NIGERIAN BANKS'EFFICIENCY PERFORMANCE:APOST 2004 BANKING REFORMS EVALUATION

BY

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BEING A Ph.D THESIS SUBMITTED TO THE DEPARTMENT OF BANKING AND FINANCE IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN BANKING AND FINANCE, COVENANT UNIVERSITY,OTA, OGUN STATE.

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CERTIFICATION

This is to certify that this thesis titled "Nigerian Banks' Efficiency Performance: A Post 2004 Banking Reforms Evaluation" is the original work of Mr.Omankhanlen Alex Ehimare and is hereby submitted for the award of the Degree of Doctor of Philosophy (Ph.D) in Banking and Finance. We also certify that this work has not been submitted for the award of Ph.D or any other degree in this or any other University.

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DECLARATION

It is hereby declared that this research work titled "Nigerian Banks' Efficiency Performance: A Post 2004 Banking Reforms Evaluation" was undertaken by Mr. Alex EhimareOmankhanlen and is based on his original study in the Department of Banking and Finance, School of Business, College of Development Studies, Covenant University, Ota, under the supervision of Professor E. O. Adegbite and Professor J.A. Oloyede. The ideas and views expressed in this research work are those of the researcher and the views of other researchers have been duly acknowledged.

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DEDICATION

This research work is dedicated to My Lord and Saviour Jesus Christ, to all men and women of good will and my parents who gave me a good foundation in life before they left this world.

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LIST OF ABBREVIATIONS AND ACRONYMS

FIR- First Bank Plc

ZEN-Zenith Bank Plc

PHB-Platinum Habib Bank Plc

UNION- Union Bank Plc

UBA-United Bank for Africa Plc

GTB- Guaranty Trust Bank Plc

FID- Fidelity Bank Plc

DIA-Diamond Bank Plc

ECO-EcobankPlc

ST.IBTC-Stanbic-IBTC

INT.-Intercontinental Bank Plc

WEMA- WEMA Bank plc

UNITY-Unity bank Plc

CITI- Citi bank

AFRIB- AfribankPlc

SPRING-Spring Bank Plc

SKYE-SKYE Bank Plc

FCMB-First City Monument BankPlc

OCEANIC- Oceanic Bank Plc

ACCESS- Access Bank Plc

STERLING- Sterling Bank Plc

ST.CHART.-Standard Chartered Bank

FINBANK- Finbank Pl

ABSTRACT

This study investigated the Nigerian Banks' Efficiency Performance. The period studied was 2005-2009.In addition to the above, the extent of the effect of the bank's fixed assets, operating expenses and total deposit on their efficiency was investigated. The effect of the bank's efficiency on their profitability was also examined. In recent years emphasis is now on using frontier analysis methods in measuring bank efficiency instead of using financial ratios .In frontier analysis, the institutions that perform better relative to a particular standard are separated from those that perform poorly. Such separation is done either by applying a parametric or non parametric frontier analysis to firms within the financial services industry.This study employed the Non parametric Data Envelopment Analysis (DEA)under the assumptions of Constant return to scale (CRS),Variable Return to Scale (VRS) and Scale Efficiency(SE) to estimate the efficiency scores of the banks .A bank with a score of 1 is efficient, while a score below 1 means the bank is inefficient. The tests of the four hypotheses were carried out using Vector autoregressive Analysis (VAR). The findings of the study revealed that GTB was the most efficient bank and it has the least reduction in inputs (4.93%) needed to produce the same amount of output. Moreover it remained efficient throughout the years 2006-2009.Overall, the worst performers are Unity bank, Afribank and UBA. Also the banks did not achieve full efficiency under the CRS, VRS and SE in any of the five years. The findings on the hypothesis tested revealed that fixed assets have a negative relationship with efficiency, operating expenses has no long run relationship with the efficiency variable and total deposit does not affect efficiency. Lastly, efficiency has a positive significant relationship with profitability. This study therefore recommend that the banks that are not efficient should study the operations of GTB the best performer to see if could be adopted to improve their efficiency and the banks should moderate their use of inputs as they could have used fewer amount of inputs to achieve the same level of output. Finally, the acquisition of fixed assets should be reasonable. This is to prevent it from reaching a point where it will impact negatively on the bank's efficiency.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

With the wave of the reforms going on in the Nigerian banking industry, it will be useful to look at the efficiency of the banks. These reforms (consolidation) are being enforcedby the CBN as a follow up to the Basel Accord of 1998 on bank capital and the subsequent general worldwide economic crisis. The Basel Committee on banking supervision (the Committee) introduced its 1988 Capital Accord (the Accord) in 1998.The Accord focused on the total amount of bank capital which is vital in reducing the risk of bank insolvency and the potential cost of a bank's failure for depositors. However, the Committee published a new Accord in 2001 and it was implemented in 2004 upon agreement by members. The rationale for the new Accord is the need for more flexibility and risk sensitivity. The new framework intends to provide approaches which are both more comprehensive and more sensitive to risk than the1988 Accord, while maintaining the overall level of regulatory capital. Capital that is more in line with the underlying risks will allow banks to manage their businesses more efficiently. (BaselCommittee 2001). The Committee believes that the benefits of a regime in which capital is aligned more closely to risk significantly exceed the cost, with the result that the banking system should be sound, safe and efficient. With these reforms, it is expected that banks in Nigeria will become financially stronger, better placed to compete internationally and to finance projects they hitherto could not. The reforms do not necessarily mean that the banks will automatically become more efficient. However, it does mean that the banks are now **potentially** more able to expand and diversify their businesses. Hence these banks' performances have to be evaluated to know which of them are more efficient.

It is usual to measure the performance of banks using financial ratios. According to Yeh (1996), the major demerit of this approach is its reliance on benchmark ratios. These benchmarks could be arbitrary and misleading. Further, Sherman and Gold (1985) noted that financial ratios do not capture the long –term performance, and aggregate many aspects of performance such as operations, marketing and financing, thereby concealing so many characteristics and uniqueness that need to be manifest. In recent years, there is a trend towards measuring bank efficiency using one of the frontier analysis methods. In frontier analysis, the institutions that perform better relative to a particular standard are separated from those that perform poorly. Such separation is done either by applying a non- parametric or parametric frontier analysis to firms within the financial services industry. The parametric approach include Stochastic Analysis, Tick Frontier and the Distribution Free Approach (DFA), while the non – parametric approach is the Data Envelopment Analysis (DEA) andthe Free Disposal Hull, (MolyneuxAlthunbas and Gardener1996).Both of these sophisticated techniques attempt to benchmark the relative performance of production units, but the techniques differ from each other mainly due to their underlying assumptions. Unlike the parametric approach, the non parametric approach puts relatively little structure on the specification of the banking technology (frontier) and thus it is relatively immune from the specification errors. In addition the latter approach does not make any assumptions regarding the structures and distributions of inefficiency. Whereas the parametric approach assumes that part of the deviations is due to pure luck or data problems and part to managerial errors. The Non parametric approach believes that all deviations are due to inefficiency. Furthermore, non- parametric frontiers are estimated using a mathematical linear programming model, thus they mark well with small samples, The parametric frontiers are estimated using econometric techniques, thus they require relatively larger sample size to estimate the unbiased coefficient of the model variables such as inputs, outputs or output prices, environmental factors, inefficiency and error term.

In the view of Sowlati (2001) performance evaluation and efficiency measurement is an important issue for managers since the inherent inefficiencies can be identified and eliminated. Measuring the banks' efficiency and performance has been widely based on a number of key efficiency and performance indicators (KPIs) like, liquidity, profitability, asset quality and capital adequacy.However, each of these indicators gives an incomplete picture of the banks' efficiency and performance. In order to have a meaningful overall measure of the bank's efficiency, a more **sophisticated** method than the traditional efficiency and performance measurement techniques is needed,hence in this study; the Data Envelopment Analysis(DEA) Approach is employed.

The Data Envelopment Analysis (DEA) is a non-parametric methodology developed by Charnes and Cooper at the University of Texas at Austin in 1978. The DEA measures efficiency by estimating an empirical production function which represents the highest values of output benefits that could be generated by input resources as given by a range of observed output/input measures and the relative efficiency of a group of similar units and identifies the best practice frontier. It also indicates targets for inefficient units to improve.

Vassiloglon and Giokas (1990) points out that DEA is quickly emerging as a leading method for efficiency evaluation in terms of both the number of research papers published and the number of applications to real – world problems. The technique was first applied to the banking industry by Sherman and Gold in1985, who used it to explore some operating aspects of bank branches. By explicitly considering the mix of resources used and services provided by individual branches they succeeded not only in identifying inefficient branches but also in locating specific areas of inefficiency at each branch. Also Favero and Papi (1995) used Data Envelopment Analysis (DEA) on a cross section of 174 Italian banks in 1991 to measure the technical and scale efficiencies of the Italian Banks. For the Nigerian banks, their efficiency need to be measured giventhe several reforms that have taken place in the industry in order to determine whether the reforms have been worthwhile or not.Of particular reference were, the 2001 universal banking reform and the 2004 banking consolidation which require banks to increase their capital from the minimum of two billion naira to twenty-five billion naira.Presently in the year 2011 universal banking has been stopped and the banks have now be classified into groups depending on the type of banking business the bank wants to perform with different capital requirement. We have regional bank with capital of ten billion naira, national bank with capital of twenty-five billion naira, international bank with capital of fifty billion naira and merchant bank's capital at fifteen billion naira.

1.2 STATEMENT OF THE RESEARCH PROBLEM

There has been a considerable body of literature investigating the efficiency of banks for the developed countries of the world especially in Europe:(Debasish (2006) Koulenti (2006),Ohene-Asare (2004), Casu,Girardone and Molyneux (2004), Mester (2003), Maudos(2002), Bikker (2001), Berger and Mester (1999),Fare, Groskoff and Lovell (1985)) amongst others.

Examining how efficient are Nigerian banks has become more compelling bearing in mind that the 2004 banking reform is a not-too- distant- event in Nigeria. This reform has since made the minimum capital base of banks in Nigeria to be #25b.This obviously requires that the relative efficiency of Nigerian banks be measured.The banking reform is still ongoing especially to make the banks more risk sensitive.While the present reforms relate to prudential matters,the stability and growth of the financial system, they may also be at variance with the competitive viability of the firms. In fact, a banking system with better resource allocation affects positively the economy, leading to more amount of funds intermediated, safe and sound banking system, greater benefits for customers in terms of price and service quality and profitability.

The dismal performance of banking firms in the 1990s is particularly instructive. In1994, about five (5) banks were declared insolvent and consequently liquidated. Between 1994 and 1998 a total of thirty-one (31) banks were liquidated in Nigeria. (Umoh 2005).Doguwa (1996), as cited by Ayadi, Adebayo and Omolehinwa (1998) noted that, banking institutions in Nigeria faced serious upheaval in the early 1990s. This period witnessed a considerable increase in the number of problem banks. According to them a joint study by the Central Bank of Nigeria (CBN) and the National Deposit Insurance Corporation (NDIC) in 1995 attributed the reasons for the distress to: the prevailing economic recession, policy induced shocks, an increase in the level of risk assumed by banks, poor quality of loans and advances, mismanagement and fraud,among others. These reasons for the increase in the number of problem banks still existed in the period under study 2005-2009 as more banks otherwise thought to be healthy are in fact distressed and can no longer meet their financial obligations. According to Fadiran,Ogwumike and Adenegan (2010),the rate of failure of the banks has been on the increase and the problem has reached unprecedented levels, with the number of banks in liquidation from1994 to 2004 standing at 36. These rather high rates of failure have severe negative implications for all stakeholders in the banking sector and the economy as a whole. What is more exasperating is the fact that the capital loss or loss in business value would have been avoidable if the banks" management had from time to time carried out efficiency measurement of their branches to know which of them is efficient and identify the inefficient ones and take corrective actions on them to avoid the insolvency the banks experienced. Since the problem is now widespread, concern is being raised on the issue of bank efficiency by the bankers, the regulatory authorities, the academia, the public and the international community. QuotingFadiran, Ogwumike and Adenegan (2010) "regulatory authorities report as at 2004 has it that there was deterioration in the level and extent ofdistress in the banking sector in the year, even though no bank was closed during the year". According toAyadi, Adebayo and Omolehinwa (1998)Bank efficiency performance monitoring in Nigeria is weak.

As a result of the implications of banks' inefficiency, the regulatory authorities, the bank operators and researchers are interested in assessing the differences in operational efficiencies among insured banks in the country. If efficiency measurement were frequently carried out in the banks by both the management and the regulatory agencies (NDIC and CBN) it is expected that theproblems would have been identified and corrective measures taken to make the banks more efficient in their utilization of resources. However, if efficiency measurement were carried out to identify the problems and corrective actions were not taken to correct them, then this research work becomes handy as it is going to show among others, the efficient banks, thereby revealing the most efficient of them whose business operations can be emulated to achieve greater efficiency.

1.3 RESEARCH QUESTIONS

The study helped to find answers to the following research questions.

1. To what extent does the bank's fixed asset size have effect on its efficiency?
2. To what extent do the operating expenses of the banks affect their efficiency?
3. What is the degree of relationship between the banks' deposit size and its efficiency?
4. To what extent does the bank's efficiency affect their profitability?

1.4 OBJECTIVES OF THE STUDY

The broad objective of this study is to measure the efficiency performance of Nigeriandeposit money banks in the post year 2004 reforms. Other specific objectives of this research include:

1. To determine the extent the banks fixed assets affect their efficiency.
2. To find out the effect of the banks' operating expense and deposit size on their efficiency.
3. To find out the extent to which the banks' efficiency affect their profitability.

1.5 HYPOTHESIS OF THE STUDY

The hypotheses of the study that were tested are the following:

- The banks' fixed assets size does not affect their efficiency
- The operating expenses of the banks do not affect their efficiency
- The banks' deposit size does not affect their efficiency
- The banks' efficiency does not affect their profitability.

1.6 SIGNIFICANCE OF THE STUDY

There has been a growing need to measure and compare the efficiency of organizationthat have similar set of units like banks, bank branches and hospitals. According to Sowlati (2001) globalization and the subsequent competition provide additional motivation for these efforts. The traditional measure of efficiency, which is the ratio of output to input, is often inadequate due to the existence of multiple inputs and outputs related to the different resources and activities of units. Other concerns in assessing performance are how to improve the performance of institutionsthat are not efficient and how to persuade them to accept the results. Production efficiency is determined by the difference between the observed ratios of combined quantities of an organization's output to input achieved by the best practice. Producing the maximum output or consuming the minimum inputs as compared to what is technically feasible is an essential step for service providers to be able to maximally attain their objectives.

The Nigerian banking Industry went through the 2004 / 2005 bank consolidation reform and this arguably was the most profound change since the evolution of banking in Nigeria. Presently,the reforms are still ongoing. The banks became more determined to be highly efficient in order to make more profit, hence have more return on investment and be more risk sensitive. Therefore, it may not be out of place to maintain that for banks to enhance and sustain their profit performance, they requirewell articulated and more scientific management of their assets and liabilities, which impact on their overall efficiency. This is all the more necessary in the light of the frequency with which the regulatory framework is changing and is expected to change in the future. In order to adapt to this change the banks have to be highly efficient.

In view of the above, a study of banks' efficiency is significant. A complete understanding of the efficiency of banks in Nigeria with special reference to what constitute its inputs and outputs and how these should be managed is useful to both the banks, investment fund managers, bank staff, the board of each bank, shareholders, depositors, researchers and the academia.

This study will be useful to the bank management who require information that will enable them determine whether or not a bank is being run in a safe and sound manner and the extent to which the bank is complying with the laws and directives of the regulatory and supervisory authorities.

The findings are expected to guide the regulatory and supervisory agencies - CBN and NDIC in developing and implementing policy strategies that will help the banks to be more efficient in utilizing their resources, thus impacting positively on the economy.

Moreover, it will help the government to fine- tune its monetary policies which the banks will help to implement to enhance the management of the volume of money and credit supply to achieve the macroeconomic objective of price stability, full employment, economic growth, balance of payment equilibrium and exchange rate stability.

To the depositors, it will enable them to know where to put their funds as savings. While the study will also be useful to future researchers to know the factors that determine what constitute the banks' inputs and outputs and it will serve as a reference work in bank efficiency measurement.A better understanding of the value added by the banks will not only assist the bank management,the academia, government and researchers in measuring the contribution of banks to economic output but ultimately assist the regulators in forming effective prudential guidelines for the banking system as a whole.

1.7 SCOPE

This study was intended to cover the 24 deposit money banks (DMBs) in Nigeria, but only 23 banks were finally covered as the last bank's data (Equitorial Trust Bank) was difficult to get, this was compounded by the fact that it is not quoted on the Nigeria Stock Exchange. The period that was covered during the study was year 2005-2009.

1.8LIMITATION TO THE STUDY. It should be noted that Data Envelopment Analysis(DEA) is primarily a diagnostic tool and does not prescribe any reengineering strategies to make inefficient units efficient. Such improvement strategies must be studied and implemented by managers by understanding the operations of the efficient units. DEA method according to Angelidis and Lyroudi (2006) gives an assumption that the entire deviation from the frontier is considered as inefficiency. Hence measurement errors and other stochastic effects will be incorporated into DEA measurement as inefficiency. Also DEA does not allow for easy comparison with other efficiency measurement tools like ratio analysis.

1.9 OUTLINE OF THE STUDY

This research work is divided into five chapters. The first chapter which gives the introduction incorporates the background to the study, the statement of the research problem,the research questions, objectives, hypothesis, significance and scope of the study. Also, limitation to the study, outline of chapters and the definition of terms are presented in this chapter.

Chapter two covers the literature review where the concepts, theories and the empirical issues are discussed. Chapter three discusses the methodology and model specification. The presentation of results and the analysis is the focus of chapter four. Chapter five presents the summary of the findings, conclusions and recommendations of the study.

1.10 DEFINITION OF TERMS

DEA- Data Envelopment Analysis is a non parametric method used to measure the efficiency of decision making units by estimating production function which represents the highest values of output benefits that could be generated by input resources as given by a range of observed output/input measures and the relative efficiency of a group of similar units and identifies the best practice frontier.

DMU- Decision making unit, this is a unit or bank whose efficiency is to be measured using DEA.

Efficiency- This is the performance of processes involved in transforming a set of inputs into a set of outputs optimally.

Peers-A group of best practice organization against which inefficient organizations or decision making units are compared.

Return to Scale- This describe the response of output to a proportionate change in inputs. The change may be constant, decreasing or increasing depending on whether the output increases in proportion to, less than or more.

Scale efficiency- This is the extent to which an organization can take advantage of return to scale (RTS) by altering its size towards achieving optimal scale.

Price efficiency- This reflects the ability of a firm to use the inputs in optimal propositions, given their respective prices and production technology.

Productivity- Productivity is the ability and willingness of an economic unit to produce maximum possible output with given inputs and technology.(Rajput and Gupta 2011)

Technical efficiency-This reflects the ability of a firm to obtain maximal output in a most efficient way from a given set of inputs.

Total economic efficiency (overall efficiency)-This is the combination of technical and price efficiency.

Structural efficiency-This is a measure of the extent to which an industry keeps up with the performance of its own best production unit.

Benchmarking-This involves comparing performance of organizations against an ideal level of performance or the industry leaders

Inputs-These are the resources utilized by a DMU in the production of outputs.

Outputs-These are goods or services produced by a DMU using inputs resources.

Bank- A business that keeps money for individual people or companies, exchanges currencies, makes loans, and offers other financial services.

Linear Programming-A mathematical method of finding the maximum and minimum values of a linear transformation problem involving variables that are subject to constraints.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Banks in developing economies have been growing in terms of their assets, deposit and capital base especially since the Basel II capital accord, which has led some countries like Nigeria to restructure their financial sector. With this growth it is expected that their efficiency will improve and these banks will impact positively on their countries' economies since there is evidence from Levine and Renelt (1992) and king and Levine (1993) that financial sector development impact positively on economic growth. This is expected as banks provide a major source of finance and their deposit liabilities represent the bulk of anation's money stock. Therefore evaluating their performance and monitoring their financial condition is important to the shareholders, depositors, government, regulatory agents, managers, academic and potential investors.

Presently financial ratios are often used to measure the overall financial soundness of a bank and the quality of its management. Financial sector regulators use financial ratios to help evaluate banks' performance as part of the Capital, Asset quality, Management, Earnings, Liquidity, Sensitivity to market risk(CAMELS) system. In evaluating the efficiency performance of banks a number of criteria such as profit, liquidity, asset quality and attitude toward risk management strategies are usually considered. According to (Barr and Siems 1994 as cited by Ayadi, Adebayo and Omolehinwa 1998) ratios do not directly measure managerial ability to convert a set of inputs into a set of outputs.

The need to measure the efficiency of economic system is important both to the academic and the policy maker. The academic argument and debates on the relative efficiency of industries and firms must be based on a well defined measurement of the concept of efficiency.

The policy maker will consider as most economically rational, the allocation of resources to different uses, if he can determine the relative efficiency of the beneficiary units. This is a concern to all managers of resources, be it in the economy, the industry or firm level, as well as the academia. This stems from the reality of the scarcity of productive resources. In order to be able to solve the resources allocation problems some measuring rod based on a reasonably well defined concept of efficiency is necessary

2.2 THE CONCEPTUAL FRAMEWORK ON EFFICIENCY

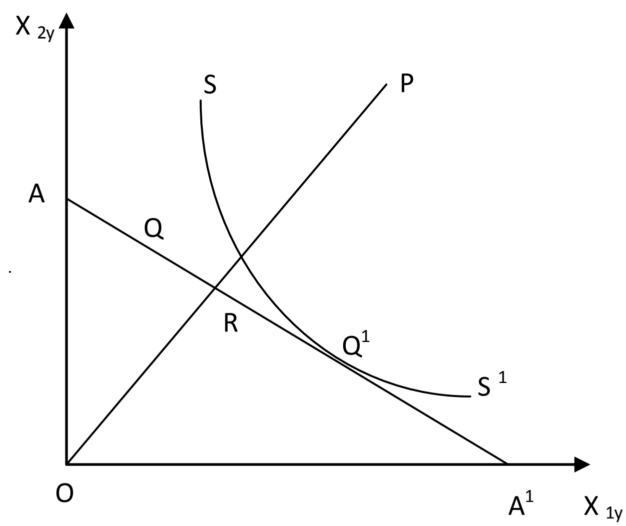
The efficiency concept is used to characterise the utilization of resources to produce outputs. According to Forsound and Hjalmarsson (1974), efficiency is a statement about the performance of processes transforming a set of inputs into a set of outputs. The authors pointed out that efficiency is a relative concept, where the performance of an economic unit must be compared with a standard unit. The identification of a standard should involve value judgement about the objective of the economic activities.

Important as it is from both the academic and practical viewpoints, the concept of efficiency has remained loosely defined in the literature (Farrel 1957).The concept means different things to different people in different circumstances. As Lau and Yotopoulo (1971) put it economic efficiency is an elusive concept in which the policy maker, economist and the engineers all have great stakes. For example, the cost accountant uses the ratio of standard cost to actual cost percent to measure production efficiency (Horngren 1972).while an engineer describes the efficiency of his machine by the relation of output to theoretical capacity or output/ theoretical capacity percent (Amey 1970).However the economist breakdown the economic efficiency of a firm or industry into two separate components: price efficiency and technical efficiency. The former measures a firm's success in choosing an optimal set of inputs, the latter its success in producing maximum output from a given set of input (Farrel 1957).Furthermore, Farrell states that once the adjective 'economic' is dropped efficiency becomes a rather nebulous concept meaning only success in achieving planned objectives whatever they maybe.

2.3 EFFICIENCY MEASUREMENT ACCORDING TO FARRELL

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

Farrell's categories are best illustrated by using a simple example (as shown in figure 2.1below) involving a firm which uses two inputs (x_1 and x_2) to produce a single output(y), under the assumption of constant returns to scale.



Source :Kouleti (2006) How Efficient are the Nordic Banks?

Figure 2.1 Farrell Efficiency

The knowledge of the unit isoquant of fully efficient firms, represented by SS^1 in Figure 2.1, permits the measurement of technical efficiency. If a given firm uses quantities of inputs, defined by the point P, to produce a unit of output, the technical inefficiency of that firm could be represented by the distance QP. The distance QP is the amount by which all inputs could be proportionally reduced without a reduction in outputs. This is usually expressed in percentage terms by the ratio QP/OP, which represents the percentage by which all inputs need to be reduced to achieve technically efficient production. The technical efficiency (TE) of a firm is most commonly measured by the ratio OQ/OP. The technical efficiency (TE) will take a value between zero and one, and thus provide an indicator of the degree of technical efficiency. A value of one indicates the firm is fully technically efficient. In fig 2.1, the point Q^1 is technically efficient since it lies on the efficient isoquant SS^1.

In addition, it is also important to measure the extent to which a firm uses the various factors of production in the best proportion, considering their prices. In fig 2.1, the input price ratio is represented by the slope of the isocost line AA^1 and allocative efficiency (AE) can also be calculated. AE of the firm operating at P is defined to be the ratio OR/OQ, since the distance RQ represents the reduction in production costs that would occur if production were to occur at the allocative (and technically) efficient point Q^1, instead of at the technically efficient, but allocative inefficient point Q.

The total economic efficiency (EE) is defined to be the ratio OR/OP, where the distance RP can also be interpreted in terms of a cost reduction. The production of the technical and allocative efficiency measures provides the measure of the overall economic efficiency.However, factor prices are often difficult to find, and Farrell recommends the technical efficiency concept.

2.3.1 TECHNICAL EFFICIENCY

Technical efficiency, the most common of the efficiency measure, reflects the ability of the firm to obtain maximum output from a set of inputs. That is, it refers to the use of productive resources in the most technologically efficient manner (Worthington, 2004). In the context of bank services production, technical efficiency will refer to the physical relationship between the resources employed, for example, Deposit, labour, fixed assets and capital and some outputs like total loans extended and Investments.

In microeconomic terms, a technically efficient production process is one that lies along the production possibilities frontier or isoquant. Given a Bank production process, that may consume twoinputs X, Y (for example- deposit and fixed assets). The technical efficiency can be depicted as shown in figure 2.2 below.

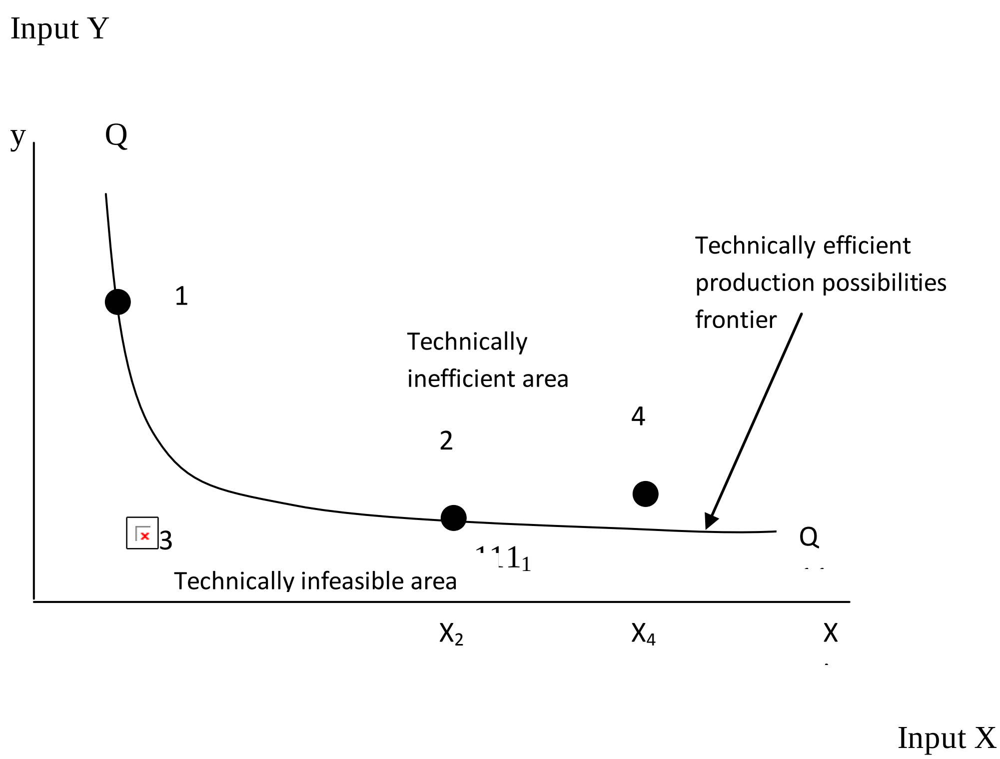
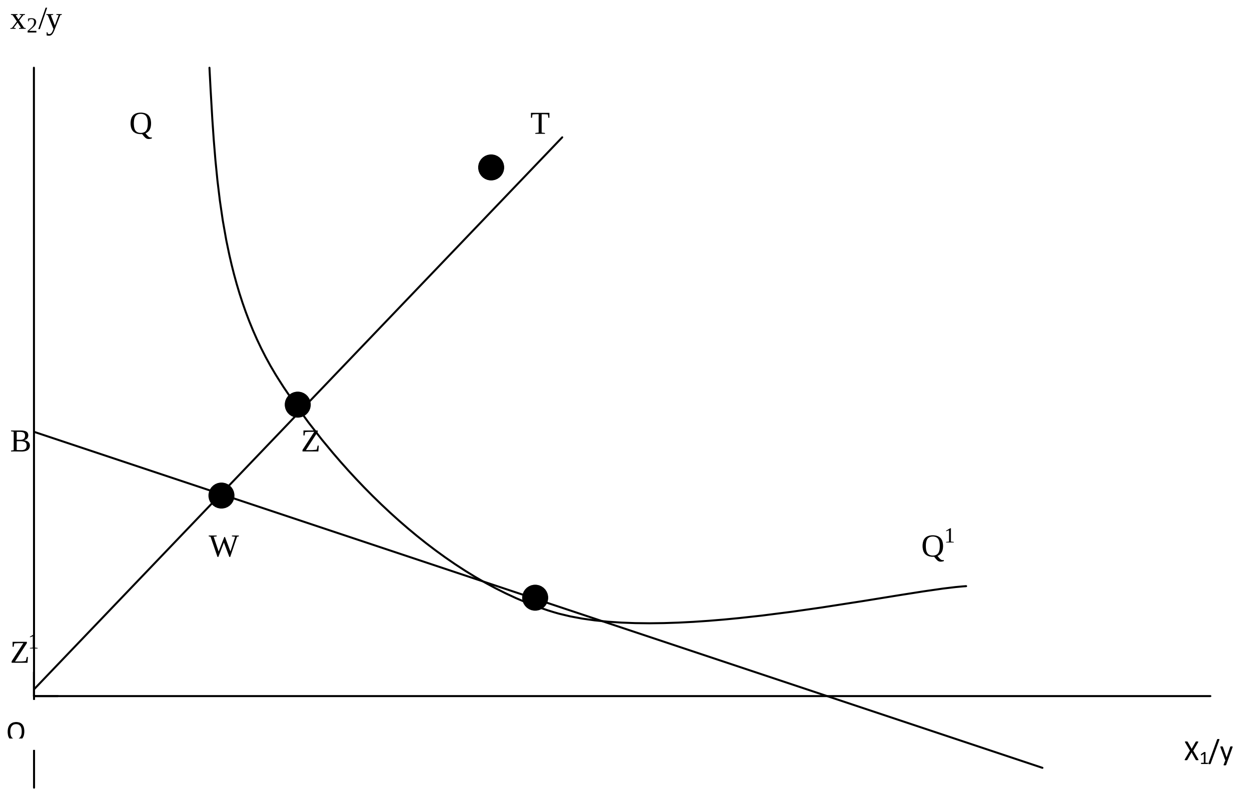


Figure 2.2: Technically Efficient Production Possibilities Frontier

Each Point lying along the production possibilities Frontier QQ_1 represent a technically efficient way of combining various quantities of x and y to produce the same amount of Q. These points are technically efficient because it is impossible to produce output Q with smaller quantities of either x or y as depicted by the line. All points to the left of the production possibilities frontier are infeasible this is because any reduction in the amount of x and y from the amount represented by the frontier leads to a drop in Q. Similarly, points to the right, represent technically inefficient way of producing Q.

2.3.2TECHNICAL ANDALLOCATIVE (PRICE) EFFICIENCY

Farrell proposed that the efficiency of a firm is of two parts: technical efficiency and allocative efficiency. Technical efficiency refers to the ability of a firm to produce maximal output from a given set of inputs over a certain time period. While allocative efficiency reflect the ability of a firm to use inputs in optimal proportion given their respective prices. It refers to whether inputs, for a given level of output and a set of input prices are chosen to minimize the cost of production, assuming that the organization being examined is already fully technically efficient (Steering Committee for the Review of Commonwealth/ State Services Provision, 1997). However, a technically efficient firm could be inefficient in allocative efficiency if inputs are not being employed in proportions that minimize its costs, given their relative input prices (Coelli, 1996). In line with Farrell's idea, the firms' efficiencies can be depicted as shownin figure 2.3 below.

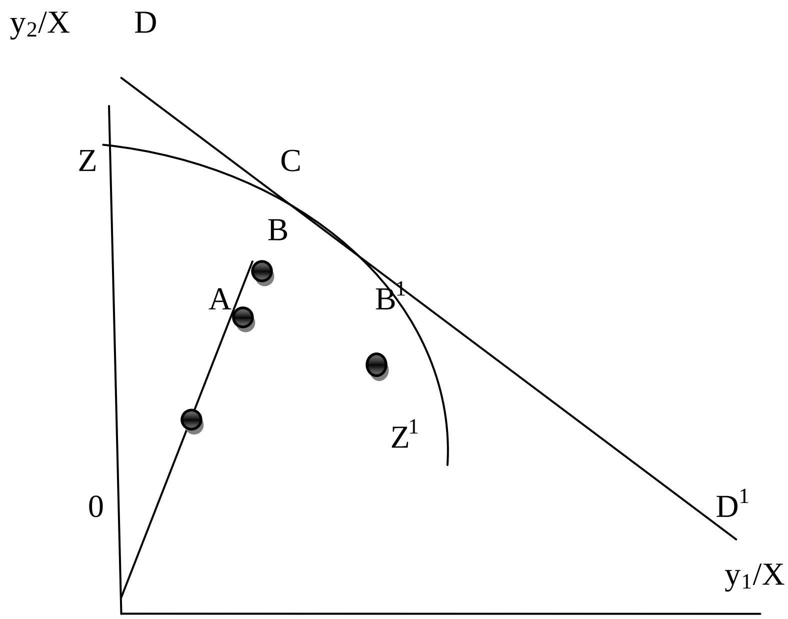


Source: Coelli (1996) A guide to DEAP version 2.1: A Data Envelopment Analysis (Computer) Program

Figure 2.3Technical and Allocative Efficiencies (Input Orientation)

A firm operating at a point T is technically inefficient with its inefficiency represented by the distance ZT. According to Coelli,(1996). The technical efficiency of a firm is most commonly measured by the ratio TE= OZ/OT

The values are usually between zero and one. A value of one indicates the firm is fully technically efficient. If the input price ratio represented by the line BB^1 (above) is known, the allocative efficiency of the firm operating at T is Allocative Efficiency (AE) = OW/OZ



Source: Coelli (1996) A guide to DEAP version 2.1: A Data Envelopment Analysis (computer) program

FIGURE2.4TECHNICAL ANDALLOCATIVE EFFICIENCY (OUTPUT ORIENTATION)

In the output orientation technical efficiency, (TE) =OA/OB using figure 2.4.The distance AB represents technical inefficiency. That is, the amount by which output could be increased without requiring extra inputs. With price information we can draw the isorevenue line DD^1, and define the allocative efficiency to be AE_O = OB/OC. This has a revenue interpretation.

Also one can define overall economic efficiency as the product of these two measures EE (OA/OC) = (OA/OB) X (OB/OC) =TE_OX AE_O .These three measures are bounded by zero and one.

The output and input oriented measures however only provide equivalent measures of technical efficiency when constant returns to scale exist. They will be unequal when increasing or decreasing returns to scale is present (Fare and Lovell, 1978)

2.4 EFFICIENCY MEASUREMENT IN BANKS DEFINED.

As already explained above the efficiency measurement discussion began with Farrel (1957) who, based on the work of Debrue (1951) and Koopmans (1951) defined a simple measure of firm efficiency that could account for multiple inputs.Farrel proposed that the efficiency of a firm consists of two components namely technical and price efficiency (or allocative efficiency).The first component reflects the ability of a firm to obtain maximum output from a given set of inputs while the second reflects the ability of a firm to use the inputs at optimal propositions given their respective prices and the production technology. The combination of these two measures provides a measure of total economic efficiency (or overall efficiency).The efficiency measures are based on the distance of observation to a best practice of efficiency frontier. This distance can be measured in a number of ways, nevertheless it can be restricted to either the horizontal or the vertical direction .When measuring horizontally, the observed input usage is compared to the input bundle with observed input ratios needed with frontier technology at observed output levels .Measuring vertically the observed outputs are compared with potential outputs at the frontier for observed inputs, keeping the relative composition of outputs as observed. Berg S.A, Forsund F.R. and Jansen E.S. (1991).

The choice of the specific efficiency measures depends on the purpose of measuring. In general, efficiency measures are applied on the following three levels. First, at the macro level, where efficiency measures are used at an aggregate level with the purpose of indicating allocativeefficiency.In particular, the economic performance of an observed allocation of resources to different sectors is compared with the result of some ideal allocation .Secondly, the industrial level, where the purpose is to measure the relative performances of the firm within an industry and as a result to give the structure of the industry. Finally, the micro level, this is where the efficiency measurement is concentrated on the utilization of resources within a firm (Forsund and Hjalmarsson1974). This study focuses on the efficiency measures on the industry level and the micro level, that is the relative efficiency of different banks and their utilization of resources.

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

2.4.1 Revenue efficiency

Revenue efficiency measures the change in a bank's revenue adjusted for random error, relative to the estimated revenue obtained from producing an output bundle as efficiently as the best practice bank in a sample facing the same exogenous variables. It is not usually directly measured but is inferred from measurements of an output distance function, which measures output efficiencies.(Adongo, Stork and Hasheela 2005).

Revenue efficiency occurs when banks charge higher prices for higher quality services which result in higher revenues if these banks have the market power to extract some of the consumer surplus that arises.

Empirical studies have found that revenue inefficiency can be attributed primarily to technical inefficiency as opposed to allocative inefficiency (Berger, Humphrey and pulley, 1995).

The main shortfall of the revenue concept is that it does not take into account the increased costs of producing higher quality services and thus focus on only one side of the overall financial picture of a bank (Deyoung and Nolle, 1996)

2.4.2 Cost efficiency

According to Adongo, Stork and Hasheela (2005) cost efficiency measures the change in a bank's variable cost adjusted for random error, relative to the estimate cost needed to produce an output bundle as efficiently as the best practice bank in thesample facing the same exogenous variable, which include variable input prices, variable output quantities and fixed netputs (inputs and outputs). It arises due to technical inefficiency which results in the use of an excess or sub-optimal mix of inputs given input prices and output quantities.

Ikhide (2000) argues that costs are less vulnerable than revenues and profits to extraordinary factors that can affect different banks or categories of banks disproportionately such as variations in open market interest rates. However, using costs alone in evaluating efficiency may not be sufficient to make inferences about banks overall performance as it does not take revenues into account. Thus it does not account well for the revenue gains from provision of higher quality services as described above or from shifts in bank lending portfolios between securities and loans (which have higher returns on the average than securities).Also cost efficiency evaluates performance, holding output quantities statistically fixed at their observed levels, which may not correspond to the optimally efficient levels that involve a different scale and mix of outputs.Therefore, a bank that is relatively cost efficient at its current output may or may not be cost efficient at its optimal output .In addition, the use of constant outputs prevents the evaluation of whether any revenue changes from shifts in outputs offset cost changes except in the special case in which outputs remain constant .This hinders the use of cost efficiency in anti-trust policy analysis because it depends on the assumption that the output of the consolidated banks equals the sum of separate outputs of the banks prior to merger.

2.4.3. Profit efficiency

In banking, costs rise in cases where they have to provide additional or higher quality services. However, revenues may increase more than the cost increase .Looking at efficiency from either the cost minimisation or revenue maximization perspective, it fails to capture the goal of banks to maximise profits by raising revenues as well as reducing costs and does not account well for the unmeasured changes in output quality (Berger and Mester 1999). This shortfall is overcome by the profit efficiency concept. The profit efficiency is divided into the Standard profit efficiency and alternative profit x – efficiency.

2.4.3.1 Standard profit efficiency

Standard profit efficiency measures the changes in a bank's variable profits adjusted for random error, relative to the estimated profit needed to produce an optimal output bundle as efficiently as the best practice bank in the sample, facing the same exogenous variables which include, variable input prices, variable output prices and fixed net puts.

Furthermore, it reflects the goal of profit maximisation by incorporating both cost and revenue issues that result from varying inputs as well as outputs. Therefore, it completely describes the economic goals of banks, which require that effort is spent to raise revenue as well as reduce costs. This corresponds well with the social benefit concept which is useful for policy analysis. This concept refers to the real value of output produced and is represented by the change in revenues for given prices less the real value of resources consumed, which is represented by the changes in costs(Akhavein, Berger & Humphrey,1997)

Standard profit inefficiency may exist and can be categorised into technical and allocative components. Technical profit inefficiency is defined as the loss of profits from failing to meet the production plan as a result of the output being too low or the inputs being too high. Allocative profit inefficiency is defined as the loss of profits from making non-profit-maximising choices of net puts in the production plan. It is modelled as if the bank was responding to shadow relative prices.

Even if banks are economically efficient (technically and allocatively efficient), standard profit inefficiency may still exist if banks are choosing the wrong level of output in order to maximise profits (Mester 2003).Therefore, a bank might do a slightly better job at minimising costs than its counterparts, but it makes less profit because it does not do a good job in selecting its output mix. A bank can always use more inputs without producing more outputs.

This means that standard profit efficiency can be negative, since banks can throw away more than 100% of their potential profits (Akhavein,Berger& Humphrey,1997).

Accountants measure profit efficiency as the percentage change in a bank's variable profit relative to assets. This measure over states efficiency because variable profits measures over states efficiency because variable profits measures earnings before taxes and fixed costs while the numerator used in the resulting ratio- return on assets (ROA) measures earnings after tax and fixed costs (Deyoung& Nolle,1996 and KPMG,2004a&2004b)

Profit efficiency also uses book values obtained from financial statement data available in the bank's annual report. These values vary with factors such as accounting conventions, capital structures of different banks, market power and macroeconomic conditions in the market in which the bank operates (Hughes Lang, Moon and Pagano 1997). The use of standard profit efficiency is justified as long as the assumptions on which it is based hold. Where this is not the case, the alternative profit X-efficiency is adopted.

2.4.3.2 Alternative profit x-efficiency

Alternative profit x-efficiency measures the change in banks variable profits adjusted for random error relative to the estimated variable profit needed to produce an optimal output bundle as efficiently as the best practice bank in a sample facing the same exogenous variables which include variable input prices variable output quantities and environmental factors. It attributes changes in efficiency to practice resulting from management efforts and environmental variables.

The alternative profit efficiency function employs the same dependent variables as the standard profit function and the same exogenous variables as the cost function. Therefore it differs from the standard profit function in that variable output quantities are used in place of variable output prices and overcome the shortfalls of the cost function by including profit in its dependent variable.

The standard profit function specification assumes that banks do not have the capacity to fix output prices while the alternative profit specification assumes that banks have no capacity to expand output. Although it is unrealistic to expect that banks actually take their output as given, this cost is outweighed by the benefit the alternative profit concept provides for analysing bank efficiency in developing countries where the assumptions underlying the cost and standard profit X- efficiency measure do not hold (Berger and Mester 1997). Alternative profit X-efficiency is important where the following conditions exist. (Adongo, Stork and Hasheela 2005).

- Substantial unmeasured differences in quality of output
- Output is not completely variable
- Output markets are oligopolistic
- Output prices are not accurately measured

2.4.3.2.1 SUBSTANTIAL UNMEASURED DIFFERENCES IN QUALITY OF OUTPUT

Inaccuracies in X- efficiency can arise if one does not control for unmeasured differences in quality that are likely to arise because financial statement data do not fully capture the heterogeneity of a bank's output. In addition, the amount of service associated with financial products is by necessity usually assumed to be proportionate to the value of the stock of assets or liabilities on the balance sheet.

The unmeasured differences in quality is controlled by alternative profit X efficiency by considering the additional revenue that covers the cost of generating higher quality output through its dependent variable. If customers in a competitive banking industry are willing to pay for the additional service provided by some banks they can survive in competitive equilibrium because they receive higher revenues that compensate for their extra costs. Therefore unlike cost efficiency it does not penalise banks for producing more costly outputs.

Standard profit efficiency by holding output prices fixed, is less able to account for differences in revenue that compensate for differences in product quality, since these revenue differences may be partly reflected in measured prices.

The standard profit efficiency function assumes that a bank can sell as much output as it wishes without having to lower its prices. This is by taking the output prices as given This may be unrealistic and could lead to an understatement of standard profit efficiency for banks with output below efficient scale that have to reduce their prices to increase output. In addition by taking output prices as given, it does not account for the effect of service quality where banks are making poor service quality choices relative to a best–practice bank which is reflected in lower output prices and revenues.

Other approaches to controlling for unmeasured difference in quality include incorporating variables that are intended to control for the quality of bank output (Mester, 1996)

2.4.3.2.2 OUTPUT IS NOT COMPLETELY VARIABLE

Alternative profit X-efficiency includes output quantities as an independent variable (as opposed to output prices), which essentially holds output statistically constant. Therefore it compares the ability of banks to generate profits for the same levels of output. This controls for the lack of variability in output and prevent a scale bias where large banks are labelled as having higher profit efficiencies than smaller banks because the latter cannot adjust their size quickly to reach the same output levels as the former. The standard profit efficiency function does not control for this because it treats large and small banks as if they should have the same variable output when facing the same exogenous variables.

2.4.3.2.3 OUTPUT MARKET ARE OLIGOPOLISTIC

The lack of perfect competition in the banking industry result in banks exercising some market power over the prices they charge such as in the oligopolistic Nigeria banking industry. By including output quantities as an independent variable the alternative profit X-efficiency function controls for the possibilities that outputs are relatively fixed and prices are chosen by the bank in the short run. This allows for efficiency difference in the setting of prices and service quality where optimising banks set their prices to the point where the market just clears for their output and choice of service quality. It also controls for efficiency difference where banks with market power may be able to increase revenues more than cost when increasing service quality because there may not be adequate competition. Furthermore it controls for efficiency differences where banks economise on service quality and keep costs relatively low. The exercise of market power that raises prices over time maybe measured as an exogenous improvement in business conditions when applying the standard profit efficiency concept but may be measured as an improvement in best practice when applying the alternative profit x-efficiency concept.

2.4.3.2.4 OUTPUT PRICES ARE NOT ACCURATELY MEASURED

Efficiency studies rely on accounting measures of cost, revenues, profits, outputs and inputs drawn from financial statement in a bank's annual report. Although financial statement figures do not directly measure prices they are assured to be accurate.

Financial statement proxies for prices are often constructed as ratios of revenue flows to stocks of assets. This may incorporate noise due to problems in matching revenue flows with the stock of assets, time periods in which they were earned and differences in asset duration, risk, liquidity and collateral. By including output quantities as an independent variable the profit x-efficiency reduces this effect and controls for inaccuracies in the output price data drawn from the financial statements.

Empirical evidence shows that measured output prices do not have the theoretically predicted strong positive relationship with profits and that output quantities do strongly predict profits suggesting that the alternative profit X-efficiency function is a better measure than the standard profit X-efficiency function. However this result may reflect a scale bias problem where output quantities are not completely variable over the short term (Humphrey and Pulley, 1997)

Furthermore, empirical literature shows that the alternative profit X-efficiency function fits the data better than the standard profit X-efficiency function (Humphrey and Pulley, 1997), which implies that when it is applied, output variables as a group are measured with less noise.

2.5 THE RETURN TO SCALE CONCEPT

The return to scale concept reflects the degree to which a proportional increase in all inputs increases output, in the long- term.

There are basically two types - constant return to scale (CRS) and variable return to scale (VRS). The constant return to scale occurs when a proportional increase in all inputs results in the same proportional increase in output. The variable return to scale can be an increasing return or deceasing return to scale. Increasing returns to scale occur when a proportional increase in all inputs results in more than a proportional increase in output, while decreasing returns to scale exists when a proportional increase in all inputs results in a less than proportional increase in output.

According to Koulenti (2006). There are many reasons why a particular firm may possess certain returns to scale properties. The most commonly used example relates to a small firm exhibiting increasing returns in particular tasks. One possible reason for decreasing returns to scale is the case where a firm has become so large that the management is not able to exercise close control over all the aspects of the production process.

2.6 THEORETICAL FRAMEWORK ON EFFICIENCY MEASUREMENT

The theoretical foundations of efficiency study were laid by Debreu (1951), Koopmans (1951), and Farrell (1957) and were extended in particular, by Fare Grosskopf and Lovell (1985 and 1994).Thetheoretical literature on productive efficiency measurement is broadly divided into the non parametric mathematical programming technique and the parametric (which is subdivided into deterministic and stochastic models) based on econometric regression theory and uses a stochastic production cost or profit function to estimate efficiency.

The most commonly used non parametric techniques are Data Envelopment Analysis (DEA) and Free Disposable Hull (FDH). While the commonly used parametric efficiency estimation techniques are the stochastic frontier analysis (SFA), the thick frontiers approach (TFA) and the distribution free approach (DFA).

2.6.1. THE PARAMETRIC TECHNIQUES

This is based on econometric regression technique and it uses a stochastic production cost or profit function to estimate efficiency. It is subdivided into deterministic and stochastic models.

2.6.1.1 STOCHASTIC FRONTIER ANALYSIS (SFA)

The Stochastic Frontier Approach (SFA) specifies a functional form for the cost, profit or production relationship among inputs, outputs and environment factors and allows for random error.SFA employs a composed error model in which inefficiencies are assumed to follow an asymmetric distribution, usually the half- normal, while random errors are assumed to follow a symmetric distribution, usually the standard normal (Aigner, Lovell, and Schmidt 1977). Greene (1990) and others have argued that alternative distributions for inefficiency may be more appropriate than the half-normal, and the application of different distributions sometimes do matter to the average efficiencies found for financial institutions (Mester 1996, Berger and DeYoung 1997).

Despite these potential problems with measuring the levels of efficiency, one positive aspect of the SFA approach is that it will always rank the efficiencies of the firms in the same order as their cost function residuals, no matter which specific distributional assumptions are imposed. That is, firms with lower cost for a given set of input prices, output quantities, and any other cost function will always be ranked as more efficient. This property of SFA has intuitive appeal for a measure of performance for regulatory purpose—a firm is measured as high in the efficiency rankings if it keeps costs relatively low. This is likely to prove helpful in meeting consistency conditions, which are primarily based on rank orders.

2.6.1.2 THE THICK FRONTIER APPROACH (TFA).

This approach specifies a functional form and assumes that deviations from predicted performance values within the highest and lowest performance quartiles of observations (stratified by size class) represent random error, while deviations in predicted performance between the highest and lowest average cost quartiles represent inefficiencies (Berger and Humphrey 1991, 1993). TFA uses the same functional form for the frontier cost function as

SFA, but is based on a regression that is estimated using only the ostensibly best performers in the data—those in the lowest average cost quartile for their size class.

Parameter estimates from this estimation are then used to obtain estimates of best practice cost for all of the firms in the data set (Berger and Humphrey 1991). Banks in the lowest average cost quartile are assumed to have above average efficiency and to form a "thick frontier".

As it is usually implemented, TFA assumes that deviations from predicted performance values within the highest and lowest performance quartiles of firms represented only random error, while deviations in predicted performance between the highest and lowest average- cost quartiles represent only inefficiencies (a special case of composed error) plus exogenous differences in the regressors. Measured inefficiencies thus are embedded in the difference in predicted costs between the lowest and the highest cost quartile. This difference may occur in either the intercepts or in the slope parameters.

In most applications, TFA gives an estimate of efficiency difference between the best and worst quartile to indicate the general level of overall efficiency, but it does not provide point estimate of efficiency for all individual firms. In its application, we need to obtain efficiency estimate for each firm in each time period so that we can compare these estimates to the other frontier efficiency methods. This requires an adjustment. The thick frontier is estimated from data limited to only the lowest cost quartile of firms for each size class. A separate efficiency term for every firm including bank firms not in the thick frontier is calculated using a method very similar to the Distribution Free Approach estimates. The estimated residuals for the entire sample are calculated and it is assumed that the inefficiency disturbances are uncorrelated with the regressors, so that a separate intercept for each firm can be recovered as the mean of its residuals. The most efficient 1% of the sample is assumed to be fully efficient and their average residuals are truncated to be the 1% point of the sample distribution, and the efficiency of each firm is determined from the difference from the frontier in these averages residuals. The TFA efficiency estimates from the panel data set (TFA-P) are based on no one set of parameter estimates over the entire time period, though it is corrected for first -order serial correlation, and the TFA efficiency estimates for each year (TFA-S) estimate the cost function parameters separately for each year.

As was the case for SFA, the levels of efficiency generated by TFA are potentially suspect, since they are based on rather arbitrary assumptions—that the lowest average cost quartile within each size class is an adequate "thick frontier" of efficient firms.

Nevertheless, there are again reasons for optimism regarding the ranking orderings generated by TFA. Since the efficiency orderings are determined by cost function residuals after controlling for input prices, output quantities, and possibly other factors, they have intuitive appeal and are likely to be very consistent with the SFA estimates and other measures of performance.

2.6.1.3 DISTRIBUTION-FREE APPROACH (DFA)

This approach developed by Berger (1993) is based on an earlier panel data approach developed by Schmidt and Sickles (1984). It avoids the strong distributional assumptions of the SFA by introducing a distribution free model. Its main advantage is that it not only uses panel data but also allows the co-efficient to vary over time. DFA specifies a functional form for the cost function as does SFA and TFA, but DFA separates inefficiencies from random error in a different way. It does not impose a specific shape on the distribution of efficiency (as does SFA), nor does it impose that deviations within one group of firms are all random error and deviations between groups are all inefficiencies (as does TFA), instead, DFA assumes that there is a “core” efficiency or average efficiency for each firm that is constant over time, while random error tends to average out over time (Schmidt and sickles 1984, Berger 1993). Unlike the other approaches, a panel data set is required, and therefore only panel estimates of efficiency over the entire time interval are available.

2.6.2. THE NON PARAMETRIC METHODS

These are non parametric mathematical programming technique which includes- Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) used in dealing with evaluating efficiency performance of manufacturing and service operations.

2.6.2.1 DATA ENVELOPMENT ANALYSIS

Data envelopment analysis (DEA) is a tool for evaluating the efficiency performance of manufacturing and service operations. According to Debasish (2006).DEA has been widely used to measure efficiency performance of different financial institutions like banks, insurance and mutual funds. Particularly in the banking sector, it has been applied to benchmark the efficiency performance of different banks or to study the efficiency estimates of different branches of a particular bank. Sherman and Gold (1985) were the first to apply

DEA to banking. In this study DEA will be used to measure the efficiency of different banks in Nigeria.

One of the earliest studies on DEA was conducted by Farell (1957) who attempted to measure the efficiency of production in the single input and output case. Charnes, Cooper and Rhodes (1978) proposed a model that generalizes the single-input and single-output measure of a decision-making unit (DMU) to a multiple-input, multiple-output setting. A DMU is an entity that uses input to produce outputs. This definition of DEA was further emphasized by Talluri (2000) when he defined DEA as a multi-factor productivity analysis model for measuring the relative efficiencies of a homogenous set of decision making units (DMUs). DEA calculates the relative efficiency scores of various Decision-Making Units (DMUs) in the particular sample. The DMUs could be banks or branches of banks. The DEA measure compares each of the banks/branches in that sample with the best practice in the sample .It tells the user which of the DMUs in the sample are efficient and which are not. The ability of the DEA to identify possible peers or role models as well as simple efficiency scores gives it an edge over other methods. As an efficient frontier technique, DEA identifies the inefficiency in a particular DMU by comparing it to similar DMUs regarded as efficient, rather than trying to associate a DMU's performance with statistical averages that may not be applicable to that DMU.(Sathye 2001). The efficiency score in the presence of multiple input and output factors is defined as:

Efficiency= Weighted sum of outputs/ Weighted sum of Inputs...................(2.1)

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

$$\max \sum^{s}_{k=1} v_k y_{kp} / \sum^{m}_{j=1} u_j x_{jp}$$

$$\text{s.t} \sum^{s}_{k=1} v_k y_{ki} / \sum^{m}_{j=1} u_j x_{ji} \leq 1$$

$$V_k, u_j \geq 0 \quad \text{v}k,j, \qquad \text{.......................} \ (2.2)$$

Where

k = 1 to s,

j = 1 to m,

i = 1 to n,

y_{ki} = amount of output k produced by DMU i,

x_{ji} = amount of input j utilized by DMU i

v_k= weight given to output k,

u_j = weight given to input j.

The fraction program shown as (2.2) can be converted to a linear program as shownin (2.3).

$$\text{Max} \quad \sum^{s}_{k=1} v_k y_{kp}$$

$$\text{s.t} \quad \sum^{m}_{j=1} u_j x_{jp} = 1$$

$\sum^{s}_{k=1} v_k y_{ki} - \sum^{m}_{j=1} u_j x_{ji} \leq 0$

$v_k, u_j \geq 0$ vk, j. (2.3)

The above problem is run in n times in identifying the relative efficiency scores of all the DMUs. Each DMU selects inputs 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.

In the usual radial forms of DEA that are based on technological efficiency, efficient firms are those for which no other firm or linear combination of firms produces as much or more of every output (given inputs) or uses as little or less of every input (given outputs). The DEA efficient frontier is composed of these undominated firms and the piecewise linear segments that connect the input/output combinations of these firms, yielding a convex production possibilities set. In the economic efficiency; efficient firms are those which minimize the cost of producing their observed outputs given the best-practice technology and input prices, while the technical efficiency is a physical concept that require the use of only quantity data for its measurement. An obvious benefit of DEA is that it does not require the explicit specification of a functional form and so imposes very little structure on the shape of the efficient frontier.

Under the usual radial forms of DEA, each firm can only be compared to firms on the frontier or their linear combinations with the same or more of every output (given inputs) or the same or fewer of every input (given outputs). In addition, other constraints are often imposed on DEA problems which require comparability with linear combinations of other firms. Other constraints specified in financial institutions research include quality controls, such as the number of branches or average bank account size, or environmental variables, such as controls for state regulatory environment. These other constraints potentially apply to both the radial and cost- based forms of DEA. Having to match other firms in so many dimensions can result in firms being measured as highly efficient solely because there are no other firms or few other constrained variables. That is, some firms may be self-identified as 100% efficient not because they dominate any other firms, but simply because no other firms or linear combination of firms are comparable in so many dimensions. Similarly, other firms may be measured as 100% efficient or nearly 100% efficient because there are only a few other observations with which they are comparable. The problem of self-identifiers and near-self-identifiers most often arises when there are a small number of observations relative to the number of inputs, outputs, and other constraints, so that a large proportion of the observations are difficult to match in all dimensions.

2.6.2.2 CHOOSING DEA MODEL

According to Sowlati (2001), Charnes, Cooper and Rhodes (CCR) (1978) in their original DEA model adopted a ratio definition of efficiency. It generalizes the single-output to single-input classical engineering ratio definition to multiple inputs and outputs without requiring pre assigned weights.

In the CCR model, it is proposed that the efficiency of any DMU can be obtained as the maximum ratio of weighted outputs to weighted inputs subject to the condition that similar ratios for every DMU are less than or equal to one. Using fractional programming, the ratio optimization problem is transformed into an ordinary linear programming problem. To obtain the efficiency of all DMUs, it is necessary to solve a series of linear programs, one for each DMU as the objective function.

DEA identifies the most efficient units and indicates the inefficient units in which real efficiency improvement is possible. The amount of resources saving or service improvement that can be achieved by each inefficient unit to make them efficient is identified and can be used as indications for management action.

Banker, Charnes, and Cooper in 1984, introduced the BCC model in which the envelopment surface is a variable return to scale. The CCR model is employed to estimate the overall technical and scale efficiency of a DMU. However, the BCC model takes into account the possibility that the most productive scale size may not be attainable for a DMU which is operating at another scale size. It estimates the pure technical efficiency of a DMU at a given scale size of operation.

Charnes, Cooper, Seiford and Stutz in 1982 developed a multiplicative model for efficiency analysis. It has a theory similar to that of CCR model; however, a multiplicative combination instead of an additive combination of outputs and inputs was used to achieve virtual outputs, and it has a piecewise log-linear envelopment surface.

The additive model was developed in1985 by Charnes. While it has the same envelopment surface as the BCC model, i.e. variable returns to scale; it projects the inefficient units onto the envelopment surface by decreasing their inputs and increasing their outputs simultaneously.

2.6.2.3 BENCHMARKING IN DEA

According to Talluri (2000), for every inefficient DMU, DEA identifies a set of corresponding efficient units that can be utilized as benchmarks for improvement. The bench marks can be obtained from the dual problem shown as below.

$$\begin{aligned}
&\text{Min} \quad \theta \\
&\text{s.t} \quad \sum\nolimits^{n}_{i=1} \lambda_i x_{ji} - \theta x_{jp} \leq 0 \qquad \forall j \\
&\qquad \sum\nolimits^{n}_{i=1} \lambda_i y_{ki} - y_{kp} \geq 0 \qquad \forall k \\
&\qquad \lambda_i \geq 0 \quad \forall i
\end{aligned} \tag{2.4}$$

where

θ = efficiency score, andλs = dual variables.

Based on problem (2.4), a test DMU is inefficient if a composite DMU (linear combination of units in the set) can be identified which utilizes less input than the test DMU while maintaining at least the same output levels. The units involved in the construction of the composite DMU can be utilised as benchmarks for improving inefficient test DMU. DEA also allows for computing the necessary improvements required in the inefficient unit's input and output to make it efficient. It should be noted that DEA is primarily a diagnostic tool and does not prescribe any reengineering strategies to make inefficient units efficient. Such improvement strategies must be studied and implemented by managers by understanding the operations of the efficient units.

Although benchmarking the DEA allows for identification of targets for improvements, it has certain limitations. A difficulty addressed in the literature regarding this process is that an efficient DMU and its benchmarks may not be inherently similar in their operating practices. This is primarily due to the fact that the composite DMU that dominates the inefficient DMU does not exist in reality. To overcome these problems researches have utilized performance-based clustering methods for identifying more appropriate benchmarks.(Talluri and Sarkis,1997), as cited by Talluri (2000). These methods cluster inherently similar DMUs into groups, and the best performer in a particular cluster is utilised as a benchmark by other DMUs in the same cluster.

2.6.2.4 SENSITIVITY ANALYSIS IN DEA

Since a separate linear program must be run to determine the relative efficiency of each DMU and in real applications the number of units is usually large, it is important to know how sensitive the efficiency scores are to the inputs and outputs. Sensitivity analysis is used to assess by how much the inputs and outputs of DMU’s can be changed without serious effects on their efficiency. Different studies have been done on sensitivity analysis of DEA models.

Charnes, Cooper,Lewin,Morey and Rousseau. (1985) studied the sensitivity of the CCR model. They focused on ranges of variation in a single output for a particular DMU which do not affect the efficiency score. Since an increase in any output cannot worsen the efficiency score, they restricted their study to reductions of outputs.

Charnes and Neralic (1990) studied the sensitivity analysis of the additive model in DEA for simultaneous change of all inputs and outputs of an efficient unit.

Zhu (1996) used modified versions of the CCR model for sensitivity analysis. Sufficient and necessary conditions for upward variations of inputs and downward variations of outputs of an efficient unit retaining its efficiency at 1.0 were provided. Seiford and Zhu (1998) provided a procedure for the sensitivity analysis of an efficient unit in a CCR model and extended Zhu's approach by allowing simultaneous changes in all inputs and outputs. They developed a new sensitivity analysis approach for CCR, BCC and additive models in 1998 and generalized the sensitivity approach by allowing small change in data movement simultaneously for all DMUs.

2.6.3 THE FREE DISPOSAL HULL (FDH)

This approach is a special case of the DEA model where the points on lines connecting the DEA vertices are not included in the frontier. Instead the FDH production possibilities set is composed only of the DEA vertices and the FDH points interior to these vertices. It relaxes the convexity assumption of DEA. The FDH frontier is either congruent with or interior to the DEA frontier. The FDH generates larger estimates of average efficiency than DEA (Tulkens 1993).

2.7ALTERNATIVE WAYS TO MEASURE EFFICIENCY

There are other approaches to measuring bank efficiency apart from the use of frontier analysis. These other ways include the following:

2.7.1 RISK RATINGS

The use of risk ratings as an alternative way to capture bank efficiency is recommended by the Basel 11 capital accord .The measure used under this approach is the value- at- risk (VAR) which is defined as the loss to an investment portfolio due to an adverse market movement. (Sardenburg and Schuermann 2003).It is a scalar measure and may not incorporate all the different aspects of the highly dimensional problem that it summarises. Risk ratings also capture credit risk, concentration risk, interest rate risk and business risk (operational risk). Operational risk is defined as the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events, thus capturing x-efficiency (Basel Committee on banking supervision 2001).

2.7.2 BANKING PRODUCTIVITY PER EMPLOYEE HOUR.

This involves using banking productivity per employee hour. This is based on the fact that the National Office of Statistics collects productivity statistics on the various sectors in the economy. Typically, the statistics view efficiency from the production approach and not from the intermediation approach.However, bank employee labour hours may be an inaccurate indicator of efficiency because of trends towards out sourcing of bank office operations to holding company affiliates and service bureaus. Failure to account either for the labour used elsewhere in the holding company but effectively working for the bank or for the cost of this labour and capital could bias productivity measure toward a spurious finding of productivity arising from the change in output per employee labour hour because of the incorporation of total labour hours worked by employees and non-employees.

2.7.3 MINIMUM RESERVE

Banking regulatory agencies use a comparison of actual reserves (required as well as excess reserves) held against the regulatory minimum as a legal basis for taking supervisory action (Demigurt-kurt and Huizinga 1998). A high ratio of actual reserves over the regulatory minimum would be an indicator of financial repression and inefficiency.

2.7.4 MONETARY AGGREGATES

Some macroeconomic studies use monetary aggregates to represent efficiency. These aggregates include the ratio of bank credit granted to the private sector to GDP as an explanatory variable in growth regressions (King and Levine 1993). This assumes that pure size of the financial system is closely related to the quality of financial services or efficiency which may not be so. In addition the level of bank credit may simply reflect the demand for bank services which may have nothing to do with the banking sector's own efficiency. The use of monetary aggregates is only justified if there is an absence of reliable data on the number and size of deposits and loans available.

2.7.5 INTEREST SPREADS AND MARGINS

This is a direct measure of bank's mark-up over cost. It is a common macroeconomic measure of efficiency. The justification for using interest spreads to measure efficiency is because financial intermediation affects the net return to savings and the gross return for investment.

Net interest margin can also be used to measure efficiency since it is argued that net interest margins mirror the interest spreads. However they also reflect a variety of other factors including bank characteristics, macroeconomic conditions, taxation, deposit insurance regulation, overall financial structure and several underlying legal institutional indicators (Demirgurt-kurt and Huizinga 1998). Therefore a change in the interest margins may be a result of changes in factors other than efficiency which interest margins cannot account for, because they only capture scale and scope economies.

2.7.6 ACCOUNTING RATIOS

Some microeconomic studies use accounting ratios such as return on assets (ROA), return on investment (ROI) and return on equity (ROE) to represent efficiency (Ikhide 2000 and Badari 2004).Ikhide (2000) argues that the use of total assets, loans or deposits like in alternative profit x-efficiency, does not sufficiently capture bank output, which he defines as the value of service rendered by banks

However, this definition only applies if the banks provision of financial service is viewed in terms of the production approach, as opposed to the intermediation approach that will be adopted in this study.

Accounting ratios are limited as measures of efficiency. Since they do not control for output mix or input prices they do not enable the determination of whether x-efficiency or scale and scope efficiency are the source of variation in bank performance (Akhavain,Berger and Humphrey,1997).Also ratios that contain assets, such as ROA, assume that all assets are equally costly to produce and all locations have equal costs of doing business. In addition, many accounting ratios exclude interest expenses which comprise most of the total bank costs and often represent operating expenses incurred elsewhere in the banking system (Berger and Humphrey, 1993).Furthermore, changes in accounting ratios may reflect a change in the numerator or denominator values as opposed to changes in the overall ratio (Demirguc-kurt&Huizinga ,1998).

Finally, accounting ratios do not capture long term performance, and aggregate many aspects of performance such operations, marketing and financing. (Sathye 2001)

2.7.7 USING FRONTIER ANALYSIS TO CAPTURE THE DEVIATION BETWEEN ACTUAL AND DESIRED PERFORMANCE

Microeconomic studies apply frontier analysis, which captures the deviation between actual and desired performance. They measure efficiency relative to an objective function for output (product) maximisation and profit maximisation. The bank is viewed as a black box where the production function is a simple relationship between inputs and outputs (Farrell 1957) and the issue facing banks is to maximise profits while reducing costs. This is done by selecting:

-The level of inputs: physical capital (k), labour (h) and technology (t) which depends on the next three choices (Frei, Harker and Hunter,1998)

-The input transformation function

-The production function for the organisation

-The mix of outputs that will maximise profits.

The bank that is best at executing these four choices within its environment will be the most x-efficient.

2.7.8 MARKET-BASED APPROACHES

According to Adongo, Stork and Hasheela [2005] some microeconomic studies use a market –based approach. This measures efficiency in terms of expected profit being earned for a given level of risk relative to a best practice bank on a risk-expected return, efficiency frontier (Hughes, Lang, Moon and Pagano 1997).A bank with too little profit for the amount of risk it is taking is deemed inefficient. Banks that achieve efficient allocations maximise the market value of their assets and are more profitable.

The use of the market-based efficiency measure assumes the existence of at least a semi-strong efficient financial market. This market provides the best measures of estimating whether firms are creating value for shareholders or not because most of the information is incorporated into prices (Brealey and Myers 1991). Under this financial market structure the relative efficiencies of banks will be reflected in market prices directly through lower cost or higher output or indirectly, through higher customer satisfaction and higher prices that translates into better stock performance (Adenso –Diaz and Gascon, 1997).

The choice of measure that one uses to measure efficiency is important because each one will give different results if used to investigate the relationship with other economic variables. The alternative profit x-efficiency measure attributed to Farrell (1975) models the bank's activities using the production function and measures how close a bank's profit is to what a best practice bank's profit would be for producing the same output bundle under similar conditions. The best practice bank defines the frontier that represents the best practice observed in the industry and not the theoretical maximum profit possible which is not easily observable.

Besides the economic approaches used to measure efficiency summarised above, many banks have their own internal bench marking procedures that are mostly used at the branch level. These consist of relatively simple comparison or rankings of offices according to a set of performance measures, which include the stock of accounts serviced or the values within various accounts. These efforts lack a powerful and comprehensive optimising methodology similar to the frontier analysis approach that will be used in this study.

2.8 THE DEFINITIONOF BANKS' INPUTS AND OUTPUTS

Attempts to measure and compare bank efficiency are bedevilled by the absence of any coherent measure of what constitutes input and output. The definition of banks inputs and outputs is an issue related directly to its function description. As a result, a variety of definitions about variables exist in the literature.

For example, Angelidis and Lyroudi (2006) citing Nathan &Neave (1992),who in examining the efficiency of Canadian banks, addressed the difficulty of determining whether deposits of banks were inputs which were converted into loans and other assets or whether they were outputs of the banking services. They followed the intermediation approach regarding deposits as inputs.

According to Stanton (1998) there was collineality between loans and deposits so he had to eliminate either loans or deposits in the input vector. He finally chose deposits as an input variable. He also supported the view that larger number of inputs increased the likelihood of an observation to be improperly enveloped.

Generally each definition of input and output carries with it a particular set of banking concepts, which influence and limit the analysis of the production characteristics of the industry. The various definitions can be classified into three categories based on the preferred approach:the user cost approach, the value added approach and the intermediation approach.

The user cost approach defines a variable as output or input oriented according to its contribution to banks revenue. That means that if the financial return on the assets exceeds the opportunity cost of funds, DMU's assets are considered as outputs.

The value added approach considers deposits as outputs. The idea is that funds are collected from depositors and there is competition among DMU's to attract customers. Berger and Humphrey (1992) modified this approach and considered deposits as both inputs and outputs. According to the intermediation approach, only banks assets are thought as outputs while deposits are regarded as inputs. The notion of this approach is that DMU's buy and sell funds acting as intermediaries between borrowers and receivers of funds.

The approach used in this study is the intermediation approach which was originally developed by Sealey and Lindley (1977) as cited by Ohene – Asare (2004) which define deposits as input and loans as output. However, no approach can be considered as superior to the others. (Pastor,Perez and Quesada (1997) as cited by Angelidis and Lyroudi (2006)).

2.9 EMPIRICAL EVIDENCE ON EFFICIENCY MEASUREMENT IN BANKING

A major empirical work on efficiency in the banking industry can be traced to Berg, Forsund and Jansen (1992) as cited by Angelidis and Lyroudi (2006).They introduced the Malmquist index as a measurement of the productivity change in the banking industry. They focused on the Norwegian banking system during the deregulation period 1980-1989. Their results indicated that the deregulation led to a more competitive environment. The increase of productivity was faster for larger banks, due to the increased competition they faced.

Favero and Papi (1995) used the non-parametric Data Envelopment Analysis on a cross section of 174 Italian banks in 1991 to measure the technical and the scale efficiencies of the Italian banking industry. In implementing both the intermediation and the asset approach the traditional specification of inputs was modified to allow for an explicit role of financial capital. In addition, regression analysis was used on a bank specific measure of inefficiency to investigate determinants of banks' efficiency. According to the empirical results, efficiency was best explained by productivity specialization by bank size and to a lesser extent by location (North-Italian banks were more efficient than South-Italian banks).

Altunbas and Molyneux (1996) examined the banking systems of France, Germany, Italy and Spain for economies of scale and scope. They found differences among four markets regarding economies of scale. However, the latter was significant only for the Italian banks, which gained as they succeeded in lowering costs.

Allen and Rai (1996) estimated a global cost function using an international database of financial institutions for fifteen countries. Their sample was divided into two groups according to the country's regulatory environment. Universal banking countries (Australia, Austria, Canada, Switzerland, Germany, Denmark, Spain, Finland, France Italy, United kingdom and Sweden) permitted the functional integration of commercial and investment banking, while separated banking countries (Belgium, Japan and USA) did not. Large banks in separated banking countries exhibited the largest measure of input inefficiency and had anti-economies of scale. All other banks had significantly lower inefficiency measure. Moreover, small banks in all countries showed significant levels of economies of scale. Italian banks, along with French, UK and USA ones were found less efficient from Japanese, Austrian, German, Danish, Swedish and Canadians ones.

Pastor, Perez and Quesada (1997) as cited by Angelidis and Lyroudi (2006) analyzed the productivity, efficiency and differences in technology in the banking systems of United States, Spain, Germany, Italy, Austria, United Kingdom, France and Belgium for the year 1992. Using the non-parametric approach DEA together with the Mamquist index, they compared the efficiency and differences in technology of several banking systems. Their study used the value added approach. Deposits, productivity assets and loans nominal values were select as measurements of banking output, under the assumption that these are proportional to the number of transactions and the flow of services to customers on both sides of the balance sheet. Similarly, personnel expenses, no-interest expenses, other than personnel expenses were employed as a measurement of banking input. According to the results France had the banking system with the highest efficiency level followed by Spain, while UK presented the lowest level of efficiency.

Bikker (2001) examined the banking productivity of a sample of European banks in various countries amongst which were Italy, Spain,France, Belgium Switzerland and Luxemburg for the period 1989-1997. His results indicated that the most inefficient banks were first the

Spanish ones, followed by the French and Italian banks. The most productive banks were the ones in Luxemburg, Belgium and Switzerland.

Hasan, Lozano-Vivas and Pastor (2000) analyzed the banking industries of Belgium, Denmark, France, Germany, Italy, Luxemburg, Netherlands, Portugal, Spain and the United Kingdom. First the authors attempted to evaluate the efficiency scores of banking industries operating in their own respective countries. Later, they used a common frontier to control for the environment conditions of each country. The results based on cross country efficiency scores suggested that the banks in Denmark, Spain and Portugal were relatively the most technically efficient and successful. Especially when the banks of these countries tried to enter any other European countries of the sample were most efficient. On the other hand, the banks in France and Italy were found to be the least efficient institutions among the ones in the sample.

Fernandez, Gascon and Gonzalez (2002) studied the economic efficiency of 142 financial intermediaries from eighteen countries over the period 1989-1998 and the relationship between efficiency, productivity change and shareholders wealth maximization. The authors applied DEA to estimate the relative efficiency of commercial banks of different geographical areas (North America, Japan and Europe). The European banks were from Austria, Belgium, Denmark, Finland, Germany, Ireland, Italy, Luxemburg, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. The three preferred outputs were total investments, total loans, and non-interest income plus other operating income. In parallel, the four inputs values were property, salaries, other operating expenses and total deposits. All these values are expressed in billions of US dollars. Their results showed that the productivity of commercial banks across the world has grown significantly (19.6%) from 1989-1998. This effect has been principally due to relatively efficiency improvement, with technological progress having a varying moderate effect.

Maudos (2002) analyzed the cost and profit efficiency of European banks in ten countries including Italy, for the period of 1993-1996. They used multiple regression analysis along with DEA and they split their sample into large, medium and small banks. Their result indicated that only medium size banks were profit efficient. Lozano-Vivas, Pastor and Pastor (2002) examined banking efficiency in ten European countries among which were Italy, Netherlands and so on for 1993. The authors adopted the value added approach and analyzed the macroeconomic environment where the banks operated. Their result showed that banking efficiency was low in Europe during that time period. Furthermore, the banks in Italy and Netherlands were the only ones which were not able to operate in a unified European banking system compared to the most efficient banks of other sampled countries.

Casu and Molyneux (2003) employed DEA to investigate whether the productivity efficiency of European banking systems have improved, and converge towards a common European frontier between 1993 and 1997.The geographical coverage of the study were France, Germany, Italy, Spain and the United Kingdom.Their results indicated relatively low average level of efficiency. Nevertheless, it was possible to detect a slight improvement in the average efficiency score over the period of analysis for almost all banking system in the sample with the exemption of Italy.

Schure, Wagenvoort and O'Brien (2004) estimated the productivity of the European banking sector for the period of 1993-1997. They found that larger commercial banks were more productive on the average than smaller banks. However the Italian and Spanish banks were found to be the least efficient.

On the other hand, Casu, Girardone and Molyneux(2004) for the period 1994-2000, in an efficiency analysis of the European banking institutions found that Italian banks had an 8.9% productivity increase, Spanish bank has 9.5% increase, while German, French and English banks had 1.8%, 0.6% and 0.1% productivity increase, respectively. The main reason for such improvement in efficiency for the Italian and Spanish bank was the cost reduction that these institutions managed to achieve.

Practically, Data Envelopment Analysis is being used in the banking sector by some banks in their reallocation of resources. See for example Oral and Yolalan (1990) who examined 20 branches of a Turkish Commercial Bank where DEA was used to reallocate resources between branches. Building on the previous work by Sherman and Gold (1985), Sherman and Ladino (1995) reported on the implementation of DEA results in the restructuring process of 36 US branches of a bank that led to actual annual savings of over $6 million. Zenios, Zenios, Agathocleous and Soteriou (1999) studied the Bank of Cyprus where the bank adopted their model and findings to establish policy guidelines and provide operational support for productivity improvements. Then, Athanassopoulos and Giokas (2000) examined 47 branches of the Commercial Bank of Greece and the DEA results were used to implement the proposed changes in the bank's performance measurement system. All the examples as cited by (Mansoury and Salehi 2011).

For Nigeria, Ayadi, Adebayo and Omolehinwa (1998) in their attempt to determine the quality of bank management used Data Envelopment Analysis (DEA) and found that the banks in Nigeria that were relatively efficient are those that have been in existence for a long period of time. Also Fadiran, Ogwumike and Adenegan (2010) in evaluating the relative efficiency of insured banks in Nigeria observed fluctuations in the performance of the banks. The number of efficient banks increases and decreases over time. The number of banks performing below the mean also increased over time. Further, they quoted previous empirical studies of Osota 1995, Afolabi and Osota 2002 and Bwala 2003 that show that most Nigerian banks are highly operationally inefficient.

CHAPTER THREE

RESEARCH METHODS

3.1 INTRODUCTION

This section describes the methods employed in the present study. It shows the procedures for data gathering and analysis. The models from which answers to questions raised in this study are obtained are also presented.

In the field of management and social sciences four main types of research methods are commonly utilized. These are observation, experimental, survey and ipso-facto methods. However, the choice of which to use depends on the researcher's focus. In this study, the ipso-facto method is utilized, since Data Envelopment Analysis (DEA) obtains evaluation of decision making units. According to Hollingsworth and Street (2006) efficiency analysis mostly utilize historical data.

Berger and Mester (1997) compared three different parametric techniques with cost and profit efficiency approaches. Their results reveal that there was little effect from the choice of parametric estimation procedure, but reinforced the view of superiority of profit based approaches. There have been studies that employ both DEA and standard regression techniques, but their findings reveal only minor differences between the two measures. [Resti (1997), Stanton (1998)]. Berger,Hunter and Timme (1993) explain the difficulties in applying translog cost function to test for efficiencies. Furthermore, they stated that the assumptions required by parametric approaches regarding the distribution of the error terms are very restrictive. DEA is an alternative approach that assumes that all deviations from the frontier are inefficiencies without any prior assumptions.

DEA is a non-parametric approach of frontier estimation. The term DEA was invented by Charnes, Cooper and Rhodes (1978). DEA measures the relative efficiency of a set of firms. In production theory there are two types of efficiency measures, at the firm's level. The first is the technical or production efficiency, which measures the levels of success that a firm has reached by producing maximum outputs from a given set of inputs. The second one is the price or allocative efficiency, which measures a firm's success in choosing an optimal set of inputs for a given set of input prices.(Angelidis and Lyroudi2006).A DEA is a technique based on linear programming that places a non-parametric surface frontier (a piecewise linear convex isoquant) over data points to determine the efficiency of each firm in relation to the frontier. The aim of DEA is to estimate relative efficiency among similar decision units that have the technology (processing procedure) to pursue similar objectives (outputs) by using similar resources (inputs). The higher efficiency is denoted by one, while the lower is denoted by zero.

One of the main advantages of DEA is that the production frontier is not determined by a specific functional form, but it is generated from the actual data of the decision making units (DMUs) under review, while the required assumptions are minimal.(Koulenti 2006).These characteristics are regarded by many researchers as the main advantages of this method, especially over the parametric approaches,like stochastic frontiers.(Koulenti 2006);(Casu and Molyneux2003). In addition Koulenti quoting Berg, Forsund and Jansen (1991) argues that the DEA approach of fitting facets as close as possible to the observations seems more appropriate when the knowledge of the underlying technologies is weak. Furthermore, it is easy to accommodate multiple input and multiple output models, where the inputs and outputs can be expressed in different units, and does not rely on price information as in the parametric frontier cases; see (Berg, Forsund and Jansen1991). DMUs are directly compared against the peer or a combination of peers. IndeedCoelli(1998) conclude that while efficiency is generally measured using either DEA or stochastic frontier methods, the DEA approach may often be the optimal choice.

DEA constructs the production-possibilities frontier from the data by using linear programming. The efficiency of a firm, or a decision making unit (DMU), as firms are called in most DEA literature, using "n" different inputs to produce "m" outputs, is measured as, the ratio of weighted outputs to weighted inputs. Once the frontier is constructed, the measure of efficiency for any DMU is derived by comparing Euclidean distance from points on the frontier, with corresponding distance from the axis to points which are below the frontier. DMUs that lie on the frontier are efficient, while DMUs under the frontier are considered inefficient, since they use the same level of inputs but produce less output, or have the same outputs but employ more inputs.

The basic shortcoming of the DEA method is its assumption that the entire deviation from the frontier is considered as inefficiency. Hence, measurement errors and other stochastic effects will be incorporated into the DEA measure as "inefficiency". According to Stanton (1998) the use of financial data has some special problems for all efficiency-measurement approaches including DEA technique. The root of difficulty is the need to translate or rescale financial data when negative values are present, to accommodate the estimation procedure or the available software.

3.2 MODEL APPROACH AND ITS JUSTIFICATION

The operational research tool of Data Envelopment Analysis (DEA) was utilized in carrying out this study, since it does not require an explicit specification of any functional form relating inputs to outputs.(Dyson 2001).The assumptions under which the DEA model is used are the constant return to scale (CRS) and the variable return to scale (VRS).The basis for the use of constant return to scale is if the decision making units are operating at optimal scale. Operating at optimal scale may not hold for all the Decision Making Units (DMUs), hence the variable return to scale (VRS) which assumes the performance of the DMUs as depending on their scale of operations is used to obtain a more robust result. This is supported byGalagedara and Edirisuriya (2004) who stated that, if uncertainty exists in the choice of the appropriate variable, variable return to scale VRS is safer in terms of obtaining a more robust result. Since we are assessing how efficient DMUs use inputs to produce outputs both CRS and VRS assumptions are necessary. This is because the deviation of the frontier of CRS from the VRS frontier represents the scale efficiency.

3.3 SOURCES AND CHOICE OF DATA

Due to the nature of the study only secondary data were used.The data used were got from the banks financial statements for the period 2005-2009. There is a debate in the literature on what constitute a bank's input and output. According to Angelidis and Lyroudi (2006) the definition of a bank's inputs and outputs is an issue related directly to its function description .As a result, a variety of definitions about variables exists in the literature. They quoted Nathan and Neave (1992) who in examining the efficiency of Canadian banks, addressed the difficulty of determining whether deposits of banks were inputs, which were converted into loans and other assets, or if they were outputs of the banking services. They followed the intermediation approach, regarding deposits as inputs. Furthermore they cited Stanton (1998) as having stated that there was collinearity between loans and deposits so he has to eliminate either loans or deposits in the input vector. He finally chose deposits as an input variable. He also supported the view that larger numbers of inputs increases the likelihood of an observation being improperly enveloped. This study will follow the intermediation approach and also regard deposits as an input. According to Berger and Humphrey (1992) as cited by Pelosi (2008), intermediation approach is well suited to analysing firm level efficiency, whereas the production approach is suited to measuring branch level efficiency. This according to Pelosi (2008) is attributable to the fact that management at the firm level will aim to reduce total cost, including interest and non – interest expenses, while at the branch level given its decentralised nature, employees have little influence over funding and investment decisions and therefore interest cost. The input data that will be used for this study will be –Total deposits, fixed assets and operating expenses. While the outputs will be- Total loans extended, net profits, and total investment. This choice of data is supported by the work of Fernandez, Gascon and Gonzalez (2002) who studied the economic efficiency of 142 financial intermediaries from eighteen countries over the period 1989-1998 and the relationship between efficiency, productivity change and shareholders wealth maximization. The authors applied DEA to estimate the relative efficiency of commercial banks of different geographical areas (North America, Japan and Europe). The European banks were from Austria, Belgium, Denmark, Finland, Germany, Ireland, Italy, Luxemburg, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Their three preferred outputs were total investments, total loans, and non-interest income plus other operating income. In parallel, the four inputs values were property, salaries, other operating expenses and total deposits. Further support to the choice of data in this study is the work of Pasiouras (2008) who in estimating the technical and scale efficiency of Greek commercial banks adopted the intermediation approach and his inputs were fixed assets, customer deposits and number of employees, while the outputs he used were loans and other earning assets. The number of factors (inputs and outputs) selected need to be small compared to the total number of DMUs to strengthen the discrimination power of DEA. Usually, the total number of DMUs should be at least twice the number of inputs plus output factors (Sathya 2006).Based on this condition, the twenty –three banks used meet the condition given since the number of inputs used is three and output is three. This added together and multiplied by two is still less than the number of banks (23) in this study; hence the rule according to (Sathya 2006) is fulfilled. The banks are grouped into two, based on the fact that some (sixteen banks) have operating expenses reported in their financial records, hence stated among their inputs, while in others(seven banks) the operating expenses were not reported in their financial records, hence not stated among their inputs. This means that this second group have two inputs and three outputs. The DEA software does not run more than 100 observation points at once, hence the first set is run and then the next set, omitting the operating expenses and including it in any of the sets does not produce different results.

3.4.1 THE MODEL

One of the first basic decisions in using Data Envelopment Analysis model is whether to use the CCR (Charnes, Cooper and Rhodes 1978) model or the BCC model (Banker, Charnes and Cooper 1984). This study employed the CCR model (after Charnes, Cooper and Rhodes 1978) where DMUs are deemed to produce the highest possible amount of output like loans with a given amount of inputs like deposits. In banking, loans are advanced from the deposits mobilized by the banks.

The efficiency score in the presence of multiple input and output factors is defined as:

Efficiency= Weighted sum of outputs/Weighted sum of Inputs (3.1)

According to Rajput and Gupta (2011) theratio is of the form:

$$\frac{u_1y_1 + u_2y_2 + \ldots\ldots\ u_ny_n,}{v_1x_1 + v_2x_2 + \ldots\ldots\ldots\ v_nx_n,}$$

Where, u and v are weights for outputy (y_1,.........y_n) and inputs x(x_1...........x_n)respectively.

Assume that for each of the n firms there is a data on K inputs and M outputs and represented by column vectors x_1 and y_1 respectively for the ith firm. This may be expressed as $u'y_i$ / $v'x_i$where u is MX_1vector of output weights and v is KX_1 vector of input weights. To arrive at the optimal weights, they define the linear programming problem as:

Max u, v ($u'y_i$ / $v'x_j$)

Subject to, $u'y_j / v'x_j \leq 1$, j=1, 2, 3, ………………n.

$u,v \geq 0$ ….. (3.2)

Solving Equation 3.2, values for u and v may be obtained such that the efficiency measure for each firm is maximised. The constraint with this model formation according to them is that it can have infinite number of solutions. Thus an additional constraint is added, $v'x_i=1$, so that this problem can be avoided. The new model, known as the transformation model, thus becomes

$\text{Max}_{\mu, v} (\mu' y_i)$

Subject to, $v'x_i = 1$

$\mu' y_j - v' x_j \leq 0$, j=1, 2, 3, ………………N.

$u,v \geq 0$ …..(3.3)

To reflect the transformation u has been replaced by μ .

This form in Equation 3.3 is known as the multiplier form of the DEA linear programming problem. Using duality in linear programming, an equivalent envelopment form of this problem may be obtained.

$\text{Min}_{\Theta, \lambda} (\Theta)$

Subject to, $-y_i + Y\lambda \geq 0$

$\Theta x_i - X\lambda \geq 0$,

$\lambda \geq 0$ …..(3.4)

where, Θ is scalar and λ is an NX_1 vector of constraints.

The value obtained for Θ will be the efficiency for the jth Decision Making Unit (DMU) .

For each DMU taken in the study a separate linear programming model would be solved. The technically efficient DMU will have a Θ=1, and all other DMU will have a Θ < 1, implying that the efficiency scores of all other DMU's will be measured relative to the technically efficient units that have a score of Θ=1. 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.

3.4.2 MODEL 1 SPECIFICATION FOR HYPOTHESES ONE, TWO AND THREE

Model Specification

In the explicit form, the model to capture the relationship between efficiency and its determinants can be expressed as

EFF = f (FA, OE, TD) ---------------------------------- (3.5)

Where

EFF is efficiency

FA is Fixed Asset

OE is Operating Expensesand

TD is Total Deposit

The econometric form of the model can be implicitly specified as:

$EFF = a_0 + \alpha_1 FA + \alpha_2 OE + \alpha_3 TD + \varepsilon_t$ ----------------------------- (3.6)

Where all the variables remain as previously defined

$a_0$is the constant term

$\alpha_1, \alpha_2, \alpha_3$are the co-efficient estimators and $\varepsilon_t$is the disturbance term.

A priori, it is expected that FA and TD will have a positive relationship with EFF while OE exhibits a negative relationship with EFF. i.e. $\alpha_1 > 0, \alpha_2 > 0$, while$\alpha_3 < 0$.

3.4.3 MODEL II FOR HYPOTHESIS FOUR

The model specification for the effect of efficiency on profitability model can be expressed as

NPRFT GR = f (EFFGR).. (3.7)

This can be represented in econometric equation as:

$NPRFTGR = \beta_0 + \beta_1 EFFGR + \varepsilon_t$ ....(3.8)

Where

NPRFT is the growth rate of net profit and

EFFGR is the Efficiency growth rate

ε_t is the error term.

In the a priori expectation profitability is expected to exhibits a positive relation with efficiency; hence there will be a direct proportionate relationship between profitability and efficiency in the above model. .i.e. $\beta_1 > 0$

3.5 MODEL VALIDITY AND RELIABILITY

Validity is the degree to which a research instrument measures what it is intended to measure (Asika 1991) that is to establish the soundness of the research instrument. We have different criteria in validity of research instrument. These are content. criterion, face and construct validity. The content validity helps to describe the extent to which a variable covers the specifically intended domains under investigation (Carmines and Zeller, 1991) while criterion validity compares variables to standards which have been proven to be close to the truth. The face validity is intended to find out if the variables used in the study were able to capture the information the researcher wanted. While construct validity refers to whether a scale measures or correlates with the theorized psychological scientific construct that it purports to measure.

The reliability of this study's models is ensured as the input and output data used are similar to the ones used in previous bank efficiency studies. See for example,Fernandez, Gascon and Gonzalez (2002), Pasiouras (2008) and Rajput and Gupta (2011)

3.6 SAMPLE SIZE DETERMINATION

The entire twenty-four (24) existing banks in Nigeria were intended to be used for this study, but only 23 banks were finally used as the last bank, Equatorial Trust Bank (ETB) a private limited bank's data could not be accessed. There is a general agreement among statisticians that the closer a sample size is to a population the more the sample statistics will be a valid estimate of the population. The 23 banks used are therefore ideal.

3.7. METHOD OF DATA ANALYSIS

Two forms of analysis are adopted in this study. In the first analysis Data Envelopment Analysis (DEA) is used to determine the efficiency scores of the banks (DMUs).In the second analysis, the hypotheses are tested using Vector auto-regression analysis (VAR)

3.7.1 METHOD OF DATA ANALYSIS USING DEA

In this study, the Data Envelopment Analysis (DEA) technique is employed to calculate the efficiency level of the banks. The Zhu (2003) DEA softwarewas used to calculate the efficiency scores of the banks. 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.According toRajput and Handa (2011),the wide acceptance of DEA as a measurement tool for measuring efficiency of the financial institution can be attributed to certain strengths of this approach. The main advantages and limitations of using DEA according to them are as follows. The data may not necessarily assume any functional form. DEA leads to a comparison of one Decision Making Unit against peer or combinations of peer. The units of input and output may vary as they do not affect the value of efficiency measure. This model can handle multiple inputs and outputs. While its limitations are, there is no assumption of statistical noise, thus the noise element gets reflected in the measured inefficiency of the DMU. Further DEA does not give absolute efficiency measures. DEA results are sample-specific. Also it makes hypothesis testing difficult, hence other statistical tool of analysis have to be used for hypothesis testing. In this study, the test of the four hypotheses was carried out using Vector Auto-Regression Analysis (VAR).This is because VAR has proved to be a flexible way to analyze economic time series. In particular, VAR models are capable of describing the rich dynamic structure of the relationships among economic variables (Bjornland 2000).

3.7.2 TECHNIQUES OF ESTIMATION FOR THE FOUR HYPOTHESES USING VAR

The following techniques of estimation were adopted by this study for the hypotheses testing using Vector Auto-Regression Analysis VAR.

Testing for Non Stationarity and Stationarity

Many economic and financial time series exhibit trend behaviour or non stationarity in the mean. Leading examples are asset prices, exchange rates and the levels of macroeconomic aggregates like real GDP. An important econometric task is determining the most appropriate form of the trend in the data. For example, in Autoregressive moving average(ARMA) modelling the data must be transformed to stationary form prior to analysis. If the data are trending, then some form of trend removal is required.

Two common trend removal or de-trending procedures are first differencing and time-trend regression. First differencing is appropriate for I(1) time series and time-trend regression is appropriate for trend stationary I(0) time series. Unit root tests can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. Moreover, economic and finance theory often suggests the existence of long-run equilibrium relationships among non stationary time series variables. If these variables are I(1), then co integration techniques can be used to model these long-run relations. Hence, pre-testing for unit roots is often a first step in the co integration modelling

Autoregressive unit root tests are based on testing the null hypothesis of difference stationary against the alternative hypothesis that of trend stationary. Stationarity tests take the null hypothesis that y_t is trend stationary.

Co integration and vector error correction modelling (VECM)

This study employs vector autoregressive (VAR) based co integration tests using the methodology developed in Johansen (1995). The purpose of this co integration tests is to determine whether the variables in the efficiency model are co integrated or not. The presence of a co integration relation(s) forms the bases of the vector error correction model (VECM) specification.

The appropriate VAR order (k) and the deterministic trend assumption is being determined in the E-view Economic package and once determined the rank of the π matrix is then tested. There are two likelihood ratio (LR) test statistics for co integration under the Johansen approach: the trace (λ_{trace}) and the maximum eigenvalue (λ_{max}) statistics.

. To determine the number of integration, the trace and maximum eigenvalue test statistic are compared to the critical value. If the test statistic is greater than the critical values, the null hypothesis that there is r co integrating vectors is rejected in favour of the corresponding alternative hypothesis.

However, the trace and the maximum eigenvalue statistic may yield conflicting results. To deal with the problem Johansen and Juselius (1990) recommend the examination of the estimated co integrating vector and basing ones choice on the interpretability of the co integrating relations. One of these approaches (maximum eigenvalue) is considered in this study. Thus a VECM is merely a restricted VAR designed for use with stationary series that have been found to be co integrated. The specified co integrating relation in the VECM restricts the long run behaviour of the endogenous variables to converge to their co integrating relationships, while allowing for short run adjustment dynamics.

Diagnostic Checks

Once estimation is complete, the residuals from the ECM must be checked for normality, heteroskedacity and autocorrelation. This check is important in the analysis of the determinants of efficiency because it validates the parameter estimation outcomes achieved by the estimated model. Diagnostic checks test the stochastic properties of the model which includes residual autocorrelation, heteroskedasticity and normality among others. These multivariate extensions of the residuals tests will be applied in this study, therefore, they are summarized below:

Autocorrelation LM test

The Lagrange Multiplier (LM) test used in this study is a multivariate test statistic for residual correlation up to the specified lag order. Normally the lag order for this test is the same as that of the corresponding VAR. The test statistic for the chosen lag order (m) is computed by running an auxiliary regression of the residuals (μ_t) on the original right hand explanatory variables and the lagged (μ_{t-m}). The LM statistic tests the null hypothesis of no serial correlation against an alternative of auto correlated residuals.

White heteroskedasticity test

This test is an extension of White's (1980) test to system of equations, as extended by Kelejian (1982) and Doornik (1995). It tests the null hypothesis that the errors are both homoskedastic and independent of regressors and that there is no problem of misspecification. The test regression is run by regressing each cross product of the residuals on the cross products of the regressors and testing the joint significance of the regression. It is important to emphasize here that the failure of any one or more of these conditions mentioned above could result into a significant test statistic. This means that under the null of no heteroskedasticity and no misspecification, the test statistic should not be significant.

Residual normality test

The residual normality test used in this study is the multivariate extension of the Jarque-Bera normality test, which compares the third and fourth moments of the residuals to those from the normal. The preferred residual factorization (orthogonalization) method for the test is by Urzua (1997), which makes a small sample correction to the transformed sample residuals before computing the Jarque-Bera statistic. The joint test is based on the null hypothesis that the residuals are normally distributed. A significant Jarque-Bera statistic, therefore, points to non-normality in the residuals. However, it is assumed that the absence of normality in the residuals may not render co integration test invalid. According to Islam and Ahmed (1999), a more important issue in carrying out the co integration analysis is whether the residuals are uncorrelated and homoskedastic.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

This chapter deals with data presentation and analysis. The Data Envelopment Analysis (DEA) was used to identify the efficient and inefficient banks and the magnitude of the inefficiency. The choice of DEA technique is its advantage of having a production frontier that is not determined by a specific functional form. It is generated from the actual data of the decision making units (DMUs) under review, while the required assumptions are minimal (Kouleti 2006)(See appendix 1 for data used).The hypotheses were tested using Vector Auto-Regression Analysis (VAR) as hypothesis testing using data envelopment analysis is difficult.Rajput and Handa (2011).The (VAR) model is one of the most flexible and easy to use models for the analysis of time series .In addition; it has proven to be especially useful for describing the dynamic behaviour of economic and financial time series.

4.2MODEL SOLUTION PROCEDURES AND RESULTS

To get the efficiency scores for each bank in the sample, it is required that the model specified in chapter three be formulated and solved for each bank. Based on this we utilize a computer package to conduct the data envelopment analysis. The DEA add-in software for Microsoft Excel is used to run the DEA model.

The table 4.1 below gives the result of the banks efficiency ratio.

Table4.1. EFFICIENCY SCORES FOR THE BANKS IN EACH YEAR

S/N	Name of Bank	2009	2008	2007	2006	2005
1	First Bank	1.000	0.955	0.770	0.770	0.616
2	Zenith Bank	0.710	0.528	0.478	0.643	0.630
3	PHB	0.370	0.780	0.440	0.630	0.930
4	Union Bank	0.490	0.580	0.450	0.490	0.440
5	UBA Bank	0.620	0.480	0.470	0.220	0.610
6	GTB	0.999	1.000	0.921	0.990	0.753
7	FID	0.587	1.000	0.950	0.633	0.797
8	DIA	0.722	0.691	0.506	0.712	0.795
9	ECO	0.779	0.582	0.633	0.690	0.668
10	ST.IBTC	0.592	0.910	1.000	0.561	0.891
11	INT	0.239	0.796	0.871	1.000	0.856
12	WEMA	0.243	0.341	0.551	0.662	0.906
13	UNITY	0.450	0.241	0.256	0.422	0.694
14	CITI	0.896	1.000	0.805	0.858	0.868
15	AFRI	0.638	0.746	0.636	0.551	0.642
16	SPRING	0.925	0.308	0.380	1.000	1.000
17	SKYE	0.859	0.807	0.633	0.785	0.643
18	FCMB	0.951	0.842	0.507	0.325	0.483
19	OCEANIC	1.000	1.000	1.000	0.421	0.805
20	ACCESS	1.000	1.000	0.735	1.000	0.595
21	STERLING	0.832	0.683	0.560	0.589	0.265
22	ST.CHART	0.635	0.749	0.903	1.000	1.000
23	FINBANK	0.402	0.288	0.233	0.396	0.782
MEAN		0.693	0.708	0.638	0.519	0.582

Source: Author's Computation from data obtained from the banks'annual report in 2011.

4.2.1 **THE BANKS' EFFICIENCY ANALYSIS**

2005

In 2005 two banks (Spring bank and Standard Chartered bank) out of the twenty three sampled bank were 100% efficient when compared with the others as their efficiency ratio calculated is 1.000. Two of the banks that is WEMA and PHB were 90% and above efficient as their efficiency ratio is less than one but lies between 0.906 and 0,999.Four of the banks – Stanbic.IBTC, Intercontinental, Citi and Oceanic bank was 80% and above efficient, having their efficiency ratio between 0.800 and 0.899. Also four of the banks: ETB, FIDELITY BANK, DIAMOND BANK and FIN BANK was 70% efficient having their efficiency ratio lying between 0.700 and 0.799. Seven of the bank: FIRST BANK, ZENITH, UBA, ECO BANK, UNITY BANK AND AFRI BANK and SKYE banks were 60% efficient, having efficiency ratio between 0.600-0.699. Only ACCESS bank was 50% efficiency having efficiency ratio of 0.595. While Union bank and FCMB have efficiency ratio of 40% as their efficiency ratio lies between 0.400 and 0.499. Sterling bank have the least efficiency ratio of 20% as its ratio is just 0.265. The mean ratio for the year was 0.582 and twenty (20) of the sampled banks performed above average and three (3) of the banks efficiency ratio fell below average. The banks are Union bank, FCMB and Sterling Bank.

2006

In the year 2006 four of the banks were (100%) efficient. These banks are Intercontinental, Spring, Access and Standard Chartered bank. Their calculated efficiency ratio is 1.00.Only one bank (GTB) was 90% and above efficient as its efficiency ratio is 0.99. Also only one bank that is Citibank has efficiency ratio above 80% its ratio is 0.858. Only three banks (First, Diamond and Skye banks) have efficiency ratio above 70%. Five of the sample banks have efficiency ratio above 60% as their ratio lies between 0.60-0.699. These banks are Zenith, PHB, Fidelity, ECO and WEMA bank. Three banks, Stanbic IBTC, Afribank and Sterling banks were 50% efficient as their efficiency ratio lies between 0.50 and 0.599. Also three banks Union, Unity and Oceanic were 40% efficient their efficiency ratio lies between 0.40-0.49. In the year two banks FCMB and Finbank were 30% efficient as their efficiency ratio lies between 0.30-0.39. UBA was the least efficient in the year 2006 with efficiency ratio of 0.22. The mean ratio for the year 2006 was 0.52. Only seventeen (17) of the banks performed above average and these banks are First, Zenith, PHB, GTB, Fidelity, Diamond, Eco, Stanbic IBTC, Intercontinental, Wema, Citi Afribank Spring, Skye, Access, Sterling and Standard Chartered bank. The rest (6 banks)- Union, UBA, unity, FCMB, Oceanic and Finbank performed below average.

2007

In 2007 two of the 23 sampled banks Oceanic and Stanbic IBTC were 100% efficient having efficiency ratio of 1.00. Only three (3) of the banks were 90% and 99% efficient having ratios between the banks are GTB, Fidelity and standard chartered bank. Foe efficiency ratio of between 80% to 89% only two (2) banks that is Intercontinental and Citibank were having efficiency ratio of between 0.80 to 0.89. Also only two (2) banks, First and Access banks were between 0.70% and 79% efficient having efficiency ratio of between 0.70 and 0.79.

During the year only three (3) banks Eco, Afribank and Skye have efficiency ratio of between 60 and 69%, having efficiency ratios of 0.60 and 0.69. For efficiency ratio between 50 and 59%, only four (4) banks, Diamond, WEMA, FCMB and sterling banks having ratios of 0.50 and 0.59make the list. While only four (4) banks – Zenith, PHB, UBA and Union banks have sufficiency ratio of between 0.40 and 0.49. Only spring bank has efficiency ratio of between 30 and 39% as its efficiency ratio is 0.380. Unity and Fin bank are the only two banks that have efficiency ratio 20 and 29% as their ratios lies between 0.20 and 0.29. The mean ratio for the year was 0.638. Only nine (9) banks – First bank, GTB, Fidelity, Stanbic IBTC, Intercontinental, CITI, Oceanic, Access and Standard Chartered banks performed above the average efficiency ratio for the year. The rest 14 banks – Zenith, PHB, Union, UBA, Diamond, Eco, WEMA, Unity, Afri, Spring, Skye, FCMB, Sterling and Fin banks performed below average.

2008

In 2008, five (5) of the sampled banks were 100% efficient having efficiency ratio of 1.000. The banks are GTB, Fidelity, CITI, Oceanic and Access banks. While only two (2) banks have efficiency ratio between 80 and 89%. Their efficiency ratio lies between 0.80 and 0.89 also, only four (4) of the sampled banks have efficiency ratio between 70 and 79%. The banks are PHB, Intercontinental, Afri and standard chartered banks. In the year under consideration, only two banks – Diamond and Sterling banks have efficiency ratio of between 60 and 69%. While only Zenith, Union and Eco banks have efficiency ratio that is between 50 and 59%. Only one bank – UBA has efficiency ratio that lies between 40 and 49%. Its efficiency ratio is 0.480. WEMA and Spring banks were the two banks whose efficiency ratio lies between 30 – 39%. Their actual ratio is 0.341 and 0.308 respectively. Unity and Fin bank were the least efficient of all the sampled banks for the year 2008. Their efficiency ratio lies between 20 and 29%. Their actual ratios were 0.241 and 0.289. The mean efficiency ratio for the year was 0.708. Only 13 banks have efficiency ratio above the average during the year. These banks are First, PHB, GTB, Fidelity, Stanbic IBTC, Intercontinental, CITI, Afri, Skye, FCMB, Oceanic, Access and standard chartered bank. The remaining ten (10) banks – Zenith, Union, UBA, Diamond, Eco, WEMA, Unity, Spring, Sterling and Fin bank performed below average.

2009

For the year 2009, only three banks – First bank, Oceanic and Access banks were 100% efficient as their efficiency ratio was 1.000 respectively. While only GTB, FCMB and Spring banks have efficiency ratio of between 90 and 99%. Also, only three banks – CITI, Skye and sterling banks were having efficiency ratios between 80 – 89%. In addition, only three banks – UBA, Afribank and Standard Chartered have efficiency ratio of between 60 and 69% as their ratios lies between 0.60 and 0.69. Fidelity and Stanbic IBTC were the next efficient having ratios of between 50 and 59%. Their actual ratios were 0.587 and 0.592 respectively. Union, Unity and Fin banks have ratios that lie between 40 and 49%. PHB was the only bank with efficiency ratio between 30 and 39%. Its actual ratio was 0.370. Intercontinental and WEMA banks were the least efficient banks during the year 2009 with efficiency ratios that lie between 20 and 29%. Their actual ratios were 0.239 and 0.243 respectively. The mean efficiency for the year was 0.693. In the year 2009, only 12 banks have efficiency score above the mean score. These banks are Firstbank, Zenith, GTBank, Diamond, Ecobank, Citi, Spring, Skye, FCMB, Oceanic, Access, and Sterling bank. Eleven (11) of the banks- PHB, union, UBA, Fidelity, ST.chart., INT, WEMA ,Unity, Afri, Finbank and St. IBTC performed below average.

4.3 DISCUSSION OF THE TECHNICAL EFFICIENCY SCORES OF EACH DMUs (BANKS) USING VARIABLE RETURN TO SCALE (VRS), CONSTANT RETURN TO SCALE(CRS) AND SCALE EFFICIENCY (SE)

TABLE4.2

TECHNICAL EFFICIENCY SCORES OF DMUs (BANKS)

		TECHNICAL EFFICIENCY (TE) SCORES			
1.FIRM NO	2.DMUs	3.VRS (TE)	4.CRS (TE)	5=column4/3col. Scale Efficiency	6.RETURN TO SCALE
1	FIRO5	0.61646	0.61643	0.999951335	INCREASING
	FIRO6	0.81929	0.78106	0.953337646	DECREASING
	FIRO7	0.8146	0.77579	0.952356985	DECREASING
	FIRO8	0.95509	0.95509	1	INCREASING
	FIRO9	1	1	1	CONSTANT
	AVG	0.841088	0.825674	0.981129193	
2	ZEN05	0.63372	0.6337	0.99996844	INCREASING
	ZEN06	0.64378	0.64377	0.999984467	INCREASING
	ZEN07	0.4788	0.47879	0.999979114	INCREASING
	ZEN08	0.52863	0.52862	0.999981083	CONSTANT
	ZEN09	1	0.71045	0.71045	DECREASING
	AVG	0.656986	0.599066	0.942072621	
3	PHB05	0.93596	0.93567	0.999690158	INCREASING

	PHB06	0.77819	0.77816	0.999961449	INCREASING
	PHB07	0.49869	0.49869	1	CONSTANT
	PHB08	1	0.96316	0.96316	DECREASING
	PHB09	1	0.37862	0.37862	DECREASING
	AVG	0.842568	0.71086	0.868286321	
4	UNIONO5	0.44729	0.44726	0.999932929	INCREASING
	UNION06	0.49018	0.49017	0.999979599	INCREASING
	UNIONO7	0.45494	0.45493	0.999978019	INCREASING
	UNIONO8	0.59884	0.58459	0.976203994	DECREASING
	UNIONO9	1	0.49894	0.49894	DECREASING
	AVG	0.59825	0.495178	0.895006908	
5	UBA05	0.61973	0.61961	0.999806367	INCREASING
	UBA06	0.25092	0.24932	0.993623466	DECREASING
	UBA07	0.47824	0.47648	0.996319839	DECREASING
	UBA08	0.61216	0.48776	0.796785154	DECREASING
	UBA09	0.8349	0.62485	0.748412984	DECREASING
	AVG	0.55919	0.491604	0.906989562	
6	GTB05	0.75368	0.75362	0.999920391	INCREASING
	GTB06	1	1	1	CONSTANT
	GTB07	1	1	1	CONSTANT
	GTB08	1	1	1	CONSTANT
	GTB09	1	1	1	CONSTANT

	AVG	0.950736	0.950724	0.999984078	
7	FID05	0.7976	0.79727	0.999586259	INCREASING
	FID06	0.63363	0.63356	0.999889525	INCREASING
	FID07	0.97236	0.9723	0.999938294	INCREASING
	FID08	1	1	1	CONSTANT
	FID09	0.64248	0.62888	0.978832026	DECREASING
	AVG	0.809214	0.806402	0.995649221	
8	DIA05	0.79547	0.79536	0.999861717	INCREASING
	DIA06	0.7124	0.7124	1	CONSTANT
	DIA07	0.50694	0.50692	0.999960548	INCREASING
	DIA08	0.69536	0.69536	1	INCREASING
	DIA09	0.75562	0.74056	0.980069347	DECREASING
	AVG	0.693158	0.69012	0.995978322	
9	ECO05	1	1	1	CONSTANT
	ECO06	1	1	1	CONSTANT
	ECO07	0.63477	0.63474	0.999952739	INCREASING
	ECO08	0.58215	0.58214	0.999982822	INCREASING
	ECO09	0.77902	0.77902	1	INCREASING
	AVG	0.799188	0.79918	0.999987112	
10	ST.IBTCO5	1	1	1	CONSTANT
	ST.IBTC06	0.59844	0.59863	1.000317492	INCREASING
	ST.IBTC07	1	1	1	CONSTANT

	ST.IBTC08	0.95026	0.91089	0.958569234	DECREASING
	ST.IBTC09	0.62895	0.59245	0.94196677	DECREASING
	AVG	0.83553	0.820394	0.980170699	
11	INT.05	0.85636	0.85611	0.999708067	INCREASING
	INT.06	1	1	1	CONSTANT
	INT.07	0.95375	0.8825	0.925294889	DECREASING
	INT.08	1	0.89833	0.89833	DECREASING
	INT.09	0.26331	0.24217	0.919714405	DECREASING
	AVG	0.814684	0.775822	0.948609472	
12	WEMA05	1	1	1	CONSTANT
	WEMA06	0.6629	0.66286	0.999939659	INCREASING
	WEMA07	0.56636	0.56635	0.999982343	CONSTANT
	WEMA08	0.34469	0.34469	1	INCREASING
	WEMA09	0.25085	0.2508	0.999800678	INCREASING
	AVG	0.56496	0.56494	0.999944536	
13	UNITY05	0.69528	0.69492	0.999482223	INCREASING
	UNITY06	0.47385	0.47384	0.999978896	INCREASING
	UNITY07	0.25945	0.25943	0.999922914	INCREASING
	UNITY08	0.24134	0.24132	0.999917129	INCREASING
	UNITY09	0.45035	0.45033	0.99995559	INCREASING
	AVG	0.424054	0.423968	0.999851351	
14	CITI05	0.8684	0.86823	0.999804238	INCREASING

	CITI06	0.85843	0.85829	0.999836912	INCREASING
	CITI07	0.83727	0.8372	0.999916395	INCREASING
	CITI08	1	1	1	CONSTANT
	CITI09	0.92975	0.92968	0.999924711	INCREASING
	AVG	0.89877	0.89868	0.999896451	
15	AFRIB05	0.64433	0.64427	0.99990688	INCREASING
	AFRIB06	0.61523	0.61513	0.999837459	INCREASING
	AFRIB07	0.69335	0.69334	0.999985577	INCREASING
	AFRIB08	0.78672	0.7845	0.997178157	DECREASING
	AFRIB09	0.63871	0.6387	0.999984343	INCREASING
	AVG	0.675668	0.675188	0.999378483	
16	SPRING05	1	1	1	CONSTANT
	SPRING06	1	1	1	CONSTANT
	SPRING07	0.3938	0.39375	0.999873032	INCREASING
	SPRING08	0.30867	0.30863	0.999870412	INCREASING
	SPRING09	0.95195	0.9519	0.999947476	INCREASING
	AVG	0.730884	0.730856	0.999938184	
17	SKYE 05	1	0.64367	0.64367	INCREASING
	SKYE06	0.76978	0.70836	0.920210969	DECREASING
	SKYE07	0.6121	0.50691	0.828148995	DECREASING
	SKYE08	0.68643	0.64011	0.932520432	DECREASING
	SKYE09	0.79785	0.79691	0.998821834	INCREASING

	AVG	0.773232	0.659192	0.864674446	
18	FCMB05	0.80601	0.48366	0.600066997	INCREASING
	FCMB06	0.36144	0.32509	0.899430058	INCREASING
	FCMB07	0.52077	0.50795	0.975382607	INCREASING
	FCMB08	0.84926	0.84232	0.99182818	INCREASING
	FCMB09	0.95466	0.95185	0.997056544	INCREASING
	AVG	0.698428	0.622174	0.892752877	
19	OCEANIC05	0.80314	0.78139	0.972918794	DECREASING
	OCEANIC06	0.41472	0.39635	0.955705054	DECREASING
	OCEANIC07	1	0.7176	0.7176	DECREASING
	OCEANIC08	1	0.54136	0.54136	DECREASING
	OCEANIC09	1	0.81792	0.81792	DECREASING
	AVG	0.843572	0.650924	0.80110077	
20	ACCESS05	0.70116	0.59505	0.848665069	INCREASING
	ACCESS06	1	1	1	CONSTANT
	ACCESS07	0.73067	0.69401	0.949826871	DECREASING
	ACCESS08	1	0.96211	0.96211	DECREASING
	ACCESS09	1	1	1	CONSTANT
	AVG	0.886366	0.850234	0.952120388	
21	STERLING05	1	0.26534	0.26534	INCREASING
	STERLING06	0.63288	0.58962	0.93164581	INCREASING
	STERLING07	0.54517	0.53606	0.983289616	DECREASING

	STERLING08	0.67921	0.66281	0.975854301	DECREASING
	STERLING09	0.82974	0.80721	0.972846916	DECREASING
	AVG	0.7374	0.572208	0.825795329	
22	ST.CHART05	1	1	1	CONSTANT
	ST.CHART06	1	1	1	CONSTANT
	ST.CHART07	0.94038	0.9039	0.961207172	INCREASING
	ST.CHART08	0.78435	0.74991	0.956091031	INCREASING
	ST.CHART09	0.62473	0.61114	0.978246603	DECREASING
	AVG	0.869892	0.85299	0.979108961	
23	FINBANK05	1	0.78297	0.78297	INCREASING
	FINBANK06	0.77335	0.39648	0.512678606	INCREASING
	FINBANK07	0.24652	0.2298	0.932175888	INCREASING
	FINBANK08	0.28369	0.27732	0.977545913	DECREASING
	FINBANK09	0.35357	0.32845	0.928953248	DECREASING
	AVG	0.531426	0.403004	0.826864731	

VRS: variable return to scale, CRS: constant return to scale, SE: scale efficiency (SE=CRSTE/VRSTE)

Source: Author's Computation from data obtained from the banks' annual reports in 2011

FIRST BANK PLC

Under the assumption of variable return to scale (VRS) , it was found that the average technical efficiency score for First bankplc is 84.10%,which implies that on average First bankplc could have used 15.90% fewer resources to produce the same amount of output.

Under the constant return to scale (CRS) assumption, the average efficiency score is 82.57% which is less than the mean efficiency score under VRS assumption. For the scale efficiency, the average score is found to be 98.11% which means that on average the actual scale of production has diverged from the most productive scale size by 2.89%. On return to scale, first bank had an increasing return to scale in 2005 and 2008, decreasing return to scale in 2006 and 2007 and constant return to scale in 2009

ZENITH BANK

Using the assumption of VRS for Zenith Bank it was found that the average technical efficiency score is 65.70% which means that on average, Zenith bank could have used 34.30% fewer resource input to produce the same amount of output while under the CRS assumption the average efficiency score is 59.91% which is less than the mean efficiency score under VRS assumption. For scale efficiency the average score was found to be 94.21%.Which means that on average the actual scale of production has moved away from the most productive scale size by 5.79%. On return to scale, Zenith bank has increasing return to scale in 2005-2007, decrease in 2009 and constant return to scale in 2008.

BANK PHB

Under the VRS assumption, it was found that the average technical efficiency score for Bank PHB during the period under study was 84.26%. This indicates that on average Bank PHB could have used 15.74% fewer resource inputs to produce the same amount of output. The bank’s average technical efficiency score under the CRS assumption was 71.09%, which is lesser than the average efficiency obtained under the VRS assumption. The average scale efficiency score for the bank was 86.83%. This implies that on average the actual scale of production have shifted away from the most productive scale size by 13.17%. Its return to scale shows increase in 2005-2006, decrease in 2008-2009 and constant in 2007.

UNION BANK

Under the assumption of VRS it was found that the average technical efficiency store for Union Bank is 59.83%, which implies that on the average Union Bank could have used 40.17% fewer resources to produce the same amount of output.

Under the CRS assumption, the average efficiency score is 49.52%. This is less than the mean efficiency score under VRS assumption. For the scale efficiency, the average score is found to be 89.50%. This means that on average the actual scale of production has strayed from the most productive scale size by 10.50%. The bank's return to scale shows increase in 2005-2007 and decrease in 2008-2009.

UBA

Using the VRS assumption for United Bank for Africa (UBA), it was found that the average technical efficiency score is 55.92%. This means that on average, the bank could have used 44.08% less resources to produce the same amount of output. While under the constant return to scale (CRS) assumption, the average efficiency is 49.16% which is less than the mean efficiency score under VRS assumption. For the scale efficiency, the average score is 90.70% which means that on average the actual scale of production has moved away from the most productive scale size by 9.30%.Its return to scale is increase in 2005 and decrease in 2006-2009

GTB

Under the VRS assumption Guarantee Trust Bank (GTB) was found to have a mean technical efficiency score of 95.07% which means that on average GTB could have used 4.93% less resources to produce the same amount of output. Under the CRS assumption, the average efficiency score for GTB was 95.07% which is actually the same under that of the VRS assumption. For the scale efficiency, the average score was 99.998% approximately 100% which means that on average the actual size of production only shifted from the most productive scale size by 0.002% which is insignificant. It can be concluded that during the period 2005 – 2009 GTB was near full efficiency in using its resource inputs in producing the same amount of output. GTB has increasing return to scale in 2005 and constant in 2006-2009.

FIDELITY BANK

Fidelity bank's mean technical efficiency score under the VRS assumption for the period was found to be 80.92%. This means, that on average the bank would have used 19.08% fewer resource inputs in producing the same amount of output. Under the constant return to scale (CRS) assumption the banks mean efficiency sore was found to be 80.64% which is less than the mean score under VRS assumption. This means scale efficiency score was 99.57%. This implies that on average the actual scale of product averaged from the most productive scale size by 0.43%.The bank has increasing return to scale in 2005-2007, constant in 2008 and decrease in 2009.

DIAMOND BANK

The bank's mean technical efficiency score under the VRS assumption for the period was 69.32%. This implies that on average the bank could have used 30.68% less resource inputs to produce the same amount of output. Under the CRS assumption, the bank's mean efficiency score was 69.01% which is less than the mean score under the VRS assumption.The bank's mean scale efficiency score for the period was 99.60%. This means that on average the bank's actual scale of production moved away from the most productive scale size by 0.40%. The bank's return to scale shows increase in 2005,2007 and 2008.It was constant in 2006 and decrease in 2009.

ECOBANK

Under the assumption of VRS, it was found that the average technical efficiency score for ECOBANK was 79.92%. This means that on average the bank could have used 20.08% less resource inputs to produce the same amount of output. Under the CRS assumption, the average efficiency score was 79.92% which was the same with the mean efficiency score under the VRS assumption. For the scale efficiency, the average score was 99.999% which is approximately 100%. This means that on average the actual scale of production only shifted from the productive scale size by 0.001%.Ecobank have increasing return to scale in 2007-2009 and constant in 2005-2006.

STANBIC IBTC

Using the assumption of VRS for Stanbic IBTC, it was found that the average technical efficiency score was 83.55%. It suggests that on average the bank would have used 16.45%

fewer resource inputs to produce the same amount of output. Under the CRS assumption the average efficiency score is 82.04% which is less than the mean score under VRS assumption.

The bank's mean scale efficiency score for the period was 98.02%. This means that on average the actual scale of production only shifted from the most productive scale size by 1.98%.The bank's return to scale is increase in 2006, decrease in 2008-2009 and constant in 2005-2007.

INTERCONTINENTAL BANK

Under the assumption of VRS, it was found that the average technical efficiency score for Intercontinental Bank was 81.47%. It indicates that the bank could have used 18.53% less resources inputs to produce the same amount of output. Under the CRS assumption, the average efficiency of the bank is 77.58% which is less than the mean score under IRS assumption. The bank's mean scale efficiency for the period was 94.86%. This implies that on average, the actual scale of production only moved away from the most productive scale size by 5.14%.Its return to scale is increase in 2005, decrease in 2007-2009 and constant in 2006.

WEMA BANK

Using the VRS assumption for WEMA bank analysis, it was found that the average technical efficiency score is 56.50% which indicates that on average, WEMA bank could have used 43.50% less resource input to produce the same amount of output.While under the CRS assumption the bank's mean efficiency score is 56.49% which is less than the mean efficiency score under VRS assumption. For scale efficiency, the average score for the bank is found to be 99.99% which has shifted away from the most productive scale size by 0.01%.The bank has increasing return to scale in 2006, 2008 and 2009.In 2005 and 2007 it was constant.

UNITY BANK

Under the VRS assumption, it was found that the average technical efficiency score for Unity bank was 42.41% which infers that on average Unity bank could have used 57.59% fewer resource input to produce the same amount of output. It is clear that this bank was over 50% inefficient in its resource input utilization to produce the same amount of output. Under the CRS assumption, the mean efficiency score is 42.40%. This is less than the 42.41% figure under VRS by 0.01%. The banks' scale efficiency score for the period was found to be 99.99%. This means that on average the actual scale of production has moved away from the most productive scale size by 0.01%. Unity bank has increasing return to scale in all the years of study.

CITI BANK

Under the VRS assumption it was found that the average technical efficiency score is 89.88% which means that on average, Citi Bank could have used 10.12% fewer resource input to produce the same amount of output while under CRS assumption, the average efficiency score is 89.87%. This is less than the average by 0.01%. The average scale efficiency score for the bank is found during the period to be 99.99%. This means that on average, the actual scale of production has diverted from the most productive scale size by 0.01%.Citi bank has increasing return to scale in 2005,2007 and 2009. In 2008 it was constant.

AFRI BANK

Under the VRS assumption it was found out that Afribank has an average technical sufficiency score of 67.57% which implies that on average, Afrbank could have used 32.43% less resource input to produce the same amount of output. Under the CRS assumption, the average efficiency score is 67.52%. This is less than the average amount under the VRS assumption by 0.05%. The average scale efficiency score for the bank is 99.94%. This means that on average the actual scale of production has diverged away from the most productive scale by 0.06%.The bank has increasing return to scale in 2005,2006,2007 and 2009. It was a decrease in 2008

SPRING BANK

Under the VRS assumption, Spring Bank was found out to have an average technical efficiency score of 73.09%. This means that on average Spring bank could have used 26.91% fewer resource input to produce the same amount of output while under the CRS assumption, the average efficiency score was 73.09%. This is exactly the same average score under the VRS assumption. For scale efficiency, the average score was found to be 99.99% which implies that on average the actual scale of production has moved from the most productive scale size by 0.01%. It has increasing return to scale in 2007-2009 and constant in 2005 and 2006.

SKYE BANK

Using the assumption of VRS for Skye bank it was found out that its average technical efficiency score was 77.32%. This indicates that the bank could have used 22.68% fewer resource inputs to produce the same amount of output. Under the CRS assumption, the average efficiency score is 65.92%. This is 11.40% less than the average figure under VRS while for scale efficiency, the average score was found to be 86.47%. This means that on average, the actual scale of production has moved away from the most productive scale size by 13.53%. The bank's return to scale shows increase in 2005 and 2009 and decrease in 2006-2008.

FCMB – First City Monument Bank

Under the VRS assumption, it was found out that FCMB has an average technical efficiency score of 69.84%. This indicates that the bank could have used 30.16% less resource inputs to produce the same amount of output during the period under study. Under the CRS assumption, the average efficiency score is 62.22%. This is less than the average efficiency score under CRS assumption by 7.62%. The bank's average scale efficiency score for the period was 89.28%. This implies that on average, the actual scale of production has shifted away from the most productive scale size by 10.72%. The bank's return to scale shows increase in 2005 - 2009

OCEANIC BANK

Using the VRS assumption for Oceanic bank, it was found out that the mean technical efficiency score was 84.36%. This implies that on average Oceanic Bank could have used 15.64% fewer resource inputs to produce the same amount of output. The bank's mean efficiency score under the CRS assumption was 65.09%.This is lesser than the mean efficiency score obtained under the VRS assumption. For scale efficiency, the average score was found to be 80.11%. This indicates that on average the actual scale of production of the bank have moved away from the most productive scale size by 19.89%. The bank's return to scale shows decrease in 2005 - 2009

ACCESS BANK

For Access Bank under the CRS assumption, it was found that the average technical efficiency score was 88.64%.This suggest that on average Access Bank could have used 11.36% lesser resource inputs to produce the same amount of output. Under the CRS assumption, the mean efficiency score is 85.02% which is smaller than the average score obtained under the VRS assumption, the bank's average scale efficiency for the period under study was found to be 95.21%.This implies that on average the actual scale of production have shifted away from the most productive scale size by 4.79%. The bank's return to scale shows increase in 2005 and decrease in 2007 and 2008 and constant in 2006 and 2009.

STERLING BANK

Under the VRS assumption, it was found out that the mean technical score for the bank was 73.74%.This indicate that on average the bank could have used 26.26% fewer resource input to produce the same amount of output. Under the CRS assumption, the bank's average efficiency score is 57.22% .This is lesser than the figure obtained under the VRS assumption. The bank's average scale efficiency score for the period was 82.58% .This means that on average, the actual scale of production have moved away from the most productive scale size by 17.42%. The bank's return to scale shows increase in 2005 and 2006 and decrease in 2007-2009

STANDARD CHARTERED BANK

Using the VRS assumption for Standard Chartered Bank analysis, it was found that its average efficiency score was 86.99%.This implies that on average the bank could have used 13.01% less resource inputs to produce the same amount of output. Under the CRS assumption the bank's mean efficiency score was 85.30% which is less than the figure obtained under the CRS assumption. The bank's scale efficiency size for the period under study was 97.91%.This indicate that on average the actual scale of production has diverged from the most productive scale size by 2.09%. The bank's return to scale shows increase in 2007 and 2008, decrease in 2009 and constant in 2005 and 2006.

FINBANK

Under the VRS assumption, it was found out that the mean efficiency score during the period of study was 53.14%.This means that on average FinBank could have used 46.86% fewer resource inputs to produce the same amount of output. While under the CRS assumption the bank's mean efficiency score was 40.30%. This 12. 84% less than the average score obtained under the VRS assumption. The average scale efficiency score for the bank during the period was 82.69%. This implies that on average the actual scale of production has moved away from the most productive scale size by 17.31%. The bank's return to scale shows increase in 2005 -2007 and decrease in 2008-2009.

4.4 RANKING OF THE BANKS'EFFICIENCY USING VRS,CRS AND SE

Table 4.3 RANKING OF THE BANKS'EFFICIENCY USING VRS,CRS AND SE

		SCORE UNDER			RANKING UNDER			
	NAME OF BANK	VRS	CRS	SE	POS	VRS	CRS	SE
1	FIRST BANK	84.11	82.57	98.11	1	GTB	GTB	ECO
2	ZENITH	65.7	59.91	94.21	2	CITI	CITI	GTB
3	PHB	84.26	71.09	86.83	3	ACCESS	ST. CH	CITI
4	UNION	59.83	49.52	89.5	4	ST .CH	ACCESS	SPRING
5	UBA	55.92	49.16	90.7	5	OCEANIC	IBTC	UNITY
6	GTB	95.07	95.07	100	6	PHB	ST.IBTC	WEMA
7	FIDELITY	80.92	80.64	99.56	7	FIRST	FIDELITY	AFRI
8	DIAMOND	69.32	69.01	99.6	8	ST.IBTC	ECO	DIA
9	ECO	79.92	79.72	100	9	UNITY	INT	FIDELITY
10	ST.IBTC	83.55	82.04	98.02	10	FIDELITY	SPRING	FIRST
11	INT	81.47	77.58	94.86	11	ECO	PHB	IBTC
12	WEMA	56.5	56.49	99.99	12	SKYE	DIAM	ST.CH
13	UNITY	42.41	42.4	99.99	13	STERLING	AFRI	ACCESS
14	CITI	89.88	89.87	99.99	14	SPRING	SKYE	INT

15	AFRIBANK		67.57	67.52	99.94	15	FCMB	OCEANIC	ZENITH
16	SPRING		73.09	73.09	99.99	16	DIA	FCMB	UBA
17	SKYE		77.32	65.92	86.47	17	AFRI	ZENITH	UNION
18	FCMB		69.84	62.22	89.28	18	ZENITH	STERLING	FCMB
19	OCEANIC		84.36	65.09	80.11	19	UNION	WEMA	PHB
20	ACCESS		88.64	85.02	95.21	20	WEMA	UNION	SKYE
21	STERLING		73.74	57.22	82.58	21	UBA	UBA	FIN
22	ST.CHARTERED		86.99	85.3	97.91	22	FIN	UNITY	STERL
23	FINBANK		53.14	40.3	82.69	23	UNITY	FINBANK	OCEANIC
	AVR		74.06783	68.98957	94.15565				

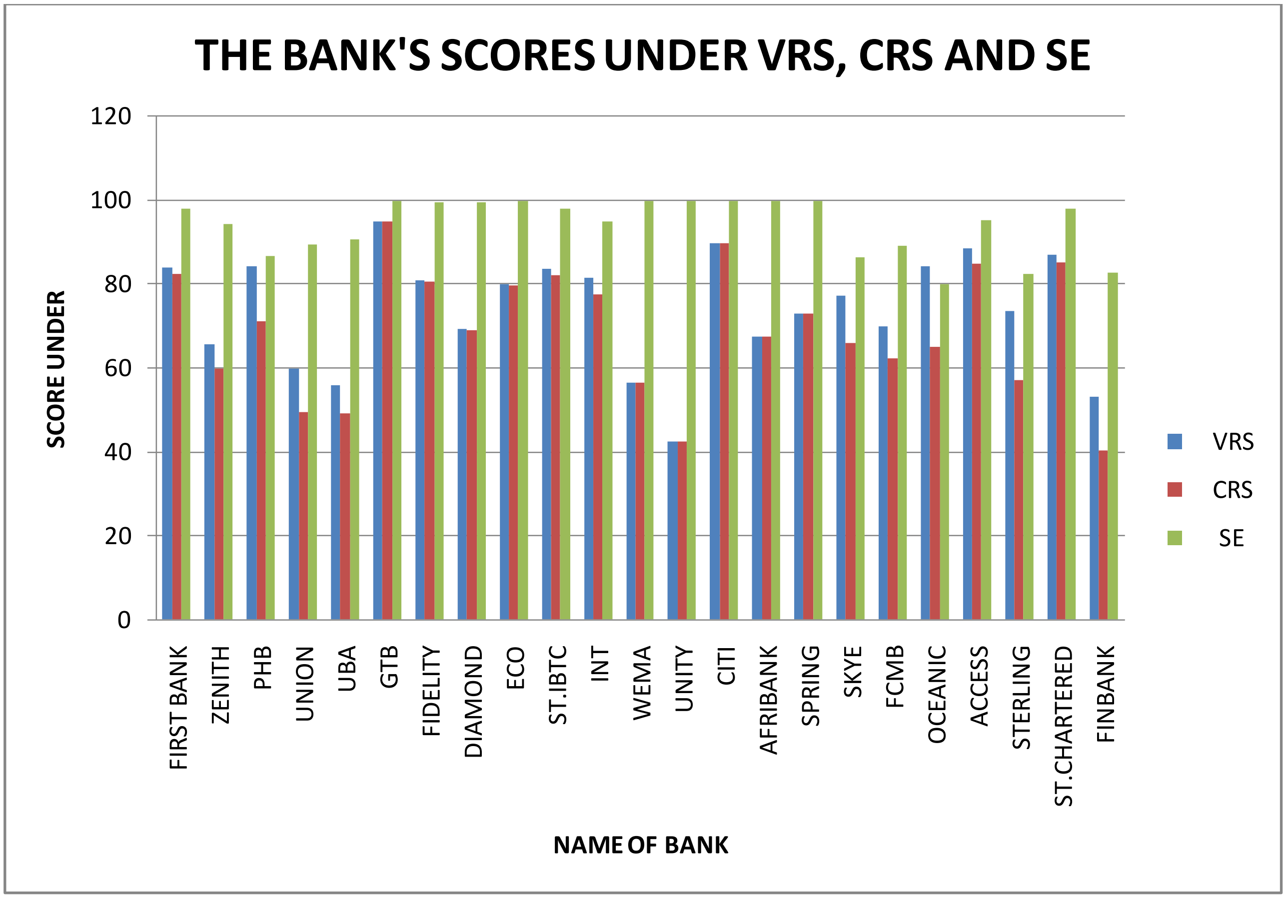


FIGURE 4.1 COLUMNS SHOWING THE BANK'S SCORES UNDER VRS, CRS AND SE

Source: Author's computation from the bank's data in 2012.

Using Figure 4.1 to rank the DMUs (Banks), it is seen that GTB is the most efficient bank on the VRS, CRS and second on SE assumption. CITI bank is the second both in VRS and CRS assumptions but the third on SE assumption. Access bank is the third on VRS, fourth on CRS and thirteen on SE assumption. Standard Chartered is fourth on VRS, third on CRS and twelveth on SE. Oceanic bank is fifth on VRS, fifteen on CRS and twenty third on SE. Bank PHB is sixth on VRS, eleventh on CRS and nineteenth on SE. First bank occupies the seventh position on VRS, fifth on CRS and tenth on SE. Stanbic IBTC is the eight on VRS, sixth on CRS and eleventh on SE. Intercontinental bank is ninth on VRS, same on CRS and fourteenth on SE. Fidelity bank is tenth on VRS, seventh on CRS and ninth on SE. Ecobank is eleventh on VRS, eight on CRS and first on SE. Skye bank is twelveth on VRS, fourth on CRS and twenty on SE. Sterling bank is thirteenth on VRS, eight on CRS and twenty two on SE. Spring bank is fourteenth on VRS, tenth on CRS and fourth on SE. FCMB is fifteenth on VRS, sixteenth on CRS and eighteenth on SE. Diamond bank occupies Sixteenth position on VRS, twelve on CRS and eight on SE. Afribank is seventh on VRS, thirteen on CRS and seventh on SE . Zenith bank occupies eighteenth position on VRS, seventeen on CRS and Fifteen on SE. Union bank occupy the nineteenth position on VRS, twenty on CRS and seventeen on SE.WEMA bank is number twenty on VRS, nineteen on CRS and sixth on SE.UBA occupy number twenty-one on VRS, same on CRS and sixteen on SE. Finbank is number twenty-two on VRS, twenty-three on CRS and twenty-one on SE. The last bank on VRS is unity bank. It is number twenty-two on CRS and fifth on SE.

4.5 TESTING OF HYPOTHESES.

This section deals with the presentation of result and analysis of the hypothesis tested. According to Rajput and Handa (2011),the wide acceptance of DEA as a measurement tool for measuring efficiency of the financial institution can be attributed to certain strengths of this approach.The main advantages and limitations of using DEA according to them are that the data may not necessarily assume any functional form; DEA leads to a comparison of one Decision Making Unit against peer or combinations of peer; the units of input and output may vary as they do not affect the value of efficiency measure and this model can handle multiple inputs and outputs. While its limitation is that there is no assumption of statistical noise, thus the noise element gets reflected in the measured inefficiency of the DMU. Further DEA does not give absolute efficiency measures; its results are sample-specific and it makes hypothesis testing difficult, hence other statistical tool of analysis have to be used for hypothesis testing. In this study, therefore, the vector auto-regressive analysis is used to test the hypothesis.

The Table 4.4 presented below shows the results of the unit root test for the data used in the study on hypotheses 1-3. This is used to test for the stationarity of the data and also determine the order of the integration associated with each variable.

4.5.1. PRESENTATION AND INTERPRETATION OF RESULT OF THE HYPOTHESES TESTED ON THE EFFECT OF FA,OE AND TD ON EFFICIENCY

Abbreviations used.

EFF= Efficiency FA= Fixed Assed OE= Operating Assets

TD = Total Deposits ADF = AugmentedDickey Fuller

Table 4.4 Unit Root Test at Levels

Variable	ADF Statistics	ADF Critical Value	Order of Integration
EFF	**-3.8069**	**-2.8877**	**I(0)**
FA	**-1.6325**	**-2.8892**	**-**
OE	**-3.9522**	**-2.9069**	**I(0)**
TD	**-2.388**	**-2.8892**	**-**

Table 4.5 Unit Root Test at first Difference

Variable	ADF Statistics	ADF Critical Value	Order of Integration
EFF	**-6.5291**	**-2.8879**	**I(1)**
FA	**-5.7265**	**-2.8897**	**I(1)**
OE	**-8.0984**	**-2.9092**	**I(1)**
TD	**-6.5147**	**-2.8897**	**I(1)**

In carrying out a unit root test the ADF test tests the null hypothesis of a unit root. Therefore, a rejection of the hypothesis under the ADF implies the series does not have a unit root and is stationary. The result for the ADF test in Table 4.4 shows that EFF and OE are stationary at levels since their test statistics are all lower than ADF at 1 per cent critical value while FA and TD of the rest of the series were non-stationary. Therefore, the variables were all differenced at first differences and they all achieved stationary state in ADF test. Hence, the series were differenced once and those that are not stationary at levels, however, became stationary in their first differences under ADF test at intercept only.

We conclude therefore, that two of the series are first difference stationary I(1) (FA and TD) while the other two (EFF and OE) are level stationary I(0), thus the variables are not integrated of the same order. Since the variables are integrated to order zero(EFF and OE) and order 1 (FA and TD), they could be co integrated when there is a linear combination of both series, so we carry all the variables to test for co integration.

Co integration

In this co-integration analysis we employ Johansen procedure to discover whether there exists a long run relationship between efficiency and its theoretical determinant. In Johansen co-integration the specification of the lag order is always required as well as the deterministic trend assumption. The Johansen co-integration test is therefore, conducted under the assumption of no trend but a constant in the series and 5 lags.

Table 4.6 shows the co-integration test results for the determinants of efficiency model that we specify based on trace and maximum Eigenvalue statistics

Table 4.6: Johansen co-integration rank test results

Series: EFF FA OE TD

Lags interval: 1 to 4

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.403113	55.17181	47.21	54.46	None **
0.236767	25.24226	29.68	35.65	At most 1
0.125503	9.571154	15.41	20.04	At most 2
0.030440	1.792976	3.76	6.65	At most 3

The maximum eigen value form of the Johansen test rejects the null hypothesis of no co-integration with an eigen value of 0.403 test statistics at the 5 percent critical value. The maximum eigenvalue test therefore, suggests at least a co-integrating vector in the efficiency model. Since 1 co integrating relationship chosen by the maximum eigen value produces an economically meaningful result, we therefore, conclude that there is at least 1 co integrating relationship in the efficiency model. Hence, there exist a long run relationship among the variables of the model and thus can be relied upon for future forecast and prediction. The other interesting conclusion from this analysis is that there are co integrating relationships between variables integrated at levels I(0) and the variables integrated to order 1, I(1). This conformswith the literature that variables integrated of different orders may be co integrated when linearly combined.

The long run relationship

The number of co integrating relationships obtained in the Johansen procedure, the number of lags and the deterministic trend assumption used in the co integration test are all used to specify a VECM. This VECM allows us to distinguish between the long and short run determinants of efficiency variable. However to identify the true co integrating relationship that have been suggested by co integration section we examine the result from the estimated VECM without any restrictions (except by those automatically imposed by E-views). We therefore normalize each of the vectors on the variable for which a clear evidence of error correction is found. A comparison of the error correction terms shows that TD with the -0.13 and S.E of 0.081 is the most significant coefficient and a correct negative sign (Lutkepohl and Kratzig 2009) but less statistically significant. This suggests that TD equation constitutes the true co integrating relation in the co integrating vector. Although it is statistically less meaningful it is correctly signed indicating a tendency to return the system back to equilibrium in cases of shocks that pull the system away from actual point. Thus given that TD shows a good evidence of error correction to the first vector, the interpretation that the last vector explains long run EFF is not an implausible one. We therefore, normalize on TD to obtain the long and short run parameter estimates.

The VECM result for the efficiency model is shown in Table 4.7.

Table: 4.7 Single equation equilibrium correction models for EFF model.

Regression

Long terms

EFF (-1)

Constant	1.318(0.00)
FA (-1)	-0.067(0.16)
OE (-1)	-0.002 (0.95)
TD (-1)	0.000 (0.99)

Short terms Dynamic

ΔEFF (-2)	-0.3002 [-2.080]

Speed of Adjustment (α) -0.130 (0.081)

Diagnostic

R-squared	0.094
Serial correlation LM	16.85{0.00}
Normality (Jarque-Beta)	1.01 {0.60}
Heteroskedasticity	9.39 {0.40}

Note: Figures within parenthesis, ( ) are marginal P-values (marginal significance level) of likelihood ratio tests under the null hypothesis that the coefficient under construction is not significant from zero. Figures within [ ] are t-ratios for the significance of dynamic terms and those in { } are P-values for the residual diagnostic checks under the null of no serial correlation, no heteroskedasticity and normality respectively.

The table 4.7 represents the results of the VECM regression which corresponds to the efficiency model that included all the variables.

FA has a negative long run relationship with efficiency(EFF) as indicated by its coefficient in the regression although not significant. This means that an increase in fixed asset(FA) retards efficiency(EFF). This result corroborates the prediction that increase in FA relative to other efficiency (EFF) factors retards efficiency.

The coefficient for operating expenses (OE) is also negative, very low magnitude, insignificant and statistically not different from zero. Thus the hypothesis that it is zero could not be rejected in the regression. We therefore accept the result and conclude that operating expenses (OE) has no long run relationship with efficiency (EFF) variable. This result is theoretically plausible (apriori) as OE should have a negative insignificant long runrelationship with efficiency (EFF). This result could be due to lack of direct connectivity and feedback mechanism between management and operations. The null hypothesis that TD is not significantly different from zero could not be rejected in the regression. This result could be an indicator of the inadequacy of this variable as to account for the changes in efficiency. Therefore, the null hypothesis is accepted for the determinant variables. This leads to the conclusion that they are not significant from zero in explaining the variation in EFF.

The short run relationship

This analysis is intended to capture the short run dynamics of the EFF model. The result for the VECM on the short run dynamics of EFF is also presented in table 4.7. However, only the result of the variable with significance is reported. The short run effects of EFF determinants are generally found to be insignificant with the exception of one (EFF) in the regression. As shown in table 4.5 only the first difference of EFF lagged twice has a significant short term impact on EFF. The first difference of EFF lagged for two periods negatively influences EFF. A crucial parameter to note in the estimation of VECMs is the coefficient which in this study, measures the speed of adjustment in EFF following a shock in the system. It can also be seen as a measure of the degree of adjustment of the actual EFF with regards to its equilibrium level. As shown in table 4.7 this corresponds to -0.130 for the regression. Based on this coefficient, about 13 percent of the gap between the actual EFF and its equilibrium is eliminated every year. That is 100% restoration back to equilibrium level (100/13=7.69230).This result implies that, in the absence of further shocks, the gap would be eliminated in approximately 8 years. This coefficient is however small and takes relatively longer time to adjust completely to equilibrium in the presence of further shocks to the system. However, the speed of adjustment in this study is not accidental or a surprise giventhe relative instability in efficiency of some banks during the study period. Since most of the short run effects from the VECM were insignificant, more information on the short run dynamics can be obtained from the impulse response and variance decomposition analyses. However before considering impulse response and variance decomposition analyses, we need to confirm that the results from the VECM we have just reported are derived from efficiency model with well –behaved residuals. Therefore, we proceeded to perform diagnostic tests on the residuals from the model specification.

Diagnostic test Diagnostic tests are crucial in this analysis, because if there is a problem in the residuals from the estimation of a model, it is an indication that the model is not efficient, such that parameter estimate from such a model may be biased. Results from the diagnostic tests performed in this study are presented at the end of table 4.7. Of importance in this analysis are the residual diagnostic tests for serial correlation, normality and heteroskedasticity. The three tests are based on the null hypothesis that there is no serial correlation, there is normality and there is no heteroskedasticity problem for the Lagrange Multiplier (LM), Jarque-Bera and White heteroskedasticity tests, respectively. In the regression analysis of table 4.7, the null hypothesis of no serial correlation, residual are normally distributed and no heteroskedasticity cannot be rejected in the three tests, since the tests are not significant. The regression passes the entire test since all the tests fail to reject their null hypothesis. Thus the regression is well-behaved and impulse and variance decomposition analyses can be applied to the model.

4.5.2**TEST OF HYPOTHESIS ON THE EFFECT OF EFFICIENCY ON PROFITABILITY.**

Table 4.8

Unit Root Test at Levels

Variable	ADF Statistics	ADF Critical Value	Order of Integration
PROFT	**-10.6231**	**--3.4902***	**I(0)**
EFFICEN	**-10.7337**	**-3.4913***	**I(0)**

Interpretation of Result

Unit root test was conducted on profitability model to determine whether the variables are stationary or not. According to the ADF test at intercept only both profit(PROFT) and efficiency (EFFICEN) were all stationary at levels using 1 per cent level of significance. This leads to the rejection of the unit root null hypothesis that there exists a unit root in the model. Hence the variables were not differenced and we therefore say that the variables were integrated to order zero I (0).

Table 4.9 Co integration Result

Date: 07/03/12 Time: 04:13
Sample (adjusted): 6 115
Included observations: 103 after adjustments
Trend assumption: Linear deterministic trend
Series: EFFGR NPRFTGR
Lags interval (in first differences): 1 to 4

Unrestricted Co integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.188657	39.71773	15.49471	0.0000
At most 1 *	0.161839	18.18411	3.841466	0.0000

Trace test indicates 2 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co integration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.188657	21.53362	14.26460	0.0030
At most 1 *	0.161839	18.18411	3.841466	0.0000

Max-eigenvalue test indicates 2 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The result of the co integration relationship is presented in table 4.9 above. The study employs Johansen (1990) and Johansen and Juselius (1992) techniques to test for the long run equilibrium relationship between profitability (NET PROFT) and efficiency (EFFICENCY). Starting with the trace test, the null hypothesis of no co integration is rejected since the test statistic (15.49) is greater than the 5 percent critical value (3.84). Likewise the null hypothesis of that there exist at most 1 co integrating vectors is rejected. The trace test, therefore, indicates 2 co integrating relationships (vectors) at the 5 per cent level of significance. The maximum Eigen value form of the Johansen test rejects the null hypothesis of no co integration and indicates that there is at most 1 co integrating vectors. Thus the empirical result indicates two co integrated relationship for both trace and maximum Eigen value test. The null hypothesis of no co integration is therefore rejected and we therefore arrive at the conclusion that **there is a long run relationship between profitability and efficiency.** From this point we proceed to identify the actual co integrating relationship.

The long run relationship

Using the number of co integrating relationship obtained, the number of lags and the deterministic trend assumption from the co integration test, we specify the VECM. This is to allow for the long and short determinant of profitability.

Table 4.10 Vector Error Correction Estimates

Date: 07/03/12 Time: 04:17
Sample (adjusted): 4 115
Included observations: 107 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Co integrating Eq:	CointEq1	
NPRFTGR(-1)	1.000000	
EFFGR(-1)	4976.764 (547.578) [9.08869]	
C	-42928.18	
Error Correction:	**D(NPRFTGR)**	**D(EFFGR)**
CointEq1	-0.030390 (0.01761) [-1.72619]	-0.000382 (4.2E-05) [-9.02557]
D(NPRFTGR(-1))	-0.631211 (0.09489)	0.000123 (0.00023)

	[-6.65172]	[0.53868]
D(NPRFTGR(-2))	-0.302394	-6.22E-05
	(0.09439)	(0.00023)
	[-3.20377]	[-0.27445]

We normalize the vector on the variable for which a clear evidence of error correction is found. A comparison of the coefficients of the error correction terms (CointEq1) at the end of table 4.10 is conducted. The result of the vector for error correction term shows that efficiency growth rate (EFFGR) has the most significant co efficient and has a correct negative sign (Lutkepohl and Kratzig 2009) although it has a low adjustment co efficient of -0.03 percent. The second variable net profit (NPRFTGR) has a correct negative sign and also significant with an adjustment co efficient of 3 percent. Thus we normalize on net profit (NPRTGR) to obtain both the long run and short run parameter estimates. We then conducted the single equation equilibrium correction models for the profitability model

Table: 4.11 Single equation equilibrium correction models for the efficiency model.

Long terms

NPRFT (-1)

Constant -42928.18

EFFGR (-1) 4976.76 (547.57)

T-statistic [9.0887]

Dynamic terms

ΔNPRFTGR (-1) -0.6312 [-6.6517]

ΔNPRFTGR (-2)) -0.3024 [-3.20377]

Speed of Adjustment (α) -0.030 (0.0176)

R-squared 0.346

The result of the vector error correction model (VECM) for the profitability model is presented in table 4.11above. The co efficient of determination from the study shows that growth in efficiency explains over 34 percent changes in the net profit attributed to the variations in efficiency growth. The analysis of efficiency growth rate (EFFGR) reveals a positive significant long run relationship with growth in net profit. In other words the empirical evidence from the analysis shows that efficiency is a significant determinant of profitability. A percentage growth in efficiency results in net profit growth.

The short run relationship

The short run relationship of the model is intended to explain the short run dynamics of the profitability model. The empirical result estimated for the short run dynamics is presented in table 4.11. The result indicates that the first difference of net profit (NPRFT) lagged once has a significant short term negative impact on itself. Also the first difference of net profit (NPRFT) lagged twice reveals a significant negative impact on itself. This implies that the previous year's net profit significantly affected the successive year's net profit.

An important parameter in the estimation of VECMs is the coefficient of adjustment which measures the speed of adjustment in net profit (NPRFT) model following a shock in the system. It is also regarded as a measure of the degree of adjustment of the actual profit to its equilibrium level. As illustrated in table 4.11 this is represented by -0.030 in the model. Based on this coefficient, it explains that about 0.03 percent of the variation in the actual profit and its equilibrium is restored every year. This result implies that, in the absence of further shocks, this difference would require much longer period of time to disappear. This indicates a slow adjustment coefficient and would take relatively longer period of time for the system to adjust completely to equilibrium.

CHAPTER FIVE

FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1SUMMARY OF WORK DONE

This chapter presents the summary of the research work, highlighting the findings from the study, conclusion and recommendations for the study. The Nigerian banking sector is continually undergoing reforms to make it better to help the economy achieve growth and development. This is being done by the regulatory authorities to ensure it has financial soundness so that it can provide a wide range of financial services and to make the banks successful in performing their role of financial intermediation. The primary role of any banking system is to channel funds to the real sector for economic growth and development. In doing this efficiency and profitability become key issues it must consider in other to be able to help transform the economy. This is now more compelling following the evidence presented of the effect of financial sector development on economic growth.(Levine and Renelt 1992),King and Levine(1993).This study employed Data Envelopment Analysis (DEA) in analyzing the input resources and output of the decision making units (Banks) to arrive at the efficiency levels of the banks. Also, vector auto-regressive analysis (VAR) is used for the hypothesis testing to arrive at choosing either the null hypothesis or alternate hypothesis.In the hypothesis testing,the following variables- fixed assets; operating expenses and total deposit are tested on the efficiency levels to arrive at the hypothesis to accept.Inaddition, the effect of efficiency on profitability of the banks is tested as the last hypothesis testing.

5.2 SUMMARY OF FINDINGS

Findings on theories and review of literature in this study have been presented in chapter two. It is based on this, that the empirical findings from this study will be presented here.

Findings from the Data Envelopment Analysis (DEA) reveal that out of the 23 banks used in the study, in the year 2005 only two banks namely; Spring and Standard Chartered banks were efficient. This represents 8.7% of the 23 banks. While the remaining twenty – one (21) banks representing 91.30% were inefficient .But there was an improvement in 2006 as four banks-Intercontinental, Spring, Access and Standard Chartered bank were efficient. This is 17.39% of the entire banks used in the study, while nineteen (19) banks representing 82.61% were inefficient. In 2007,the number of efficient banks fell to two (2) banks (8.70 %) of the total number (only Oceanic and Stanbic IBTC bank) ,while the remaining twenty-one (21)(91.30%) banks were inefficient. In 2008, the number of efficientbanks went up to five banks namely; GTB, Fidelity, Citi, Oceanic and Access.This is 21.74% of the 23 banks used in the study .A total of 18 banks (78.26%) were inefficient.In 2009,the number of efficient banks was three (3) (13.04 %), while the remaining twenty (20) banks (86.96 %)were inefficient. From the above analysis, it can be seen that the entire banks during the years under study did not yield up to 50% total efficiency in any particular year .Even with the consolidation and reforms carried out in the industry during the period none of the years recorded up to ten banks having full efficiency. Generally, it was a mixed result for all the banks as shown in table 4.1 as they had full efficiency in some years and inefficiency in other years.

Under the Constant Return to Scale (CRS)Variable return to scale (VRS) and Scale Efficiency, the listed banks below were efficient in the years attached to them.(See table 5.1)

TABLE 5.1: BANKS AND THEIR YEAR OF EFFICIENCY UNDER VRS, CRS AND SE

		VRS	CRS	SE
1	First Bank	2009	2009	2008 & 2009
2	Zenith bank	2009	-	-
3	PHB	2008 & 2009	-	2007
4	Union	2009	-	-
5	GTB	2006-2009	2006-2009	2006-2009
6	Fidelity	2008	2008	2008
7	Diamond	-	-	2006 & 2008
8	Ecobank	2005 & 2006	2005 & 2006	2005, 2006 &2009
9	Stanbic IBTC	2005 & 2007	2005 & 2007	2005 & 2007
10	INT	2006 & 2008	2006	2006
11	WEMA	2005	2005	2005 & 2008
12	Citi bank	2008	2008	2008
13	Spring	2005 & 2006	2005 & 2006	2005 & 2006
14	Skye	2005	-	-
15	Oceanic	2007- 2009	-	-
16	Access bank	2006,2008 &2009	2006 & 2009	2006 & 2009
17	Sterling bank	2005	-	-
18	Standard Chartered	2005 & 2006	2005 & 2006	2005 & 2006
19	Finbank	2005	-	-

The only banks that did not have any full efficiency under VRS, CRS and SE in any of the five years were UBA, Unity bank, Afribank and FCMB. While UBA and Afribank had mixed result in terms of return to scale, FCMB and unity banks had increasing return to scale in all the five years. This means that over time the two banks will achieve fully efficiency in their operations.

Overall GTB is the most efficient bank and it serves as the peer bank whose business processes can be emulated by the other banks intheir use of inputs resources to produce output. It has the least reduction in input needed (4.39 %) to produce the same amount of output. It remained efficient throughout the years 2006-2009.This means that it was completely efficient for four years out of the five years period under study. The worst performers were Unity, Afribank, FCMB and UBA

5.2.1 FINDINGS ON THE HYPOTHESES TESTING

HYPOTHESIS 1

It is observed in the analysis that fixed assets have**a negative (-0.067) long run relationship with efficiency as indicated by its coefficient in the regression although not significant.** This means that a continuous increase in Fixed Asset will reach a point where it will start to retard the efficiency of the bank.

HYPOTHESIS 2

The coefficient for operating expenses is also negative, (-0.002) very low magnitude, insignificant and statistically not different from zero. Thus the hypothesis that it is zero could not be rejected in the regression. We therefore accept the result and conclude that **operating expenses have no long run relationship with the efficiency variable.** This result is not theoretically plausible as operating expenses should have a significant long run relationship with efficiency. This result could be due to lack of direct connectivity and feedback mechanism between management and operations.

HYPOTHESIS 3

The null hypothesis that total deposit is not significantly different from zero could not be rejected in the regression (actual result is 0.000). This result could be an indicator of the inadequacy of this variable to account for the changes in efficiency. Therefore, the null hypothesis that **the banks' deposit size does not affect their efficiency is accepted for the determinant variables which lead to the conclusions that they are not significant from zero in explaining the variations in efficiency.**

HYPOTHESIS 4

The result of the analysis of the effect of efficiency on profitability shows that it has a positive significant long run relationship with profitability. (34%) In other words there is need to strengthen efficiency if there is to be prospect for positive significant effect on profitability in the future.

A crucial parameter to note in the estimation of VECM is the coefficient which in this study, measures the speed of adjustment in efficiency following a shock in the system. It can also be seen as a measure of the degree of adjustment of the actual efficiency with regards to its equilibrium level. As shown in table 4.9 this corresponds to -0.130 for the regression. Based on this coefficient, about 13 percent of the gap between the actual efficiency and its equilibrium is eliminated every year. i.e 100% restoration back to equilibrium level (100/13=7.69230).This result implies that, in the absence of further shocks, the gap would be eliminated in approximately in 8 years. This coefficient is however small and takes relatively longer time to adjust completely to equilibrium in the presence of further shocks to the system. However, the speed of adjustment in this study is not accidental or a surprise given the relative instability in efficiency of some of the banks during the study period.

5.3 CONCLUSION

The study has provided empirically the efficiency levels of the banks during the period under study using the input and outputs used for the study. It is an established fact that there is inefficiency in the banks use of resource inputs as showed by the study.The study hasshowed by how much the resource inputs could have been reduced to produce the same amount of outputs during the period. This means that the resource inputs could have been better utilised to produce the outputs.

Also management action and feedback from operation is needed to improve the efficiency level of the banks.

In all GTB have the best efficiency in its use of the resource inputs to produce the stated output; hence its way of doing business could be copied by the other banks. Also the banks like FCMB and Unity bank with continuous increasing return to scale over the period can achieve full efficiency if it is sustained.

5.4RECOMMENDATIONS

With the growing evidence of the effect of financial sector development on any country's economic growth, it has become apparent that monetary authorities should now focus more attention on making the financial sector of the economy better managed especially in resource utilization. The banking sector which forms a major component of the economy is responsible for financial intermediation. Based on this it needs to be efficient in its resource allocation and utilization.

Based on the need for the banking sector to be efficient with regard to the findings of this study the following recommendations are enunciated:

1.It is essential that the regulatory and supervisory authorities (CBN and NDIC) formulate and implement monetary policies that are effective in helping the banks to improve their operations, thereby leading to efficiency in resource allocation and utilization.

2. The banks should see to it that they adopt the monetary policies in a way to improve their operations.

3.The effect of new technologies on banking operations should be examined from time to time in relation to their effect on productivity in utilization of resources to achieve efficiency and productivity.

4.Risk assessment and risk management should be taken seriously both by the banks and the regulatory authorities in the management and regulation of banking business in Nigeria. The evidence obtained from the profits / losses declared by the banks during the period under study, it is obvious that the reforms in the banking industry has brought out its true picture in terms of its financial performance.

5. Some of the banks, like UBA, Unity,Afribank and FCMB should realigned their operations so that they can be efficient, as they are not currently efficient in either on CRS,VRS and SE. The operation of GTB can be studied by them as the bank has the best efficiency performance in the group.

6. In addition some of the banks like Sterling, Diamond, and First bank so on (see table 4.3) could reduce their resource inputs by the percentages stated in the analysis in chapter four to

still be able to achieve their current output. For example first bank 15.90%, fidelity 19.08%, diamond bank 30.68% and ECO bank 20.08% so on.

7. The fixed assets acquisition by the banks should be watched closely by them as the continuous increase in fixed asset may reach a point as showed by the hypotheses testing where it will start to retard the efficiency of the banks.

8. The instability in the efficiency of some of the banks necessitate that the banks take proactive actions to strengthen their efficiency.

9. Though, some of the banks have huge deposit their loan portfolio is small compared to the amount of loan they grant from it. It is recommended that the banks increase the amount of loans granted to generate income for the bank and better the economy especially the productive sector.

10. The inefficiency experienced in the banks needs managerial attention. This could be in resource input reallocation in the various banks.

11. The net loss recorded by the banks could be revised to net profits if the banks can achieve efficiency in their business operations. This the banks can achieve with more management and operations feedback on resource input utilization.

5.5 RESEARCH CONTRIBUTION TO KNOWNLEDGE

This studyhas contributed to the numerous works in the field of efficiency measurement and Data envelopment analysis in the following ways:

1. The study has shown that Data envelopment analysis can help bank managers, regulatory authorities, the government, shareholders, depositors and any other interested parties to

evaluate how efficient a bank is being run especially with reference to resource allocation and utilization.

2.This study has clearly shown that if efficiency is achieved in the banking operation it will go a long way to reduce the spread between the bank's deposit and lending rates.as the cost of operations by the banks go down they will be able to give good interestpayment to depositors who will be encouraged by the increased interest payment to save more, thereby making more funds available for intermediation by the banks in the economy.

3. The study will help in benchmarking, rating, mergers and acquisitions in the banking industry.

4.The banks used in the study that have economy of scale especially by their large deposits do not have high return to scale as their efficiency ratios were low.

5. In addition, the study succeeded in establishing the fact that total deposit if well utilized by the banking system has the tendency to return the system back to equilibrium in cases of shocks that pull the system away from actual points.

6. Lastly, the study has revealed that fixed assets have a negative long run relationship with efficiency. This means that a continuous increase in a bank's fixed assets will reach a point it will start to retard the bank's efficiency as they have to be maintained.

5.6 SUGGESTION FOR FURTHER RESEARCH

The following areas of further study are suggested for further research.

i, Bank performanceevaluation using Financial Ratios and Data Envelopment Analysis and

ii, A comparative study of Nigeria Bank Efficiency: Pre and Post 2004 bank consolidation.

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APPENDIX 1

BANK'S INPUT AND OUTPUT DATA USED FOR ANALYSIS (2005-2009)

	INPUT	OUTPUT					
YEARS	1.TOTAL DEP in N'M	2 FIXED ASSET in N'M	3.O. EXP in N'M	4.T. LOAN in N'M	5. N.PROFIT in N'M	6. T. INV in N' M.	
FIR05	264,988	12,108	26,648	114,673	12,184	24,655	
FIR06	390,846	13,952	33,748	175,657	16,053	63,729	
FIR07	581,827	16,850	41,446	219,185	18,355	64,048	
FIR08	661,624	29,155	62,260	437,768	30,473	71,532	
FIR09	1,071,836	38,320	81,533	684,107	35,074	65,336	
ZEN05	233,413	15,097	18,154	122,494	7,156	6,139	
ZEN06	392,864	23,102	31,298	199,708	11,489	14,581	
ZEN07	568,012	34,544	45,388	218,305	17,609	45,524	
ZEN08	1,161,46	48,086	85,095	413,731	46,525	70,298	
ZEN09	1,111,328	75,171	103,410	669,261	18,365	180,285	
PHB05	21,893	1,684	2,855	18,612	703	6,493	
PHB06	109,870	7,613	4,623	37,142	2,416	44,581	
PHB07	307,887	18,291	14,124	100,159	7,637	69,539	
PHB08	739,442	34,245	31,883	312,881	19,437	285,549	
PHB09	457,472	50,822	125,223	177,434	395,613	109,299	
UNION05	200,511	14,482	23,745	78,684	9,375	17,142	
UNION06	252,418	20,612	31,965	116,060	10,036	33,578	
UNION07	417,406	25,029	41,154	149,376	12,126	60,333	
UNION08	649,334	26,120	47,203	244,845	24,737	72,602	
UNION09	782,043	55,407	68,205	336,812	-286,168	129,025	
UBA05	205,110	6,154	15,737	67,610	4,653	7,835	
UBA06	757,407	32,226	43,522	107,194	11,468	55,097	
UBA07	897,651	48,213	44,424	320,229	19,831	80,228	
UBA08	1,258,05	56,165	58,345	421,748	40,002	111,454	
UBA09	1,151,06	63,497	111653	543,289	12,889	199,161	
GTB05	95,564	7,400	13,300	65,035	5,331	32,333	
GTB06	212,834	11,729	12,199	83,477	8,678	116,429	
GTB07	290,792	19,750	17,689	113,705	13,013	170,070	
GTB08	445,740	36,030	35,522	416,444	28,073	196,832	
GTB09	662,261	41,286	49,963	538,138	23,848	114,952	
FID05	20,572	1,390	14,053	13,892	1,237	5,045	
FID06	81,593	5,053	38,863	38,661	3,162	26,694	
FID07	176,681	7,271	70,318	70,238	4,160	74,285	

FID08	378,544	17,290	229,156	230,713	13,356	185,848	
FID09	288,808	24,335	15,821	161,297	1,414	9,469	
DIA05	74,777	3,222	7,876	40,823	2,527	1,418	
DIA06	144,570	8,346	16,088	77,930	-332,125	3,037	
DIA07	211,635	15,953	18,666	96,385	6,931	9,990	
DIA08	403,710	26,162	24,570	231,445	11,822	26,670	
DIA09	449,020	34,949	27,356	296,538	4,884	42,180	
ECO05	32,452	2,366	0	19,131	1,668	2,366	
ECO06	84,041	6,370	0	52,279	3,559	6,370	
ECO07	222,885	14,253	15,469	116,181	7,450	14,253	
ECO08	310,714	18,818	26,002	144,917	-5	18,818	
ECO09	243,831	21,382	30,614	183,719	-4,588	21,382	
ST.IBTC5	57,073	5,204	2,746	50,068	4,124	4,372	
ST.IBTC6	72,896	5,958	6,806	35,590	5,363	28,787	
ST.IBTC7	72,455	8,345	9,937	79,636	6,942	68,172	
ST.IBTC8	98,914	14,905	24,545	99,010	9,214	71,846	
ST.IBTC9	170,411	26,267	29,694	110,967	6,258	61,776	
INT.05	110,014	3,444	8,817	52,599	5,023	1,158	
INT06	254,407	11,395	573	172,315	7,560	60,840	
INT07	480,133	21,737	42,567	278,610	15,480	121,649	
INT08	1,098,49	37,674	72,342	450,062	34,773	240,451	
INT09	837,566	55,835	105,841	158,100	-174,491	99,444	
WEMA05	61,285	4,163	0	46,183	844	22,735	
WEMA06	85,605	7,147	8,525	53,703	-6,602	14,907	
WEMA07	125,476	11,716	11014	68,797	2,554	31,885	
WEMA08	136,122	14,411	16794	48,394	-57,739	35,281	
WEMA09	108,385	13,780	13,294	28,637	-11,668	8,283	
UNITY05	24,743	952	2,539	11,282	410	335	
UNITY06	79,684	12,823	7,137	37,023	1,371	1,476	
UNITY07	145,794	13,164	13,050	36,590	721	1,364	
UNITY08	320,120	13,905	26,722	51,882	-13,242	15,895	
UNITY09	214,821	16,525	36,553	87,818	-15,856	9,534	
CITI05	44,969	2,078	4,411	27,588	3,120	5,514	
CITI06	61,062	2,677	4,690	35,490	7,722	10,250	
CITI07	79,135	3,647	6,207	42,386	6,946	20,103	
CITI08	96,263	3,511	6,019	58,303	8,530	18,874	
CITI09	125,113	3,138	7,455	44,856	11,891	18,023	
AFRIB05	68,857	5,157	9,050	25,969	81,040	28,106	
AFRIB06	88,435	5,137	9,663	30,172	2,684	27,869	
AFRIB07	135,645	7,605	11,971	61,386	5,197	40,035	
AFRIB08	217,976	9,365	19,323	104,226	10,033	48,648	

AFRIB09	249,506	13,321	31,471	118,224	-230,140	33,585	
SPRING5	26,562	1,242	2,777	15,617	400,288	3,214	
SPRING6	0	0	0	0	0	0	
SPRING7	112,548	6,735	22,110	30,966	99,892	19,974	
SPRING8	129,507	7,687	18,278	30,250	72,533	14,080	
SPRING9	142,697	7,383	11,243	15,903	24,164	69,554	
SKYE05	22,623	1,192	0	12,123	493	5,665	
SKYE06	125,472	9,674	0	71,718	2,467	48,477	
SKYE07	269,316	12,414	0	108,450	5,517	81,601	
SKYE08	501,596	20,081	0	244,511	15,126	114,214	
SKYE09	452,918	40,893	0	317,764	1,130	72,274	
FCMB05	26,857	1,903	0	11,436	798	159	
FCMB06	70,297	6,917	0	19,071	2,841	9,829	
FCMB07	187,991	12,761	0	83,577	5,806	24,815	
FCMB08	251,580	16,574	0	186,565	13,720	24,736	
FCMB09	322,419	20,906	0	270,189	3,466	43,004	
OCEANIC05	167,451	5,232	0	77,766	5,897	51,874	
OCEANIC06	310,033	14,457	0	99,120	9,299	42,321	
OCEANIC07	693,925	29,727	0	339,499	17,537	320,672	
OCEANIC08	1,088,881	62,969	0	503,694	-234,676	156,505	
OCEANIC09	556,782	66,214	0	387,804	-89,008	163,435	
ACCESS05	32,608	2,417	0	16,183	501	8,385	
ACCESS06	110,879	3,953	0	54,111	737,149	43,967	
ACCESS 07	205,235	8,162	0	107,751	6,083	43,396	
ACCESS08	351,789	13,365	0	244,596	16,057	165,840	
ACCESS09	409,349	26,154	0	360,388	-880,752	97,581	
STERLING05	12,380	2,152	0	1,723	-4,821	1,951	
STERLING06	75,026	7,217	0	38,946	962	8,428	
STERLING07	106,934	4,864	0	45,958	621	7,153	
STERLING08	184,730	5,218	0	65,788	6,523	33,234	
STERLING09	160,470	5,089	0	78,140	-6,660	28,466	
ST.CHART05	33,440	1,179	0	19,776	2,432	18,579	
ST.CHART06	37,542	1,546	0	29,408	5,787	24,176	
ST.CHART07	47,113	4,888	0	35,740	6,951	17,473	
ST.CHART08	93,176	6,197	0	61,516	8,027	10,390	
ST.CHART09	126,591	6,107	0	62,937	7,413	27,292	
FINBANK05	16,158	1,699	0	11,138	312	260	
FINBANK06	20,415	2,385	0	7,126	-7,073	260	
FINBANK07	146,807	8,128	0	28,472	2,649	5,057	
FINBANK08	391,406	11,437	0	60,333	953	9,859	
FINBANK09	197,041	16,056	0	44,485	150,097	36,056	

SOURCES : BANK'S ANNUAL REPORT FOR 2005-2009

NOTE: FIRST SIXTEEN BANKS HAVE THREE INPUTS AND THREE OUTPUTS, WHILE THE LAST SEVEN BANKS HAVE TWO INPUTS AND THREE OUTPUTS.ALL FIGURES IN MILLIONS OF NAIRA.

1.Total deposit 2. Fixed asset 3. Operating expenses 4. Total loans 5. Net profit 6.Total investment

THE THREE INPUTS AND THREE OUTPUTS AS OBTAINEDFROMTHEDEASOFTWARE.

Inputs	**Outputs**
TOTAL DEPOSIT	TOTAL LOANS
FIXED ASSET	NET PROFIT
OPERATING EXPENSES	TOTAL INVESTM.

DMU No.	*DMU Name*	*Input-oriented VRS Efficiency*	*Input-oriented CRS Efficiency*	*Input-oriented RTS*
1	FIR05	0.61646	0.61643	Increasing
2	FIR06	0.81929	0.78106	Decreasing
3	FIR07	0.81460	0.77579	Decreasing
4	FIR08	0.95509	0.95509	Increasing
5	FIR09	1.00000	1.00000	Constant
6	ZEN05	0.63372	0.63370	Increasing
7	ZEN06	0.64378	0.64377	Increasing
8	ZEN07	0.47880	0.47879	Increasing
9	ZEN08	0.52863	0.52862	Constant
10	ZEN09	1.00000	0.71045	Decreasing
11	PHB05	0.93596	0.93567	Increasing
12	PHB06	0.77819	0.77816	Increasing
13	PHB07	0.49869	0.49869	Constant
14	PHB08	1.00000	0.96316	Decreasing
15	PHB09	1.00000	0.37862	Decreasing
16	UNION05	0.44729	0.44726	Increasing
17	UNION06	0.49018	0.49017	Increasing
18	UNION07	0.45494	0.45493	Increasing
19	UNION08	0.59884	0.58459	Decreasing
20	UNION09	1.00000	0.49894	Decreasing
21	UBA05	0.61973	0.61961	Increasing
22	UBA06	0.25092	0.24932	Decreasing
23	UBA07	0.47824	0.47648	Decreasing
24	UBA08	0.61216	0.48776	Decreasing
25	UBA09	0.83490	0.62485	Decreasing
26	GTB05	0.75368	0.75362	Increasing
27	GTB06	1.00000	1.00000	Constant
28	GTB07	1.00000	1.00000	Constant
29	GTB08	1.00000	1.00000	Constant

30	GTB09	1.00000	1.00000	Constant
31	FID05	0.79760	0.79727	Increasing
32	FID06	0.63363	0.63356	Increasing
33	FID07	0.97236	0.97230	Increasing
34	FID08	1.00000	1.00000	Constant
35	FID09	0.64248	0.62888	Decreasing
36	DIA05	0.79547	0.79536	Increasing
37	DIA06	0.71240	0.71240	Constant
38	DIA07	0.50694	0.50692	Increasing
39	DIA08	0.69536	0.69536	Increasing
40	DIA09	0.75562	0.74056	Decreasing
41	ECO05	1.00000	1.00000	Constant
42	ECO06	1.00000	1.00000	Constant
43	ECO07	0.63477	0.63474	Increasing
44	ECO08	0.58215	0.58214	Increasing
45	ECO09	0.77902	0.77902	Increasing
46	ST.IBTC05	1.00000	1.00000	Constant
47	ST.IBTC06	0.59844	0.59836	Increasing
48	ST.IBTC07	1.00000	1.00000	Constant
49	ST.IBTC08	0.95026	0.91089	Decreasing
50	ST.IBTC09	0.62895	0.59245	Decreasing
51	INT.05	0.85636	0.85611	Increasing
52	INT06	1.00000	1.00000	Constant
53	INT07	0.95375	0.88250	Decreasing
54	INT08	1.00000	0.89833	Decreasing
55	INT09	0.26331	0.24217	Decreasing
56	WEMA05	1.00000	1.00000	Constant
57	WEMA06	0.66290	0.66286	Increasing
58	WEMA07	0.56636	0.56635	Constant
59	WEMA08	0.34469	0.34469	Increasing
60	WEMA09	0.25085	0.25084	Increasing
61	UNITY05	0.69528	0.69492	Increasing
62	UNITY06	0.47385	0.47384	Increasing
63	UNITY07	0.25945	0.25943	Increasing
64	UNITY08	0.24134	0.24132	Increasing
65	UNITY09	0.45035	0.45033	Increasing
66	CITI05	0.86840	0.86823	Increasing
67	CITI06	0.85843	0.85829	Increasing
68	CITI07	0.83727	0.83720	Increasing
69	CITI08	1.00000	1.00000	Constant
70	CITI09	0.92975	0.92968	Increasing
71	AFRIB05	0.64433	0.64427	Increasing
72	AFRIB06	0.61523	0.61513	Increasing

73	AFRIB07	0.69335	0.69334	Increasing
74	AFRIB08	0.78672	0.78450	Decreasing
75	AFRIB09	0.63871	0.63870	Increasing
76	SPRING05	1.00000	1.00000	Constant
77	SPRING06	1.00000	1.00000	Constant
78	SPRING07	0.39380	0.39375	Increasing
79	SPRING08	0.30867	0.30863	Increasing
80	SPRING09	0.95195	0.95190	Increasing

APPENDIX 111

SHOWING DEA RESULT FOR THE SECOND SET OF DATA WITH THE TWO INPUTS AND THREE OUTPUTS (FOR SEVEN BANKS)

Inputs	**Outputs**
TOTAL DEPOSIT	TOTAL LOANS
FIXED ASSET	NET PROFIT
	TOTAL INVESTM.

DMU No.	***DMU Name***	***Input-Oriented VRS Efficiency***	***Input-Oriented CRS Efficiency***	***Input-Oriented RTS***
1	SKYE05	1.00000	0.64367	Increasing
2	SKYE06	0.76978	0.78539	Increasing
3	SKYE07	0.61210	0.63388	Increasing
4	SKYE08	0.68643	0.80729	Increasing
5	SKYE09	0.79785	0.85981	Increasing
6	FCMB05	0.74109	0.48366	Increasing
7	FCMB06	0.36144	0.32509	Increasing
8	FCMB07	0.52077	0.50795	Increasing
9	FCMB08	0.84926	0.84232	Increasing
10	FCMB09	0.95466	0.95185	Increasing
11	OCEANIC05	0.80314	0.80571	Increasing
12	OCEANIC06	0.41472	0.42153	Increasing
13	OCEANIC07	1.00000	1.00000	Constant
14	OCEANIC08	1.00000	1.00000	Constant
15	OCEANIC09	1.00000	1.00000	Constant
16	ACCESS05	0.70114	0.59505	Increasing

17	ACCESS06	1.00000	1.00000	Constant
18	ACCESS 07	0.73067	0.73570	Increasing
19	ACCESS08	1.00000	1.00000	Constant
20	ACCESS09	1.00000	1.00000	Constant
21	STERLING05	1.00000	0.26534	Increasing
22	STERLING06	0.63288	0.58962	Increasing
23	STERLING07	0.54517	0.56035	Increasing
24	STERLING08	0.67921	0.68352	Increasing
25	STERLING09	0.82974	0.83203	Increasing
26	ST.CHART05	1.00000	1.00000	Constant
27	ST.CHART06	1.00000	1.00000	Constant
28	ST.CHART07	0.94038	0.90390	Increasing
29	ST.CHART08	0.78435	0.74991	Increasing
30	ST.CHART09	0.62473	0.63510	Increasing
31	FINBANK05	1.00000	0.78297	Increasing
32	FINBANK06	0.77338	0.39648	Increasing
33	FINBANK07	0.24652	0.23337	Increasing
34	FINBANK08	0.28369	0.28800	Increasing
35	FINBANK09	0.35357	0.40268	Increasing

APPENDIX 1V

DATA FOR ANALYSIS OF THE RELATION BETWEEN EFFICIENCY AND PROFITABILITY GROWTH RATE(HYPOTHESIS 4)

Years	NET PROFIT	EFFICIENCY	NPGR	EFFGR
FIR05	12,184	0.61	31.75476034	26.2295082
FIR06	16,053	0.77	14.33999875	0
FIR07	18,355	0.77	66.020158	23.37662338
FIR08	30,473	0.95	15.09861189	5.263157895
FIR09	35,074	1	-79.59742259	-37
ZEN05	7,156	0.63	60.55058692	1.587301587
ZEN06	11,489	0.64	53.26834363	-26.5625
ZEN07	17,609	0.47	164.2114828	10.63829787
ZEN08	46,525	0.52	-60.5265986	36.53846154
ZEN09	18,365	0.71	-96.17206643	30.98591549
PHB05	703	0.93	243.6699858	-32.25806452
PHB06	2,416	0.63	216.1009934	-30.15873016
PHB07	7,637	0.44	154.5109336	77.27272727
PHB08	19,437	0.78	1935.360395	-52.56410256
PHB09	395,613	0.37	-97.63025988	18.91891892
UNION05	9,375	0.44	7.050666667	11.36363636
UNION06	10,036	0.49	20.82502989	-8.163265306
UNION07	12,126	0.45	103.9996701	28.88888889
UNION08	24,737	0.58	-1256.841978	-15.51724138
UNION09	-286,168	0.49	-101.625968	24.48979592
UBA05	4,653	0.61	146.4646465	-63.93442623
UBA06	11,468	0.22	72.92465992	113.6363636
UBA07	19,831	0.47	101.7144874	2.127659574
UBA08	40,002	0.48	-67.77911104	29.16666667
UBA09	12,889	0.62	-58.63914966	21.4516129
GTB05	5,331	0.753	62.78371788	31.47410359
GTB06	8,678	0.99	49.95390643	-6.96969697
GTB07	13,013	0.921	115.7304234	8.577633008
GTB08	28,073	1	-15.05004809	-0.1
GTB09	23,848	0.999	-94.81298222	-20.22022022
FID05	1,237	0.797	155.6184317	-20.57716437
FID06	3,162	0.633	31.56230234	50.07898894
FID07	4,160	0.95	221.0576923	5.263157895
FID08	13,356	1	-89.4129979	-41.3
FID09	1,414	0.587	78.71287129	35.43441227

DIA05	2,527	0.795	-13243.05501	-10.44025157
DIA06	-332,125	0.712	-102.0868649	-28.93258427
DIA07	6,931	0.506	70.56701775	36.56126482
DIA08	11,822	0.691	-58.68719337	4.486251809
DIA09	4,884	0.722	-65.84766585	-7.479224377
ECO05	1,668	0.668	113.3693046	3.293413174
ECO06	3,559	0.69	109.3284631	-8.260869565
ECO07	7,450	0.633	-100.0671141	-8.056872038
ECO08	-5	0.582	91660	33.84879725
ECO09	-4,588	0.779	-189.8866609	14.37740693
ST.IBTC5	4,124	0.891	30.04364694	-37.03703704
ST.IBTC6	5,363	0.561	29.44247623	78.25311943
ST.IBTC7	6,942	1	32.72832037	-9
ST.IBTC8	9,214	0.91	-32.08161493	-34.94505495
ST.IBTC9	6,258	0.592	-19.73473953	44.59459459
INT.05	5,023	0.856	50.50766474	16.82242991
INT06	7,560	1	104.7619048	-12.9
INT07	15,480	0.871	124.6317829	-8.610792193
INT08	34,773	0.796	-601.8002473	-69.97487437
INT09	-174,491	0.239	-100.4836926	279.0794979
WEMA05	844	0.906	-882.2274882	-26.93156733
WEMA06	-6,602	0.662	-138.6852469	-16.7673716
WEMA07	2,554	0.551	-2360.728269	-38.11252269
WEMA08	-57,739	0.341	-79.79182182	-28.73900293
WEMA09	-11,668	0.243	-103.5138841	185.5967078
UNITY05	410	0.694	234.3902439	-39.19308357
UNITY06	1,371	0.422	-47.41064916	-39.33649289
UNITY07	721	0.256	-1936.615811	-5.859375
UNITY08	-13,242	0.241	19.74022051	86.7219917
UNITY09	-15,856	0.45	-119.6770938	92.88888889
CITI05	3,120	0.868	147.5	-1.152073733
CITI06	7,722	0.858	-10.04921005	-6.177156177
CITI07	6,946	0.805	22.80449179	24.22360248
CITI08	8,530	1	39.4021102	-10.4
CITI09	11,891	0.896	581.5238416	-28.34821429
AFRIB05	81,040	0.642	-96.68805528	-14.17445483
AFRIB06	2,684	0.551	93.62891207	15.42649728
AFRIB07	5,197	0.636	93.05368482	17.29559748
AFRIB08	10,033	0.746	-2393.83036	-14.4772118
AFRIB09	-230,140	0.638	-273.932389	56.73981191
SPRING5	400,288	1	#VALUE!	#VALUE!

SPRING6	NA	NA	#VALUE!	#VALUE!
SPRING7	99,892	0.38	-27.38857967	-18.94736842
SPRING8	72,533	0.308	-66.68550867	200.3246753
SPRING9	24,164	0.925	-97.95977487	-30.37837838
SKYE05	493	0.644	400.4056795	21.89440994
SKYE06	2,467	0.785	123.6319416	-19.36305732
SKYE07	5,517	0.633	174.170745	27.48815166
SKYE08	15,126	0.807	-92.52941954	6.44361834
SKYE09	1,130	0.859	-29.38053097	-43.77182771
FCMB05	798	0.483	256.0150376	-32.71221532
FCMB06	2,841	0.325	104.3646603	56
FCMB07	5,806	0.507	136.3072683	66.07495069
FCMB08	13,720	0.842	-74.73760933	12.94536817
FCMB09	3,466	0.951	70.13848817	-15.35226078
OCEANIC05	5,897	0.805	57.69035103	-47.70186335
OCEANIC06	9,299	0.421	88.59017099	137.5296912
OCEANIC07	17,537	1	-1438.176427	0
OCEANIC08	-234,676	1	-62.07196305	0
OCEANIC09	-89,008	1	-100.5628708	-40.5
ACCESS05	501	0.595	147035.5289	68.06722689
ACCESS06	737,149	1	-99.1747937	-26.5
ACCESS 07	6,083	0.735	163.9651488	36.05442177
ACCESS08	16,057	1	-5585.159121	0
ACCESS09	-880,752	1	-99.45262685	-73.5
STERLING05	-4,821	0.265	-119.9543663	122.2641509
STERLING06	962	0.589	-35.44698545	-4.923599321
STERLING07	621	0.56	950.4025765	21.96428571
STERLING08	6,523	0.683	-202.1002606	21.81551977
STERLING09	-6,660	0.832	-136.5165165	20.19230769
ST.CHART05	2,432	1	137.9523026	0
ST.CHART06	5,787	1	20.11404873	-9.7
ST.CHART07	6,951	0.903	15.47978708	-17.05426357
ST.CHART08	8,027	0.749	-7.649184004	-15.22029372
ST.CHART09	7,413	0.635	-95.79117766	23.1496063
FINBANK05	312	0.782	-2366.987179	-49.36061381
FINBANK06	-7,073	0.396	-137.4522833	-41.16161616
FINBANK07	2,649	0.233	-64.02416006	23.60515021

FINBANK08	953	0.288	15649.94753	39.58333333
FINBANK09	150,097	0.402	-100	-100

NPRFTGR is the growth rate of profitability

EFFGR is the growth rate of efficiency

Growth Rate (GR)
$=\Delta X/X1*100$

APPENDIX V

VECM E-VIEW RESULT FOR HYPOTHESES 1-3

Co integration Result

Date: 04/01/12 Time: 07:19
Sample: 1- 115
Included observations: 58
Test assumption: Linear deterministic trend in the data
Series: EFF FA OE TD
Lags interval: 1 to 4

Eigen-value	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.403113	55.17181	47.21	54.46	None **
0.236767	25.24226	29.68	35.65	At most 1
0.125503	9.571154	15.41	20.04	At most 2
0.030440	1.792976	3.76	6.65	At most 3

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 co integrating equation(s) at 5% significance level

Un-normalized Co integrating Coefficients:

EFF	FA	OE	TD	
0.365976	0.029839	-0.356388	0.402175	
-0.372057	0.291208	-0.179905	-0.223574	
-0.772089	-0.236691	0.051216	0.226807	
-0.086587	-0.215633	-0.001133	-0.008579	

Normalized Co integrating Coefficients: 1 Co integrating Equation(s)

EFF	FA	OE	TD	C
1.000000	0.081532	-0.973801	1.098910	-5.047741
	(0.18372)	(0.38858)	(0.47786)	
Log likelihood	-120.0138			

Normalized Co integrating Coefficients: 2 Co integrating Equation(s)

EFF	FA	OE	TD	C
1.000000	0.000000	-0.836315	1.051928	-5.073598
		(0.43410)	(0.47724)	
0.000000	1.000000	-1.686295	0.576235	0.317146
		(0.96654)	(1.06260)	
Log likelihood	-112.1782			

Normalized Co integrating

Coefficients: 3 Co integrating Equation(s)				
EFF	FA	OE	TD	C
1.000000	0.000000	0.000000	0.062634	-1.438039
			(0.10499)	
0.000000	1.000000	0.000000	-1.418518	7.647667
			(0.25213)	
0.000000	0.000000	1.000000	-1.182921	4.347118
			(0.17583)	
Log likelihood	-108.2891			

Sample(adjusted): 3- 80
Included observations: 68
Excluded observations: 10 after adjusting endpoints
Standard errors & t-statistics in parentheses

	EFF	FA	OE	TD
EFF(-1)	0.502896	0.416713	0.251947	-0.088465
	(0.14914)	(0.70294)	(0.72518)	(0.63025)
	(3.37188)	(0.59281)	(0.34743)	(-0.14037)
EFF(-2)	-0.040617	-0.486936	-0.093634	0.110004
	(0.15088)	(0.71112)	(0.73362)	(0.63759)
	(-0.26920)	(-0.68474)	(-0.12763)	(0.17253)
FA(-1)	-0.017307	0.128885	0.045129	-0.200183
	(0.05017)	(0.23644)	(0.24392)	(0.21199)
	(-0.34499)	(0.54510)	(0.18501)	(-0.94429)
FA(-2)	0.003298	0.091957	-0.212763	-0.007967
	(0.05208)	(0.24547)	(0.25324)	(0.22009)
	(0.06332)	(0.37462)	(-0.84018)	(-0.03620)
OE(-1)	0.020922	0.016866	0.252234	-0.044809
	(0.03836)	(0.18080)	(0.18652)	(0.16210)
	(0.54542)	(0.09329)	(1.35234)	(-0.27643)
OE(-2)	0.026094	-0.240815	-0.135055	0.090342

	(0.03723)	(0.17549)	(0.18105)	(0.15735)
	(0.70078)	(-1.37221)	(-0.74597)	(0.57416)
TD(-1)	0.042025	0.331399	0.259981	0.654423
	(0.04755)	(0.22413)	(0.23122)	(0.20095)
	(0.88373)	(1.47860)	(1.12439)	(3.25659)
TD(-2)	-0.073579	0.175054	0.349600	-0.124184
	(0.05146)	(0.24253)	(0.25020)	(0.21745)
	(-1.42989)	(0.72179)	(1.39728)	(-0.57109)
C	0.419922	3.516766	2.847017	7.181017
	(0.46233)	(2.17904)	(2.24797)	(1.95371)
	(0.90827)	(1.61391)	(1.26648)	(3.67559)
R-squared	0.246983	0.220103	0.264326	0.195602
Adj. R-squared	0.144879	0.114354	0.164574	0.086531
Sum sq. resids	2.575772	57.21787	60.89508	45.99608
S.E. equation	0.208943	0.984781	1.015933	0.882947
F-statistic	2.418940	2.081377	2.649824	1.793350
Log likelihood	14.80637	-90.61801	-92.73574	-83.19547
Akaike AIC	-0.170776	2.929941	2.992228	2.711631
Schwarz SC	0.122983	3.223700	3.285986	3.005390
Mean dependent	0.683132	9.467357	9.904759	12.08340
S.D. dependent	0.225951	1.046429	1.111504	0.923820

Determinant Residual Covariance	0.002799
Log Likelihood	-186.0773
Akaike Information Criteria	6.531685
Schwarz Criteria	7.706719

Regression Result

Dependent Variable: EFF(-1)
Method: Least Squares
Date: 04/03/12 Time: 13:25
Sample(adjusted): 2 81
Included observations: 76
Excluded observations: 4 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FA(-1)	-0.066819	0.047588	-1.404116	0.1646
OE(-1)	-0.002150	0.036383	-0.059101	0.9530

TD(-1)	0.000391	0.042952	0.009108	0.9928
C	1.318321	0.347329	3.795602	0.0003

R-squared	0.094452	Mean dependent var	0.670382
Adjusted R-squared	0.056721	S.D. dependent var	0.221642
S.E. of regression	0.215265	Akaike info criterion	-0.182700
Sum squared resid	3.336402	Schwarz criterion	-0.060030
Log likelihood	10.94261	F-statistic	2.503299
Durbin-Watson stat	0.994753	Prob(F-statistic)	0.066011

Date: 04/01/12 Time: 07:08
Sample(adjusted): 4 76
Included observations: 64
Excluded observations: 9 after adjusting endpoints
Standard errors & t-statistics in parentheses

Co integrating Eq:	CointEq1
EFF(-1)	1.000000
FA(-1)	-1.087899 (1.91126) (-0.56920)
OE(-1)	-1.826022 (2.75072) (-0.66383)
TD(-1)	3.789517 (5.75468) (0.65851)
C	-18.03893

Error Correction:	D(EFF)	D(FA)	D(OE)	D(TD)
CointEq1	-0.022216 (0.01811) (-1.22647)	0.104560 (0.08968) (1.16595)	0.241130 (0.09505) (2.53675)	-0.130200 (0.08059) (-1.61556)
D(EFF(-1))	-0.256607	0.244860	-0.131122	-0.301605

	(0.14320)	(0.70895)	(0.75146)	(0.63711)
	(-1.79195)	(0.34539)	(-0.17449)	(-0.47339)
D(EFF(-2))	-0.300190	-0.574621	-0.835063	-0.593051
	(0.14431)	(0.71443)	(0.75727)	(0.64204)
	(-2.08021)	(-0.80431)	(-1.10273)	(-0.92369)
D(FA(-1))	0.030316	-0.681322	0.164045	-0.380481
	(0.04933)	(0.24424)	(0.25888)	(0.21949)
	(0.61453)	(-2.78961)	(0.63367)	(-1.73348)
D(FA(-2))	0.053686	-0.540314	-0.187448	-0.459972
	(0.04995)	(0.24728)	(0.26211)	(0.22222)
	(1.07484)	(-2.18504)	(-0.71516)	(-2.06986)
D(OE(-1))	-0.047391	0.282162	-0.109786	-0.147170
	(0.04101)	(0.20304)	(0.21522)	(0.18247)
	(-1.15553)	(1.38969)	(-0.51012)	(-0.80655)
D(OE(-2))	-0.049003	-0.020465	-0.126779	0.002213
	(0.03842)	(0.19019)	(0.20160)	(0.17092)
	(-1.27556)	(-0.10760)	(-0.62887)	(0.01295)
D(TD(-1))	0.076943	0.011286	-0.451057	0.250050
	(0.05816)	(0.28792)	(0.30519)	(0.25875)
	(1.32300)	(0.03920)	(-1.47796)	(0.96637)
D(TD(-2))	-0.011622	0.311830	-0.029307	0.285936
	(0.05697)	(0.28206)	(0.29897)	(0.25348)
	(-0.20399)	(1.10556)	(-0.09803)	(1.12805)
C	0.004605	-0.001584	-0.008460	0.006989
	(0.02707)	(0.13402)	(0.14206)	(0.12045)
	(0.17009)	(-0.01182)	(-0.05955)	(0.05803)
R-squared	0.211106	0.306365	0.278617	0.235883
Adj. R-squared	0.079623	0.190759	0.158387	0.108530
Sum sq. resids	2.524624	61.87785	69.52130	49.97408
S.E. equation	0.216223	1.070461	1.134650	0.962001
F-statistic	1.605583	2.650084	2.317361	1.852197
Log likelihood	12.63724	-89.73300	-93.46007	-82.89595
Akaike AIC	-0.082414	3.116656	3.233127	2.902998
Schwarz SC	0.254912	3.453982	3.570453	3.240324
Mean dependent	0.001109	-0.011904	-0.015229	-0.010299
S.D. dependent	0.225382	1.189959	1.236818	1.018878
Determinant Residual		0.004179		

Covariance	
Log Likelihood	-187.9589
Akaike Information Criteria	7.248715
Schwarz Criteria	8.732947

VECM E-VIEW RESULT FOR HYPOTHESIS 4

Using Growth rate of Profitability and Efficiency

Date: 07/04/12 Time: 19:08
Sample (adjusted): 6 115
Included observations: 103 after adjustments
Trend assumption: Linear deterministic trend
Series: NPRFTGR EFFGR
Lags interval (in first differences): 1 to 4

Unrestricted Co integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.188657	39.71773	15.49471	0.0000
At most 1 *	0.161839	18.18411	3.841466	0.0000

Trace test indicates 2 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.188657	21.53362	14.26460	0.0030
At most 1 *	0.161839	18.18411	3.841466	0.0000

Max-eigenvalue test indicates 2 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co integrating Coefficients (normalized by b'*S11*b=I):

NPRFTGR	EFFGR
-0.000137	-0.009337
1.51E-05	-0.077479

Unrestricted Adjustment Coefficients (alpha):

D(NPRFTG)	8015.420	-416.8594
D(EFFGR)	3.672735	19.12386

1 Co integrating Equation(s): Log likelihood -1692.067

Normalized co integrating coefficients (standard error in parentheses)

NPRFTGR	EFFGR
1.000000	67.94507
	(122.117)

Adjustment coefficients (standard error in parentheses)

D(NPRFTG)	-1.101452
	(0.23732)
D(EFFGR)	-0.000505
	(0.00069)