Slack-Based Technical Efficiency Analysis for Deposit Money Banks in Nigeria

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Abstract

This study investigates the input and output slacks as determinants of the relative technical efficiency of Deposit Money banks in Nigeria and specifically provides empirical evidence on the relative input wastages and output shortfalls that could have been improved upon by the respective banks in Nigeria to achieve 100% technical efficiency. Relying on the Slack-Based Methodology of Data Envelopment Analysis (SBM-DEA) to determine the relative technical efficiency of the respective banks, the study recommends how each bank could have reduced its slacks to achieve 100% technical efficiency in its operations.

Keywords: *Slack-Based, Technical Efficiency, Deposit Money Banks, Nigeria*

1.0 Introduction

The profitability of banks depends on how efficient they used a combination of inputs to generate outputs. The inputs include both human and material inputs. The human inputs include the number of employees, the managerial quality of the employees, their job allocation and functions and how effective they carry out their functions including effective supervision. The material inputs include the resources deployed such as shareholder funds, customer deposits and physical assets. These inputs are used to generate outputs which include loans and advances, profits, value added and investments (Asekome, 2014).

The ultimate desire of any bank is to increase profitability by using minimal inputs to generate maximum outputs. The higher the ratio between output and input the greater the efficiency of banks and vice versa. If a bank uses more than the minimal input to produce a given output, then there are input wastages called input slacks. As well, if a bank produces lesser output from the expected given input, then there are output slacks.

Efficiency and productivity in banks may depend on the ability and competence of senior management and board of directors to allocate and control over-head expenses. It is logical and rational to believe that economically, bank management would endeavor to minimize operating expenses with a view to maximizing profitability. However, Edwards (1977) and Williamson's (1963) position deviates from this view arguing that under the expense preference theory, bank management may prefer utility maximization rather than profit maximization by increasing staff expenditure, managerial emoluments and thus making only discretionary profits.

Efficiency ratios which are used to differentiate efficient from inefficient banks are popular tools for measuring the amount of inputs needed to produce one unit of operating revenue that may consist of interest income and non-interest or fee income (Hays, Lurgio and Gilbert (2011). Banking efficiency may be classified into different types such as technical, allocation and cost efficiency all of which constitute economic efficiency. The relative economic efficiency of firms may be compared by the construction of production frontiers. In a situation of constant returns to scale (CRS), efficient firms are those that are able to use the minimum possible set of inputs to produce a given output unit.

1.2 Statement of the Research Problem

Several studies have revealed that input or output slacks are the major causes of inefficiency in banks that may be attributed to variation in level of technology, economics of scale as well as human factors (Fried, Lovell and Schmidt: 1994) the extent and magnitude of these slacks have not been specifically determined for each banks by few available studies especially in less developed countries like Nigeria. Although few studies on banking efficiency

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in Nigeria indicated the level of technical efficiency (Abraham & Ogunniyi (2010), Muhammed (2008) and Olaosebikan (2009), there have been no further work that have specifically identified the input and output slacks and the improvements needed to raise the technical efficiency of each bank in Nigeria to 100%. Until such detailed findings are made available, it shall not be easy to identify the level of inefficiency due to such slacks. It shall also not be possible to provide relevant recommendations on measures to reduce such wastages and to improve on the level of efficiency of banks operating in the country and other developing countries with similar operating environment.

1.3 Objectives of the Study

The objectives of this research is to examine the input and output slacks as a measure of relative technical efficiency of deposit money banks in Nigeria as well as to specifically estimate the relative improvements that were needed by the respective banks to operate at 100% technical efficiency frontier.

1.4 Hypotheses

Based on the above objectives, the hypotheses for the study are:

i. That deposit money banks in Nigeria are not technically efficient
ii. That deposit money banks in Nigeria do not have zero operational inputs and outputs slacks

2.0 Review of the literature

Banking efficiency measurement has attracted lots of studies in the literature (Berger and Humphrey (1997). Asekome and Aihie (2016) noted that previous studies in Nigeria by Abraham & Ogunniyi (2010) using the multi-stage DEA model revealed that 25% of the banks were inefficient. Although, the study attributed the inefficiency to scale inefficiency or inappropriate uses of inputs, it did not indicate the specific slacks in the input and output matrix and the improvement needed to achieve 100% technical efficiency.

Sobodu & Akiode (1998) in their study on bank performance and supervision in Nigeria during the transition to a deregulated economy used the DEA for data analysis covering the period 1983-1993 to determine the relative efficiency of banks in Nigeria. They used five alternative DEA models and selected inputs and outputs to construct the alternative models:

In the first model, they selected inputs to include total deposits; interest expenses; total capital; and overhead expenses while output consisted of Gross earnings and earning assets (loans and advances). In the second model they selected inputs to include interest expenses, total capital and over-head expenses while output consisted of Gross earnings and earning assets. In the third model, they selected inputs to include interest expenses, total capital and over-head expenses while output variables consisted of Gross earnings and earning assets. They went further to use a fourth model selecting the input variables to include interest expenses, total capital and over-head expenses while output variables consisted of gross earnings and earning assets. Finally they used a fifth model to include total deposits, interest expenses, and total capital expenses as inputs while outputs consisted of Gross earnings and earning assets

The study concentrated on investigating and evaluating the effect of the structural adjustment programme (SAP) as well as the policy effects of financial sector deregulation on the quality of management and thus efficiency of the Nigerian banking system. The objective was to evaluate the significance of changes in management quality, measure relative efficiency and to assess the significance of the differences between the so called healthy and distressed banks as classified by monetary authorities. To facilitate inter temporal and cross sectional data comparison, they aggregated the entire sample of banks with consistent data availability during the period of study including the so called old and new generation banks as well as private and government owned banks. The study revealed amongst others that "the banking industry efficiency declined significantly during the years immediately following the adoption of deregulation with shift improvement in subsequent years" which accordingly was attributable to "policy inconsistency effect" Sobodu & Akiode (1998), p 3. Although the authors used five DEA models with various inputs and output variables, covering the period 1983 to 1993 that that witnessed frequent policy changes on banking sector regulation in Nigeria, the study however was silent on productivity measurement, specific slacks measurement. As well, the study did not specifically determine the improvements needed to raise the technical efficiency to 100% by eliminating input and output slacks during the period covered by the study.

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Olaosebikan (2009) carried out a study on the efficiency of Nigeria Banks from 1995 to 2005. It covered the period before and after the increase in minimum capital requirement. The study applied the intermediation approach and selected two inputs (loans and liquid assets) with three inputs (capital, deposit and labour) measured in thousands of naira. Labour was measured in numbers of employees. Using the DEA methodology the results indicated that "the Nigeria banking efficiency fluctuated during the early part of the period and showed signs of steady improvement during the latter part of the minimum capital requirement implementation period" (Olaosebikan (2009), p.3.
He, however, posited that like in many other sub-Saharan countries, there are several other challenges including high overhead costs, personnel costs, loan loss provisioning, poor infrastructure, inflexible labour markets and cumbersome commercial courts. These results agreed with those of Sobodu & Akiode (1998) as well as those of Isik & Hassan, (2002); Hauner & Peiris, (2005) in Ugandan. Although these factors were challenges that could have affected performance, the studies were silent on the extent to which they affected productivity, and as well, did not specifically indicates quantifiable improvements needed to achieve zero slacks and thus achieving 100% technical efficiency.

Asekome (2014) contended that a close observation of the selection and combination of inputs and output variables shows that all the inputs and output variables used in some previous studies in Nigeria were selected from the same basket of variables in which case many of the inputs and outputs variables in the models were repeatedly selected. The implication is that the different models with various inputs and output combinations used for the study would definitely give varying results in the data analysis and thus with possible eventual analytical and controversial explanations on the level of the relative technical efficiencies of the respective banks.

In this study we widen the scope and number of variables with emphasis on those that are more relevant to the banking intermediation process. By using one composite variable model, this approach reduces the need for multiple explanations on the findings from our data analysis with more effective concluding remarks. This is in recognition that the DEA considers and provides results on relative rather than absolute efficiency performance.

3.0 Methodology

The sample size in this study is made up of the 15 commercial banks that were publicly quoted on the Nigerian Stock Exchange during the period from 2005 to 2011. The data were obtained from the Central Bank of Nigeria Statistical Bulletin, the various commercial banks' annual financial statements, the Nigeria Stock Exchange Fact Book and the NDIC annual reports. The Data Envelopment Analysis proposed by Charnes, Cooper and Rhodes (1978).and the Slack-Based Methodology SBM-DEA Tone:(2002) are applied to analyze the data.

The DEA model measures the relative technical efficiency of a homogenous set of decision making units that use multiple inputs to produce multiple outputs such as banks. For the purpose of this study, the four input variables are total deposits, physical capital, operating expenses and number of employees. The four output variables are gross loans and advances less non- performing loans (net loans and advances), investments, net after tax and value added.

Data envelopment analysis (DEA) can be input if it defines the efficiency frontier by identifying the maximum possible proportional reduction in the use of inputs while holding the output constant while the output oriented approach strives to achieve the maximum possible output while using a fixed level of inputs Coellli & Rao, (2005).Under the constant returns to scale (CRS) technology, the two approaches gives the same technical efficiency results but provides unequal scores when operating under variable returns to scale (VRS). The DEA methodology sets a benchmark efficiency where scores are assigned as unity or less and an individual firm lies between 0 and 1 depending on the relative efficiency of the firm.

3.1 Model Specification and Data Analysis

In this study we are evaluating the relative efficiency of commercial banks (DMUs) represented respectively by j = 1, 2, 3…N. We assume that each bank uses x_i inputs to produce y_r outputs. Thus we specify the relative efficiency (h_o) for each bank (DMUo) by the following linear programming problem.

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Maximize

$$h_o = \sum_{r=1}^{s} \left(u_r y_{ro} - u_o \right)$$

Subject to:

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

$$\sum_{r=1}^{s} u_r y_{ri} - \sum_{i=1}^{m} v_i x_{ij} - u_o \leq 0 \qquad (1)$$

$$u_r \geq \epsilon, \; v_i \geq \epsilon$$

For $i = 1, 2, 3 \ldots M$, $r = 1, 2, 3 \ldots S$ and $j = 1, 2, 3 \ldots N$

The subscript 0 represents the jth bank or DMU being evaluated.

X_{rj} denotes inputs (i) for each bank j, while y_{rj} denotes the output (r) for each bank

The weights u_r and v_i represent the shadow cost price of one unit of outputs and inputs respectively for each bank. Therefore in line with the Charnes, Cooper and Rhodes (1978) and the Banker, Charnes and Cooper (1984) models, this expectation gives a pair of expressions for a linear programming problem, and the dual problem model is to:

$$\text{Minimize} \quad \Theta_o - \epsilon \left(\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ \right) \qquad (2)$$

Subject to:

$$\Theta_o X i_o = \sum_{j=1}^{n} x i_j \lambda_j + S i^- = o \quad \text{for} \quad i = 1, 2, 3 \ldots M$$

$$\sum_{j=1}^{n} y_{rj} \lambda_j - S^+_r = y_{ro}, \; \lambda \geq 0, \; S_j^- \geq 0, \; S_r^+ \geq 0 \qquad (2)$$

For $i = 1, 2, 3, \ldots M$, $r = 1, 2, 3, \ldots S$, $j = 1,2,3 \ldots\ldots N$

$$1 = \sum_{j=1}^{n} \lambda_{oj},$$

The symbol Θ is a scalar that takes a value greater than or equal to one ($\Theta \geq 1$) and $\Theta - 1$ is the proportional increase in outputs that could be achieved by the jth bank when the inputs are held constant. Similarly $1/\Theta$ gives the technical efficiency (TE) that varies between zero and one for output oriented technical efficiency score. The scalar variable Θ measures the level of efficiency under the terms of input oriented constant returns to scale (CRS).

The optimal values of s+, s- and λ_j must be positive and thus satisfies the inequalities

$$y_{ro} \leq \sum_{i=1}^{n} y_{ri} \lambda_i \text{ and } \Theta_o x_{io} \geq \sum_{j=1}^{n} x_{ij} \lambda_j \qquad (3)$$

For $r = 1, 2, 3 \ldots S$, $i = 1, 2, 3 \ldots M$

The symbols s+ and s- are slacks representing output short falls and input surpluses respectively. Technical efficiency could best be obtained by excluding the slacks and this is achievable if and only if, all the following conditions apply: $\Theta = 1$, and $S^+_r = 0$, $S^-_i = 0$

For $i = 1, 2, 3 \ldots M$ and $r = 1, 2, 3 \ldots S$

The condition $\Theta = 1$ implies that DMUo is located on the production efficiency frontier where S^+_r and S^-_r being equal to zero. In line with Tone (2002), we could as well reformulate an equivalent output oriented DEA model as follow:

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Maximize

$$\sum_{j=1}^{n} \lambda r_j + \epsilon \left(\sum_{i=1}^{m} S_i^- + \sum_{r=1}^{s} S_r^+ \right)$$

Subject to:

$$\Theta^* X_{io} = \sum_{j=1}^{n} x_{ij} \lambda_j - S_i^- \quad \text{for} \quad i = 1, 2, 3 \ldots\ldots M$$

$$y_{ro} = \sum_{j=1}^{n} y_{rj} \lambda_j - S_r^+ \quad \text{for} \quad r = 1, 2, 3 \ldots\ldots S$$

$$\sum_{j=1}^{n} \lambda_j \leq 1 \qquad (4)$$

With $0 \leq \lambda_j, S_i^-, S_r^+$

Where Θ^* is the optimal value of Θ from equation (4) above

In evaluating the performance of commercial banks in Nigeria, this study attempts to ascertain how well the banks performed during the period of the study and how much their performance could be improved upon and thus the study attempts to find the maximum inputs that could increase output proportionately without any input slacks (wastages) while achieving the highest possible output without output short falls or slacks.

4.0 Empirical Results and Discussion of Findings

The results of the data envelopment analysis obtained under constant return to scale (CRS), variable return to scale (VRS) as well as scale efficiency of the analysis are shown in the table. The technical efficiency scores show that only 2 banks (Stanbic and Sterling banks) were operating at constant returns to scale while 13 banks were operating under decreasing returns to scale as shown in table 1 below. No bank operated at increasing returns to scale.

Table 1: Technical and Scale Efficiency Scores for Deposit Money Banks in Nigeria

S/N	DMU (BANKS)	Constant Return to Scale (CCR)Technical Efficiency	Variable Return to Scale (BCC) Technical Efficiency	Scale Efficiency	Remarks
1	Access Bank	0.407	0.612	0.666	Drs
2	Diamond Bank	0.851	1.000	0.851	Drs
3	Eco Bank	0.487	0.823	0.592	Drs
4	FCB Bank	0.416	0.640	0.651	Drs
5	Fidelity Bank	0.647	0.790	0.819	Drs
6	First Bank	0.771	1.000	0.771	Drs
7	GTB	0.656	1.000	0.656	Drs
8	Skye Bank	0.503	0.608	0.827	Drs
9	Stanbic IBTC Bank	1.000	1.000	1.000	Crs
10	Sterling Bank	1.000	1.000	1.000	Crs
11	UBA	0.745	1.000	0.745	Drs
12	Union Bank	0.403	1.000	0.403	Drs
13	Unity Bank	0.580	0.608	0.954	Drs
14	Wema Bank	0.520	0.936	0.555	Drs
15	Zenith Bank	0.617	1.000	0.617	Drs
	Mean	0.640	0.868	0.740	

Author's computation from DEAP Version 2.1, unpublished Ph.D thesis, 2014

Input and output Variable Scores

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The input variable slacks in table 2 below show the amount of excess inputs being used to produce a given output while output slacks show the output deficiency from a given level of inputs. In a perfectly technical efficiency production situation, it is expected that both input and output slacks should be reduced to zero. Slacks indicate potential improvement in input and output variables needed to operate at the efficiency frontier.

Table 2: Summary of Input and Output Slacks Scores

S/N	DMU (BANKS)	Summary of Output Slacks				Summary of Input Slacks			
		Performing Loans(N)	Investments (N)	Profit After Tax (N)	Value Added (N)	Customer Deposits (N)	Fixed Assets (N)	Operating Expenses (N)	No. of Employees
1	Access Bank	0.000	1670281.603	2284597.227	1188130.362	0.000	17658.648	997275.132	27.656
2	Diamond Bank	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	Eco Bank	0.000	14461864.777	1099810.890	0.000	0.000		1115757.748	79.920
4	FCB Bank	560687.068	13336559.846	1612095.101	0.000	2214987.389		0.000	0.000
5	Fidelity Bank	0.000	7101984.794	874254.963	983046.915	14457.188	0.000	0.000	114.114
6	First Bank	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	GTB	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Skye Bank	0.000	5291527.579	1585446.039	1360766.346	0.000	0.000	577658.349	231.872
9	Stanbic IBTC Bank	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	Sterling Bank	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	UBA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	Union Bank	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	Unity Bank	15457194.964	0.000	1700136.199	684514.143	8045442.314	0.000	728662.928	407.316
14	Wema Bank	0.000	469492.380	2813566.860	0.000	0.000	0.000	1255034.621	182.416
15	Zenith Bank	0.000	0.000	0.000	2988272.475	0.000	0.000	0.000	0.000
	Mean	1067858.802	2822114.065	797993.819	480315.349	684992.459	14181.273	311625.919	136.220

Source: Author's Computation from DEAP version 2.1; unpublished PhD thesis, 2014

The table 2 above shows that the 7 banks that were technically inefficient under constant and variable return to scale had output slacks of various amounts while the same banks also had input slacks of various amounts. The mean output slacks of the inefficient banks were N1,067,858.802, N2,822,114.065, N797,993.819 and N480,315.349 respectively for performing loans and advances, investments, profit after tax and value added. This implies that these banks had their largest output short fall in investment, followed by performing loans. They needed to have improved on these outputs. The mean input slacks for the inefficient banks were N684,992.459, N14,181.273, N311,625.919 respectively for total customer deposits, fixed assets and operating expenses and 136 number of staff. These slacks could be reduced without reducing the level of outputs. For the efficient banks that enjoyed technical and or scale efficiency, input and output slacks were observed to have been eliminated or reduced to zero.

Potential Improvement for individual Deposit Money Banks in Nigeria

Access Bank

The technical efficiency of the bank was 40.7% under constant return to scale (CRS) and 61.2% under variable return to scale (VRS). To attain the 100% technical efficiency target, the bank needed to improve its performing loans and advances by 63.41%, investments by 83.33%, profit after tax by 51.669%, Value added by 10.75% while input variables should have been improved upon by 0.73%, 23.84% and 7.9% respectively for fixed assets, operating expenses and number of employees.

Diamond Bank

Although the bank scored a technical efficiency of 85.1% under the constant return to scale (CRS), the VRS technical efficiency score was 100%. This implies that under VRS, the bank does not have any slacks since it attained relative efficiency of 100% under this scenario. Any adjustment to improve its technical efficiency from 85.1% to 100% could have been addressed from pure technical (managerial expertise) and technological innovation as well as scale optimality.

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Ecobank

The bank scored 48.7% and 82.3% CRS and VRS respectively while operating under decreasing return to scale. To attain the 100% technical efficiency, the bank needed to have improved by 21.56%, 152.9%, 93.48%, 215.6% respectively on its loans and advances, investments, profit after tax and Value added while the bank could have reduced its inputs by 1.18%, 25.4% and 115.29% for fixed assets, operating expenses and number of employees.

First City Monument Bank

FCMB scored 41.6% and 64% technical efficiency under CRS and VRS respectively while operating under decreasing returns to scale. To attain the desired efficiency target, the bank could have increased its output by 61.2%, 84%, 258.4%, 56.36% respectively for loans and advances, investments, profit after tax and Value added while inputs could have been improved by increasing total customer deposits by 8.25%, and reduce fixed assets by 8.78%.

Fidelity Bank

The bank scored 64.7% and 79% under CRs and VRS respectively. For the bank to achieve the 100% technical efficiency frontier, it could have improved on its output variables by 26.59, 167.34%, 97.27%, and 62.31% respectively while increasing total customer deposit by 7% but reducing number of staff by 33.36%

First Bank

Although First Bank scored a technical efficiency of 77.11% under constant return to scale (CRS) while the VRS technical efficiency score was 100%. This implies that under VRS, the bank does not have any slacks in its output and input variable since it attained relative efficiency of 100% under this scenario. Any adjustment to improve its technical efficiency from 77.1 to 100% could have been addressed from pure technical (managerial expertise) and technological innovation as well as scale optimality.

Guaranty Trust Bank

GTB scored a technical efficiency of 65.6% under the constant return to scale (CRS) while the VRS technical efficiency score was 100%. This implies that under VRS, the bank does not have any slacks in its output and input variables since it attained relative efficiency of 100% under this scenario. Any adjustment to improve its technical efficiency from 65.6% to 100% could have been addressed from pure technical (managerial expertise) and technological innovation as well as scale optimality.

Skye Bank

The bank scored 50.3% and 60.8% under CRs and VRS respectively. For the bank to achieve the 100% technical efficiency frontier, it could have improved on its output variables by 64.47%, 157.88%, 386.06%, and 82.75% respectively. On the inputs side, the bank could have reduced its operational expenses and number of employees by 19.23% and 46.94% respectively.

Stanbic IBTC Bank

The bank scored 100% technical efficiency under both CRS and VRS. This implies that the bank was technically 100% relatively efficient and thus had zero slacks as it operated within the best frontier and thus meeting the desired target within the industry.

Sterling Bank

The bank scored 100% technical efficiency under both CRS and VRS implying that the bank was technically 100% relatively efficient and thus had no output and input slacks as it operated within the best frontier and thus meeting the desired frontier within the industry in Nigeria.

United Bank for Africa

The bank scored a technical efficiency of 74.5%under the constant return to scale (CRS) while the VRS technical efficiency score was 100% implying that under VRS, the bank does not have any slacks in its output and input

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variables since it attained relative efficiency of 100%. Any adjustment to improve its technical efficiency from 74.5 to 100% could have been addressed from pure technical (managerial expertise) and technological innovation as well as scale optimaility.

Union Bank

Union Bank scored a technical efficiency of 40.3% under CRS while the VRS technical efficiency score was 100% implying that under VRS, the bank does not have any slacks in its output and input variables. Any adjustment to improve its technical efficiency from 40.3% to 100% could have been addressed from pure technical (managerial expertise) and technological innovation as well as scale optimality.

Unity Bank

Unity Bank scored a technical efficiency of 58% under the CRS while the VRS technical efficiency score was 60.8%. It could have improved on its output variables by 159.1%, 64.38%, 479.46%, and 96.81% for loans and advances, investments, profit after tax and value added respectively. On the inputs side, the bank could have reduced its operational expenses and number of employees by 32.51%, 28.7% and 69.71% respectively for total customer deposits, operating expenses and number of employees.

Wema Bank

Wema Bank scored a technical efficiency of 52% under the CRS while the VRS technical efficiency score was 93.6%. It could have improved on its output variables by 6.86%, 8.92%, 340.1%, and 71.31% for loans and advances, investments, profit after tax and value added respectively. On the inputs side, the bank could have reduced its inputs by 17.40%, and 64.15% respectively for operating expenses and number of employees.

Zenith Bank

Zenith Bank scored a technical efficiency of 61.7% under the constant return to scale (CRS) and 100% score under the VRS meaning that under VRS, the bank does not have any slacks in its output and input variables since it attained relative technical efficiency of 100% if it operates at constant return to scale (CRS). Any adjustment to improve its technical efficiency from 61.7% to 100% could have been addressed from pure technical (managerial expertise) and technological innovation as well as scale optimality.

5.0 Summary of Findings

Based on the analysis carried out in the study, it is revealed that most deposit money banks operated below the 100% technical efficiency frontier for various reasons. Only two banks (Stanbic and Sterling) out of the 15 banks covered in the study operated at 100% technical efficiency level both at the VRS and CRS measures of efficiency. The two banks had zero slacks. The remaining 13 banks operated below the efficiency frontier. Of the 13 banks that operated below the efficiency frontier, 6 banks had 100% technical efficiency under VRS but less than 100% technical efficiency under the CRS. This implies that even though the banks were able to obtain 100% technical efficiency by correctly varying the use of their inputs but fell below the relative efficiency frontier due to inadequate managerial or technological expertise even though they had zero input slacks in their operations. The remaining 7 banks operated below the relative efficiency frontier. They were technically inefficient under the CRS as well as under the VRS. This implies that they had inputs and outputs slacks arising from deficiency in both managerial, scale and technological innovations.

5.1 Conclusions and Recommendations

The study examined the input and output slacks as a measure of relative technical efficiency of deposit money banks in Nigeria as well as to specifically provide empirical estimates on the relative improvement needed by the respective banks to achieve 100% technical efficiency by reducing inputs wastages and output shortfalls to zero. The study relied on the Slack-Based Methodology of Data Envelopment Analysis (SBM-DEA) to determine the relative technical efficiency of the banks and thereafter empirically determine the slacks of each bank during the period

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covered by the study. The study revealed that 8 banks had zero slacks if they operated under variable return to scale while the remaining 7 banks had various levels of slacks bother the CRS and VRS and thus were less than 100% technically efficient. Out of the 8 banks that were technically 100% efficient, 6 were less than 100% technically efficient under CRS. Thus only 2 banks were 100% technically efficient under the CRS and VRS. The study recommends the need to operate at optimal scale, improvement on the optimal combination of inputs as well as adopting technological innovations and improvement in managerial efficiency as measures to reduce the inputs and output slacks that contribute mainly to banks operating below the technical efficiency frontiers in the banking sector in Nigeria.

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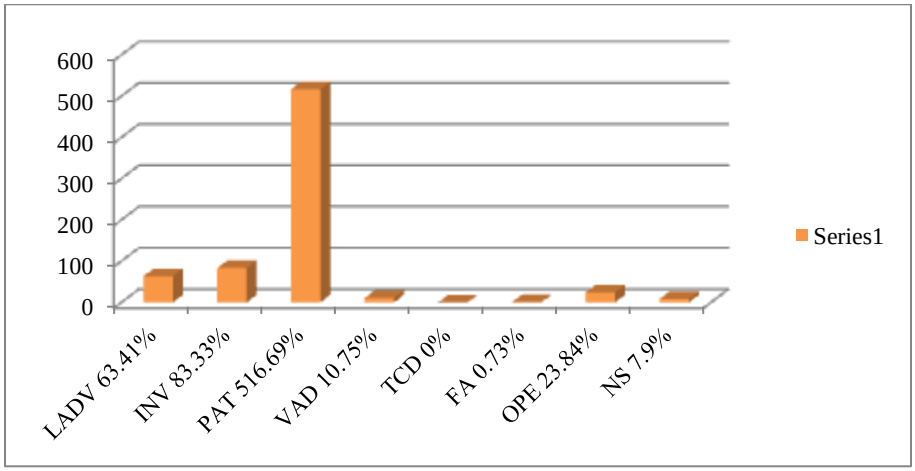
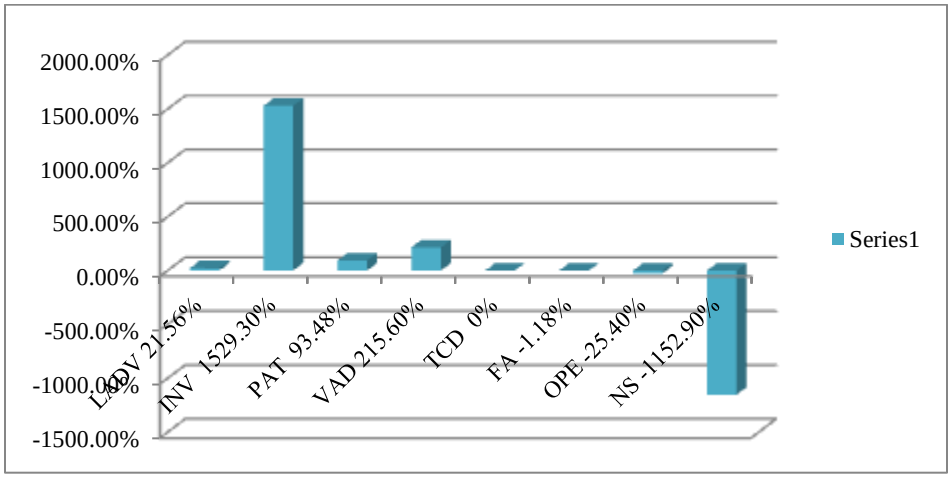
APPENDICES

EFFICIENCY SCORES AND POTENTIAL IMPROVEMENTS FOR THE 7 BANKS THAT HAD INPUTS AND OUTPUT SLACKS.



Appendix I. Potential Improvements for Access Bank



Appendix II. Potential Improvements for Eco Bank

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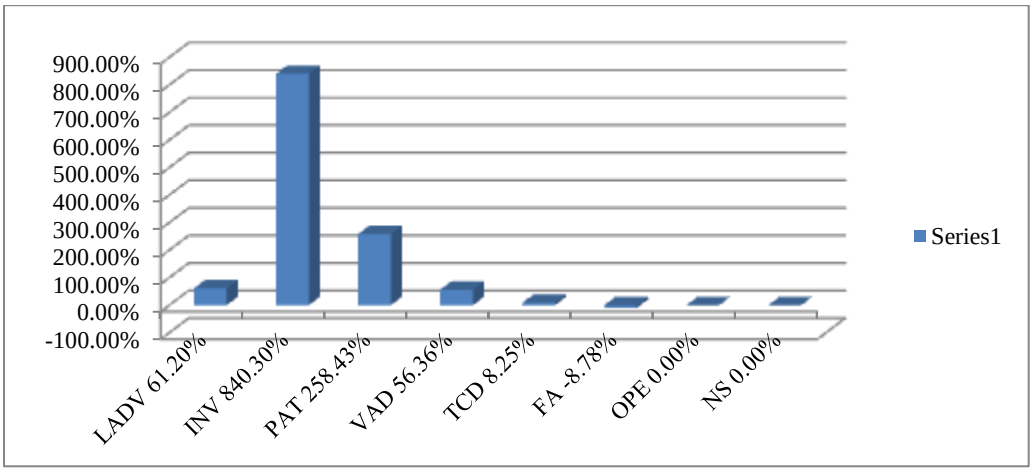
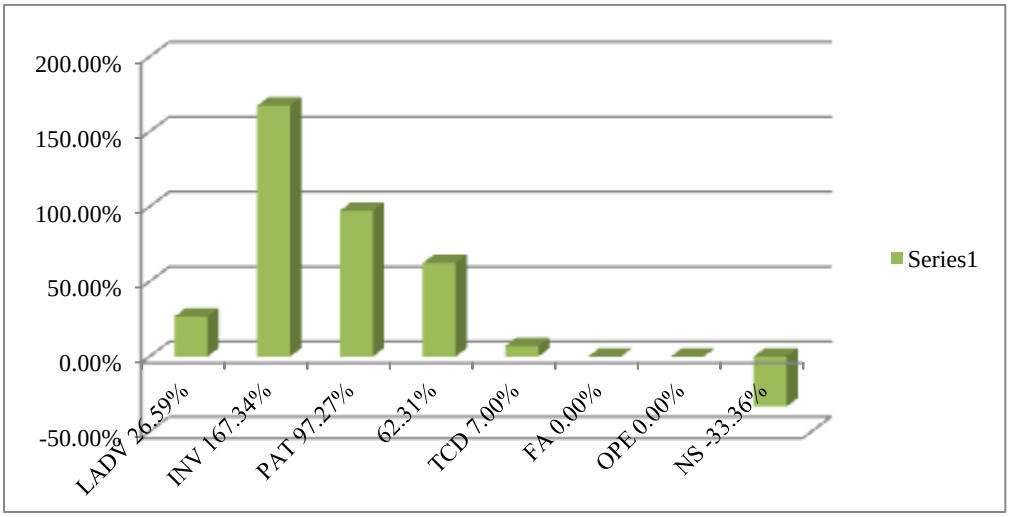


Appendix III. Potential Improvements for FCMB Bank



Appendix IV. Potential Improvements for Fidelity Bank

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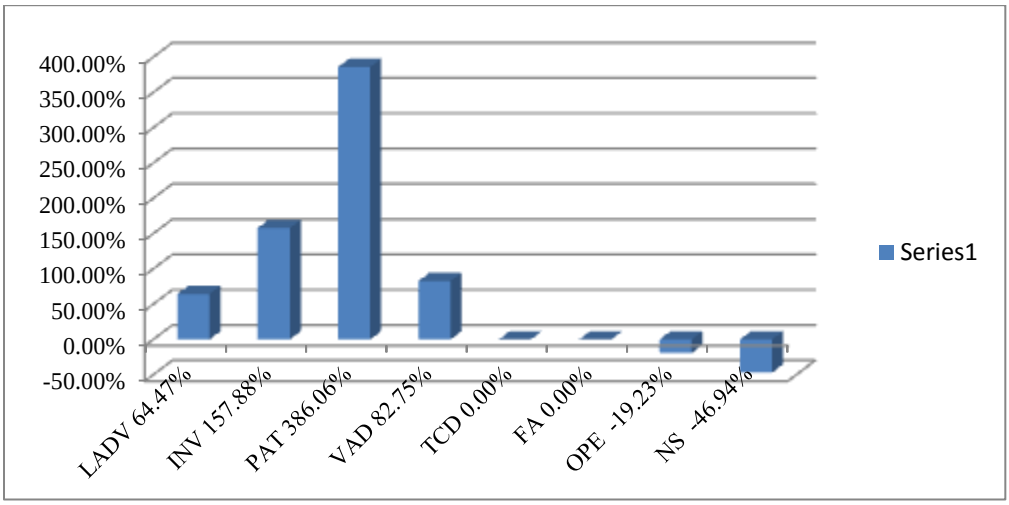
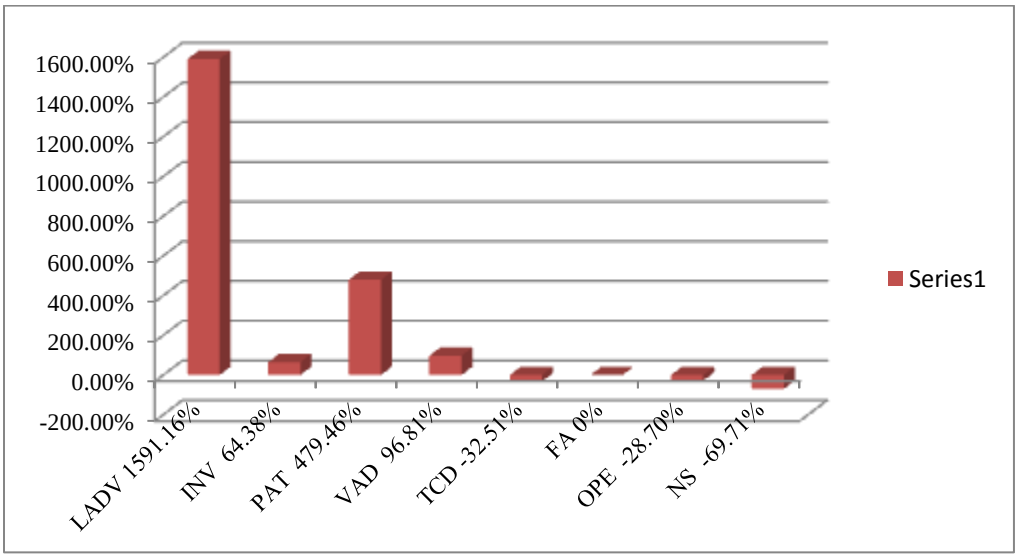


Appendix V. Potential Improvements for Skye Bank



Appendix VI. Potential Improvements for Unity Bank

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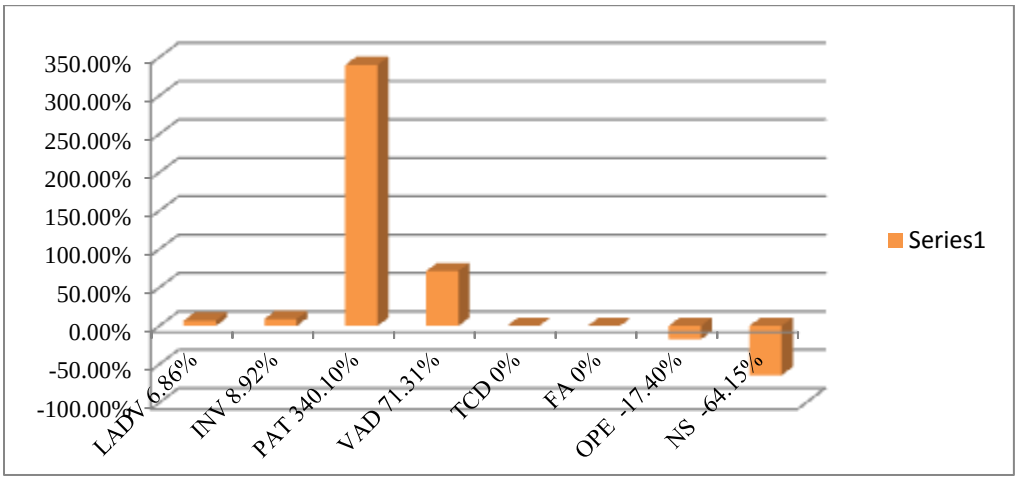

Appendix VII. Potential Improvements for Wema Bank

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