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Empirical Evaluation of Banks Recapitalization in Nigeria: An Application of DEA in the Language R

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ABSTRACT: This study investigates the impact of Banks recapitalization exercise in Nigeria with the aim of finding out if the recapitalization is of any benefit. The Study employed secondary data obtained from financial statement of commercial banks in Nigeria. We consider the following variables for the year 2000 to 2004: Salaries and Wages, Interest Income and Interest Expenses with the average of N50840000, N242400000 and N94060000 as an Input variables and Earning Asset, Fixed Asset and Total Deposit with the average of N69000000, N43820000 and N4.031e+08 as an output variable. Equally, the following N50840000, N242400000 and N94060000 gives the average inputs and N350400000, N132400000 and N2.061e+09 averages output for the year 2006 to 2010. In addition, the Pearson's product-moment correlation indicate a significance relationship between the inputs and output variables with p-value = 0.001817<0.05. Results of DEA under various conditions (assumptions) show that: Recapitalization policy in Nigeria has a significance effect on banks performance, since most banks achieved 100% efficiency after recapitalization than before recapitalization.

Keywords: DEA, Efficiency Ratio, Efficiency Score, Constant Return to Scale (CRS), Variable Return to Scale (VRS), nonparaeff in R package.

I. INTRODUCTION

It is widely recognized that the financial system plays a crucial role in promoting economic development by separating the saving and investment functions. Investment in all economics sectors, particularly the real sector, made possible by the financial resources in the financial system, increases the quantum of goods and services. The financial system includes banking institution are important economic agents in the payment system. Bank facilitate economic transaction between various national and international economic units and by so doing, it encourages trade, commerce and industry[15].

It is needless to say that, banking system is able to play the positive role in economic development only if it is functioning efficiently. However, if repressed, inefficient and incapable of providing timely and quality services, the banking system could become a major hindrance to economic growth and development [12, 14].
Commercial banking which is a large component of the Nigerian financial Sector started in 1892 with the establishment of the first banking firm, Standard Bank Nigeria Ltd. (now First Bank Plc). Since then, the number of commercial banks in Nigeria has changed overtime. The banking industry is effectively dominated by a few banks. Moreover, the rash of financial distress resolution options including outright liquidation, mergers and holding action had profound consequences on competition in the commercial banking market. Thus, a better understanding of the structural changes in the financial sector as a whole is of great importance to all stake holders, and to regulators, especially as it would help in designing appropriate legislation to enhance competition.

Distress appears to be a new development in the Nigerian banking industry because of its wide phenomenon effects in the 90's, but the fact is that this problem has been with the banks right from the inception of banking system in Nigeria. A number of reasons have been attributed to financial distress of commercial banks. According to Sanusi [17] as cited in Musa [11],one major cause of the distress in the sector was that the increase in the number of banks overstretched the

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existing human resources capacity of banks which resulted into many problems such as poor credit appraisal system, financial crimes, accumulation of poor asset quality among others. A result of the reason stated above is that most if not all of the banks that failed in Nigeria failed due to non-performing loans. Arrears affecting more than half the loan portfolio were typical of the failed banks. Many of the bad debts were attributable to moral hazard: the adverse incentives on bank owners to adopt imprudent lending strategies, in particular insider lending and lending at high interest rates to borrowers in the most risky segments of the credit markets contrary to the interests of the bank's creditors (mainly depositors or the government if it explicitly or implicitly insures deposits), which, if unsuccessful, would jeopardize the solvency of the bank [10].

It was as a response to get another round of impending crisis on the banking sector that on July 6, 2004, the Central Bank of Nigeria announced a major reform programme that would transform the banking landscape of the country. The main thrust of the 13-point reform agenda was the prescription of a minimum shareholders" funds of N25 billion for a Nigerian deposit money bank not later than December 31, 2005. The banks were expected to shore up their capital through the injection of fresh funds where applicable, but were most importantly encouraged to enter into merger/acquisition arrangements with other relatively smaller banks thus taking the advantage of economies of scale to reduce cost of doing business and enhance their competitiveness locally and internationally [19].

This was not the first time that Nigerian Banks were asked to shore up their capital base from a modest value of N10million naira minimum paid-up capital in 1988, Nigerian commercial banks were required to maintain capital not below N50 million in 1991. Between 1991 and 2005 subsequent increases have also been made ranging from N500 million in 1997; N1billion in 2001; N2billion in 2002 to N25 billion in 2005.

Capital is the cornerstone of bank's financial strength. It supports bank operations by providing a buffer to absorb unanticipated losses from its activities and, in the event of problems, enabling the bank to continue to operate in a sound and viable manner while the problems are addressed or resolved. The maintenance of adequate capital reserves by a bank can engender confidence in the financial soundness and stability of the bank by providing continued assurance that it will honor its obligations to depositors and creditors. A measure of the capital strength of a bank is the capital adequacy ratio, which is the amount of bank's regulatory capital expressed as a percentage of its risk-weighted assets. Prudential guidelines on 'capital adequacy' set out three main elements that determine a bank's capital these are:

- Credit risk associated with exposures;
- Market risk arising from banking activities; and
- The form and quality of capital held to support this exposure

Traditional approaches to bank regulation emphasize the view that the existence of capital adequacy regulation plays a crucial role in the long-term financing and solvency position of banks, especially in helping the banks to avoid bankruptcies and their negative externalities on the financial system. In general, capital or net worth serves as a buffer against losses and hence failure. In addition to this, the performance of the banks would also be enhanced although this has not been empirically investigated.
In this research work we are considering variety of inputs and output which have relationship with one another for the measurement of recapitalization of banks. The inputs Includes interest expenses, interest income and salaries and wages while the outputs include the fixed asset, total deposit and the earnings Assets.

A. Rationales for Bank Recapitalization in Nigeria

Prior to 1992, the minimum paid up capital requirement for banks in Nigeria was N12 million for merchant banks and N20 million for commercial banks. A review that year moved the requirements to N40 and 50 million respectively. This level lasted till 1997 when a uniform N500 million capital was introduced. The reason for discontinuing the dichotomy was allow for a level playing field and realization that there was no real difference between the capital requirements of the two categories. It was also to prepare the system for the introduction of universal banking. In 2000, the minimum capital was moved to N1 billion for new banks, while existing banks were expected to meet this level by December 2002. Total N2 billion minimum paid up capital was introduced for new banks in 2001 while existing banks were given until December 2004 to comply. The reasons for these adjustments include:

- To increase cost of IT and other infrastructure.
- Comparison with other jurisdictions.
- Inflation and increasing interest rates.

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- Depreciation of the national currency, the Naira.
- Strengthening the operational capacity of deposit money banks.
- Minimizing the risk of distress

There was also the need to curb the spate of requests for licenses which in many cases were not backed with any serious intension. The absorptive capacity of the system was also an issue, i.e. things like the executive capacity to run the banks, supervisory resources, the cut throat competition that was breeding malpractices, etc. Consequently, on July 6, 2004, the Central Bank of Nigeria (CBN) made a policy pronouncement the highlight was the increment of the earlier N2-N2.5 billion with full compliance deadline fixed for the end of the year. The rationale as indicated is that most banks in Nigeria have a capital base of about 298 million US dollars compared to 526 million US dollars for the smallest bank in Malaysia. Further reasoning include that globally, size has become an ingredient for success. An enhanced capital-base, all things being equal is expected to confer competitive edge on a bank. It would enable the bank acquire relevant technology, engage high quality personnel and absorb shock. It would also position the bank to offer better and value-added services while increasing its earning capacity.

According to the CBN, the new minimum capacity base was aimed at enhancing capabilities to finance large projects as well as ensure a capital base that can support service delivery channels. Ultimately, the recapitalization policy is expected to result in:

- Cost savings (attributable to economics of scale as well as more efficient allocation of resources)
- Revenue enhancement (resulting from the impact of consolidation on bank size scope and overall market power)
- Shareholders pressure on management to improve profit margins and returns on investment, made possible by new and powerful shareholder block.
- Financial stability characterized by the smooth functioning of various components of the financial system with each component resilient to shock.

Globalizing the banks to make for a more globally integrated financial services industry and facilitate the provision of wholesale financial services and geographical expansion of banking operations. Be abreast with new developments which impose high fixed costs and the need to spread these cost across a large customer base. Facilitate risk reduction due to change in organizational focus and efficient organizational structure. Be in tandem the advent of deregulation which removed many important legal and regulatory barriers [13].

B. Statement of the Problem

Many developing countries have experienced banking problems requiring major reforms to address weak banking supervision and inadequate capital. It has been shown that in addition to deposit insurance (implicit or explicit), official capital adequacy regulations play a crucial role in aligning the incentives of bank owners with depositors and other creditors[4].

For banks to be able to function effectively and maintain high efficiency level in the economy and to contribute meaningfully to the economic growth and development of a country, then the industrial sector must be safe, sound and stable, being devoid of any economic problem that can tilt it off the rail of achieving its primary duty of satisfaction, such as distress.

Due to inflation and the general socio-economic decline and political uncertainties around us which have taken a large toil on the banking industry, most banks have suffered from loss of business and this has resulted to loss of income. The banks were unable to pay customers on demand due to non-availability of liquid cash. The public lost confidence in the banking industry.

However, it is not altogether clear whether the imposition of recapitalization requirements actually reduces risk-taking incentives. Santos [2] notes that actual capital requirements may increase risk-taking behaviour. Also, Shrieves, and Dahl [3], argue that higher capital requirements may induce borrowers to shift to capital markets and in the process impair capital allocation, while Gorton and Winton [18] show that raising capital requirements can increase the cost of capital. Thus, theory provides conflicting predictions on whether capital requirements curtail or promote bank

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performance. This study shall make effort at clearing the air as regard the impact of recapitalization on bank performance with evidence drawn from the Nigerian banking sector.

In carrying out this research, attention would be focused on commercial banks in Nigeria and time frame to be considered shall be between 2000 and 2010. Thirteen commercial banks were selected and five years 2000-2004 is referred to as "before recapitalization" while five years 2006-2010 is termed "after recapitalization". The year 2005 is used as based year, since 2006 is starting year for implementing the N25bn paid up capital [16].

II. METHODOLOGY

Data Envelopment Analysis (DEA) is a relatively new "data oriented" approach for evaluating the performance of a set of peer entities called Decision Making Units (DMUs) which convert multiple inputs into multiple outputs. The definition of a DMU is generic and flexible. Recent years have seen a great variety of applications of DEA for use in evaluating the performances of many different kinds of entities engaged in many different activities in many different contexts in many different countries. Here, the Decision Making Units (DMUs) are thirteen selected banks in Nigeria.

In their originating study, Charnes, Cooper, and Rhodes [9] described DEA as a 'mathematical programming model applied to observational data that provides a new way of obtaining empirical estimates of relations - such as the production functions and/or efficient production possibility surfaces – that are cornerstones of modern economics'. Formally, DEA is a methodology directed to frontiers rather than central tendencies. Instead of trying to fit a regression plane through the *center*of the data as in statistical regression, for example, one 'floats' a piecewise linear surface to rest on top of the observations. Because of this perspective, DEA proves particularly adept at uncovering relationships that remain hidden from other methodologies. For instance, consider what one wants to mean by "efficiency", or more generally, what one wants to mean by saying that one DMU is more efficient than another DMU. This is accomplished in a straightforward manner by DEA without requiring explicitly formulated assumptions and variations with various types of models such as in linear and nonlinear regression models [5].

Development of DEA Formula

DEA is a multi-factor productivity analysis model for measuring the relative efficiencies of a homogenous set of decision making units (DMUs). The efficiency score in the presence of multiple input and output factors is defined as:

$$\textit{Efficiency} = \frac{Weightedsumofoutput}{Weightedsumofinput} \quad (1)$$

Assuming that there are *n* DMUs, each with *m* inputs and *s* outputs, the relative efficiency score of a test DMU *p* is obtained by solving the following model proposed by Charnes et al. (1978):

$$Max \frac{\sum_{k=1}^{s} V_k y_{kp}}{\sum_{j=1}^{m} u_j x_{jp}}$$

Subject to

$$Max \frac{\sum_{k=1}^{s} V_k y_{ki}}{\sum_{j=1}^{m} u_j x_{ji}} \leq 1, \forall i, V_k, u_j \geq 0 \quad \forall k, j. \quad (2)$$

Where

k = 1 to s, j = 1 to m,i= 1 to n, yki= amount of output k produced by DMU i, xji= amount of input j utilized by DMU i,

v_k= weight given to output k, uj= weight given to input j.

The fractional program shown as (2) can be converted to a linear program as shown in (3).

$$\text{Max } \sum_{k=1}^{s} V_k y_{kp}$$

Subject to

$$\sum_{j=1}^{m} u_j x_{jp} = 1$$

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$$\sum_{k=1}^{s} V_k y_{ki} - \sum_{j=1}^{m} u_j x_{ji} \leq 0, \qquad \forall i$$

$V_k, u_j \geq 0 \quad \forall k, j.$ (3)

The above problem is run *n* times in identifying the relative efficiency scores of all the DMUs. Each DMU selects input and output weights that maximize its efficiency score. In general, a DMU is considered to be efficient if it obtains a score of 1 and a score of less than 1 implies that it is inefficient [8].

Variable coding

Table 1

S/N Variable	Output factor	Coding	Input factor	Coding
1	Fixed Asset	Y1	Interest expenses	X1
2	Total Deposit	Y2	Interest income	X2
3	Earnings Asset	Y3	Salaries and Wages	X3

Table 2

S/N	Decision Making Units	Symbol
1.	ACCESS BANK	A.
2.	AFRI BANK	B.
3.	DIAMOND BANK	C.
4.	ECOBANK	D.
5.	FIRST BANK	E.
6.	GUARANTEE TRUST BANK	F.
7.	OCEANIC BANK	G.
8.	UNION BANK	H.
9.	UNITED BANK	I.
10.	WEMA BANK	J.
11.	ZENITH BANK	K.
12.	FIDELITY BANK	L.
13.	FCMB	M.

Package Description

The package contains methods to estimate technologies and measure efficiencies using DEA andSFA. Data Envelopment Analysis (DEA) are supported under different technology assumptions(fdh, vrs, drs, crs, irs, add), and using different efficiency measures (input based, output based, Hyperbolic graph, additive, super, directional).

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Table3

Technology Assumption	Meaning
Fdh	Free disposability hull, no convexity assumption
Vrs	Variable returns to scale, convexity and free disposability
Drs	Decreasing returns to scale, convexity, down-scaling and free disposability
Crs	Constant returns to scale, convexity and free disposability
Irs	Increasing returns to scale, (up-scaling, but not down-scaling), convexity and free disposability
Irs	Increasing returns to scale (up-scaling, but not down-scaling), additivity, and free disposability
Add	Additivity (scaling up and down, but only with integers), and free disposability
fdh+	A combination of free disposability and restricted or local constant return to scale

In this work, we only focus on the following Analytical Procedures based on DEA Assumptions:

- Constant Return to Scale (CRS) – an increase in inputs of banks proportionate increase in the output. The CRS approach assumes a linear relationship between the inputs and outputs.
- Variable Return to Scale (VRS) – an increase in inputs produces a disproportionate increase in the output. The VRS approach assumes a non-linear relationship between the inputs and outputs.
- Efficiency Ratio = a single composite/virtual ratio between the institution's aggregated weighted inputs and aggregated weighted outputs weighted in the context of the observed best practice performance in the peer group.
- Efficiency Score = a measure of the technical efficiency of the institution in the context of performance of peer institutions. It is expressed as a number between 0 (0%) and 1 (100%).
    - An institution is rated as fully efficient (score of 1 or 100%) "On the basis of available evidence if and only if the performance of other [institutions] does not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs.
    - Specific score represents the distance of how far the given institution is from the efficiency frontier [7].

DEA Orientations

- Output Orientation (O/O) – inputs are kept constant while the possibility of expansion of outputs is explored.
- Output Maximization // MORE Outputs with SAME Inputs Feasible performance targets.
- Input Orientation (I/O) – outputs are fixed and the possibility of reduction in inputs is explored.
- A value of 1 shows no change over the observed period. A value greater than 1 indicates improvement in productivity, whereas a value less than 1 represents a decline in performance [6].

The R codes for running the analysis were shown in the appendix A (nonparaeff package) [1]

III. PRESENTATION AND ANALYSIS OF RESULTS

A. Descriptive Statistics of the DMUs (BANKS)

Table1: Descriptive Statistics before Recapitalization

13 Banks in the year 2000-2004 (before recapitalization)	**Outputs**			**Inputs**		
	Earning Asset	Fixed Asset	Total Deposit	Salaries and Wages	Interest Income	Interest Expenses
Maximum	201300000	378000000	1.484e+09	122100000	131300000	43990000

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Minimum	15270000	5410000	4.670e+07	2337000	7578000	4575000
Mean	69000000	43820000	4.031e+08	16480000	47290000	17560000
Standard deviation	62238351	101032254	417444127	32752595	36306260	11083305

Table2: Descriptive Statistics after Recapitalization

13 Banks in the year 2006-2010 (after recapitalization)	**Outputs**			**Inputs**		
	Earning Asset	Fixed Asset	Total Deposit	Salaries and Wages	Interest Income	Interest Expenses
Maximum	836300000	267900000	5.366e+09	124400000	541600000	192400000
Minimum	96460000	29210000	5.081e+07	9974000	76200000	15940000
Mean	350400000	132400000	2.061e+09	50840000	242400000	94060000
Standard deviation	231513814	83491486	1645454835	37353101	150186398	54056176

The table 1&2 above simply describe the type of data we are using statistically. It was observed that: the mean of both inputs and outputs after recapitalization is more than the mean of before recapitalization based on the thirteen banks selected across Nigeria.

Fig. 1: Scatter plot of inputs and outputs variables

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From the figure 1 above, it can be deduced that under before recapitalization some banks are found to be technically inefficient than the other due to their highly utility of inputs than the outputs. Looking at the points D and K, on the graph they shows the evidence of less efficient than others and only few banks were found to be efficient. Consequently, all the banks after recapitalization were found to be technically efficient based on the fact that they minimized and maximized the use of inputs and outputs variables. When we compare the two instances, it showcases that after recapitalization influence the effectiveness of thirteen selected commercial banks in Nigeria than before recapitalization.

Table 3: It shows the possible correlation that exist between inputs and outputs variables

Correlation between input and output Before Recapitalization			
	Salaries	Interest expenses	Interest income
Earning asset	-0.01417233	0.2169604	0.7507484
Fixed asset	0.08644833	-0.1208947	0.1477602
Deposit	-0.16010620	0.3750828	0.4555744
Pearson's product-moment correlation, p-value = 0.001817<0.05			
Correlation between input and output After Recapitalization			
	Salaries	Interest expenses	Interest income
Earning asset	0.6793752	0.8001377	0.8674789
Fixed asset	0.7243018	0.8274623	0.7142097
Deposit	0.8468353	0.7941516	0.8645735
Pearson's product-moment correlation, p-value = 2.074e-13<0.05			

It was observed from the table 3 above that: there is a slight relationship between the input (Interest expenses, Interest income and Salaries and Wages) and output variables (Fixed Asset, Total Deposit and Earnings Asset) with the p-values (***0.001817***) less than 0.05 which is the level of significance under before recapitalization compared to After recapitalization that has a perfect and strong positive correlation between the variables inputs and outputs with p-value (***2.074e-13***) less than 0.05. This implies that after recapitalization inputs and outputs are more efficient compare to before recapitalization in thirteen selected commercial banks in Nigeria.

B. DEA Analysis

Table 4: DEA Analysis Before recapitalization

	Input Orientation (2000-2004)				**Output Orientation (2000-2004)**			
DMUs	*Efficiency Score*	*CRS*	VRS	Efficiency Ratio	*Efficiency score*	*CRS*	VRS	Efficiency Ratio
ACCESS BANK	1.0000000	0.8863186	1.0000000	0.8863186	1	1.128262	1.000000	0.8863186
AFRI BANK	1.0000000	0.7950453	1.0000000	0.7950453	1	1.257790	1.000000	0.7950453
DIAMOND BANK	0.4688817	0.3630347	0.4244599	0.8552862	1	2.754558	2.241144	0.8136131
ECOBANK	1.0000000	0.5710895	1.0000000	0.5710895	1	1.751039	1.000000	0.5710895
FIRST BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000

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GUARANTEE TRUST BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
OCEANIC BANK	1.0000000	0.6354093	0.6357049	0.9995350	1	1.573789	1.439763	0.9148386
UNION BANK	1.0000000	0.6230646	0.7183973	0.8672982	1	1.604970	1.572760	0.9799313
UNITED BANK	1.0000000	0.7761641	0.9654891	0.8039076	1	1.288387	1.031757	0.8008126
WEMA BANK	1.0000000	0.6391380	0.6474745	0.9871246	1	1.564607	1.394644	0.8913698
ZENITH BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
FIDELITY BANK	1.000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
FCMB	1.0000000	0.8612162	1.0000000	0.8612162	1	1.161149	1.000000	0.8612162
Average	0.959145	0.780806	0.876271	0.894371	1	1.391119	1.206159	0.88371

The results obtained from table 4 above, can be interpreted as follows: The efficiency scores estimate shows the extent to which both inputs and outputs would lead to reduced or increased in equal portion to reach the service leading edge. Column one for both inputs and output orientations represent the efficiency scores of the thirteen selected banks in Nigeria. Twelve out of thirteen selected banks in Nigeria achieved efficiency scores of 100% and the only bank with less efficiency score of 47% is Diamond bank under input orientation. This implies that, twelve banks are found to be technically efficient in terms of their inputs (Salaries and Wages, Interest Income and Interest Expenses) and all the thirteen banks were found to be technically efficient under outputs (Earning Asset, Fixed Asset and Total Deposit). In general, since the average efficiency scores of inputs is 96% and that of outputs is 100%, this implies a weak efficiency in input orientation of Nigeria banks "Before Recapitalization".

The last three columns represent Constant return to scale (CRC), variable return to scale (VRS) and efficiency ratio under both input and output orientations. The average size of the efficiency scores in the constant returns case is 78% with four banks achieving an efficiency score of 100% which is lesser compared with the average size efficiency scores of 88% in the Variable return to scale with eight banks achieving an efficiency scores of 100%. This implies a potential reduction in Salaries and Wages, Interest Income and Interest Expenses, on average, of 22% across the banks with 100% optimal and adequate operation in Earning Asset, Fixed Asset and Total Deposit. Another important technical efficiency is the efficiency ratio, in which we have its average to be 89% under input orientation. Since the value of efficiency ratio is less than one (100%) then we conclude that the banks are apparently operating with 89% optimal scale. If we consider the output orientation, the average efficiency score of the thirteen banks is 1.391119, indicating that these banks on average may be able to increase all their outputs by 39 per cent using the same amount of inputs. And the average efficiency score under VRT is 1.206159, indicating that the banks on average may able to increase all their outputs by 21% using the same amount of input.

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In a nutshell, the less efficient banks has an efficiency score of 47%, which has an average efficiency score of 96%, the average size of the efficiency scores in the constant returns case is 78% with four banks achieving an efficiency score of 100%, The average size of the efficiency scores in the Variable returns case is 88% with eight banks achieving an efficiency score of 100%, the potential reduction in inputs variables is at an average 22% across the banks and the efficiency ratio is 89% optimal. All this were obtained from the table 4.4 above for "Before Recapitalization".

Table 5: DEA Analysis After recapitalization

	Input Orientation (2006-2010)				Output Orientation (2006-2010)			
DMUs	*Efficiency Score*	*CRS*	VRS	Efficiency Ratio	*Efficiency score*	*CRS*	VRS	Efficiency Ratio
ACCESS BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
AFRI BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
DIAMOND BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
ECOBANK	1.0000000	0.7164354	0.8397420	0.8531614	1	1.395799	1.244614	0.8916857
FIRST BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
GUARANTEE TRUST BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
OCEANIC BANK	1.0000000	1.0000000	1.0000000	1.0000000	1	1.000000	1.000000	1.0000000
UNION BANK	1.0000000	0.5326819	0.5375601	0.9909254	1	1.877293	1.747046	0.9306199
UNITED BANK	0.6820535	0.5154656	0.5198544	0.9915575	1	1.939994	1.397768	0.7205015
WEMA BANK	1.0000000	0.5967200	1.0000000	0.5967200	1	1.675828	1.000000	0.5967200
ZENITH BANK	1.0000000	0.7210736	1.0000000	0.7210736	1	1.386821	1.000000	0.7210736
FIDELITY BANK	1.0000000	0.5223969	0.7043774	0.7416435	1	1.914253	1.674452	0.8747288
FCMB	1.0000000	0.7124669	0.8878399	0.8024723	1	1.403574	1.191484	0.8488926
Average	0.975543	0.793634	0.883798	0.899812	1	1.353351	1.17349	0.891094

This table 5 is similar to table 7 in terms of interpretation. The following results were deduced from the above table (table 7): the less efficient banks has an efficiency score of 68% with an average efficiency score of 98%, the average size of the efficiency scores in the constant returns case is 79% with six banks achieving an efficiency score of 100%, The average size of the efficiency scores in the Variable returns case is 88% with eight banks achieving an efficiency score of 100%, the potential reduction in inputs variables is at an average 21% across the banks and the efficiency ratio is 89% optimal.Since the after recapitalization has high efficiency ratio than before recapitalization, then, recapitalization policy in Nigeria has a significance effect on banks performance (see table 6).

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Table 6: Summary of the result obtained from the DEA.

Analytical Procedure	Before Recapitalization	After Recapitalization
Bank with less Efficiency Score	47%	68%
Average Efficiency Score	96%	98%
Constant Returns to Scale	78%	79%
Number of banks achieving 100% efficiency	4	6
Average Efficiency Ratio	88%	89%

IV. CONCLUSION/RECOMMENDATIONS

This study has analysed the relationship between bank recapitalization and monetary discomfort of commercial banks in Nigeria. From the results of the study, we concluded that there exists a possible relationship between the selected variables of interest. The results of Data Envelopment Analysis clearly show that: Recapitalization policy in Nigeria has a significance effect in monitoring the performance of commercial Banks. Most commercial banks in Nigeria achieved 100% efficiency in year 2006-2010 and imply a good performance of banks after recapitalization than before recapitalization. In the light of the problems being encountered in the Recapitalisation programme by some banks and the need to eliminate distress in our economy, the following measures would help to address or reduce the problem and also help the already Capitalized banks to consolidate their position in the money market and banking sector as a whole.

i. Commercial banks should have a code of conduct and a powerful disciplinary.
ii. Re-engineering and staff restructuring should be made the watchword to have highly skilled staff on hand for disposition of bank products and services.

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Appendix A

The R codes for the analysis are as follows:

A.1: After recapitalization

```
library (nonparaeff)
x1<- with (data, cbind(earning.asset,fixed.asset,deposit))
y1 <- with (data, cbind(salaries,interest.expenses,interest.income ))
tab.dat = data.frame(x1,y1)
############free disposability hull for input#####
(fdhio = fdh(tab.dat, noutput = 1, orientation = 1))
############free disposability hull for output#####
(fdhioo = fdh(tab.dat, noutput = 1, orientation = 2))
1/fdhioo
####### Variable returns to scale for input########
vrio = dea(tab.dat, noutput = 1, orientation = 1, rts = 2)
####### Variable returns to scale for output########
vroo = dea(tab.dat, noutput = 1, orientation = 2, rts = 2)
#######Constant returns to scale, convexity and free disposability for input #####
crio = dea(tab.dat, noutput = 1, orientation = 1, rts = 1)
###########Constant returns to scale, convexity and free disposability for output######
croo = dea(tab.dat, noutput = 1, orientation = 2, rts = 1)
########## Input-oriented scale efficiency ##############################
seio = crio$eff/vrio$eff
########### output-oriented scale efficiency  ##############################
seoo = vroo$eff/croo$eff
par(mfrow=c(2,1))
plot(x1,y1,type="p", main="Scatter plot of Inputs and Outputs After Recapitalization", xlab="Input",ylab="Output")
cor(x1,y1)
cor.test(x1,y1)
```

A.2: Before recapitalization

```
############free disposability hull for input#####
(fdhio = fdh(tab.dat, noutput = 1, orientation = 1))
############free disposability hull for output#####
(fdhioo = fdh(tab.dat, noutput = 1, orientation = 2))
1/fdhioo
####### Variable returns to scale for input########
vrio = dea(tab.dat, noutput = 1, orientation = 1, rts = 2)
####### Variable returns to scale for output########
vroo = dea(tab.dat, noutput = 1, orientation = 2, rts = 2)
#####Constant returns to scale, convexity and free disposability for input ######
crio = dea(tab.dat, noutput = 1, orientation = 1, rts = 1)
#######Constant returns to scale, convexity and free disposability for output ###
croo = dea(tab.dat, noutput = 1, orientation = 2, rts = 1)
###### Input-oriented scale efficiency  ############
seio = crio$eff/vrio$eff
##### output-oriented scale efficiency  ###########
seoo = vroo$eff/croo$eff
plot(x,y,type="p", main="Scatter plot of Inputs and Outputs Before Recapitalization",
xlab="Input",ylab="Output",)
cor(x,y)
cor.test(x,y)
```