion on efficiency measurement began with Farrell (1957) who, based on the work of Debreu (1951) and Koopmans (1951), defined a simple measure of firm efficiency that could account for multiple inputs. He adopted the approach that divided the economic efficiency of a firm or industry into two separate components: technical efficiency and price efficiency (or allocate efficiency). The former measures a firm's success in producing maximum outputs from a given set of inputs, the latter relates to its success in choosing an optimal set of inputs (Farrel 1957). The combination of these two processes provides a measure of total economic efficiency (or overall efficiency).

According to Adongo, Stork and Hasheela, (2005) the concepts for measuring efficiency fall into three categories- revenue, cost and profit efficiency. These concepts according to them established an economic foundation for analyzing bank efficiency because they are based on economic optimization in reaction to market price, competition and other business conditions rather than being based solely on the use of technology.

Revenue efficiency measures the change in a bank's revenue adjusted for random error, relative to the estimated revenue obtained from producing an output bundle as efficiently as the best practice bank in a sample facing the same exogenous variables. According to Adongo et al (2005) cost efficiency measures the change in a bank's variable cost adjusted for random error, relative to the estimated cost needed to produce an output bundle as efficiently as the best practice bank in the sample using the same exogenous variables, which include variable input prices, variable output quantities and fixed net puts (inputs and outputs). It arises due to technical inefficiency which results in the use of an excess or sub-optimal mix of inputs given input prices and output quantities.

Profit efficiency in banks occurs as a result of rise in costs in their bid to provide additional or higher quality services. However, revenues may increase more than cost increases. Looking at efficiency from either the cost minimization or revenue maximization perspective, it fails to capture the goal of banks to maximize profits by raising revenues as well as reducing costs and does not account well for the unmeasured changes in output quality (Berger and Mester 1999). This shortfall is overcome by the profit efficiency concept.

Theoretical Framework on Efficiency Measurement

The theoretical literature on productive efficiency measurement is broadly divided into two, the non parametric and the parametric techniques. There are three main parametric frontier approaches to measuring efficiency, namely the stochastic frontier approach (SFA), the distribution free approach (DFA) and the thick frontier approach (TFA). Data envelopment analysis (DEA) is the most common among the non-parametric approaches, which also

include the free disposal hull (FDH). However, the parametric techniques are often preferred as they generally correspond well with cost and profit efficiency concept studies (Berger & Humphrey, 1997). The non-parametric methods have two major drawbacks. Firstly, they generally assume there is no statistical measurement error and use luck as factors affecting outcomes (Vannet, 2002).

The parametric techniques use a stochastic production cost or profit function to estimate efficiency. The parametric techniques (SFA, TFA and DFA) are less prone to classify measurement errors or effects of luck as inefficiency, because they allow for random errors. On the other hand, parametric approaches can suffer from bias due to imposing a specific distribution on the unknown pattern of inefficiency (Bauer, Berger, Ferrier, and Humphrey, 1998).

Stochastic Frontier Analysis

Of the three parametric approaches, the Stochastic Frontier Analysis (SFA) which was independently proposed by Aigner, Lovell, and Schmidt (1977) and Meeusen and Van den Broeck (1977) has been a significant contribution to the econometric techniques for the estimation of production, cost and profit frontiers and for the estimation of the technical and economic efficiency of firms.

SFA allows for random errors associated with the choice of the functional form, resulting in a stochastic frontier. It is often referred to as a decomposed error model where the part representing statistical noise follows a symmetric distribution and the other part, representing inefficiency, follows a particular one-sided distribution. Consider a model in the panel form as specified by Battese and Coelli (1995):

$$Y_{it} = \beta X_{it} + \varepsilon_{it}$$

Where, Y_{it} is the cost (or log) of the i-th firm at time t

X_{it} is a kx1 vector of input and output prices of the i-th firm at time t

β Is the vector of unknown parameters

ε_{it} Is the error component of the i-th firm at time t which the frontier decomposes further.

When the error term is decomposed, the SFA model becomes

$$Y_{it} = \beta X_{it} + (V_{it} + U_{it})$$

Where,

V_{it} is the symmetric random variable representing errors of approximation and other sources of statistical noise of the i-th firm at time t assumed to be iid[N?0, σ_v^2?] and U_{it} is the non-negative random variable which is assumed to account for technical inefficiency and assumed to be . iid[N(0,0_v^2)]

There are certain factors that influence the environment in which production takes place e.g. ownership, form, regulation etc. one of the ways to handle them is by including them as control variables. Following the Battese and Coelli (1995) specification, inefficiencies are assumed to be a function of a set of explanatory variables associated with inefficiency of units over time:

$$U_{it} = Z_{it}\delta + w_{it}$$

Where,

Z_{it} vector of variables which may influence the efficiency of units / firms

δ vector of unknown parameters to be estimated

$w_{it} \sim iid\ N(0, \sigma_w^2)$ random variables reflecting effect of statistical noise

$$u_{it} \sim iid\ N^{+}(z_{it}^{T}\delta, \sigma_u^2)$$

There are two forms of estimation with the cost function. They are log-linear Cobb-Douglas and log-linear translog function. The Model for both are stated below

Cobb-Douglas: $\ln Y_{it} = \beta_0 + \sum \beta_n \ln X_{nt} + (V_{nt} + U_{nt})$

Translog: $\ln Y_{it} = \beta_1 + \sum \beta_n \ln X_{nt} + \frac{1}{2} \sum \sum \beta_{nm} \ln X_{nt} + (V_{nt} + U_{nt})$

The log-linear translog function is assumed to better as it is capable of explaining the model better than the Cobb-Douglas function (Duffy and Papageorgiou, 2000; Oluitan 2014). The parameters of the frontier model and the composed errors can be obtained using either the maximum likelihood (ML) estimation or the corrected ordinary least squares (COLS) directly. Some studies suggest that ML estimation is the preferred method. For example, Coelli (1995) and Olesen*et al.* (1980) show that ML estimation tends to outperform COLS in large sample sizes. Specifically, "the ML estimator can be shown to be consistent and asymptotically normally distributed (CAN) with variances that are no larger than the variances of any other CAN estimator (that is, the ML estimator is asymptotically efficient)" (Coelli*et al.* 2005, pp 218).

Empirical Studies on Efficiency Measurement in Banking

Since late 1980s, a substantial research effort has been directed towards measuring the efficiency of financial institutions, especially commercial banks. A comprehensive review of efficiency studies as they relate to financial institutions has been provided by Berger and Humphrey (1997). They conducted a study based on survey of 130 previous studies that covered 21 countries and find that the various methodologies do not produce consistent result. Allen and Rai (1996) estimate a global cost function using an international database of financial institutions for fifteen countries. Their sample was divided into two groups according to the country's regulatory environment. They find that Universal banking countries (Australia, Austria, Canada, Switzerland, Germany, Denmark, Spain, Finland, France Italy, United kingdom and Sweden) permitted the functional integration of commercial and investment banking, while separated banking countries (Belgium, Japan and USA) did not. Large banks in separated banking countries exhibited the largest measure of input inefficiency and had anti-economies of scale. All other banks had significantly lower inefficiency measure. Moreover, small banks in all countries showed significant levels of economies of scale. Italian, French, UK and USA banks were found less efficient when compared with Japanese, Austrian, German, Danish, Swedish and Canadians banks.

Using a stochastic cost frontier approach, Karim (2001) investigates banking efficiency in the four ASEAN counties (Indonesia, Malaysia, the Philippines and Thailand) over the period from 1989 until 1996. The average cost efficiency of these ASEAN banks deteriorates over this sample period. Karim (2001) suggests that the deterioration in efficiency over this period may have contributed to the Asian financial crises in 1997. Moreover, his results show that there are significant differences in banking efficiency across the four ASEAN countries. On average, Thai banks are the most efficient, followed by Malaysian banks, Indonesian banks, whilst Philippine banks are the least efficient. Karim (2001) also finds that privately owned banks are more cost efficient than state-owned banks and those larger banks tend to have higher cost efficiency scores than smaller banks.

Fernandez etal (2002) study the economic efficiency of 142 financial intermediaries from eighteen countries over the period 1989-1998 and the relationship between efficiency, productivity change and shareholders wealth maximization. The authors applied DEA to estimate the relative efficiency of commercial banks of different geographical areas (North America, Japan and Europe). The three preferred outputs were total investments, total loans, and non-interest income plus other operating income. In parallel, the four inputs values were property, salaries, other operating expenses and total deposits. Their results showed that the productivity of commercial banks across the world has grown significantly (19.6%) from 1989-1998. This effect has been principally due to relatively efficiency improvement, with technological progress having a varying moderate effect.

Nazami and Mahmud, (2004) identify key factors determining the technical efficiency differentials among Turkish commercial banks in the pre and post-liberalization periods, using the technical inefficiency effects model. The study found that loan quality, size, ownership of the banks, and profitability has a positive and significant impact on the technical efficiencies of banks. Idialu (2007) measures the efficiency of Nigerian banks using Data Envelopment Analysis (DEA) methodology which covers the period 1999 to 2004.The study examine the relative efficiency using operating and intermediation approaches. The data used in operating approach includes four inputs (interest and related cost, overhead expenses, provision for bad and doubtful debts and capital related administrative expenses (depreciation)) and one output the gross earnings. For the intermediation approach, he used three inputs (fixed assets and other assets, number of employees and total deposits) and two outputs (total loans extended and investments). The result of the research give an efficiency level between 75.8% - 88.8% and 64.3% - 88.1% average on operating approach and intermediation approach respectively.

Tahir &Haron (2008) examine the technical efficiency of the Malaysian commercial banks over the period of 2000-2006, using stochastic frontier approach. The findings explained that the level of efficiency of Malaysian commercial banks has increased during the period of study and also found that Domestic Banks are more efficient relative to Foreign Banks. Idialu (2010) examine the efficiency of Nigerian banks using the Stochastic Frontier Analysis (SFA) which covers the period of 2000 2004. The result of the investigation carried out reveal that there is inefficiency in the Nigerian banking system and that the level of inefficiency ranges between 0 and 19 percent of total cost. In other words, the Nigerian banks still have the

capacity to reduce their Total Cost of operation between 0 19 percent during the years observed if they operate along the efficient frontier.

Kiyota (2011), research on efficiency of commercial banks operating in 29 Sub-Saharan African (SSA) countries for the period of 2000 2007 conducts a comparative analysis of profit efficiency and cost inefficiency adopting the Stochastic Frontier Analysis (SFA). The result shows a general improvement in the cost efficiency of domestic and SSA foreign banks for the period 2000 2004, while the period 2004 2007 is characterized with upward and downward trend in the cost inefficiency of the two types of banks.

Sharma, Raina & Singh, (2012) examine the technical efficiency of scheduled commercial banks in India using balanced panel data which covers the period of 2005-05 to 2009-10. They also examine the sources of inefficiency. Their findings prepared on the basis of Cobb-Douglas production functional and inefficiency model indicate that they (commercial banks) have improved in technical efficiency level where the relationship depends heavily on fixed assets and deposit inputs. The result of the findings on the sources of inefficiency shows that priority advance to total advance ratio and public owned banks have a significant positive relationship with the technical efficiency of banks.

Oke and Poloamina (2012) investigate some cost efficiency correlates of fifteen selected deposit money banks in Nigeria. The research covers the period 2001 2008. Using the DEA approach to obtain the cost efficiency, the Random effects Tobit regression, they obtain the correlates of cost efficiency. The results of the research show that credit risk is the most significant variable that negatively influenced efficiency in the model at 5 % level, followed by foreign bank ownership that showed a positive effect on efficiency.

Oluitan (2014) examines the efficiency of the financial sector in African countries. The study estimates cost function with the use of a single output and multi-input variables for about forty-seven (47) African countries over a period of ten years. Following the intermediation approach, three outputs employed in the analysis are Loans, Other Earning Assets and Other Operating Income, while input and netput variables are Labour, Physical Capital and Cost of Funds. The result shows that inefficiency ranges between 24 26 percent of cost for the industry. Chen (2009) as cited by Oluitan (2014) has a similar result from his research on banks in the Sub-Saharan Middle Income countries with a result of 20-30 percent inefficiency.

Eriki and Osifo (2014) evaluate the performance efficiency of nineteen selected commercial banks in Nigeria for the year 2009 using descriptive and Data Envelopment Analysis (DEA) approach. They employ three performance efficiency scores of constant returns to scale (CRS), variable returns to scale (VRS) and scale efficiency models, using two inputs and outputs namely Total assets and Equity (share capital) as inputs while Interest income and Gross earnings served as outputs respectively. The results show that small and medium banks were more efficient than mega banks.

Research Methodology

Data Analytical Method

The study uses fifteen (15) deposit money banks (DMBs) over the period 2002 2013 totaling 180 observations is used in analyzing the cost efficiency. The intermediation approach is employed. This decision is motivated from the fact that it is widely used and a good approach for evaluation because it is inclusive of interest expense (interest paid to depositors), which often accounts for one half to two thirds of total costs (Berger and Humphrey, 1997).

We use three outputs, and input variables in the analysis. The outputs variables are Loans, Other Earning Assets and Non Interest Revenue while Physical Capital, Labour and Deposit are considered as inputs. Thus the input prices are price of physical capital, cost of labour, and cost of funds. The price of physical capital is defined as the ratio of depreciation to fixed asset; cost of labour is personnel expenses as a ratio of total assets. The cost of funds (deposits) is interest expenses as a ratio of total deposit while the Total Cost comprises interest expenses and non-interest expenses. The choice of data is supported by the work of Hollo and Nagy, (2006) who studied bank efficiency in the enlarged European Union as well as Oluitan, (2014) who examined the efficiency of about three hundred and twenty-nine (329) banks from forty-seven (47) African countries.

The bank specific data used for the study is obtained from the annual reports obtained from the websites of the respective banks under observation while the macroeconomic variables are from the World Bank dataset.

Model Specification and Data Analysis

The translog model that is estimated is stated in the equation below:

$$Y_{it} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + 0.5\beta_5 X_1^2 + 0.5\beta_6 X_2^2 + 0.5\beta_7 X_3^2 + 0.5\beta_8 X_4^2 + \beta_9 X_1 X_2 + \beta_{10} X_1 X_3 + \beta_{11} X_1 X_4 + \beta_{12} X_2 X_3 + \beta_{13} X_2 X_4 + \beta_{14} X_3 X_4 + V_{it} + U_{it}$$

Where,

Y_{it} is the logarithm of Total Cost for the firms (banks);

X_1 is the logarithm of output (total loans; other earning assets; non interest revenue);

X_2 is the price of physical capital;

X_3 represent the cost of labour (wages);

X_4 represents the cost of borrowed funds (deposits).

In order to estimate the level of inefficiency is modeled as a half normally distributed random variable that can be influenced by some macro-economic variables. From the various methods which can be used in accounting for heterogeneity among banks, environmental factors are included into the model following Hollo and Nagy (2006) and Oluitan (2014). These factors are inflation (INF), private sector credit as a percentage of Gross Domestic Product (PSCRGDP), liquid liabilities as a percentage of GDP (LLY) and domestic bank assets as a percentage of GDP (DBAGDP). Thus, the technical efficiency equation is:

$$U_{it} = \delta_0 + \delta_1 PSCRGDP_{it} + \delta_2 DBAGDP_{it} + \delta_3 LLY_{it} + \delta_4 INF_{it} + W_{it}$$

Where:-
PSCRGDP is Private Sector Credit by the Deposit Money Banks as a percentage of GDP;
DBAGDP is Domestic Bank Assets as a percentage of GDP;
LLY is Liquid Liabilities as a percentage of GDP and
INF is Inflation rate

We conduct the summary statistics for the variables and this is presented in table 1 below.

Table 1 Summary Statistics for Bank Related Variables in Nigeria (2002-2013)

`	Total Cost	Loans	Other Earning Assets	Non Interest Revenue	Price of Physical Capital	Cost of Labour	Cost of Funds
Mean	6.663	7.582	7.229	6.164	-0.637	-1.194	-1.193
Median	7.463	7.933	8.044	7.041	-0.789	-1.561	-1.343
Maximum	8.373	9.053	9.054	7.990	2.242	0	0
Minimum	0	0	0	0	-1.389	-3.271	-2.429
Std. De.	2.368	1.779	2.363	2.409	0.444	0.778	0.543
No of Obs	180	180	180	180	180	180	180

The result of the estimation is provided in table 2 below. As earlier stated, each of the three output variables is analyzed against the input and macroeconomic variables.

Table 2 Estimation Output of Cost Efficiency of Nigerian DMBs

Bank Specific Variables	Regression 1- Model with Output as Loans	Regression 2 – Model with Output as Other Earning Assets	Regression 3 – Model with Output as Non Interest Revenue
Constant	-0.10***(0.04)	-0.15***(0.15)	-0.01*(0.008)
Loans	0.02***(0.04)		
Other Earning Assets		-0.26***(0.06)	
Non Interest Revenue			1.04***(0.12)
Price of Physical Capital	-1.33***(0.72)	-0.91**(0.87)	-2.46***(0.27)
Cost of Labour	-1.97***(0.29)	-1.36(0.40)	0.38(0.22)
Cost of funds	-3.32***(0.35)	-7.57***(0.49)	1.72***(0.42)
Half Square of Loans	0.00***(0.01)		
Half Square of Other Earning Assets		0.06***(0.01)	
Half Square of Non-Interest Revenue			-0.09***(0.03)
Half Square of Price of Physical Capital	-0.01***(0.06)	0.22***(0.14)	-0.23***(0.06)
Half Square of Cost of Labour	-0.08(0.09)	0.22(0.24)	0.17***(0.03)
Half Square of Cost of Funds	-5.39***(0.44)	-4.59***(0.56)	-1.38***(0.15)
Loans*Price of Physical Capital	0.18(0.08)		
Other Earning Assets*Price of Physical Capital		0.04***(0.08)	
Non Interest Revenue*Price of Physical Capital			0.29**(0.03)
Loans*Cost of Labour	0.01(0.03)		
Other Earning Assets*Cost of Labour		0.06***(0.02)	
Non Interest Revenue*Cost of Labour			-0.09***(0.02)
Loans*Cost of Funds	-0.68(0.04)		
Other Earning Assets*Cost of Funds		-0.09***(0.04)	
Non Interest Revenue*Cost of Funds			-0.58***(0.07)
Cost of Physical Capital*Labour	-0.21***(0.07)	-0.05***(0.18)	-0.19***(0.03)
Cost of Physical Capital*Cost of Funds	0.40***(0.38)	-0.40***(0.47)	-0.05***(0.09)
Labour*Cost of Funds	-1.14***(0.11)	-0.65***(0.21)	-0.20***(0.04)
Efficiency Result			
Economic Specific Variables	Regression 1	Regression 2	Regression 3
Constant	-5.67***(1.31)	-12.51***(4.01)	-7.31***(1.12)
Private Sector Credit as % of GDP	-12.58***(2.31)	-5.10***(1.90)	-7.55***(1.09)
Inflation	20.65***(3.53)	25.12***(7.77)	17.74***(2.02)
Domestic Bank Assets as a % of GDP	-1.34***(0.99)	35.05***(10.56)	5.56***(1.00)
Liquid Liabilities as a % of GDP	-7.24***(0.92)	-8.42***(2.05)	-2.33***(0.36)
σ	5.66***(0.77)	11.49***(2.80)	1.99***(0.15)
Y	0.971***(0.001)	0.982***(0.001)	0.990***(0.00)
Log likelihood	-61.10	-140.92	-6.4865
Likelihood ratio test	351.99	225.18	415.83

Note: Figures in parenthesis ( ) are the Standard error of the variables. The symbols of ***;** and * depicts 1%; 5% and 10% level of significance for the coefficients.

The sum of variance ( ) and (variance of inefficiency term over sum of variance) are both jointly highly significant. This result suggests a proper specification of the model. Also, the likelihood ratio test of the three regression model is high, which serve as an indication of a valid specification of the model. It also implies that both and are important in the determination of cost efficiency for deposit money banks in Nigeria.

From the analysis, gamma of 0.990 is the highest for the model with non-interest revenue as the output variable. These suggest that these banks are highly efficient with cost in determining their non-interest revenue. Following this model, is the model with other earning assets as the output variable, which has 0.982 as the gamma. The third model which has Loans as the output variable has 0.971 as gamma. This suggests that cost efficiency of these banks ranges from 97.1 - 99.0 percent. The corresponding cost inefficiency of these banks ranges from 1- 3 percent. Consequently, the banks can avoid about 1 - 3 percent of cost expended in its operation if the sector operates along the efficiency frontier. This is a signal that the industry operates very close to the efficiency frontier.

The macro-economic variables included in the study are important in determining the efficiency estimates of the banking sector. The estimates for the private sector credit as a percentage of GDP shows a significant relationship and inversely related to inefficiency. That is, an increase in private sector credit will reduce the sector's inefficiency. The liquid liabilities as a percentage of GDP follows the same trend with the private sector credit as it shows a significant relationship to the efficiency of the sector. In the model with Loan as output, the coefficient of domestic bank assets as a percentage of GDP shows a negative relation which shows that an increase in domestic bank assets will tend to reduce efficiency of banks as cost will be increased as well as loan and advances.

The consistency of this result is shown in Idialu (2010) who examined the efficiency of Nigerian banks using the Stochastic Frontier Analysis (SFA). He observed cost inefficiency of the industry to range from 0-19 percentage. Also, in the research of Oluitan and Mobolaji, (2013), efficiency of Nigerian banks classified under the West African Countries indicated a high level of cost efficiency.

Summary of Findings

Prior to this investigation, the handful research which has been carried out on cost efficiency of Nigerian DMBs has showed a high level of percentage in efficiency level. This implies that the basic assumption of firms to minimize cost has to a significant level been practiced by the banks in the country. Most of the period covered in this research falls within the recapitalization period which suggests that the exercise has positively affected the level of efficiency of the banks within the country. The level of efficiency within the industry in Nigeria is higher than what obtains within the region based on past research by one of the authors of this work.

The result of this study is also consistent with previous research findings as it reports a high level of cost efficiency in operation of DMBs which varies within 97.1 to 99.0 percent. This reflects a very close range to the efficient frontier. The three models estimated with one output each show that: The model with Loans as output variable has 0.971 as gamma which signifies 97.1 percent cost efficiency of the sector in determining Loans. Furthermore the estimates of the model reports 98.2 and 99.0 percent as level of cost efficiency of the banks in determining other earning assets and non-interest revenue respectively.

Conclusions

This paper measures cost efficiency level of Nigerian banking sector during the period 2002 to 2013 by analyzing a sample of fifteen deposit money banks (DBMs). The main contribution of this paper is that it focuses on more recent years and it uses a relative large sample of fifteen Nigerian banks. The result is consistent with literature and previous researches and suggests that recapitalization has had meaningful impact in the level of efficiency of the banks in the country. As noted earlier, there is only a handful of inquiry into the efficiency of the banking sector in the Nigerian economy, as such, this study add to the existing ones and can also be sourced for reference.

Recommendations

This study measures the cost efficiency in most recent years and it is relatively comprehensive by including fifteen (15) deposit money banks. It recommends that reforms and regulation should be continuous to ensure appropriate standard that aids efficiency. Any lax in this direction can cause downward trend in the current situation. Therefore, consistency and improvement should be maintained by the regulators and management of the banks.

Suggestions for Further Research

The effect of recapitalization cannot be fully ascertained until a research is conducted for pre and post periods. Similarly, the study uses fifteen top banks that account for over 60% of banking activities. We need to ascertain if size is relevant to the level of efficiency attained in this study. All these will be our focus in future research in that area.

List of Banks Included in the Research

ACCESS BANK
DIAMOND BANK PLC
ECO BANK PLC
FIRST BANK PLC
FIRST CITY MONUMENT BANK PLC
FIDELITY BANK PLC
GUARANTY TRUST BANK PLC
SKYE BANK
STAMBIC IBTC BANK
STERLIN BANK PLC
UNITED BANK FOR AFRICA PLC
UNION BANK PLC

UNITY BANK PLC
WEMA BANK PLC
ZENITH BANK PLC

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