# How far has Banks' Efficiency Changed Overtime in Nigeria? An Empirical Investigation

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***Abstract***

*This study investigates how banks' efficiency has changed overtime in Nigeria. The study applied Data Envelopment Analysis technique to obtain efficiency estimates such as technical efficiency, pure technical efficiencyand scale efficiency for the period 2007 – 2012. The Malmquist Productivity Index, which measures technical change and efficiency change, was also obtained. The results suggests mixed developments in terms of technical, pure technical and scale efficiencies of banks during the assessment period. Average pure technical efficiency at 39.8 percent is higher than the scale and technical efficiencies at 30.0 and 24.5 percent, respectively, while average technical change and efficiency change index were at 1.2 and 2.3 points, respectively.*

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**Key words:** Efficiency, Data Envelopment Analysis, Banking sector.

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## I. Introduction

Banks, particularly in developing economies play a catalytic role in mobilizing investible funds which aids economic growth. Through their intermediation role, banks serve as 'quality controllers' in guiding capital to profitable projects in order to ensure higher returns and accelerate the growth of output. The extent to which banks succeed in meeting these expectations in the economic space is to a large extent dependent on their efficiency. This is because like all other processes, banking depends on a combination of inputs to generate outputs.

Thus, efficiency connotes that a bank should use a minimum of inputs to generate the maximum level of output given of course, the constraints imposed by the operating environment. In other words, efficiency is the ratio of output to input. There is higher level of efficiency if either the same level of input is used to produce more output or the same level of output is attained with a lower level of input. Efficiency measure reaches optimum level at a point where the highest possible output per unit of input is attained and it will only take technological or

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other changes in the production process to further increase efficiency (Sherman and Zhu, 2006).

Evidences abound from a number of studies (Thierry Buchs and Johan Mathisen, 2005, Sandrine Kablan, 2010, Spong et al. 2013) to show that banks that are efficient enjoy substantial cost and competitive advantages over their counterparts that are not. In terms of economy-wide benefits, a higher level of efficiency in the banking system would enhance financial stability, product innovation and increase access to financial services to households and firms. Efficiency has been at the core of the various banking sector reform efforts across the globe through banking consolidation, merger and acquisition, and technological innovation. Increasing attention has been focused on controlling costs in banking and providing services and products more efficiently.

Nigeria has not been short of efforts at repositioning the banking system for greater efficiency. For instance, the 2004 banking consolidation exercise which shrunk the number of banks from 89 marginal banks to 25 (and later reduced to 24) better capitalized institutions was generally adjudged to be successful. This measure was applauded both locally and internationally having restored the hitherto waning public confidence in the banking system.

However, in the face of this seeming progress in the banking system since 2004, there has been no empirical study to ascertain the level of efficiency of Nigerian banks. There is need to gauge the extent to which policy measures and their outcomes in the banking system have impacted on the level of efficiency of Nigerian banks. As noted by Berger and Humphrey (1997) *"the information obtained from efficiency studies could be used to: assess the effects of deregulation, mergers or market structure on efficiency; address research issues by describing the efficiency of an industry, ranking firms, or checking how measured efficiency may be related to different efficiency techniques employed; and improve managerial performance by identifying 'best practices' and worst practices' associated with high and low measured efficiency, respectively, and encouraging the former practices while discouraging the latter".*

There are a lot of empirical studies on efficiency of the banking system in developed economies and only few on emerging and developing countries. This work would, therefore, provide a basis for evaluating the success of the far-reaching banking sector reforms that have been implemented in Nigeria.

Against this background, the objective of this paper is to investigate how the various reform measures have impacted on banks' efficiency over the period 2007 to 2012. The paper is divided into five sections. Following this introduction,

section two presents a review of related literature, while section three gives overview of recent banking sector reforms in Nigeria since 2004. Section four contains the methodology, efficiency measurement, data used for the study and the findings, while section five concludes the paper.

## II. Review of Related Literature

There is an enormous literature on bank efficiency discussing different aspects such as the role of bank consolidation, merger and acquisition, ownership, bank risk, bank size; and differences in the regulatory framework and its impacts on banking efficiency, aimed to facilitates banks' growth and reposition them for effective performance.

Berger and Humphrey (1997) in their research work on efficiency of financial institutions surveyed 130 studies in 21 countries using five different approaches to efficiency measurement, namely: data envelopment analysis (DEA), free disposal hull approach, (FDA), stochastic frontier approach (SFA), distribution free approach (DFA) and the technical frontier approach (TFA). They found that the various efficiency approaches did not necessarily yield consistent results. The efficiency estimates of the non-parametric DEA were similar to those of the parametric frontier models SFA, DFA and TFA. But the non-parametric method generally yielded slightly lower mean efficiency estimates and seemed to have greater dispersion than the result of the parametric model. They suggested some improvements that could bring about a more consistent, accurate and useful efficiency estimates for financial institutions in the areas of government policy, research and managerial performance.

Elyasiani and Mehdian (2006), conducted a study on the comparative efficiency performance of small and large US commercial banks in the pre and post deregulation periods, to investigate whether the relative efficiency performance of small and large banks has changed following the changes in the banking environment in the 1980s as well as contrast the rate of technological change achieved by these two groups of banks over this time period. Using a flexible non-parametric approach to contrast the productive efficiency of a sample, the study finds that in the pre-deregulation environment small banks were more efficient than the large banks, while in the deregulated environment small and large banks were equally efficient. Further analysis suggests that small and large banks possessed separate and dissimilar best practice frontiers. The efficiency patterns of the two sample groups may, therefore, suggest a correlation with distinct characteristics of the markets and environments in which they operated. The evidence in this study corroborated with the findings reached under the assumption of identical frontiers.

Favero and Papi (2006), conducted a study on technical efficiency and scale efficiency on the Italian banking sector, using a non-parametric data envelopment analysis approach. The objective of the paper was to produce econometric measures of efficiency for the Italian banking sector comparable with the one proposed in the literature for the US and European banking industries. Technical and allocative efficiencies were established.This result was robust to adjustments in the specification of input and outputvariables suggested by the intermediation approach and by the asset approach. In addition, the authors applied regression analysis on a bank-specific measure of inefficiency to investigate determinants of banks' efficiency. They concluded that efficiency is best explained by productive specialization, size and, to a lesser extent, by location.

A similar work was conducted by Fukuyama (2006) on the technical and scale efficiency of Japanese commercial bank, with the objective of investigating banks' efficiency structure, using a non-parametric approach. The result suggests that the major cause of overall technical inefficiency was pure technical inefficiency. In addition, the findings revealed the existence of elements of scale inefficiency. The author further compared statistically the relationship between the bank's status and size and the various efficiency scores. In terms of Spearman's rank correlation analysis, evidence of pure and overall efficiency was almost the same as the five-level classification analysis.

In their study on "Bank Efficiency and Competition in Low-Income Countries: The Case of Uganda", Hauner and Peiris, (2005) analyzed the impact of the far-reaching banking sector reforms undertaken in the country, which aimed at improving competition and efficiency. Using the DEA models, they found an increase in the level of competition and noted that this was associated with a rise in the level of efficiency. They also noted that, on average, larger banks and foreign-owned banks had become more efficient, while smaller banks were less-efficient in the face of increased competitive pressure. They, however, expressed concern that the state-dominated, inefficient, and fragile banking systems in many low-income countries, especially in sub-Saharan Africa, were major hindrance to economic growth.

A related study by Buchs and Mathisen (2005) on "Competition and Efficiency in Banking: Behavioral Evidence from Ghana", assessed the degree of bank competition while discussing efficiency with regard to banks' financial intermediation. They applied panel data to variables derived from a theoretical model and found evidence of a non-competitive market structure in the Ghanaian banking system, which they noted, could hamper financial intermediation. They argued that the structure, as well as the other market

characteristics, constitutes an indirect barrier to entry thereby shielding the large profits in the Ghanaian banking system. Their analysis suggested that achieving effective fiscal adjustment may be a necessary condition to deepen and increase the efficiency of the Ghanaian banking system.

Obafemi (2012) applied the data envelopment analysis (DEA) approach to study the technical efficiency of Nigerian banks from 1984 to 2004. The result showed that on the average, Nigerian banks were not efficient within the study period. However, it showed that liberalization improved the efficiency of banks in Nigeria, though the improvement did not last as the efficiency of some of the banks waned with continued liberalization. This, they noted tended to support the consolidation exercise. Furthermore, the study showed that the efficiencies of some of the banks that collapsed during the 2004 consolidation exercise were continually on the decline. It also showed that privately owned banks were more efficient than publicly owned banks within the period of study.

Also, a study by Olaosebikan (2009) investigated the efficiency of the Nigerian banking system between 1999 and 2005. Bank efficiency was evaluated using data envelopment analysis (DEA) and the main determinants were identified using a Tobit model. The results indicated that efficiency fluctuated during the first part of the period and improved during the recent years, a period associated with the increase in minimum capital requirement. Differences in bank efficiency were explained by problematic loans and bank size.

## III. Overview of Recent Banking Sector Reforms in Nigeria

The experiences of many countries have shown that regular reforms in the banking sector remain indispensable for a stable, healthy and efficient financial system. The need for reforms becomes greater with increasing sophistication in financial products and prevalent policy imperatives. The Nigerian banking sector has witnessed a number of reforms over the years largely in response to distress in the sector, often resulting from poor corporate governance principles, undercapitalization, inadequate supervision and regulation as well as macroeconomic imbalances and policy ineffectiveness.

The recent reforms in the Nigerian banking sector was necessitated by both the impact of the 2007/2008 global financial crisis and some of the outcomes of the 2004 banking sector consolidation programme. The 2004 banking consolidation exercise was adopted as part of the dynamic process for promoting the safety, soundness and stability of the Nigerian banking system, following a comprehensive assessment that revealed severe weaknesses, including low capital base; weak corporate governance; gross insider abuses that resulted in huge toxic assets; over-dependence on public sector funds and income from

foreign exchange trading; neglect of small and medium scale savers; an oligopolistic structure of the banking system as the first 10 banks accounted for more than 70 per cent of total deposits and assets; etc. The policy thrust of the consolidation exercise was to grow the banks and position them to play pivotal roles in driving development across the sectors of the economy. As a result, banks were consolidated through mergers and acquisitions, raising the capital base from N2 billion to a minimum of N25 billion, which reduced the number of banks from 89 to 25 in 2005, and later to 24.

Beyond the recapitalization of the banks, the regulatory reforms also emphasized risk-focused and rule-based regulatory framework, zero tolerance in regulatory framework to information rendition and infraction; strict enforcement of corporate governance principles in banking. Other measures included the revision and updating of relevant laws for effective corporate governance and ensuring greater transparency and accountability in the implementation of banking laws and regulations, as well as the introduction of a flexible interest rate based framework that made the monetary policy rate the operating target.

According to Sanusi 2010, the consolidation programme resulted in a number of positive gains, which included the emergence of well capitalized banks. However, the ensuing moral hazard of a bourgeoning system soon resulted in financial fragility. The banking industry was badly affected as some banks were in grave condition and faced liquidity problems, owing to their significant exposure to the capital market in the form of margin lending. Furthermore, in the wake of high oil prices in the international oil market, a section of the industry had extended huge facilities to the operators in the oil and gas sectors, particularly those operating at the downstream segment. As crude oil prices tumbled during the crisis, most of these facilities became non-performing and banks that were significantly exposed to the sector were badly affected.

As part of its liquidity support, the CBN Discount Window was expanded in October 2008 to accommodate money market instruments such as Bankers' Acceptances and Commercial Papers in order to avert a liquidity crisis. With the Expanded Discount Window (EDW) in place, banks took advantage of this facility and increased their commitment. It turned out that a significant number of them became totally dependent on it for survival. When the CBN closed down the EDW and, in its place, guaranteed inter-bank placements, it was observed that the same number of banks were the main net-takers under the guarantee arrangement, indicating that they had a deep-rooted liquidity problem.

In order to address these issues and ensure financial stability in the system, the CBN decided to ascertain the true state of the health of the banks by first

carrying out a joint special examination (CBN/NDIC) of all the banks in June 2009 to review, evaluate and determine the quality of the banks portfolios. The findings of the special examination revealed several infractions including: substantial non-performing loans, poor corporate governance, management, weaknesses, insufficient capital adequacy and illiquidity.

In addition to the above, some other internally interdependent factors that led to the crisis experienced in the banking sector in the post-consolidation era included: inadequate regulatory and supervisory frameworks, inadequate disclosure and lack of transparency among operators, instability in macro-economic variables, lack of investor and consumer education and poor business environment. These problems necessitated the 2009 banking reforms initiated by the CBN.

Thus, the CBN moved decisively to strengthen the industry, protect depositors and creditors and restore public confidence and safeguard the integrity of the Nigerian banking industry by replacing the top management of eight out of the ten banks that were identified as the source of instability in the industry. The CBN injected the sum of ₦620.0 billion or about $4.1 billion into the affected banks in the form of Tier II capital in an effort to prevent a systemic banking crisis. The Boards of the remaining two were directed to recapitalize as they were adjudged to have insufficient capital for their levels of operation. Arrangements were also made to recover non-performing loans from the banks' debtors, while guaranteeing all foreign credits and correspondent banking commitments of the affected banks.

As an additional measure to strengthen the reform process, the CBN initiated a blueprint for reforming the Nigerian financial system in general and the banking sector in particular in the next ten years. The blueprint code-named "The Project Alpha Initiatives of the CBN" is built on 4 pillars viz: enhancing the quality of banks, establishing financial stability, enabling healthy financial sector evolution and ensuring that the financial sector contributes to the real economy[11]. Going forward, subsequent policy measures were geared towards a strong evolving and stable banking sector in Nigeria.

## IV. Methodology

The literature proposes several techniques for measuring bank efficiency, such as data envelopment analysis (DEA), stochastic frontier approach (SFA), distribution free approach (DFA) or thick frontier approach among others. This study adopts

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[11]***Sanusi Lamido Sanusi "The Nigerian Banking Industry: what went wrong and the way forward"*** *Convocation Lecture delivered at the Convocation Square, Bayero University Kano, February 26, 2010.*

the DEA, because it is a non-parametric approach that allows us to assess the performance of banks as homogeneous decision making units (DMUs). It does not require any specification of a functional form of the production function.

The DEA approach has its origins in Farrell (1957) who applied it to a production unit employing a single input with which to produce a single output. It was later generalized by Charnes *et al.* (1978) to handle DMUs facing multiple inputs and multiple outputs. Similarly, DEA has been identified as a linear programming problem that provides a means of calculating apparent efficiency levels within a group of organizations. The efficiency of a firm is calculated relative to the group's observed best practice.

In an attempt to contribute to the study, Tahir et al. (2009) revealed that this methodology identifies an efficiency frontier from which we can measure the distance of each DMU from the frontier. Efficient DMUs form the frontier, while less efficient ones are located inside the frontier. Efficiency score is, thus, measured as the ratio of the weighted sum of outputs to the weighted sum of inputs. For any DMU in the sample, this ratio is equal to or less than unity. DMUs with an efficiency score of unity are considered relatively efficient and make up the frontier, while those with a score below unity are considered inefficient.

Earlier studies conducted by Farrell (1957) showed that the concept of efficiency measurement can be divided into two components, technical efficiency (TE) and allocative efficiency (AE). Farrell referred to technical efficiency as the firm's ability to obtain maximal output from a given set of input, while allocative efficiency means the firm's ability to use input in optimal proportions, given their respective prices and production technology.

## IV.1 Efficiency Measurement in Banking

The studies conducted earlier and relayed by Tahir, et al. (2009), reveal that the main objective of DEA is to determine which firms are operating on their efficient frontier and which firms are not.

Tahir, et al. (2009), considered a general framework where *n* DMUs exists and each consumes the same *m* inputs to produce the same *s* outputs. Precisely, DMUj uses xij (I = 1, 2, 3..., m) of input i to produce yrj (r = 1, 2, 3..., s) of output r assuming that xij > 0 and yrj > 0 (Tahir et al. 2009).

The specific DMU being evaluated has to solve the following optimization problem:

$$\max h_0 = \sum_{r=1}^{s} u_r y_{ro} / \sum_{i=1}^{m} v_r x_{io} \quad (1)$$

Subject to the constraints:

$$\sum_{r=1}^{s} u_r y_{rj} / \sum_{i=1}^{m} v_i x_{ij} \leq 1, \quad u_r \geq 0, v_i \geq 0 \quad (2)$$

for i = 1,2, ..., m; r = 1, 2,... s; j = 1, 2,..., n. where $h_o$ is the ratio of virtual outputs to virtual inputs, the $u_r$'s and the $v_j$'s are the variables and the $y_{ro}$'s and the $x_{jo}$'s are the observed output and input values of the DMU to be evaluated. A set of normalizing constraints guarantees that no DMU, including the one evaluated, can obtain an efficiency score that exceeds unity. Thus, DEA establishes a benchmark efficiency score of unity that no individual firm can exceed. If the efficiency score ho = 1, DMUo satisfies the necessary condition to be DEA efficient; otherwise it is DEA inefficient.

The Charnes, Cooper and Rhoades model (CCR model) followed an assumption of constant returns to scale. This assumption was later relaxed to allow for the evaluation of variable returns to scale and scale economies. Specifically, the efficient frontier may be derived using four alternative returns to scale assumptions; constant returns to scale (CRS); variable returns to scale (VRS), non-increasing returns to scale (NIRS); and non-decreasing returns to scale (NDRS).

Yue (1992) and Tahir et al. (2009), defined the following assumptions of efficiency the banking industry. A bank exhibits increasing returns to scale (IRS) if a proportionate increase in inputs and outputs places it on the production frontier. A bank exhibits constant returns to scale (CRS) if a proportionate increase or decrease in inputs or outputs move the firm either along or above the frontier. A bank which is not on the frontier is defined as experiencing non-increasing returns to scale if the hypothetical bank with which it is compared exhibits either constant (CRS) or decreasing returns to scale (DRS). A similar definition applies for non-decreasing returns to scale.

A firm which is efficient under the assumption of variable returns to scale (VRS) is considered technologically efficient; the VRS score represents pure technical efficiency (PTE), whereas a firm which is efficient under the assumption of constant returns to scale (CRS) is also technologically efficient (TE) as it uses the most efficient scale of operation. Tahir et al. (2009), suggests that from the measures of technical (T) and pure technical (PT) efficiency, it is possible to drive a measure of scale efficiency:

$$S = TE / PTE \quad (3)$$

or

$$S = CRS / VRS \quad (4)$$

where $0 \leq S \leq 1$ since $CR \leq VR$. If the value of S equals 1, the firm is scale efficient, while all values less than 1 reflect scale inefficiency. If scale inefficiency exists ($S \leq 1$), the source of inefficiency is the result of operating at either increasing ($NI < VR$) or decreasing ($NI = VR$) returns to scale.

Another important feature to consider when measuring bank efficiency and performance is the Malmquist productivity index (MPI). It measures productivity change over time at DMU level, where productivity is defined by the ratio of output to input. An increase in the ratio indicates an increase in productivity. Thus, the indexes are decomposed into Efficiency Catch Up and Boundary Shift (Technical Change) components, which involves a series of period-to-period comparisons.

According to Moffat, et al., (2009), "the catch-up component compares the closeness of bank(x) in each period to that of other period's efficiency boundary. If the catch-up component value is equal to unity, then bank(x) will have the same distance from the respective boundaries in period's t and t + 1. A catch-up value that is greater than unity means that bank(x) will perform more efficiently in t + 1 than in period t. However, for the boundary-shift component, a value greater than unity represents productivity gain by a bank(x), implying that for a given amount of output it uses lower input levels in period t + 1 than in period t. On the other hand, a boundary shift value that is less than one means productivity losses have been incurred by bank(x), in that it uses more inputs in period t + 1 than in t to produce the same amount of output. When the boundary shift value is equal to one then there is neither productivity gain nor loss in both periods."

Thus, the index allows for technical change (TC) or progress to speed up, slow down and even reverse within the sample period. Any technical change above unity indicates technological progress, meaning that the efficiency frontier has shifted out, compared to the previous period. A value below unity suggests technical regress, while efficiency change (EC) measures change above unity or one which also means that the estimated bank has moved closer to the efficient (best-practice) frontier. A value less than unity measures "catching up" or "falling behind".

## IV.2 Data

The data for this research work was sourced from the CBN e-FASS monthly returns of twenty-four DMBs in Nigeria for the period 2007 – 2012, (See Appendix 1 – 6).

According to Tahir et al. (2009, p. 99), *"the evaluation of bank efficiency creates several problems which arise as a result of the nature and function of financial intermediaries, especially as banks are multi-product firms that do not produce or market physical products. One of the major problems in the study of bank efficiency is the specification of bank inputs and outputs. There has been long-standing disagreement among researchers over what banks produce. The most debatable issue is the role of deposits and, more specifically, whether they should be treated as inputs and/or outputs. Some researchers such as Elyasiani and Mehdian (1990), and Lang and Welzel (1996), treat them as inputs, but researchers such as Berger and Humphrey (1991), and Ferrier and Lovell (1990), treat deposits as outputs while other researchers such as Humphrey (1990) and Aly et. al., (1990) treat them simultaneously as inputs and outputs"*.

Thus, these studies as highlighted above indicate two ways of measuring bank outputs; the production approach and the intermediation approach. Under the production approach, banks create accounts, process deposits and loans and acquire operating costs. Under the intermediation approach, banks are treated as financial intermediaries that combine deposits, labour and capital to produce loans and investments. The values of loans and investments are treated as output measures; labour, deposits and capital are inputs; and operating costs and financial expenses comprise total cost.

Given the role of DMBs in Nigeria, this research uses the intermediation approach to define bank input and output. Accordingly, three inputs: (X) and three outputs: (Y) are used, viz Total Assets (X1), Capital Adequacy Ratio (X2) and Liquidity Ratio (X3); Total Operating Income (Y1), Net Profit/Loss before Tax (Y2) and Non-performing Loans (Y3).

DEA provides an efficiency rating that is generally denominated between zero and 1, which will inter-changeably be referred to as an efficiency percentage between the range of zero and 100%. The upper limit is set as 1 or 100% to reflect the view that a DMU cannot be more than 100% efficient.

Performance Improvement Measurement (PIM) -Version 3, DEA Frontier program was used to perform all computations. The first stage of our analysis (as shown figure 1) is the efficiency trends of the banking sector for the review period 2007 - 2012. The average efficiency results for individual years were 38.1, 50.7, 62.4, 35.5, 70.5 and 84.3 per cent, respectively.

## IV.3 Empirical Findings

**Figure 1: Efficiency Trends**


Our efficiency estimates indicate that the efficiency levels of the sector was on the increase over the review period, except in 2010, as evidenced by the success of the consolidation exercise and the boom it created in the capital market. Some banks also created this boom through margin lending to the oil & gas industry. These developments had quick benefits, but not long-lasting effect leading to some of the problems that emanated in the thick of financial crisis.

In 2008/2009, the banking sector remained relatively strong and stable, as evidenced by the outcomes of the various indicators, as financial deepening continued, the sector's ability to finance real activity grew stronger; and the banking habit and efficiency of intermediation improved further. Thus, these factors helped in building up the efficiency levels despite the challenges.

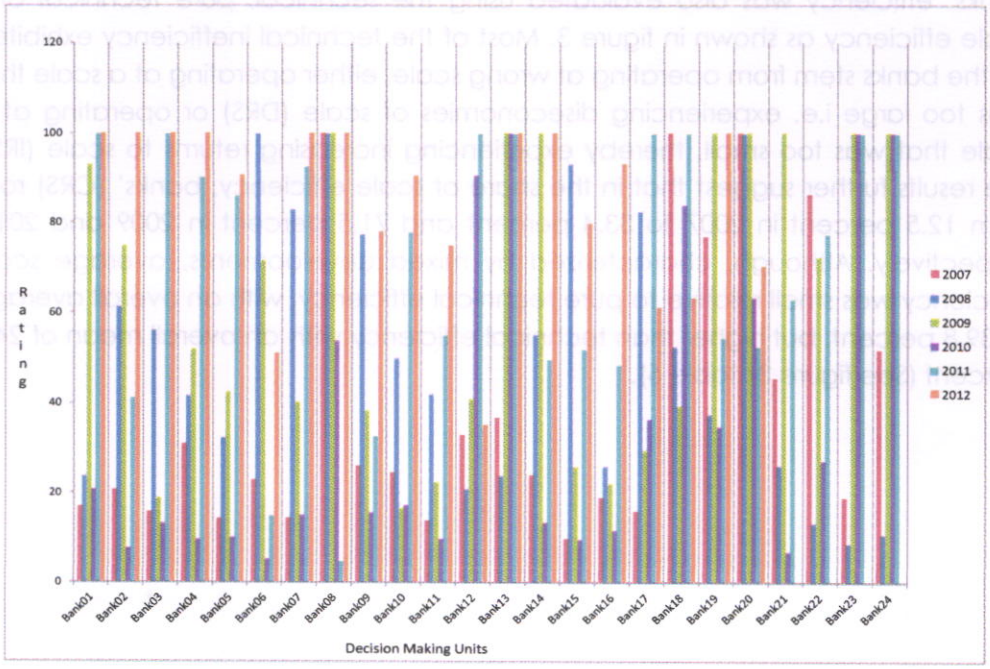
Certainly, the challenges centered on the 2007/2009 global economic and financial crises, which strained the gains made in the banking sector from the consolidation exercise. The impact of the crises and a combination of regulatory lapses and some corporate governance issues necessitated another round of reforms in 2009.

Notwithstanding, to further address the challengesas earlier mentioned, the Bank provided liquidity support through the CBN discount window as well as the guaranteed inter-bank placement; replaced the chief executives of some banks identified as unethical bankers, further injected the sum of N620 billion as second tier capital and the release of "Alpha-Project" blue-print to re-strengthen the banking industry. However, the efficiency levels fell steadily in 2010 as insulated

effects and picked up in 2011 as a result of the effect of large toxic non-performing assets of some of the banks which lingered on and the lagged effect of the AMCON interventions to take-off their bad assets. The improvement in banking system liquidity due to the AMCON actions resulted in the efficiency surge recorded by the banks in 2011 and 2012. Overall, the efficiency levels of the Nigerian banking sector co-varied with liquidity developments in the economy.

At the micro level, in 2007, the efficiency measurement result suggests that (3 DMUs), bank08, bank18 and bank20 recorded relative efficiency rating of 100 per cent each. These three banks comprise the best practice set or best practice frontier, which implied that their input-output combinations lies on the DEA frontier or form the frontier, hence, signaling efficiency. The remaining 21 banks were inside the frontier and remained inefficient, while the industry's overall relative efficiency was at 38.1 percent (See table 2 and figure 2).

**Figure 2: Decision Making Units Efficiency Ratings**




A similar trend was witnessed in 2008, suggesting that (3 out of the 24 DMUs) i.e. bank08, bank18 and bank20 formed the frontier, while the remaining banks were inside the frontier and remained inefficient. Despite being inefficient, efforts were made by bank15, bank07, bank17 and bank09 having scored 93.2, 82.8, 82.4 and 77.2 per cent, respectively to have operated closer to the frontier. A holistic look at the banking sector's average relative efficiency grade reveals an increase of 12.6 percentage points over the preceding year's level to record 50.7 per cent.

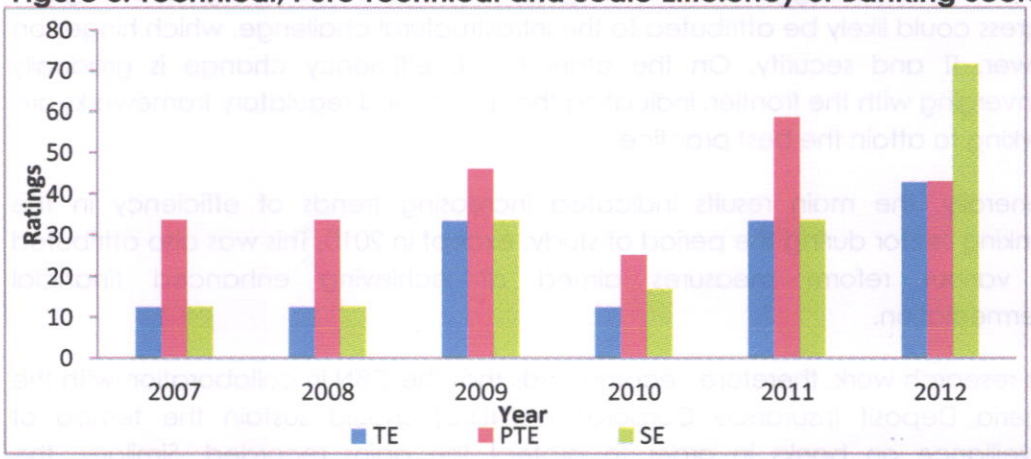
In 2009, 8 banks formed the frontier, while the industry performance stood at 62.4 percent, which showed a relative change of 11.7 and 24.3 percentage points when compared with 2008 and 2007, respectively. The result in 2010 suggested that (3 DMUs) bank13, bank23 and bank 24 were efficient. The remaining 21 banks remained inefficient.

More recently in 2012, the efficiency result suggests a higher performance record with 9 out of 21 banks attaining 100 percent relative efficiency level. The overall result indicated a sectoral record of 84.3 percent. However, the banking sector's performance during the study period highlighted a yearly average of 38.1, 50.7, 62.4, 35.5, 70.5 and 84.3 percent, respectively.

Thus, the overall ratings of the banking sector suggests that 12.5 percent of the industry was efficient in 2007, 2008 and 2010; attained higher levels of 33.4 percent in 2009 and 2011; and highest level of 42.9 percent in 2012 (table 5).

Banks' efficiency was also evaluated using the technical, pure technical and scale efficiency as shown in figure 3. Most of the technical inefficiency exhibited by the banks stem from operating at wrong scale, either operating at a scale that was too large i.e. experiencing diseconomies of scale (DRS) or operating at a scale that was too small, thereby experiencing increasing returns to scale (IRS). The results further suggest that in the share of scale efficiency, banks' (CRS) rose from 12.5 percent in 2007 to 33.4 percent and 71.5 percent in 2009 and 2012, respectively. Although, characterized by mixed developments, average scale efficiency was small relative to pure technical efficiency, with an overall average of 39.8 percent, but higher than technical efficiency with an overall mean of 24.5 percent (See figure 3/ table 5).

**Figure 3: Technical, Pure Technical and Scale Efficiency of Banking Sector**




The Malmquist productivity index for technical change (TC) of the banking sector for the reference periods 2008 - 2009 and 2009 - 2010 which stood at 1.1 and 3.0 points, respectively suggests on the average that the frontier had shifted out, compared to the previous level, signifying technological progression. However, for the reference periods 2007 - 2008, 2010 - 2011 and 2011 - 2012, the efficiency index stood at 0.9, 0.3 and 0.7 points, respectively suggesting therefore, that the frontier had an overall technological retrogression. On the other hand, the efficiency change (EC) for most of the reference periods were above unity, where the banks' efficiency points moved closer to the (best-practice) frontier, except for the period 2009 - which period falling behind (See table 6).

## V. Concluding Remarks

This study investigated the extent to which efficiency in the banking sector has changed overtime in Nigeria. Data Envelopment Analysis (DEA) methodology, a non-parametric approach was employed to distinguish between technical, pure technical and scale efficiencies. In addition, Malmquist productivity index for technical change and efficiency change were also obtained.

The results suggested mixed developments in terms of technical, pure technical and scale efficiencies of banks during the assessment period. Average pure technical efficiency at 39.8 percent is higher than the scale and technical efficiencies at 30.0 and 24.5 percent, respectively. The analysis further revealed a gradual increase over the review period, except in 2010. This is due to the workings of policy and regulatory frameworks as well as the reform measures introduced. Thus, the banking sector has become more efficient between 2007 and 2012.

The results further suggested that the gap in the banks' technological change or regress could likely be attributed to the infrastructural challenge, which hinges on power, IT and security. On the other hand, efficiency change is gradually converging with the frontier, indicating that policy and regulatory frameworks are working to attain the best practice.

Generally, the main results indicated increasing trends of efficiency in the banking sector during the period of study, except in 2010. This was also attributed to various reform measures aimed at achieving enhanced financial intermediation.

This research work, therefore, recommends that the CBN in collaboration with the Nigeria Deposit Insurance Corporation (NDIC) should sustain the tempo of surveillance on banks in order to protect the gains recorded. Similarly, the authorities should design and incorporate efficiency measurement template into their surveillance activities to monitor efficiency bench-mark for the industry. This template is expected to provide the authority with an instant position on bank's performance.

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**Table 1: Banks' Efficiency Ratings (CRS - Technical Efficiency) [Percent]**

| DMU | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| Bank01 | 16.78 | 23.79 | 93 | 20.66 | 100 | 100 |
| Bank02 | 20.55 | 61.38 | 74.61 | 7.53 | 41.14 | 100 |
| Bank03 | 15.63 | 56.15 | 18.72 | 13.08 | 100 | 100 |
| Bank04 | 30.82 | 41.57 | 51.88 | 9.51 | 90.12 | 100 |
| Bank05 | 14.1 | 32.31 | 42.39 | 9.97 | 85.95 | 90.47 |
| Bank06 | 22.8 | 100 | 71.32 | 5.09 | 14.92 | 50.93 |
| Bank07 | 14.27 | 82.83 | 40.13 | 14.9 | 92.63 | 100 |
| Bank08 | 100 | 100 | 100 | 53.75 | 4.72 | 100 |
| Bank09 | 25.88 | 77.24 | 38.18 | 15.46 | 32.7 | 77.84 |
| Bank10 | 24.43 | 49.86 | 16.48 | 17.13 | 77.8 | 90.25 |
| Bank11 | 13.65 | 41.84 | 22.31 | 9.61 | 55.13 | 74.75 |
| Bank12 | 32.84 | 20.77 | 40.76 | 90.39 | 100 | 35.11 |
| Bank13 | 36.66 | 23.77 | 100 | 100 | 100 | 100 |
| Bank14 | 23.9 | 55.1 | 100 | 13.26 | 49.64 | 100 |
| Bank15 | 9.6 | 93.16 | 25.71 | 9.45 | 51.94 | 79.61 |
| Bank16 | 18.8 | 25.89 | 21.99 | 11.52 | 48.43 | 93.1 |
| Bank17 | 15.75 | 82.41 | 29.3 | 36.39 | 100 | 61.06 |
| Bank18 | 100 | 52.46 | 39.19 | 83.73 | 100 | 63.16 |
| Bank19 | 76.72 | 37.39 | 100 | 34.65 | 54.49 | 100 |
| Bank20 | 100 | 100 | 100 | 63.22 | 52.52 | 70.1 |
| Bank21 | 45.33 | 26.07 | 100 | 6.7 | 62.98 | 0 |
| Bank22 | 86.14 | 13.17 | 72.13 | 27.07 | 77.3 | 0 |
| Bank23 | 18.78 | 8.68 | 100 | 100 | 100 | 0 |
| Bank24 | 51.61 | 10.64 | 100 | 100 | 100 | 0 |
| **Average** | **38.1** | **50.7** | **62.4** | **35.5** | **70.5** | **84.3** |

**Source: Performance Improvement Measurement DEA Software - V3 Result**

**Table 2: Banks' Efficiency Rating (VRS - Pure Technical Efficiency)[Percent]**

| DMU | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| Bank01 | 48.78 | 32.29 | 100 | 52.79 | 100 | 100 |
| Bank02 | 49.68 | 100 | 76.44 | 48.81 | 75.51 | 100 |
| Bank03 | 40.08 | 75.48 | 54.83 | 71.53 | 100 | 100 |
| Bank04 | 60.63 | 100 | 53.2 | 37.19 | 98.31 | 100 |
| Bank05 | 46.38 | 37.48 | 51.76 | 50.95 | 100 | 90.47 |
| Bank06 | 95.4 | 100 | 100 | 54.08 | 63.26 | 50.93 |
| Bank07 | 48.64 | 100 | 59.83 | 63.25 | 100 | 100 |
| Bank08 | 100 | 100 | 100 | 87.45 | 96.43 | 100 |
| Bank09 | 80.22 | 90.86 | 70.59 | 59.41 | 68.37 | 78.81 |
| Bank10 | 72.89 | 51.65 | 47.82 | 53.04 | 87.98 | 90.27 |
| Bank11 | 50.57 | 42.18 | 54.33 | 77.8 | 86.24 | 74.75 |
| Bank12 | 76.05 | 21.26 | 81.46 | 100 | 100 | 35.11 |
| Bank13 | 84.12 | 26.84 | 100 | 100 | 100 | 100 |
| Bank14 | 69.27 | 60.78 | 100 | 79.91 | 100 | 100 |
| Bank15 | 34.7 | 100 | 56.46 | 69.49 | 81.83 | 85.22 |
| Bank16 | 100 | 76.49 | 93.14 | 69.39 | 93.24 | 93.1 |
| Bank17 | 100 | 90.05 | 86.86 | 84.92 | 100 | 61.06 |
| Bank18 | 100 | 100 | 45.46 | 100 | 100 | 74.88 |
| Bank19 | 100 | 44.18 | 100 | 80.23 | 100 | 100 |
| Bank20 | 100 | 100 | 100 | 94.73 | 100 | 70.1 |
| Bank21 | 100 | 57.79 | 100 | 100 | 100 | 0 |
| Bank22 | 100 | 52.55 | 100 | 53.11 | 95.85 | 0 |
| Bank23 | 52.19 | 11.15 | 100 | 100 | 100 | 0 |
| Bank24 | 90.1 | 39.6 | 100 | 100 | 100 | 0 |
| **Average** | **75.0** | **67.1** | **80.5** | **74.5** | **93.6** | **85.2** |

**Source: Performance Improvement Measurement DEA Software - V3 Result**

**Table 3: Banks' Scale Efficiency Rating (CRS/VRS) [Percent]**

| DMU | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| Bank01 | 0.3440 | 0.7368 | 0.9300 | 0.3914 | 1.0000 | 1.0000 |
| Bank02 | 0.4136 | 0.6138 | 0.9761 | 0.1543 | 0.5448 | 1.0000 |
| Bank03 | 0.3900 | 0.7439 | 0.3414 | 0.1829 | 1.0000 | 1.0000 |
| Bank04 | 0.5083 | 0.4157 | 0.9752 | 0.2557 | 0.9167 | 1.0000 |
| Bank05 | 0.3040 | 0.8621 | 0.8190 | 0.1957 | 0.8595 | 1.0000 |
| Bank06 | 0.2390 | 1.0000 | 0.7132 | 0.0941 | 0.2359 | 1.0000 |
| Bank07 | 0.2934 | 0.8283 | 0.6707 | 0.2356 | 0.9263 | 1.0000 |
| Bank08 | 1.0000 | 1.0000 | 1.0000 | 0.6146 | 0.0489 | 1.0000 |
| Bank09 | 0.3226 | 0.8501 | 0.5409 | 0.2602 | 0.4783 | 0.9877 |
| Bank10 | 0.3352 | 0.9653 | 0.3446 | 0.3230 | 0.8843 | 0.9998 |
| Bank11 | 0.2699 | 0.9919 | 0.4106 | 0.1235 | 0.6393 | 1.0000 |
| Bank12 | 0.4318 | 0.9770 | 0.5004 | 0.9039 | 1.0000 | 1.0000 |
| Bank13 | 0.4358 | 0.8856 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| Bank14 | 0.3450 | 0.9065 | 1.0000 | 0.1659 | 0.4964 | 1.0000 |
| Bank15 | 0.2767 | 0.9316 | 0.4554 | 0.1360 | 0.6347 | 0.9342 |
| Bank16 | 0.1880 | 0.3385 | 0.2361 | 0.1660 | 0.5194 | 1.0000 |
| Bank17 | 0.1575 | 0.9152 | 0.3373 | 0.4285 | 1.0000 | 1.0000 |
| Bank18 | 1.0000 | 0.5246 | 0.8621 | 0.8373 | 1.0000 | 0.8435 |
| Bank19 | 0.7672 | 0.8463 | 1.0000 | 0.4319 | 0.5449 | 1.0000 |
| Bank20 | 1.0000 | 1.0000 | 1.0000 | 0.6674 | 0.5252 | 1.0000 |
| Bank21 | 0.4533 | 0.4511 | 1.0000 | 0.0670 | 0.6298 | 0.0000 |
| Bank22 | 0.8614 | 0.2506 | 0.7213 | 0.5097 | 0.8065 | 0.0000 |
| Bank23 | 0.3598 | 0.7785 | 1.0000 | 1.0000 | 1.0000 | 0.0000 |
| Bank24 | 0.5728 | 0.2687 | 1.0000 | 1.0000 | 1.0000 | 0.0000 |
| **Average** | **0.5** | **0.8** | **0.7** | **0.4** | **0.7** | **1.0** |

**Source: Performance Improvement Measurement DEA Software - V3 Result**

**Table 4: Summary of Banks' Efficiency**

| year | No. of | Technical Efficiency | | Pure Technical Efficiency | | Scale Efficiency | |
|---|---|---|---|---|---|---|---|
| | Banks | No. of EB | Ratings | No. of EB | Ratings | No. of EB | Ratings |
| 2007 | 24 | 3 | 12.5 | 8 | 33.4 | 3 | 12.5 |
| 2008 | 24 | 3 | 12.5 | 8 | 33.4 | 3 | 12.5 |
| 2009 | 24 | 8 | 33.4 | 11 | 45.9 | 8 | 33.4 |
| 2010 | 24 | 3 | 12.5 | 6 | 25.0 | 4 | 16.7 |
| 2011 | 24 | 8 | 33.4 | 14 | 58.4 | 8 | 33.4 |
| 2012 | 21 | 9 | 42.9 | 9 | 42.9 | 15 | 71.5 |
| Mean Overall | | 5.7 | 24.5 | 9.3 | 39.8 | 6.8 | 30.0 |

Note: EB = Efficient Banks

**Table 5: Summary of Malmquist Banks' Efficiency Index**

| | TC | EC | TFPG (M1) | First Efficiency | 2nd. Efficiency |
|---|---|---|---|---|---|
| 2007 - 2008 | 0.9 | 2.3 | 1.4 | 38.1 | 50.7 |
| 2008 - 2009 | 1.1 | 2.3 | 1.5 | 50.7 | 62.4 |
| 2009 - 2010 | 3.0 | 0.6 | 1.4 | 62.4 | 35.5 |
| 2010 - 2011 | 0.3 | 3.9 | 0.7 | 35.5 | 70.5 |
| 2011 - 2012 | 0.7 | 2.4 | 1.4 | 67.6 | 84.3 |
| | 1.2 | 2.3 | 1.3 | 50.9 | 60.7 |

Source: PIM-DEA Software Results

**Appendix 1:**

**DMUs: Input - Output Variables (N'Million), 2007**

| DMU | Total Assets | Capital Adequacy Ratio | Liquidity Ratio | Total Operating Income | Net Profit/Loss before Tax | Non-performing Loans |
|---|---|---|---|---|---|---|
| Bank01 | 1,024,692.9 | 37.82 | 68.57 | 8,287.8 | 2,731.0 | 10,547.4 |
| Bank02 | 683,005.3 | 27.97 | 69.79 | 8,823.8 | 3,109.0 | 17,368.4 |
| Bank03 | 538,743.6 | 8.36 | 99.21 | 5,235.6 | 2,024.0 | 6,263.9 |
| Bank04 | 1,121,597.0 | 16.05 | 59.56 | 10,398.8 | 5,433.2 | 3,564.1 |
| Bank05 | 596,040.9 | 25.25 | 73.08 | 5,148.2 | 2,152.7 | 4,491.9 |
| Bank06 | 139,024.3 | 27.67 | 100.24 | 1,380.6 | 811.8 | 1,407.6 |
| Bank07 | 407,913.0 | 12.00 | 70.36 | 3,655.0 | 1,113.5 | 5,459.1 |
| Bank08 | 87,557.9 | (63.50) | 21.80 | 3,905.8 | (9,188.6) | 91,511.1 |
| Bank09 | 332,398.1 | 10.42 | 43.44 | 4,876.7 | 2,203.3 | 3,223.2 |
| Bank10 | 226,669.0 | 16.99 | 57.89 | 2,455.9 | 1,363.8 | 7,072.3 |
| Bank11 | 318,046.6 | 19.85 | 85.03 | 2,758.8 | 952.1 | 4,826.1 |
| Bank12 | 411,048.2 | 11.01 | 48.85 | 5,704.7 | 3,457.0 | 10,205.9 |
| Bank13 | 222,744.9 | 15.75 | 41.22 | 2,980.3 | 1,582.8 | 13,464.5 |
| Bank14 | 306,560.5 | 14.16 | 49.53 | 3,478.3 | 1,656.1 | 10,411.4 |
| Bank15 | 346,236.4 | 30.66 | 121.22 | 2,083.3 | (1,670.8) | 10,706.5 |
| Bank16 | 106,704.0 | 32.20 | 151.67 | 1,357.8 | (303.3) | - |
| Bank17 | 132,822.0 | 15.80 | 49.66 | 1,285.2 | 139.1 | 4,828.0 |
| Bank18 | 814,662.6 | 17.34 | 70.48 | 50,762.9 | 20,862.1 | 98,427.5 |
| Bank19 | 232,702.3 | 10.44 | 51.39 | 5,703.4 | 4,571.9 | 14,611.4 |
| Bank20 | 143,177.5 | 26.44 | 32.15 | 9,689.5 | 1,419.9 | 17,709.7 |
| Bank21 | 126,330.6 | 36.17 | 56.07 | 1,304.2 | 687.3 | 12,433.7 |
| Bank22 | 812,273.5 | 29.51 | 41.04 | 21,495.8 | 10,464.5 | 11,151.5 |
| Bank23 | 1,069,988.2 | 23.53 | 51.86 | 7,014.4 | (3,791.3) | 3,760.4 |
| Bank24 | 268,346.4 | 5.03 | 41.88 | 6,709.4 | 2,444.1 | 24,536.1 |

**Source: Electronic - Financial Analysis Surveillance System (e-FASS), Central Bank of Nigeria**

**Appendix 2:**

**DMUs: Input - Output Variables (N'Million), 2008**

| DMU | Total Assets | Capital Adequacy Ratio | Liquidity Ratio | Total Operating Income | Net Profit/Loss before Tax | Non-performing Loans |
|---|---|---|---|---|---|---|
| Bank01 | 1,394,154.3 | 25.90 | 41.93 | 11,767.3 | 3,007.4 | 14,594.4 |
| Bank02 | 950,677.3 | 23.18 | 36.77 | 15,459.6 | 5,318.3 | 18,084.0 |
| Bank03 | 737,479.9 | 24.86 | 38.30 | 7,580.1 | 3,804.4 | 10,241.1 |
| Bank04 | 1,699,552.3 | 30.97 | 66.07 | 14,978.7 | 6,406.4 | 9,231.3 |
| Bank05 | 902,509.3 | 15.29 | 50.42 | 8,373.3 | 2,642.3 | 1,792.9 |
| Bank06 | 158,736.0 | 22.77 | 73.39 | 2,158.4 | 1,606.4 | 1,200.3 |
| Bank07 | 468,787.6 | 18.98 | 36.33 | 7,145.2 | 3,589.5 | 12,909.8 |
| Bank08 | 123,709.4 | (46.18) | 13.13 | 12,372.4 | 761.9 | 77,448.0 |
| Bank09 | 422,277.3 | 11.49 | 32.22 | 6,335.6 | 2,982.7 | 12,705.1 |
| Bank10 | 475,409.4 | 36.20 | 50.51 | 4,676.3 | 2,256.6 | 14,043.8 |
| Bank11 | 449,145.9 | 34.10 | 38.91 | 4,471.5 | 1,787.4 | 9,535.1 |
| Bank12 | 974,913.1 | 26.91 | 41.55 | 6,921.2 | 1,850.9 | 6,266.1 |
| Bank13 | 562,769.1 | 31.92 | 42.85 | 4,237.5 | 1,252.9 | 22,108.3 |
| Bank14 | 502,392.6 | 22.42 | 42.45 | 5,854.5 | 2,568.4 | 9,395.4 |
| Bank15 | 363,703.8 | 24.27 | 108.33 | 6,278.1 | 3,219.4 | 6,949.5 |
| Bank16 | 161,729.1 | 29.04 | 111.37 | 1,343.1 | 413.2 | - |
| Bank17 | 163,424.2 | 11.61 | 45.17 | 2,579.2 | 1,283.1 | 6,655.6 |
| Bank18 | 1,380,248.8 | 11.11 | 30.52 | 13,867.3 | 6,507.5 | 72,131.9 |
| Bank19 | 318,038.6 | 7.65 | 37.11 | 3,312.4 | 1,078.8 | 37,933.2 |
| Bank20 | 188,600.9 | 14.53 | (33.10) | 11,918.6 | 1,782.0 | 55,146.8 |
| Bank21 | 214,079.5 | 23.38 | 48.70 | 1,557.2 | 500.3 | 19,064.8 |
| Bank22 | 1,190,234.9 | 20.58 | 35.97 | 14,121.4 | 571.5 | 15,571.8 |
| Bank23 | 1,228,401.3 | 17.65 | 33.03 | 9,564.5 | 586.7 | 10,713.9 |
| Bank24 | 312,429.4 | 35.71 | 38.20 | 3,323.3 | 185.4 | 19,766.2 |

**Source: e-FASS, Central Bank of Nigeria**

**Appendix 3:**

**DMUs: Input - Output Variables (N'Million), 2009**

| DMU | Total Assets | Capital Adequacy Ratio | Liquidity Ratio | Total Operating Income | Net Profit/Loss before Tax | Non-performing Loans |
|---|---|---|---|---|---|---|
| Bank01 | 1,783,609.3 | 18.03 | 40.89 | 15,005.4 | 6,809.0 | 81,530.0 |
| Bank02 | 1,365,502.6 | 12.50 | 44.60 | 13,256.3 | 4,707.5 | 34,767.0 |
| Bank03 | 639,085.9 | 28.19 | 43.05 | 637.2 | 10,471.0 | 59,434.4 |
| Bank04 | 1,583,461.1 | 27.99 | 63.37 | 13,083.8 | 10,953.4 | 38,320.9 |
| Bank05 | 1,024,067.8 | 15.21 | 42.80 | 7,233.5 | 3,328.2 | 17,269.6 |
| Bank06 | 205,228.7 | 22.88 | 106.41 | 5,144.6 | 2,805.2 | 1,392.5 |
| Bank07 | 624,460.1 | 20.30 | 38.28 | 5,934.5 | 3,994.0 | 35,006.6 |
| Bank08 | 196,482.4 | (68.42) | 46.23 | 3,176.0 | (24,263.1) | 138,606.2 |
| Bank09 | 366,792.1 | 21.84 | 40.67 | 3,469.7 | 2,195.6 | 90,337.8 |
| Bank10 | 446,171.6 | 41.37 | 67.12 | 3,101.0 | (752.0) | - |
| Bank11 | 466,509.5 | 35.84 | 53.32 | 2,231.0 | 5,299.7 | - |
| Bank12 | 598,044.3 | (22.63) | 21.61 | 3,144.7 | (194,206.1) | - |
| Bank13 | 391,691.2 | (68.90) | 19.47 | (1,367.7) | (6,514.8) | 308,958.1 |
| Bank14 | 617,754.0 | 16.11 | 42.11 | 16,927.9 | 13,924.6 | - |
| Bank15 | 334,048.4 | 28.13 | 63.01 | 3,113.9 | 1,307.0 | 17,183.5 |
| Bank16 | 179,821.8 | 18.96 | 58.05 | 2,072.3 | (1,673.6) | 11,147.1 |
| Bank17 | 205,383.9 | 13.47 | 46.47 | 2,120.0 | 880.0 | 16,999.2 |
| Bank18 | 1,153,110.3 | (4.39) | 40.62 | 5,484.6 | (27,498.9) | 222,125.7 |
| Bank19 | 259,182.9 | (4.78) | 28.33 | 8,985.0 | 5,413.7 | 52,774.8 |
| Bank20 | 231,242.7 | (1.94) | 70.73 | 16,276.6 | (24,609.6) | 92,531.1 |
| Bank21 | 161,890.8 | (48.15) | 36.92 | 1,040.0 | (382.1) | 15,698.2 |
| Bank22 | 1,057,982.4 | (18.65) | 16.34 | (95,807.1) | (47,440.0) | 582,740.2 |
| Bank23 | 691,789.4 | (56.09) | 9.52 | 2,006.5 | 64,358.5 | 527,396.6 |
| Bank24 | 212,047.3 | (64.37) | 30.99 | 2,878.3 | (15,800.6) | 144,081.9 |

**Source: e-FASS, Central Bank of Nigeria**

**Appendix 4:**

**DMUs: Input - Output Variables (N'Million), 2010**

| DMU | Total Assets | Capital Adequacy Ratio | Liquidity Ratio | Total Operating Income | Net Profit/Loss before Tax | Non-performing Loans |
|---|---|---|---|---|---|---|
| Bank01 | 1,977,332.9 | 20.51 | 47.61 | 19,524.1 | 7,526.5 | 73,407.0 |
| Bank02 | 1,452,637.0 | 18.13 | 49.13 | 3,531.0 | (785.9) | 40,811.6 |
| Bank03 | 726,305.9 | 28.59 | 34.30 | 6,809.0 | 1,617.8 | 40,766.6 |
| Bank04 | 1,827,189.0 | 29.45 | 66.87 | 16,958.6 | 6,434.2 | 18,867.0 |
| Bank05 | 1,087,633.4 | 17.94 | 47.94 | 9,570.7 | 4,899.3 | 35,347.9 |
| Bank06 | 263,800.0 | 28.77 | 99.84 | 1,603.6 | 492.5 | 857.6 |
| Bank07 | 566,888.5 | 18.30 | 41.32 | 7,215.8 | 1,654.5 | 44,476.3 |
| Bank08 | 207,238.5 | (170.32) | 74.47 | 9,915.7 | 8,595.1 | 45,234.5 |
| Bank09 | 460,541.1 | 21.48 | 51.30 | 3,778.2 | (1,893.2) | 57,979.2 |
| Bank10 | 501,147.5 | 41.92 | 59.77 | 4,460.6 | 1,151.0 | 70,855.5 |
| Bank11 | 526,735.9 | 29.25 | 32.83 | 6,040.0 | 4,089.9 | - |
| Bank12 | 547,788.6 | (46.91) | 23.68 | (358.9) | 56,523.2 | 30,401.2 |
| Bank13 | 315,261.6 | (138.05) | 26.32 | 4,302.5 | 1,635.1 | 362,549.7 |
| Bank14 | 663,917.1 | 14.67 | 30.47 | 5,820.7 | 1,532.9 | 37,786.8 |
| Bank15 | 377,295.2 | 27.07 | 46.24 | 3,613.1 | 1,400.1 | 14,237.2 |
| Bank16 | 225,639.7 | 16.04 | 63.75 | 2,781.2 | 990.2 | 9,735.0 |
| Bank17 | 262,882.7 | 7.93 | 46.88 | 11,416.6 | 294.5 | 8,707.3 |
| Bank18 | 976,479.3 | (57.34) | 90.14 | 97,576.1 | 91,930.8 | 92,576.7 |
| Bank19 | 323,683.7 | 7.10 | 46.65 | 13,385.0 | 10,583.7 | 18,770.8 |
| Bank20 | 208,056.9 | (50.54) | 87.24 | 15,645.9 | 13,452.7 | 31,503.4 |
| Bank21 | 122,065.1 | (55.72) | 45.12 | 969.2 | (4,411.1) | - |
| Bank22 | 1,056,980.9 | (19.00) | 44.59 | (2,420.0) | 31,870.5 | - |
| Bank23 | 648,557.8 | (84.06) | 29.01 | 77,399.9 | 76,604.1 | 147,826.4 |
| Bank24 | 218,099.0 | (220.14) | 57.06 | 25,568.8 | 18,453.3 | 63,092.1 |

**Source: e-FASS, Central Bank of Nigeria**

**Appendix 5:**

**DMUs: Input - Output Variables (N'Million), 2011**

| DMU | Total Assets | Capital Adequacy Ratio | Liquidity Ratio | Total Operating Income | Net Profit/Loss before Tax | Non-performing Loans |
|---|---|---|---|---|---|---|
| Bank01 | 2,505,343.6 | 20.73 | 60.13 | 41,509.8 | 6,132.1 | 18,894.4 |
| Bank02 | 1,648,617.3 | 17.31 | 55.50 | 11,135.9 | (4,781.3) | 8,540.1 |
| Bank03 | 971,621.0 | 14.95 | 28.67 | 4,496.4 | 189.0 | 19,979.8 |
| Bank04 | 2,247,992.4 | 26.72 | 63.65 | 20,066.0 | 9,635.5 | 29,061.0 |
| Bank05 | 1,532,536.7 | 14.73 | 54.24 | 11,831.0 | 5,519.4 | 28,747.6 |
| Bank06 | 380,103.0 | 19.88 | 97.47 | 1,938.2 | 1,178.4 | 15.5 |
| Bank07 | 763,557.6 | 16.04 | 46.19 | 7,289.2 | (8,432.9) | 27,921.5 |
| Bank08 | 219,221.8 | 16.60 | 85.04 | 18.2 | (202.4) | 1,307.4 |
| Bank09 | 575,845.0 | 18.05 | 70.48 | 3,678.9 | 33.0 | 8,996.3 |
| Bank10 | 743,276.5 | 30.76 | 55.93 | 7,800.8 | 1,236.7 | 22,832.4 |
| Bank11 | 625,079.4 | 25.54 | 48.67 | 6,195.1 | (4,512.9) | 10,557.1 |
| Bank12 | 346,140.8 | 40.98 | 105.13 | 17,306.0 | 13,610.0 | 5,124.4 |
| Bank13 | 322,507.9 | 25.20 | 94.45 | 30.5 | (3,335.1) | 42,391.4 |
| Bank14 | 871,956.3 | 14.85 | 32.13 | 6,508.6 | 716.4 | 7,470.7 |
| Bank15 | 545,564.3 | 20.75 | 67.54 | 3,518.2 | 1,093.4 | 17,680.0 |
| Bank16 | 317,908.3 | 13.99 | 64.51 | 2,633.5 | 1,493.2 | 10,137.0 |
| Bank17 | 330,302.9 | 12.20 | 46.93 | 13,527.5 | 1,575.6 | 3,337.4 |
| Bank18 | 890,037.7 | 18.26 | 87.22 | 1,980.9 | 20,181.9 | 67,644.5 |
| Bank19 | 380,768.7 | 10.03 | 46.55 | 4,898.6 | (848.5) | 7,072.3 |
| Bank20 | 237,512.4 | 9.85 | 55.97 | 4,586.7 | 158.4 | 2,848.5 |
| Bank21 | 211,398.5 | 6.29 | 72.18 | 2,632.5 | 1,134.9 | 8,420.7 |
| Bank22 | 603,562.4 | 14.73 | 46.26 | 8,209.8 | 494.8 | 14,416.7 |
| Bank23 | 680,737.8 | 3.47 | 109.21 | 7,068.0 | 1,522.2 | 8,651.0 |
| Bank24 | 249,886.7 | 3.27 | 94.60 | 6,166.2 | 4,112.4 | 11,263.4 |

**Source: e-FASS, Central Bank of Nigeria**

**Appendix 6:**

**DMUs: Input - Output Variables (N'Million), 2012**

| DMU | Total Assets | Capital Adequacy Ratio | Liquidity Ratio | Total Operating Income | Net Profit/Loss before Tax | Non-performing Loans |
|---|---|---|---|---|---|---|
| Bank01 | 2,701,388.0 | 16.21 | 47.59 | 22,306.2 | 1,439.5 | 37,297.9 |
| Bank02 | 918,032.3 | 18.66 | 53.77 | 14,985.4 | 5,234.6 | 3,358.0 |
| Bank03 | 1,538,484.0 | 19.10 | 50.00 | 5,164.2 | 1,041.4 | 30,982.9 |
| Bank04 | 2,488,674.8 | 24.10 | 63.36 | 30,341.0 | 11,731.1 | 31,433.5 |
| Bank05 | 1,625,158.8 | 16.67 | 52.49 | 12,592.2 | 5,480.0 | 21,859.9 |
| Bank06 | 337,450.3 | 21.53 | 87.05 | 2,708.1 | 1,404.5 | 4,689.6 |
| Bank07 | 1,070,510.8 | 15.92 | 40.02 | 9,603.0 | 2,481.6 | 20,892.5 |
| Bank08 | 276,580.7 | 20.90 | 79.74 | 4,652.1 | 3,292.5 | 7,757.2 |
| Bank09 | 1,349,543.0 | 16.49 | 52.20 | 8,857.1 | (1,779.1) | 20,613.8 |
| Bank10 | 922,010.7 | 26.95 | 53.43 | 12,210.5 | 163.6 | 8,294.3 |
| Bank11 | 945,359.3 | 18.54 | 58.79 | 8,738.8 | 4,058.8 | 7,748.8 |
| Bank12 | 330,280.1 | 25.89 | 76.56 | 1,273.8 | (14,715.3) | 3,749.9 |
| Bank13 | 307,774.4 | 31.46 | 145.15 | 7,353.9 | 1,455.3 | 500.3 |
| Bank14 | 1,087,467.0 | 16.24 | 36.61 | 6,489.8 | 1,973.7 | 23,280.6 |
| Bank15 | 598,314.8 | 16.80 | 56.26 | 5,457.1 | (1,562.6) | 14,054.5 |
| Bank16 | 439,467.1 | 18.25 | 90.43 | 4,649.0 | 3,348.7 | 8,307.6 |
| Bank17 | 577,974.2 | 12.30 | 55.69 | 4,806.4 | 1,061.1 | 5,666.9 |
| Bank18 | 918,032.3 | 21.49 | 89.78 | 2,352.1 | (2,643.1) | 17,522.8 |
| Bank19 | 397,101.7 | 10.31 | 35.79 | 4,237.1 | 2,456.0 | 12,932.0 |
| Bank20 | 255,913.5 | 6.07 | 53.42 | 1,999.4 | 478.0 | 5,145.7 |
| Bank21 | - | - | - | - | - | - |
| Bank22 | - | - | - | - | - | - |
| Bank23 | - | - | - | - | - | - |
| Bank24 | - | - | - | - | - | - |

**Source: e-FASS, Central Bank of Nigeria**

**Note:** The input-output variables gap observed in appendix 6 or 2012 came as a result of the merger of some banks in the industry.