



A Publication of Departments of Accounting & Finance and Business Administration, Fountain University, Osogbo.  
Journal homepage: [www.osogbojournalofmanagement.com](http://www.osogbojournalofmanagement.com)

## EVALUATION OF DEPOSIT MONEY BANK'S EFFICIENCY IN NIGERIA: DATA ENVELOPMENT ANALYSIS

AJAYI, Michael Adebayo<sup>1</sup>, NAGERI, Ibraheem K.<sup>2</sup>, ABOGUN, Segun<sup>3</sup>, & ABDULMUMIN, B. Ayoola<sup>4</sup>

*Department of Finance, University of Ilorin*  
*Department of Accounting, University of Ilorin*

### Abstract

*Ability of banks to manage risk and make better use of informational disproportion between borrowers and lenders are the essence of bank's activities. The efficiency of Nigerian banks has become more compelling bearing in mind the various banking reform and regulations adopted by the Central Bank of Nigeria in recent year. The objective of this study is to evaluate the efficiency of deposit money banks quoted on the Nigerian Stock Exchange during the period of 2011-2015. The study follows the intermediation approach, using the Data Envelopment Analysis. Result indicates that the national licensed banks have better mean efficiency score in 2011, 2012, 2013, the international licensed banks are better in 2014 and the 2015 score shows no significant difference. The best performing bank with international license is GT Bank while Stanbic IBTC and Sterling bank are the joint best practice banks with national license. The inefficiency is attributed to scale inefficiency rather than pure technical inefficiency. Recommendations include that the regulatory authorities should be proactive in their function to cover aspects of loan disbursement, deposit mobilization and investment assets and ensure compliance.*

**Keywords:** Banks, Efficiency, Data envelopment, Output, Input

### 1 INTRODUCTION

The ability of banks to manage risk and make better use of informational disproportion between borrowers and lenders are the essence of bank's activities as suggested by the literatures (Koch & MacDonald 2006; Bessis 2010; Matthews & Thompson 2008; Saunders & Cornett 2008; Ibrahim 2013) on financial intermediation. These abilities are integral components of bank output which influence the managerial incentives to produce financial services prudently and efficiently (Hughes & Mester 2008).

Spong, Sullivan and DeYoung (1995) opined that efficient and effective utilization of resources have always been important in banking, but recent events such as increasing competition for financial services, technological innovation, and banking consolidation focusing

*Corresponding Author:* +2348033963850; +2348117631440

*Email:* [maajayi@unilorin.edu.ng](mailto:maajayi@unilorin.edu.ng); [adeajayi4jesus@yahoo.com](mailto:adeajayi4jesus@yahoo.com) 68

more attention on controlling costs in banking and providing services and products efficiently are bringing even greater emphasis to banking efficiency.

In Nigeria, the banking system has steadily evolved, following wide and far-reaching reforms embarked upon by the Central Bank of Nigeria (CBN), Nigerian Deposit Insurance Corporation (NDIC) and other regulatory authorities. The Universal Banking system was adopted in 2001, allowing the banks to diversify into non-banking financial businesses such as insurance, stock broking, micro finance and others. As necessity to strengthen the banks in the new model of universal banking, the 2004 consolidation programme raised the capital base of Deposit Money Banks (DMB) in Nigeria from N2 billion to a minimum of N25 billion. The aim of the 2004 consolidation programme was to drive, grow and position the banks in order for them to play important roles in driving development across the sectors of the Nigerian economy (Sanusi 2012). The 2004 consolidation reduced the number of banks from 89 to 25 in 2005, and later to 24.

In 2008, as a result of the banking crisis caused by the inherent weaknesses and fragmentation of the financial system, the CBN pronounced a guideline known as “The Project Alpha Initiative” for reforming the Nigerian financial system in general and the banking sector in particular. To address the observed challenges, the CBN in 2010, reviewed the universal banking system by directing banks to focus on their core banking business. Under the new system, licensed banks will be authorized to carry on Commercial banking (with either of regional, national or international license); Merchant (investment) banking; Specialized banking (microfinance, mortgage, non-interest banking (regional and national); and Development finance institutions which came into effect on the 15<sup>th</sup> day of November, 2010 (CBN 2010).

In 2010, the Asset Management Corporation of Nigeria (AMCON) was established with the responsibilities aimed at addressing the problem of non-performing loans in the Nigerian banking industry. DMBs in Nigeria were mandated to adopt a uniform accounting year end of 31<sup>st</sup> December to avoid regulatory arbitrage and provide level playing ground for all operators (CBN 2008) which commenced in 2009 and been extended to Other Financial Institutions (OFIs) with effect from December 2012 (CBN 2012). The DMBs have been collaborating with the regulators in the capital market to reduce the cost of transactions, especially bond issues to encourage alternative funding sources apart from banks and also attract more foreign portfolio investors into the Nigerian financial sector (Sanusi 2012). The CBN also introduced minimum regulatory capital adequacy ratio (CAR) of 15% applicable to banks with international authorisation and Systemically Important Banks (SIBs) and a CAR of 10% applicable to other banks.

Despite these steps taken by the regulatory authorities of banking in Nigeria, recently this year (2016), the CBN have to release a statement to contradict a rumour that a DMB (Skye bank which the CBN had changed its board and management in July, 2016) has been liquidated (CBN 2016). “The attention of the Central Bank of Nigeria (CBN) has been drawn to the content of a malicious message urging customers of Skye Bank to withdraw their deposits or transfer them to other banks based on the vile allegation that Skye Bank has been liquidated by the CBN”.

The CBN further stated that all banks in Nigeria are safe and depositors have no cause to fear over their deposits. Also in August, 2016, when Nigeria experienced scarcity of US Dollar, the CBN barred nine (9) DMBs from the Foreign Exchange Market (FOREX) for failure to remit over \$2 billion belonging to the Nigerian National Petroleum Corporation (NNPC)/ Nigeria Liquefied Natural Gas Company (NLNG) to the Treasury Single Account (TSA) but readmitted them back before the end of the month after the DMBs remitted all outstanding NNPC/NLNG deposits in their possession to NNPC's Treasury Single Account (TSA) at the CBN. The efficiency of Nigerian banks has become more compelling bearing in mind the various banking reform and regulations adopted by the CBN in recent years especially during the categorization of DMBs and uniform accounting year. The banking reform is still ongoing especially in order to make the banks more risk sensitive, because banking system with better resource allocation affects the economy positively, leading to increased amount of intermediation, safe and sound banking system, greater benefits for customers in terms of price and service quality, delivery and profitability (Omankhanlen, 2013).

Therefore the objective of this study is to evaluate the efficiency of DMBs quoted on the Nigerian Stock Exchange by revealing the most efficient of them whose business operations can be emulated to achieve greater efficiency. Despite the importance of evaluating bank efficiency and the enormous empirical investigations carried out on the banking sectors of several countries, it was found that developed countries have received the most attention in this area and the empirical evidence is still limited for banks belonging to developing countries which Nigeria is one. This study covers the fifteen (15) quoted DMBs in Nigeria, categorized into international and national banks based on their licensing requirements. The period that was covered during the study was 2011-2015 and the choice of the year is that all the DMBs fully complied with the uniform accounting year by 2010 and that the new categorization was effective in 2010.

## 2 LITERATURE REVIEW

The concept of efficiency measurement was introduced by Farrell (1957) based on the work of Debrue (1951) and Koopmans (1951). Farrell (1957) defined a simple measure of firm efficiency that could account for multiple inputs and proposed that the efficiency of a firm consists of two components namely, technical and price efficiency (or allocation efficiency). The first component reflects the ability of a firm to maximize output from a given set of inputs while the second reflects the ability of a firm to minimize input in optimal output propositions, given their respective prices and production technology. Koulenti (2006) assert that the combination of these two measures of efficiency provides a measure of total economic efficiency (or overall efficiency).

Omankhanlen, (2013) and Irsova, (2009) explain the return to scale concept as the degree or influence of a proportionate increase in all inputs to increase in output. If this impact is the same (changes in inputs and outputs are the same) the case is known as constant returns to scale (CRS). On the other hand, if this impact is increasing or decreasing (changes in inputs and outputs are either increasing or decreasing) the case is known as variable returns to scale (VRS). Thus, VRS can be increasing return or decreasing return to scale; increasing returns to scale is when proportionate increase in inputs results in more than proportionate increase in output while

decreasing returns to scale is when proportionate increase in inputs results in less than proportionate increase in output (Omankhanlen 2013)

The theory of efficiency evaluation is broadly divided into the non-parametric mathematical programming technique and the parametric (which is subdivided into deterministic and stochastic) technique based on econometric regression theory and uses a stochastic production cost or profit function to estimate efficiency (Bauer, Berger, Ferrier & Humphrey 1998; Ferreira 2012; Kablan 2007; Kořak, Zajc & Zorić 2009). The non-parametric approach known under the name of Data Envelopment Analysis (DEA) entails the estimation of frontier (an analysis of the relative evaluation of the efficiency on the ratio of input to output multiple situations, by taking each DMU and measuring its relative efficiency to an envelopment surface of the best DMU(s)), employing the linear programming technique to construct a piecewise linear combinations to connect a set of best practice Decision Making Units (DMU). DEA provide information on technical efficiency, do not allow for random error, and does not require an explicit functional form specification of the production function (Berger & Humphrey 1997 and Berger & Mester 1997).

DEA has been used in various studies (Karray & Chichti 2013; Garcia-Garza 2011; Ferreira 2012; Hassine & Limani 2014; Holló & Nagy, 2006; Fadiran, Ogwumike and Adenegan 2010; Omankhanlen 2013; Bwala 2003; Li 2009) to evaluate efficiency of financial institutions like banks, insurance and mutual funds to benchmark the efficiency or to estimate the efficiency of different bank in various countries. Another non parametric approach is a special case of the DEA model known as Free Disposal/Disposable Hull (FDH) where the points connecting the DEA vertices are not included in the frontier but the FDH production possibilities set is determined by the DEA vertices and the (FDH)points interior to these vertices. FDH relaxes the convexity assumption of DEA, is either congruent with or interior to the DEA frontier and generates larger estimates of average efficiency than DEA (Kořak, Zajc & Zorić 2009; Tulkens 1993; Omankhanlen 2013).

The parametric techniques based on econometric regression theory that are commonly used to estimate efficiency are the Stochastic Frontier Analysis (SFA), the Thick Frontier Approach (TFA) and the Distribution Free Approach (DFA). The stochastic frontier analysis (SFA) attempts to decompose the residual of the frontier into inefficiency and noise by making explicit assumptions about the inefficiency component's distribution and specifying a functional form for the cost, profit or production relationship among inputs, outputs and environmental factors (Holló & Nagy 2006; Omankhanlen 2013; Irsova, 2009).

The Thick Frontier Analysis (TFA) employs the same functional form for the frontier cost function as SFA, based on regression estimates of only the ostensibly best performers in the DMU. The regression estimates are then used to obtain the best practice cost for all of the firms in the data set (Berger & Humphrey 1991). DMUs in the lowest average cost quartile are assumed to have above average efficiency and thus form a —thick frontier. If cost a particular DMU is higher than thick frontier (best performing DMU) then that particular DMU is cost inefficiency (Kořak, Zajc & Zorić 2009).

Distribution Free Approach (DFA) is based on panel data approach but DFA avoids the strong distributional assumptions of the SFA by introducing a distribution free model. DFA

advantage is not only applicability of panel data but it allows the co-efficient to vary over time. DFA specifies a functional form for the cost function like SFA and TFA, but separates inefficiencies from random error in a different way (Omankhanlen 2013). Empirically, literatures on bank efficiency is substantial and heavily geared towards studies of U.S banks followed by European banks at a distant second while the study in less developed countries (including Nigeria) is relatively small (Kořak, Zajc & Zorić 2009). Ferreira (2012) study the effects of the banking institutions efficiency, measured through DEA, and of the concentration of the bank markets on economic growth in 27 European Union (EU) countries for the time period between 1996 and 2008 and findings indicates positive effect of bank cost efficiency on economic growth as previously conclude by King and Levine, 1993; Levine and Zervos, 1998; Hassan, Sanchez and Yu 2011. While the bank market concentration indicates negative also in line with Cetorelli and Gambera (2001) result.

Bonin, Hasan and Wachtel (2005) evaluates bank efficiency in eleven (11) transition countries focusing on efficiency-ownership relationship using the SFA procedure. The result shows that private domestic ownership is insufficient to ensure bank efficiency while foreign owned banks are cost efficient. Hassine and Limani (2014) analyses the efficiency of Islamic banks in the Middle East and North Africa (MENA) region over the period of 2005-2009 employing DEA, and the impact of the banking characteristics on the efficiency scores. The result shows that the dominant source of overall inefficiency of these banks is organizational (technical inefficiency) rather than regulatory (allocative inefficiency).

Irsova (2009) compared the variations of SFA and DEA results of 32 studies on the USA and 14 on the transitional countries using the meta-regression approach. The result indicates that efficiency score is determined by the design of methodology, the largest variation in the estimated scores of SFA and DEA are due to Fourier-flexible functional form application and the rank order correlation between SFA and DEA increase with an increase in the homogeneity degree in the sample. Shahid, Rehman, Niazi and Raof (2010), compare the efficiency of conventional and Islamic Banks in Pakistan using a sample of five (5) banks each over the period of 2005-2009. The DEA result indicates that conventional banks is technically efficient than Islamic banks. Karray & Chichti (2013) employs DEA using a panel data of 402 commercial banks from 15 developing countries over the period of 2000-2003 to assess the effect of bank size on technical efficiency. The results shows that all size of banks except the largest banks which shows high levels of scale inefficiency are technically inefficient at a total average of 46% due to pure technical inefficiency for all size of banks except the largest banks for which we found high levels of scale inefficiency.

In Nigeria, one of the pioneer studies include Ayadi, Adebayo and Omolehinwa (1998) examine the quality of bank management using the DEA and found that the relatively efficient banks in Nigeria are those that have been in existence for a long period of time. Recently, Fadiran, et al. (2010) evaluates the efficiency of insured banks in Nigeria and observed fluctuations in the performance of the banks. The number of efficient banks increases and decreases over time and banks performing below the mean also increased over time.

Oke and Poloamina (2012) investigates some cost efficiency correlates of fifteen DMBs in Nigeria over the period 2001-2008 applying the random effects Tobit regression to estimate

the correlates of cost efficiency obtained from DEA. The findings revealed net assets as a better index for measuring bank size-efficiency other than total assets. Omankhanlen (2013) investigates Nigerian banks efficiency performance during the period of 2005-2009 employing the DEA under the assumptions of CRS, VRS and Scale Efficiency (SE) to estimate the efficiency scores. Findings revealed that GTB is the most efficient bank and it has the least reduction in inputs to produce the same magnitude of output while Unity bank, Afribank and UBA did not achieve full efficiency under the CRS, VRS and SE in any of the five years.

Ajisafe and Akinlo (2014) examined the relationship between competition and efficiency of commercial banks in Nigerian during the period of 1990 – 2009 by employing the pooled least square and dynamic panel generalised method of moment estimation technique with fixed effect. The result shows that there is positive and significant relationship between the degree of competition and efficiency of commercial banks in Nigeria. Owolabi and Ajayi (2013) made a comparative analysis on the financial efficiency of banks in the pre and post-merger and acquisitions of banks in Nigeria by applying t-test statistics and the result indicates that the banks were more financially efficient in the post-mergers and acquisitions period.

Okorie and Agu (2015) investigates the impact of Nigerian banking sector reforms on Nigerian banks' performance, efficiency and the determinant in the pre and post consolidation period, adopting DEA. The finding shows varying levels of efficiency in both periods. In the post-consolidation period, some banks still remained inefficient, but is a general improvement in efficiency.

### **3 METHODOLOGY**

One major problem in the study of bank efficiency is the specification of bank inputs and outputs. There has been long-standing disagreement over what banks produce and the most debatable issue is the role of deposits, whether deposit is input and/or output variable. Elyasiani and Mehdiian (1990); Lang and Welzel (1996) treat deposit as inputs, Humphrey (1991); Ferrier and Lovell (1990) treat deposits as outputs while others like Humphrey (1990) and Aly, Grabowski, Pasurka, and Rangan, (1990) treat deposit as both inputs and outputs (Tahir, Bakar & Haron 2009).

There are two (2) ways of measuring bank outputs namely; the production approach and the intermediation approach. In the production approach, banks produce accounts of various sizes by processing deposits and loans by incurring capital and labour costs while banks are treated as financial intermediaries that combine deposits, labour and capital to produce loans and investments in the intermediary approach (Fereira 2012 and Tahir et al. 2009).

Studies on efficiency is usually based on the estimation of efficiency frontiers with the best combinations of inputs and outputs and then on the analysis of the deviations from the frontier which correspond to the losses of efficiency. Thus, this study follows the intermediation approach as done by Fereira (2012) and Tahiret al. (2009) using the Data Envelopment Analysis (DEA) under the assumptions of constant return to scale (CRS) and the variable return to scale (VRS). VRS score represents pure technical efficiency (PT), whereas constant returns to scale (CRS) represent technological efficiency while the deviation of the frontier of CRS from the

VRS frontier represents Scale Efficiency (ration of CRS to VRS). The input combination used for this study is –total deposits and total equity while the outputs combination is - total loans extended, net profits and investment securities which is the modification of Omankhanlen, (2013).

The linear programming technique is used to find the set of coefficients (*u*'sand *v*'s) that will give the highest possible efficiency ratio of outputs to inputs for the DMU being evaluated. The mathematical model of DEA is given as:

$$\text{Maximise } \theta = \frac{u_1y_{1o} + u_2y_{2o} + u_3y_{3o} + \dots + u_r y_{ro}}{v_1x_{1o} + v_2x_{2o} + v_3x_{3o} + \dots + v_m x_{mo}} = \frac{\sum_{r=1}^s u_r y_{ro}}{\sum_{i=1}^m v_i x_{io}} \dots \dots (1)$$

(Maximize the efficiency rating  $\theta$  for DMU o)

Subject to the constraint that same set of *u* and *v* coefficients is applied to all other DMUs being compared, no DMU will be more than 100% efficient such that;

$$\begin{aligned} DMU1 &= \frac{u_1y_{11} + u_2y_{21} + u_3y_{31} + \dots + u_r y_{r1}}{v_1x_{11} + v_2x_{21} + v_3x_{31} + \dots + v_m x_{m1}} = \frac{\sum_{r=1}^s u_r y_{r1}}{\sum_{i=1}^m v_i x_{i1}} \leq 1 \\ DMUo &= \frac{u_1y_{1o} + u_2y_{2o} + u_3y_{3o} + \dots + u_r y_{ro}}{v_1x_{1o} + v_2x_{2o} + v_3x_{3o} + \dots + v_m x_{mo}} = \frac{\sum_{r=1}^s u_r y_{ro}}{\sum_{i=1}^m v_i x_{io}} \leq 1 \\ DMUj &= \frac{u_1y_{1j} + u_2y_{2j} + u_3y_{3j} + \dots + u_r y_{rj}}{v_1x_{1j} + v_2x_{2j} + v_3x_{3j} + \dots + v_m x_{mj}} = \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1 \end{aligned}$$

$$u_1, \dots, u_s > 0 \text{ and } v_1, \dots, v_m \geq 0$$

DEA accommodates multiple inputs and outputs and provides significant information about where efficiency improvements can be achieved and the magnitude of the potential improvements (Sherman & Zhu 2006).

The fractional form of equation 1 in algebraic formulation is given as:

$$\text{Maximise } \theta = u_1y_{1o} + u_2y_{2o} + u_3y_{3o} + \dots + u_r y_{ro} (= \sum_{r=1}^s u_r y_{ro})$$

Subject to the constraint that

$$v_1x_{1o} + v_2x_{2o} + v_3x_{3o} + \dots + v_m x_{mo} = \sum_{i=1}^m v_i x_{io} = 1$$

$$u_1y_{1j} + u_2y_{2j} + u_3y_{3j} + \dots + u_r y_{rj} \leq v_1x_{1j} + v_2x_{2j} + v_3x_{3j} + \dots + v_m x_{mj}$$

The standard mathematical notation of the above expression is:

$$\sum_{r=1}^s u_r y_{rj} \leq \sum_{i=1}^m v_i x_{ij}$$

Thus, the DEA model is actually calculated as:

$$\text{Maximise } \sum_{r=1}^s u_r y_{ro}$$

Subject to

$$\sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0, j = 1, \dots, n$$

$$\sum_{i=1}^m v_i x_{io} = 1$$

$$u_r, v_i \geq 0$$

Where there are  $n$  DMUs.

To obtain the efficiency reference set (peers and peers weight) for DMUs, the dual linear programming model is employed, given as:

*Minimise*  $\theta$

Subject to

$$\sum_{j=1}^n \lambda_j x_{ij} \leq \theta x_{io} \quad i = 1, 2, 3, \dots, m; \quad (i)$$

$$\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, 3, \dots, s; \quad (ii)$$

$$\lambda_j \geq 0 \quad j = 1, 2, 3, \dots, n \quad (iii)$$

The dual linear programming model is seeking the efficiency rating, *Minimise*  $\theta$  subject to the constraint:

- (i) That the weighted sum of the inputs of the other DMUs is less than or equal to the inputs of the DMUs being evaluated.
- (ii) That the weighted sum of the outputs of the other DMUs is greater than or equal to the service unit being evaluated.
- (iii) The weights are the  $\lambda$  (lambda) values.

The other DMUs with non-zero lambda values are the units in the Efficiency Reference Set (ERS). When DEA tries to *Minimise*  $\theta$  for the DMU being evaluated and it cannot find  $\lambda$  weights that will generate efficiency level below 1 or 100%, such DMU is therefore an efficient DMU when there is no opportunity to improve efficiency compared with the performance of other DMUs in the data set. The DMUs in this study are the quoted DMBs in Nigeria which are Fifteen (15) as at August 2016. The DMBs are categorized as either national or international

based on their license of operation. The data collected from the financial statements of the DMBs and the range covers the period of 2011-2015.

#### 4 RESULT AND DISCUSSION

**Table1: Efficiency scores for the international licensed DMBs in each year**

International Licensed DMBs	2011		2012		2013		2014		2015	
	CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS
Access bank	0.832	0.986	0.915	1.000	0.759	0.910	0.897	1.000	0.909	1.000
Diamond Bank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.756	1.000
First Bank	1.000	1.000	1.000	1.000	0.984	1.000	1.000	1.000	1.000	1.000
FCMB	1.000	1.000	0.945	1.000	0.770	0.935	1.000	1.000	0.934	1.000
Fidelity Bank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
GTBank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Skye Bank	1.000	1.000	1.000	1.000	1.000	1.000	0.942	1.000	1.000	1.000
Union Bank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UBA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Zenith Bank	0.731	0.747	0.843	0.933	0.844	0.847	1.000	1.000	1.000	1.000
Mean	0.956	0.973	0.970	0.993	0.936	0.969	0.984	1.000	0.960	1.000

**Source:** Author's Computation, 2016.

**Table 2: International licensed DMBs Efficient Reference Set**

Year	Bank	Peer summary	Peer weight
2011	Access Bank	FCMB	0.721
		GTBank	0.279
	Zenith Bank	UBA	0.197
		GTBank	0.001
		Fidelity Bank	0.661
		Skye Bank	0.141
2012	Zenith Bank	Skye Bank	0.226
		GTBank	0.001
		Fidelity bank	0.773
2013	Access Bank	Diamond Bank	0.441
		GTBank	0.559
	FCMB	GTBank	0.242
		Diamond Bank	0.372
		First Bank	0.386
	Zenith Bank	GTBank	0.001
		Skye Bank	0.999
2014	None	None	None
2015	None	None	None

**Source:** Author's Computation, 2016.

Table 1 give results of efficiency scores estimated according to the output orientated DEA method for international licensed and quoted DMBs in Nigeria respectively under the

assumption of CRS and VRS. The average efficiency score over all the period is 0.96 for CRS and 0.99 with VRS. Individually, in 2011, all the DMBs are efficient under both CRS and VRS except Access and Zenith banks. Access bank is peered to FCMB and GTBank with peer weight of 0.721 and 0.279 respectively (see table 2) which indicates that access bank need to use a combination of 72% and 28% of the input of FCMB and GTBank respectively (which is less than its current combination of inputs) to have its current output. Zenith bank is peered with UBA, GTBank, Fidelity bank and Skye bank with peer weight of 0.197, 0.001, 0.661 and 0.141 respectively which indicates that Zenith bank need to use a combination of 19.7%, 0.1%, 66.1% and 14.1% of the inputs of UBA, GTBank, Fidelity bank and Skye bank (which is lower to have its current input) to have its current output. Access bank has decreasing return to scale while zenith bank has an increasing return to scale and other banks has constant return to scale.

In 2012, Access bank and FCMB have less than 100% (above 90%) efficiency score in CRS but with 100% efficiency under VRS, Zenith bank have less than 100% efficiency score in both CRS and VRS scores while other internationally licensed and quoted banks are efficient under CRS and VRS. Only Zenith bank has peer with Skye bank, GTBank and Fidelity bank with peer weights of 22.6%, 0.1% and 77.3% respectively indicating that zenith bank need a combination of 22.6%, 0.1% and 77.3% of the inputs of Skye bank, GTBank and Fidelity bank (which is less than its current input combination) to produce its current output. On return to scale, Access bank and FCMB has decreasing return to scale while zenith bank has an increasing return to scale and all other banks in the category has constant return to scale in 2012.

In 2013, Access, FCMB and Zenith banks have less than 100% efficiency score in both CRS and VRS (Access and FCMB have above 90% under VRS), First bank have less than 100% efficiency under CRS but 100% efficiency under VRS while other internationally licensed and quoted banks are efficient under both CRS and VRS. Access bank has peer with Diamond and GTBank with peer weights of 44.1% and 55.9% respectively indicating that access bank should have used the combination of 44.1% and 55.9% of the inputs of diamond and GTBank (which is less than its current input combination) to produce its current output.

FCMB has peer with GTBank, Diamond bank and First bank with peer weights of 0.242, 0.372 and 0.386 respectively indicating that FCMB should have used the combination of 24.2%, 37.2% and 38.6% of the inputs of GTBank, Diamond bank and First bank respectively (which is less than its current input combination) to produce its current output. Zenith bank has peer with GTBank and Skye bank with peer weights of 0.1% and 99.9% respectively indicating that Zenith bank should have used the combination of 0.1% and 99.9% of the inputs of GTBank and Skye bank (which is less than its current input combination) to produce its current output. Access bank, First bank, FCMB and Zenith bank has decreasing return to scale while other banks in the category have constant return to scale in the year.

In 2014 and 2015, all internationally licensed and quoted banks are efficient under the VRS in both years while Access bank and Skye bank has less than 100% (but attain 90%) efficiency under CRS in 2014 and Access bank, Diamond bank and FCMB has less than 100% (Access bank and FCMB attain above 90% and diamond bank attain 76%) efficiency under CRS in 2015. All the banks has no peer, no peer weight and no peer count indicating that the banks have significantly improved their efficiency in 2014 and 2015. During 2014, Access bank has

decreasing return to scale while Skye bank has an increasing return to scale and other banks in the category has constant return to scale. In 2015, Access bank, Diamond bank and FCMB has decreasing return to scale and other bank in the category has constant return to scale.

**Table 3: Efficiency scores for the national licensed DMBs in each year**

National Licensed DMBs	2011		2012		2013		2014		2015	
	CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS	CRS	VRS
Ecobank	1.000	1.000	1.000	1.000	0.986	1.000	1.000	1.000	1.000	1.000
Stanbic IBTC	1.000	1.000	0.905	1.000	1.000	1.000	1.000	1.000	N.A	N.A
Sterling Bank	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Unity Bank	0.779	0.908	1.000	1.000	1.000	1.000	0.933	1.000	1.000	1.000
Wema Bank	1.000	1.000	1.000	1.000	1.000	1.000	0.729	0.824	0.875	1.000
Mean	0.956	0.982	0.981	1.000	0.997	1.000	0.932	0.965	0.969	1.000

**Source:** Author's Computation, 2016.

**Table 4: International licensed DMBs Efficient Reference Set**

Year	Bank	Peer summary	Peer weight
2011	Unity Bank	Stanbic IBTC	0.799
		Ecobank	0.109
		Sterling Bank	0.092
2012	None	None	None
2013	None	None	None
2014	Wema Bank	Unity Bank	0.285
		Sterling Bank	0.259
		Stanbic IBTC	0.456
2015	None	None	None

**Source:** Author's Computation, 2016.

Table 3 give results of efficiency scores estimated according to the output orientated DEA method for quoted DMBs with licensed to operate nationally in Nigeria under the assumption of CRS and VRS. The average efficiency score over all the period is 0.97 for CRS and 0.99 with VRS. Annually for individual banks in 2011, only Unity bank has less than 100% efficiency in 2011 from both CRS and VRS while other banks in the category attain 100% efficiency score. Unity bank is peered to Stanbic IBTC, Ecobank and Sterling bank with peer weight of 0.799, 0.109 and 0.092 respectively (see table 4) which indicates that Unity bank need to use a combination of 79.9%,10.9% and 9.2% of the input of Stanbic IBTC, Ecobank and Sterling bank respectively (which is less than its current combination of inputs) to have its current output. Unity bank has decreasing return to scale and other bank has constant return to scale.

In 2012, Stanbic IBTC has less than 100% (above 90%) efficiency score in CRS but with 100% efficiency under VRS. Despite having less than 100% efficiency under CRS, Stanbic IBTC bank does not have any peer for improved utilization of input and all other banks achieve 100% efficiency under both CRS and VRS with no peer summary and no peer weight. This indicates that none of the nationally licensed DMBs showed a significant better utilization of

input than the other in the year. Stanbic IBTC has an increasing return to scale and other bank has constant return to scale.

During the year 2013, Ecobank did not achieve 100% (above 90%) efficiency under CRS but achieves 100% efficiency under VRS. Ecobank does not have any peer for improved utilization of input and all other banks achieved 100% efficiency under both CRS and VRS with no peer summary and no peer weight. This shows that none of the DMBs in this category showed a significant better utilization of input than the others in the year. Ecobank has decreasing return to scale and other bank has constant return to scale. In 2014, Unity bank have less than 100% (above 90%) efficiency score under CRS but 100% efficiency under VRS, Wema bank have less than 100% efficiency under both CRS and VRS while other national licensed and quoted banks are efficient under both CRS and VRS. Wema bank has peer with Unity bank, Sterling Bank and Stanbic IBTC Bank with peer weights of 0.285, 0.259 and 0.456 respectively indicating that access bank should have used the combination of 28.5%, 25.9% and 45.6% of the inputs of Unity bank, Sterling Bank and Stanbic IBTC Bank respectively (which is less than its current input combination) to produce its current output. Both Unity and Wema banks have decreasing return to scale and other bank has constant return scale in the year.

In 2015, Wema bank has below 100% efficiency score under CRS but has 100% efficiency score under VRS but the result of Stanbic IBTC is not available as at the time of this study. The other banks in the category have 100% efficiency under both CRS and VRS efficiency scores. There was no peer and no peer weight which indicates that none of the nationally licensed DMBs showed a significant better utilization of input than the other in the year. Wema bank has increasing return to scale and other banks except Stanbic IBTC (result not available) has constant return to scale.

The result analysis showed that many licensed DMBs are efficient under the new guidelines with respect to the grant of licenses, authorisations and scope of operations for DMBs in Nigeria which commenced in 2010. The best performing DMB with international license is GTBank based on the number of peers it has (6 peers) over the year 2011 till 2013 while Stanbic IBTC and Sterling bank are the joint best practice bank in the national licensed category with two (2) peer over the year 2011 till 2015. Over all, the national licensed banks has better mean efficiency score in 2011, 2012, 2013, while the international licensed banks has better mean efficiency score in 2014 and the 2015 mean efficiency score shows no significant difference. The inefficiency of DMBs in Nigeria is attributed to scale inefficiency rather than pure technical inefficiency.

## 5 CONCLUSION AND RECOMMENDATIONS

This study evaluates the efficiency of quoted DMBs in Nigeria using DEA approach during the era of new licensing, authorisations and scope of operations for DMBs in Nigeria covering the periods of 2011-2015. The empirical review shows diverse result from past periods based on changes in the number of banks due to policy changes in the scope of operations for DMBs which has always been subject to changes in order to accommodate each period's peculiarities for banking operation in Nigeria. The paper follows the intermediation approach using the input combination of total deposits and total equity while the outputs combination is total loans

extended, net profits and investment securities. All variables are annual data source from annual audited financial result of the banks covering the periods of 2011 to 2015.

Findings reveals that many licensed DMBs are efficient under the new guidelines with respect to the grant of licenses, authorisations and scope of operations for DMBs in Nigeria which commenced in 2010. The best performing DMB with international license is GTBank based on the number of peers it has (6 peers) over the year 2011 till 2013 while Stanbic IBTC and Sterling bank are the joint best practice bank in the national licensed category with two (2) peer over the year 2011 till 2015. In conclusion, the national licensed banks has better mean efficiency score in 2011,2012, 2013, while the international licensed banks has better mean efficiency score in 2014 and the 2015 mean efficiency score shows no significant difference. The results also indicates that the quoted DMBs in Nigeria with international license inefficiency is attributed to scale inefficiency rather than technical and/or technological inefficiency while the DMBs with national license inefficiency is also attributed to scale inefficiency and not technological and/or technical efficiencies.

As a result of the findings in this paper, the following recommendations were proffered for policy consideration; the CBN and the NDIC should be proactive and viable in their regulatory framework and supervisory function of the DMBs covering all aspect such as loan disbursement, deposit mobilization, investment assets of the DMBs if conform to regulatory specification. Investors in bank stock and shares should also be protected by ensuring that the DMBs have the required capital adequacy ratio as measurement of competence. Auditors of financial reports of DMBs can also be hold responsible by CBN and NDIC for improper representation in financial statements that is duly certified as true and fair by the auditor after investigation. Based on the evidence obtained from the profits / losses (as a measure of risk) declared by the banks during the period under study, banks and the regulatory authorities need to be more serious with Risk assessment and management. Some of the banks should adjust their operations in order to be efficient. For example international licensed bank can study the operation of GTB as the best performing bank in the group while Stanbic IBTC and Sterling bank can be studied by other bank in the national licensed category.

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Corresponding Author: +2348033963850; +2348117631440

Email: [maajayi@unilorin.edu.ng](mailto:maajayi@unilorin.edu.ng); [adeajayi4jesus@yahoo.com](mailto:adeajayi4jesus@yahoo.com) 80

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