CHAPTER ONE

INTRODUCTION

1.1 The Problem

Over the years, the Nigerian banking industry has been plagued with structural weaknesses and frequent systemic crises which led to several distresses. A pertinent regulatory measure for strengthening the banks to enhance performance is consolidation of the industry. Advocates of bank consolidation believe that it would produce more efficient banks and healthier banking system less prone to bank failures (Mishkin, 2007). This is the too-big-to-fail syndrome. However, some believe that it may lead to a reduction in lending to small businesses and that banks rushing to expand into new geographic markets may take increased risks leading to bank failures (Mishkin, 2007). Nigeria's 2004/2005 bank consolidation was a revolution, which initially was viewed with skepticism by the operators in the industry.[1] Many of the bankers protested vehemently and made representations to the government, highlighting a plethora of reasons why the policy would not work. The interesting thing is that what appeared like an impossible mission at the outset later metamorphosed into something practicable through dogged determination of operators. According to Adedipe (2006), market-induced consolidation normally holds out promises of scale economies, gains in operational efficiency, profitability improvement and resource maximization. The outcomes have however, not totally confirmed these supposed benefits and they have varied across jurisdictions, especially when compared with the pre-consolidation expectations in Nigeria (Adedipe, 2006). For instance, the return on equity in Nigeria's deposit money banks reduced from 27.35 in 2004 to 22.01 in 2008 despite the increase in the bank's minimum capital by 1150 per cent through bank consolidation in

[1] The 2004/2005 consolidation of Nigerian deposit money banks commenced on July 6, 2004 with the main thrust of the reform being the increment of capital base of the banks from 2 billion naira to 25 billion naira. All banks were given December 31, 2005 to comply.

2004/2005 (see CBN, 2008). Although, this consolidation was policy induced, such fall in performance might be unexpected. The consolidation is said to involve merging of some banks through tenuous business combinations and there were some cases of few weak banks coming together to form a bigger weak bank (Arua, 2007). One possibility is that credit risk would increase in the event of a sound bank merging with an unsound one, thereby reducing efficiency and productivity of the banks (see Shih, 2003; Delis and Papanikolaou, 2009).

The banking system consolidation presented enormous challenges of integration of people, processes and systems in the merged institutions. The post- consolidation challenges arising from integration are fairly common among the merged institutions. However, integration of banking activities is a gradual process which cannot be achieved instantly. At the end of 2006, most of the banks that emerged from the consolidation were at different stages of integration (CBN, 2006). Besides, Ebong (2006) posits that inability to effectively and timely resolve the human resource issue is the major cause of merger and acquisition failure worldwide. This is because the harsh restructuring that is required after bank consolidation to increase efficiency is often restricted by internal opposition in the merged firm. At the time of the merger, differences in work culture and methods of communication among the banks willing to merge can be an arduous affair.

The adoption of universal banking policy which became operational in 2001 led to the emergence of financial groupings which combined banking, insurance and security businesses by a bank.[2] This resulted in the banks showing a heightened appetite to establish branches especially in the West African sub-region. These financial groupings no doubt resulted in the interflow of financial resources and connected transactions, which bring with them some challenges like contagion risk, more complex and often non-transparent ownership structures (CBN, 2006).

[2] This policy regime was rescinded at the end of 2010.

These challenges tend to put negative pressure on efficiency and productivity growth of the banks. Consequently, consolidated supervision has become an effective method for the simultaneous monitoring of the financial state of institutions that make up a group. The financial grouping would be relevant if the banks were enjoying economies of scale. However, risk implications posed a huge challenge to the banks and required them to improve their risk management.

In the 21st century, most banks have also had to confront the challenge of harmonizing their products using modern technologies. In most cases, best features of similar products offered by the merged institutions have had to be extracted and re-branded to depict the identity of the new organization. This has seen the industry witnessing an unprecedented launch and re-launch of an array of products, most of which were targeted essentially at deposit mobilization. The competition for deposits seems acute in the sector.

The report of a special audit conducted by Nigeria's apex bank on the banks operating in the country in mid and late 2009 showed that ten banks out of the twenty-four banks in the country had varying problems which included illiquidity, capital inadequacy and poor corporate governance. One quick response of the banks' management was drastic cost-cutting and 'fat' trimming, which often constitutes part of the immediate policies of management to address an x-inefficiency problem. However, not all cost-cutting exercises concern x-inefficiency. Perhaps, some may be re-optimizing (input and/ or output) quantity responses to changes in exogenous factors, such as the prices of inputs or outputs. At times, fat trimming occurs in response to wealth and profit declines.

It is necessary, therefore, to ask the following questions: How has efficiency of deposit money banks in Nigeria changed over time, especially shortly before, during and after

consolidation? How did productivity change in the banking industry over time? Is it necessary that banks should be domestic or foreign to achieve scale economies? How do bank specific factors such as size, credit risk, competition, universal banking policy, profitability and ownership influence efficiency?

1.2 Objectives of the Study

The overall objective of the study is to examine effects of consolidation on efficiency and productivity of the deposit money banks in Nigeria. In view of this, the study specifically sought to-

i. estimate efficiency and the x-inefficiency scores of the banks over time, with emphasis on size, capital consolidation and foreign or domestic ownership.

ii. determine the trend of economies of scale in the banking industry .

iii.compute the total factor productivity change mix in the banking industry over the period under review.

iv. assess the impacts of some bank specific variables on cost efficiency.

1.3 Justifications for the Study

Bank efficiency and productivity have continually remained critical issues to both the public and policy makers, especially in transition countries that have been faced with one banking crisis or the other. Operations of inefficient and unproductive banks in an economy may pose additional risks to the banking system and its safety net thereby disrupting money supply and payment system (see Rao, 2002). Thus, studies aimed at addressing the level of productivity change, efficiency and its determinants in an economy, such as Nigeria, undergoing substantial changes in its banking markets and banking regulations are imperative.

One gap in the past studies is that available evidence on efficiency of banks in terms of size and domestic or foreign ownership are mixed, probably due to differences in methodology and workings of the economy. For instance, Berger and Humphrey (1992), Kwan and Eisenbeis (1996) and Sensarma (2006) found higher efficiency for large banks over small banks while the contrary was found by Altunbas et al. (2000), Jemric and Vjucic (2002) and Rao (2002). On the other hand, Jemric and Vujcic (2002), Bonin et al. (2005), Staikouras et al. (2007) and Cadet (2008) found foreign banks to be more efficient than domestic banks while Roa (2005) and Sensarma (2006) found the opposite. Thus, there is a need for further investigation on bank efficiency in this regard. More importantly, studies on changes in efficiency and productivity of banks in periods shortly before, during and after consolidation are scanty in the literature.[3] This study, therefore, examined changes in bank efficiency/productivity in few years prior to the consolidation, during the reform and few years after the reform. In doing this, whether total or net assets are more appropriate for measuring bank size was evaluated as both indices can be used as proxies for consolidation. The controversy on change in efficiency/ productivity of foreign and domestic banks was also investigated using Nigeria as a case study.

A number of studies have analyzed efficiency of banks in Nigeria (see Sobodu and Akiode, 1995; Osota, 1995; Jerome, 2004; Bwala, 2003; Fadiran, 2006; Idialu, 2007, Obafemi, 2008, Olaosebikan, 2009, Kiyota, 2009 and Idialu and Yomere, 2010). While some of these studies only addressed technical (in)efficiency of the banks, only Olaosebikan (2009) computed both allocative efficiency and cost efficiency of the banks using DEA. One novelty of this study is that it broadened the capital consolidation- efficiency model to include the impacts of universal banking policy and bank listing on the stock exchange on cost efficiency. It further investigated the behaviour of technical, allocative and cost efficiency of banks if the financial

[3] Earlier studies by Suhaimi (2005) and Olaosebikan (2009) have provided some insights.

intermediation theory is extended by including equity capital as input and earnings per share as its price in the model.[4]

Bank efficiency reflects the comprehensive evaluation of all the input and output projects, including the operating achievements that can be inferred from various kinds of financial reporting and the operating outcome that cannot be taken into account directly in financial analysis (Deng et al., 2007). Bank efficiency is not only the manifestation of a bank's comprehensive competitive strength, but also an in-depth evaluation index of achievements. Therefore, the outcomes of the study would inform the major banking sector stakeholders in a number of ways in that they could have a clear understanding of the in-depth performance of their banks and adopt measures for improvement. Also, foreign investors can have intuition on the nature and performance of the Nigerian banking industry and this can guide them in undertaking investment in the region since the country is believed to have the prospect of attaining the status of International Financial Centre (IFC) similar to world financial markets like United States, United Kingdom, Germany, Singapore and Japan in the nearest future.

The use of financial ratios as measures of banks' efficiency by organizations and some researchers are fraught with deficiencies. Comparing the financial ratios of different banks is not appropriate unless the banks are nearly identical in terms of product mix, bank size, market conditions, and other characteristics that can affect the costs of the banks (Chen, 2001). A major demerit of using financial ratios as performance evaluation index is its reliance on benchmark ratios and these benchmarks could be arbitrary and may mislead analysts (Yeh, 1996). Further, Sherman and Gold (1985) noted that financial ratios do not capture the long- term performance, and it aggregates many aspects of performance such as operations, marketing and financing. We

[4] Although, the modified intermediation method includes the shareholders' fund or equity capital as input, it says nothing about the input price.

note that the statistical based "efficient cost frontier" method adopted in this study measures efficiency more accurately.

The aim of Nigeria to become a financial hub in Africa; join the league of top 20 economies in the world by the year 2020;[5] provide one of the top 50 mega banks and develop a consistent strategy for the financial system are good missions. However, achieving such a mega bank by only consolidating the banks without addressing their efficiency problem could further lead to distress of inefficient and less productive banks irrespective of their status. Therefore, the findings of this study can serve as a basis for further monetary policy formulation, directives and implementation strategies in Nigeria.

1.4 Scope of the Study

The study covered deposit money banks (DMBs)[6] that retained their names (excluding consideration of conversion from Private Limited Company to Public Liability Company) after the 2004/2005 consolidation of banks in Nigeria. The identity- retained banks include, Access Bank Plc, Afribank Plc, Citibank Nigeria Limited, Diamond Bank Plc, Ecobank Nigeria Plc, Equitorial Trust Bank Limited, First City Monument Bank Plc, Fidelity Bank Plc, First Bank of Nigeria Plc, Guaranty Trust Bank Plc, Intercontinental Bank Plc, Oceanic Bank International Plc, Standard Chartered Bank Nigeria Ltd, United Bank of Africa Plc, Union Bank of Nigeria Plc, Wema Bank Plc and Zenith International Bank Plc.[7] The empirical analysis covered 2001-2008 period.

[5] The Financial System Strategy (FSS 2020) or Vision 2020 is meant to achieve Goldman Sach's prediction that Nigeria and Egypt in Africa are among the next 11 countries that have the potential to be "BRIC like". The BRICs are the economies of Brazil, Russia, India and China.

[6] Deposit money banks are resident corporations and quasi-corporations which have any liabilities in the form of deposits payable on demand, transferable by cheque or otherwise usable for making payments.

[7] The number of operating banks in Nigeria as at July 2011 was twenty-four which later dropped down to 21 in 2012. Nigeria International Bank Limited, a foreign bank changed its name to Citibank Nigeria Limited in 2004.

The banks were classified into small, medium and large banks based on their total assets.[8] Further classification was made on the basis of net assets. Separate analysis was conducted on the foreign banks –Ecobank Nigeria Plc, Citibank Nigeria Limited and Standard Chartered Bank Nigeria Limited against the indigenous banks.[9]

The analysis of the study commenced from 2001 because of the frequent structural changes in the Nigerian banking industry due to bank crises and unstable financial sector reforms. Also, since only deposit money banks are considered, 2001 is the appropriate starting period when implementation of universal banking policy (that brought about the DMBs identity) began in Nigeria. The period 2001-2008 also reflects some major economic episodes and critical events in the banking industry and the economy. Such economic hallmarks include bank consolidation directives and financial sector reforms which began in 2004 and the global financial crisis which started in the third quarter of 2007 and extended to 2009.

1.5 Organization of Study

The rest of the thesis is organized as follows: Chapter two centers on background information on the Nigerian banking climate. Here we gave a brief history of banking developments in Nigeria, crisis and regulations in the sector, growth in the industry, developments in the sector relative to some countries and continents and the operational efficiency of the banks. Following this is chapter three which contains a review of theoretical and empirical literatures relating to efficiency, productivity change and economies of scale, as well as conceptual framework, measurement, methodology and specification issues. In chapter four,

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First City Monument Bank Plc and Intercontinental Bank Plc were dropped from the sample because they did not have account data for 2001 and 2004 respectively due to alterations in their financial year. Intercontinental Bank was acquired by Access Bank on October 14, 2011 after the shareholders' approval.

[8] See Rao (2002) Jemric and Vujcic (2002) and Kasman (2002) for bank's classification based on total assets.

[9] Stanbic/IBTC Bank was another foreign bank in Nigeria but was not chosen because it did not fit our specification.

the theoretical and methodological frameworks for the thesis are presented, while the empirical analysis results and interpretations of the results are presented in chapter five. The summary of main findings, policy implications, conclusion, recommendations, limitations and suggestions for further research are presented in chapter six.

CHAPTER TWO

THE NIGERIAN BANKING SECTOR

2.1 Introduction

The Nigerian banking sector is a growing one and it has undergone series of restructuring to engender its stability in order to promote the country's economic growth and development. This chapter presents background information on Nigerian banking. Specifically, it discusses some historical developments of banking in the country, crisis and regulations issues in the banking market, growth in the sector, developments in the sector relative to some countries and continents as well as operational efficiency of the banks based on accounting ratios.

2.2 Some Historical Developments of Banking in Nigeria[10]

The different licensed banks in Nigeria fall into four different "generations" (Ajayi and Ojo, 2006). The first generation banks were those licensed before the country's independence in 1960. The licensed banks between 1960 and 1980 were regarded as second generation banks while the third generation banks were the ones licensed between 1980 and 1991. The fourth generation banks were the ones licensed from 1998 to date. Majority of the banks operating in Nigeria currently fall in the last two categories. They are often referred to as the new generation banks while the other ones are called the old generation banks.

Banking activities commenced in Nigeria in 1892 with the establishment of African Banking Corporation, which was saddled with the responsibility of distributing Bank of England notes for the British Treasury. The African Banking Corporation was absorbed in 1894 by Bank of British West Africa (later called Standard Bank, now First Bank of Nigeria Plc). In 1917, the Barclays Bank DCO (now called Union Bank of Nigeria Plc) was established. Union Bank was

[10] This section largely summarized the work of Ajayi and Ojo (2006) while adding some updates.

one of the ten savaged banks by the Central Bank of Nigeria (CBN) in 2009.[11] It is now owned by its core investor, African Capital Alliance Consortium after signing a Transaction Implementation Agreement (TIA) with it on August 1, 2011. Subsequently after 1917, some banks were licensed but were later distressed. In 1949, the British and French Bank, the precursor of the United Bank for Africa Plc commenced operations. These banks were established to provide banking services for the British commercial interest and colonial administration in West Africa. The Bank of British West Africa became the agent of the Currency Board in 1912 when the West African Currency Board was formed. Until 1912, the Bank of British West Africa had been the main importer of currency for the British Treasury.

For a considerable period of time, the three banks mentioned above that were initially foreign-owned dominated the financial sector of the Nigerian economy.[12] Nigerians criticized this domination, as anecdotal evidences existed that the banks did not only favour expatriates but also openly discriminated against Nigerians in the processes of carrying out their banking duties especially in the allocation of loans and financing the development needs of the country (See Ajayi and Ojo, 2006). They were alleged to favour their foreign owners rather than Nigerians and the Nigerian economy. The domination provoked resentment which after independence led to the government's move to secure greater local control over the financial system towards ensuring improved access to credit for the priority areas of the economy and for indigenous businesses. Also, these foreign banks (expatriate banks) then had their head offices overseas where their liquidity was derived from. The Banque Internationale Pour L'Afrique Occidental (BIAO), called Afribank Nigeria Plc for many years, a foreign bank then but later indigenous,

[11] The ten banks that were savaged from distress risk by the CBN in 2009 were Union Bank of Nigeria Plc, Wema Bank Plc, Equitorial Trust Limited, Finbank Plc, Oceanic Bank International Plc, Intercontinental Bank Plc, Spring Bank, Bank PHB, Afribank Nigeria Plc and Unity Bank Plc.
[12] The three banks are now indigenous banks.

was also founded in 1960. Afribank Nigeria Plc was one of the three nationalized banks in August 2011.[13] After the bank's nationalization, its name became Mainstreet Bank Limited.

In 1933, National Bank of Nigeria, the first indigenous bank that managed to survive for some time was established. It was, however, acquired by Wema Bank Plc in 2004. Other banks that were established before 1933 included the Industrial and Commercial Bank and the Nigerian Mercantile Bank. These two banks failed as a result of inadequate capital, fraudulent practices and bad management. In most cases, indigenous banks in Nigeria originated from state support and assistance. However, government participation in ownership of banks might have largely been discouraged because of its attendant inefficiency. Armchair banking culture of some Nigerian indigenous banks might have also been discouraged by the recent massive withdrawal of government fund from the banks.

Another indigenous bank was the African Continental Bank Limited, which started operation as a private company under the name, Tinubu Properties Limited in 1937. In January 1947, it became Tinubu Bank Limited. In November, the same year, Tinubu Bank Limited was registered as the African Continental Bank Limited. As a result of the postwar conditions of increased economic activity and high export prices, numerous banks grew up in the Nigerian economy. In May 1945 to January 1947, four indigenous banks were founded. Only two of these banks- the African Continental Bank and the Agbonmagbe Bank (now Wema Bank Plc) stood the test of time though currently (up to 2012) only the latter still exists.

[13] Afribank Nigeria Plc, Bank PHB and Spring Bank Plc were nationalized on August 5, 2011. That is, their assets and liabilities were bought over by Nigerian government through its agency- Asset Management Corporation of Nigeria (AMCON). This was due to the high probability of the banks' failure to meet the recapitalization deadline billed for September 30, 2011. It was reasonable for CBN to pre-empt the banks' failure than wait till September 30, 2011 when they might be distressed. The organization and incorporation of the bridge or nationalized banks was done by the Nigeria Deposit Insurance Corporation (NDIC). It was expected that AMCON would open negotiation with willing investors that would take over the bridge banks. Bridge bank is provided for in Nigeria's constitution for resolving problems in the banking sector to enhance depositors' protection and promote stability in the sector.

Some of the banks that scaled the hurdles in the banking sector in early1980s that are still in existence are First City Monument Bank Plc (which was established in 1982 as a domestic bank with some foreign participation in share ownership) and Nigeria International Bank Limited, now known as Citibank Nigeria Limited, established in 1984. The latter which is a foreign bank and a subsidiary of Citigroup, USA, stood alone after the 2004/2005 consolidation but the former acquired erstwhile Co-operative Development Bank Plc and Nigeria America Bank.

It is important to state that the introduction of the Structural Adjustment Program (SAP) brought into being a new phase of banking in Nigeria. The underlying philosophy was to institute a more efficient system for the allocation of resources. The period from 1986 saw a systematic removal of controls that were deemed injurious to the operation of the financial system. Thus, the objective of liberalization was to make the system more market oriented. The major policy thrust during the period of de-regulation includes: relaxation of the conditions for the licensing of banks, de-regulation of interest rate regime, promulgation of new CBN and other financial institutions Decree numbers 24 and 25 of 1991, establishment of the Nigeria Deposit Insurance Corporation (NDIC) and introduction of open market operation (OMO). The de-regulation led to a phenomenal growth in the number of banks. In 1986, Ecobank Nigeria Plc was incorporated and was granted a banking licence in 1989. The bank is a subsidiary of Ecobank Transnational Incorporated (ETI), Lome, Republic of Togo. It is thus a foreign bank in Nigeria as its parent company consistently owns over 70 per cent of its equity. Another bank licensed during the SAP era is Fidelity bank Plc which was incorporated in 1987 as a domestic bank. Intercontinental Bank Plc and Access Bank Plc were also established in 1989 as indigenous banks, and, in an ironic twist, the latter was to acquire the former in October 2011. In 1990, Guaranty Trust Bank

Plc, Oceanic Bank International Plc, Zenith Bank International Plc, Diamond Bank Plc and Equitorial Trust Bank Limited among others were incorporated as domestic banks. It should be noted that some of the other banks established during SAP were either acquired or merged with the strong banks during the 2004/2005 consolidation exercise, though some of these banks failed. For example, First Bank of Nigeria Plc acquired former First Bank Nigeria Merchant Bankers; United Bank for Africa Plc acquired erstwhile Standard Trust Bank Plc and Continental Trust Bank; Union Bank Plc acquired former Universal Trust Bank Plc, Union Merchant Bank and Broad Bank Limited; Afribank Plc acquired former Afribank (Merchant Banker); Wema Bank Plc acquired erstwhile National Bank Plc and Lead Bank Plc; Oceanic Bank International Plc acquired former International Trust Bank; Fidelity Bank Plc acquired erstwhile Manny Bank Plc and FSB International Plc; Intercontinental Bank Plc acquired former Gateway Bank Plc, Global Bank Plc and Equity Bank Nigeria Limited; Access Bank Plc acquired former Marina Bank and Capital Bank Nigeria Limited; Equitorial Bank Limited acquired erstwhile Devcom Bank Limited; Diamond Bank Plc acquired former Lion Bank and AIB International Bank. However, Zenith Bank International Plc, and Guaranty Trust Bank Plc stood alone. The failed banks were erstwhile African Express, Assurance Bank, City Express Bank, Eagle Bank, Gulf Bank, Fortune Bank, Liberty Bank, Metropolitan Bank, Triumph Bank, Society Generale Bank, All State Trust Bank, Trade Bank, Hallmark Bank and Lead Bank. Ecobank Nigeria Plc acquired the restructured business of African International Bank Ltd on February 29, 2008 as well as Oceanic Bank International in December 2011.

The re-entry of foreign fully-owned banks was noticeable in 1999 when democracy was restored in the country. Standard Chartered Bank Nigeria Limited was incorporated on 6 May 1999 as a wholly-owned bank by Standard Chartered Holdings (Africa) BV, itself a 100 per cent

subsidiary of Standard Chartered Bank, United Kingdom. Stanbic Merchant Bank Limited, a subsidiary of South Africa based Standard Bank Group was also established in 1999. The bank embraced the universal banking policy and was converted to a commercial bank in 2001. Its name was changed to Stanbic/ IBTC due to the merger of the bank with the former IBTC Chartered Bank in 2006. However, Standard Chartered Bank Nigeria Limited just like the Citibank Nigeria Limited did not merge with any bank.

After the 2004/2005 consolidation of banks in the country, Skye Bank Plc, Sterling Bank Plc, Bank PHB, Unity Bank Plc, Spring Bank Plc and Finbank Plc became operational in 2006 as new entities. Skye Bank Plc is a product of mergers of erstwhile Prudent Bank Plc, EIB International Bank, Bond Bank and Reliance Bank. Sterling Bank emanated from the mergers of former NBM Bank Limited, Magnum Trust Bank, Trust Bank, NAL Bank Plc and Indo Nigeria Bank. The combinations of erstwhile NNB International Bank Plc, Centrepoint Bank Plc, Societe Tropical Commercial Bank, Bank of the North, First Interstate Bank, New African Bank, Pacific Bank and Intercity Bank Plc brought about Unity Bank Plc. Spring Bank Plc is a product of combinations of former Citizen International Bank, ACB Bank Plc, Guardian Express Bank, Omega Bank Plc, Trans International Bank Plc and Fountain Trust Bank. While Finbank Plc stood alone, Bank PHB was formed by the merger between Platinum Bank Plc and Habib Nigeria Bank Plc. However, in September 2011, Equitorial Trust Bank Limited merged with Sterling Bank Plc and Finbank Plc was acquired by First City Monument Bank Plc. Bank PHB and Spring Bank Plc were nationalized on August 5, 2011 and their names were changed to Keystone Bank Limited and Enterprise Bank Limited, respectively.

A Federal Court of Appeal in Abuja, on February 20, 2009, declared that the CBN and the NDIC wrongly revoked the license of Savannah Bank in 2002 and ordered that the bank

should be allowed to return to business. A special tripartite joint task force comprising of the CBN, NDIC and Savannah Bank was constituted in 2011 with the mandate of harmonizing the bank's records to galvanize its re-entry into the banking market in 2012. Similarly, Societe Generale Bank Nigeria (SGBN) Limited was approved by CBN in June 2012 to return to business under a new name, HeritageBank, haven met the financial requirement to operate as a regional bank, although would require fresh recapitalization.[14]

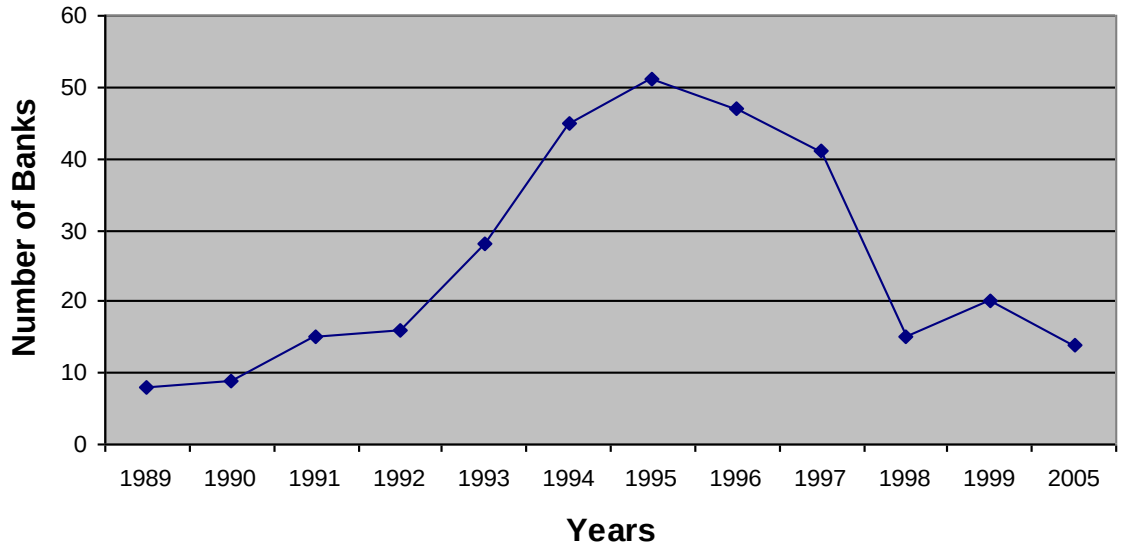
2.3 Banking Crisis and Regulations in Nigeria

Several banks especially indigenous banks that were established during the 'mushrooming' period (1925 to 1929) closed down almost as soon as they were established (Nnanna, 2005). Similarly, between 1923 and 1945 as well as during the banking boom period of 1950 and 1951, several banks either voluntarily wound-up or were closed down by the government due to insufficient capital, bad management, poor record-keeping, rapid expansion of offices, illiquidity, fraudulent directors, reckless and imprudent lending, and absence of banking regulations to specify their code of conduct (Nnanna, 2005). Bank failure weakens public confidence in the system, creates problems for the economy, including sudden contraction of the money supply, disruption of the payment system through breaking of already established credit lines, severance of client relationship, individual losses and contagion effect. In 1952, the Nigerian Government, on the recommendation of Panton Commission in 1946 promulgated the Banking Ordinance which became the first banking legislation in Nigeria. The Ordinance set out the rules and regulations that guided banking activities in Nigeria and provided for minimum paid-up capital, maintenance of adequate liquidity and statutory reserve funds, imposition of

[14] This approval by the CBN came after five years of SGBN's victory in a Federal High Court at Abuja over its unlawful withdrawal of banking licence by the CBN and its liquidation by NDIC.

credit ceilings and the examination and supervision of banks. The Ordinance was abrogated with the establishment of Central Bank of Nigeria (CBN) by Act of 1958 and commenced operations on 1st July, 1959. Earlier, especially between 1960 and 1965, the supervision of banks was a shared responsibility between the CBN and the Federal Ministry of Finance (FMF). While the Bank handled off-site supervision, the FMF was in charge of on-site supervision.[15] From 1966, however, the CBN took over the overall responsibility of banking supervision. Also, prior to the promulgation of the Banks and other Financial Institutions (BOFI) Act No. 25 of 1991 as amended, the Ministry was the approving authority of bank licenses on the recommendation of the CBN. The entire responsibility of bank licensing was, however reverted to CBN from 1991.

Fig. 2.1: Distressed Banks in Nigeria (1989-2005)



Source: Extracted Data from Asogwa (2005) and NDIC various issues
Note: No bank was distressed after 2005 up to date (2012)

[15] On –site examination relates to the physical examination of the books, records and affairs of a bank so as to generate information that would reveal the ability of the bank to meet the demands of its depositors and creditors. Such an examination would also appraise the competence of its management and compliance with the laws, rules and regulations as well as its viability as a going concern. Off-site supervision includes review of financial conditions of banks, compilation of reports and bank rating to facilitate prompt supervisory responses as required.

Figure 2.1 graphically presents banking crises in Nigeria from 1989 with the distress of eight banks, made worsened in 1995 with the liquidation of 51 banks which were later reduced to 47, 41, 15 and 20 in 1996, 1997, 1998 and 1999 respectively. The ability of the regulatory and supervisory agencies to prevent, and resolve the banking distress was severely handicapped by the absence of a comprehensive regulatory framework for distress/ crisis management. It was against this background that CBN and the Nigeria Deposit Insurance Corporation (NDIC) decided in December 2001 to put in place a framework on distress resolution. The NDIC was established by decree No. 22 of 1988 of deposit insurance and related services to banks to ensure the safety of insured depositors' money with the banks. The essence is to promote confidence in the banking industry. There was also a remarkable liquidation in Nigeria involving 14 banks which failed in 2005 as a result of their inability to meet the December 31, 2005 deadline for recapitalization. Subsequently, the CBN instituted a number of measures aimed at strengthening its supervisory roles, introduced Monetary Policy Rate (MPR) to replace Minimum Rediscount Rate in 2006, conducted special audit on the deposit money banks in 2009, sacked erring managing directors, referred them and other affected people to Economic and Financial Crime Commission (EFCC) for prosecution in law courts, bailed out the affected banks and replaced the erring managing directors. The apex bank also gave recapitalization directives to some banks with inadequate capital, established AMCON in 2010 to buy over about 2.3 trillion naira non-performing assets of the rescued banks, directed banks to move their Automated Teller Machines (ATMs) to their premises in 2010 to control unhealthy competition in locating ATM centres and strengthened corporate governance by enforcing maximum of ten years term for managing directors. These measures also included nationalizing three banks in 2011 and taking actions towards achieving a cash-less economy by trying out the Scheme in Lagos from January 1,

2012[16] and further facilitating merger and acquisition of four banks, among other policy thrusts and directives. The CBN has also repealed the universal banking policy regime,[17] mandated banks to divest from non-banking business and began to issue licence to banks to engage in regional or national or international banking in addition to licencing more micro-finance banks as well as issuing licence for establishing mortgage banks, non-interest banks, merchant banks, development banks and discount houses. [18] In the same vein, the CBN through a circular on May 18, 2012 directed DMBs to raise fresh capital from the offshore capital markets via private placements or public offerings; pursue an offshore merger or acquisition and if and if external capital raising fails, submit a strategy for exiting the relevant foreign jurisdictions not later than 30 June 2012. This development is due to the fact that some of the offshore subsidiaries, particularly those inherited from acquired banks are not performing well.

2.4 Growth in Branch Network and Numeric of Nigerian Banks (1970-2008)

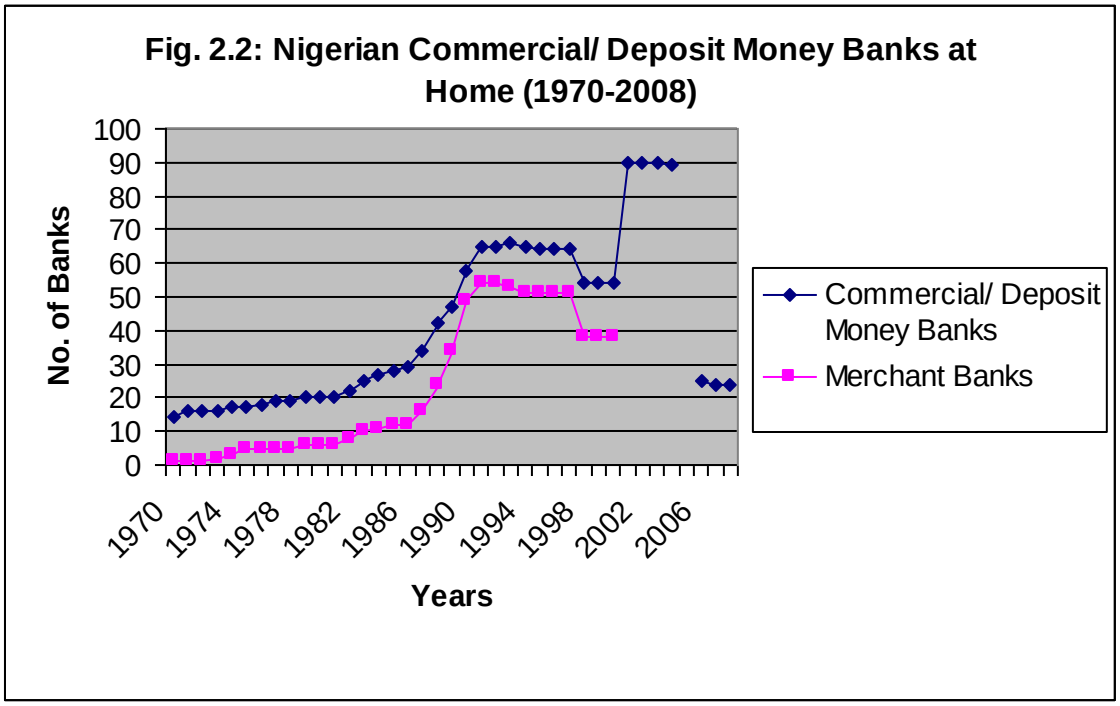
Figure 2.2 and 2.3 show that prior to 2004/2005 consolidation era, commercial banks in Nigeria grew numerically from 14 banks (273 branches) in 1970 to 89 banks (3492 branches-

[16] The implementation of the cash-less policy began in Lagos on January 1, 2012 as a pilot scheme designed to study the effects of the policy on people and businesses. It stipulated a cash handling charge on daily cash withdrawals or cash deposits that exceeded ₦150000 for individuals and ₦1000000 for corporate bodies. The aim was to reduce the amount of physical cash circulating in the economy and encourage more electronic based transactions, such as payment for goods, services and transfers.

[17] During universal banking policy regime in Nigeria, banking business in the country was defined as the business of receiving deposits on current, savings or other accounts; paying or collecting cheques drawn or paid in by customers; provision of finance, consultancy and advisory services relating to corporate and investment matters, making or managing investment on behalf of any person; and provision of insurance marketing services and capital market business as well as any other services as the Governor of the Central Bank of Nigeria, may, by gazette, designate as banking business. Therefore, the banking business became universal, without restriction to either commercial or merchant banking business. Before the universal banking policy implementation, merchant banks majorly engaged in discounting bills of exchange and wholesale banking while commercial banks were largely retail banks that engaged mainly in borrowing (including deposit acceptance) and lending activities.

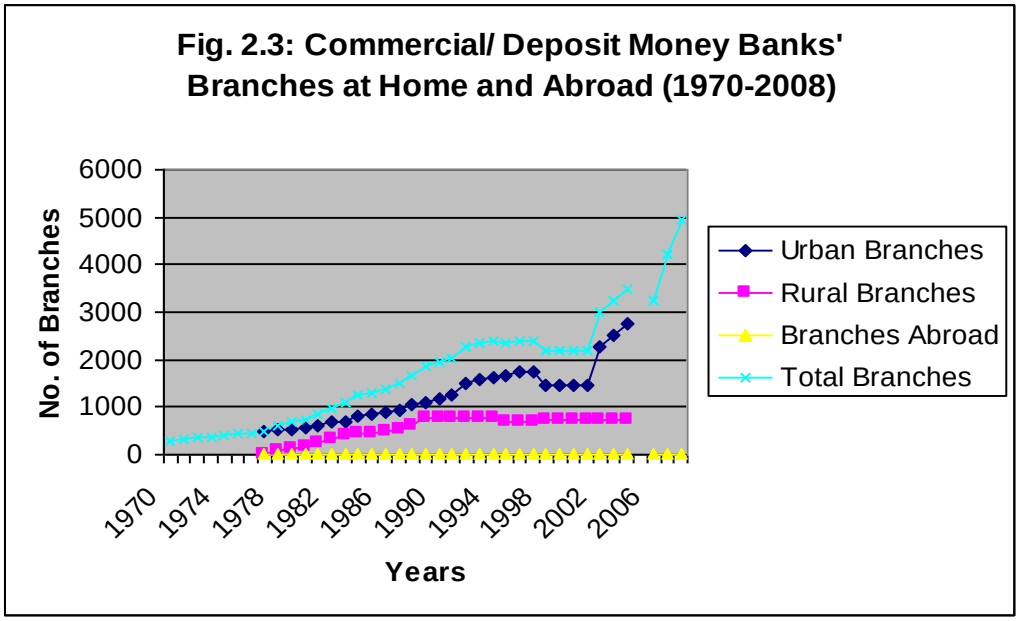
[18] Jaiz Bank Plc is a pioneer non-interest bank in Nigeria. Although the bank was incorporated in 2003, its operational capability has been strengthened with the implementation of non-interest banking/ Islamic banking policy in Nigeria in 2011

2765 urban branches, 722 rural and 5 foreign branches) in 2004[19]. There was only 1 merchant bank in the country in 1970 but this increased to 38 in 2000 with 113 branches (CBN, 2010). The Universal Banking reform brought about the demise of merchant banks in Nigeria until the repeal of the policy in December 2010. Many of the merchant banks applied for conversion into commercial banks in 2000 while others went out of business. The main goal of the universal banking policy was to ensure efficient delivery of all financial services at reduced costs, and also improve bank risk-return profile via diversification effects.



Source: Extracted Data from Central Bank of Nigeria Statistical Bulletin (2010)
Note: There was no merchant bank after 2000 due to implementation of universal banking policy in 2001, and the name, commercial bank, applied up to 2000 after which the banks became deposit money banks (DMBs). Also, there was no data on number of DMBs in 2005 consequent to the 2004/2005 bank consolidation exercise, hence the break in 2005 as shown in the above and subsequent graph in Fig. 2.3.

[19] CBN ensured that only "fit and proper" persons were granted banking licence, subject to the prescribed minimum paid-up capital in 1960 – 1985. The post Structural Adjustment Programme (SAP) or 'de-control regime' (1986-2004) was characterized as period during which the neo-liberal philosophy of "free entry" was over- stretched and banking licences were dispensed by the political authorities on the basis of patronage (Nnanna, 2005).



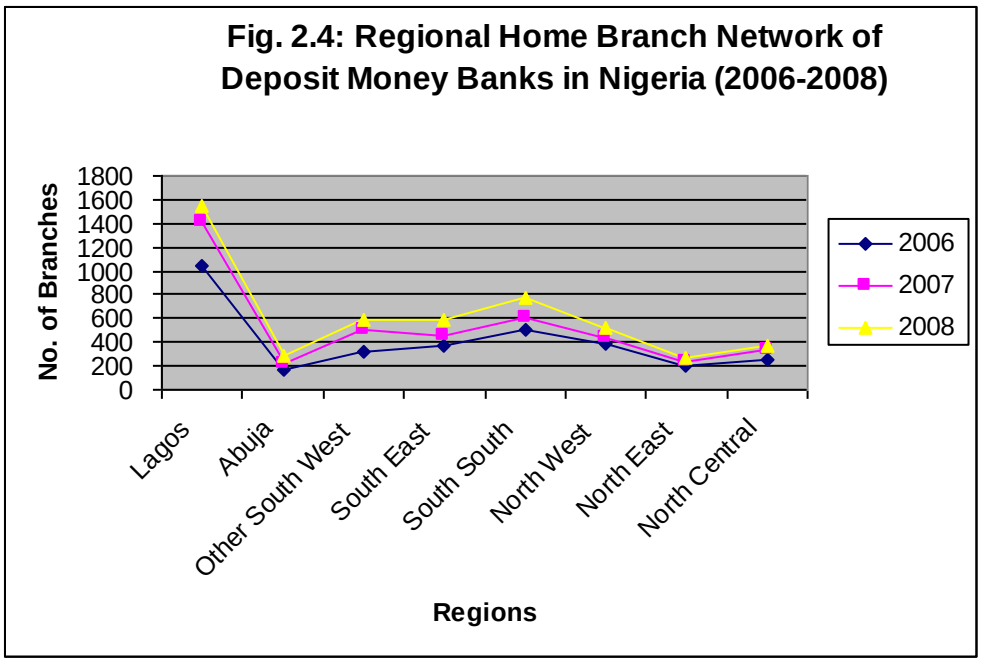
Source: Extracted Data from Central Bank of Nigeria Statistical Bulletin (2010)
Note: Classification of branches into urban and rural stopped in 2005 due to bank consolidation of 2004/2005.

In an attempt to foster efficiency and productivity of Nigerian banking industry as part of efforts toward meeting the development challenges of the 21st century, the minimum capital base of the DMBs was increased significantly from ₦2 billion in 2004 to ₦25 billion in 2005. This exercise lasted for 18 months (July 6, 2004 to 31stst December, 2005). The specific objectives of the increment include the repositioning of the financial system in the country; strengthening and consolidating the banking system; checking real and feared distress in banks; encouraging merger and acquisitions among the banks, internationalization of the Nigerian banking system; and reducing/ eliminating the overall dependence on public sector deposits and neglect of small and medium class savers.

Post 2004/2005 bank consolidation in Nigeria has recorded more growth in branch network locally. **Figure 2.3** shows the total domestic branches increment from 3492 in 2004 to 4952 in

2008. This was due to the fact that the branches of the erstwhile merged/acquired banks were inherited. Also, Nigerian banks have the culture of growing their branch network from time to time, a phenomenon some banks see as a performance index.

Figure 2.4 presents concentration of branch network of banks on regional basis in Nigeria over the period, 2006-2008.[20] The highest concentration was in Lagos (1038 in 2006, 1407 in 2007 and 1551 in 2008) while the least concentration was in North Eastern Nigeria (198 in 2006, 242 in 2007 and 272 in 2008). The incidence of low concentration of banks in this region might be due to low the level of commercial activities in the States. Besides, the number of Nigerian bank branches abroad, as indicated in **figure 2.3** rose from 5 in 2004 to 8 in 2008.



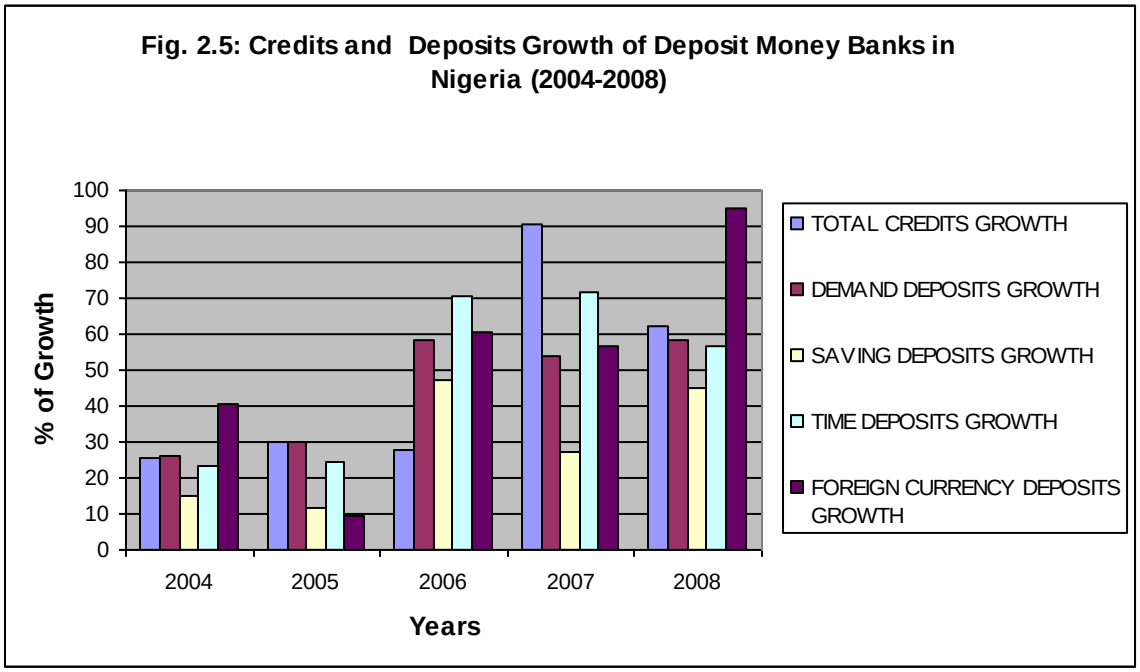
Source: Data Extracted from Central Bank of Nigeria Statistical Bulletin (2010)

[20] We separated Lagos from other South Western states because of its distinctiveness as the commercial nerve of Nigeria. Abuja is the Federal Capital territory. Other South Western states include Ekiti, Ogun, Ondo, Osun and Oyo. The South Eastern states comprise Abia, Anambra, Imo, Enugu and Ebonyi while the South South are Akwa-Ibom, Bayelsa, Cross River, Delta, Edo and Rivers. The North West includes Jigawa, Kano, Katsina, Kebbi, Kaduna, Sokoto and Zamfara. Included in the North Eastern states are Yobe, Bornu, Taraba, Adamawa, Bauchi and Gombe while the North Central states are Benue, Kogi, Kwara, Nasarawa, Niger and Plateau.

2.5 Post- Consolidation Growth in Deposits and Credits

The growth of total credits that Nigerian banks injected into the economy, and their deposits- demand, savings, time and foreign currency are graphically shown in **figure 2.5.** On average, deposit money banks recorded 27.83 per cent increment of total credits into the economy in 2004-2005, which increased further by 60.14 per cent in 2006-2008. The demand deposits increased by 28.03 per cent in 2004-2005 and by 56.83 per cent in 2006-2008. However, saving and foreign currency deposits underwent a shock in 2005 as depositors were careful about which bank to commit their money. On average, saving deposits increased by 13.46 per cent in 2004-2005 and by 39.82 per cent in 2006-2008. Foreign currency deposits grew by 25.01 per cent in 2004-2005 and by 70.69 per cent in 2006-2008. In the same vein, time deposits recorded 23.97 per cent increase in 2004-2005 and 66.42 per cent increase in 2006-2008. The significant growth of all the deposits in 2006-2008 justifies the fact that public confidence in the country's banking industry improved after the bank consolidation.

Fig. 2.5: Credits and Deposits Growth of Deposit Money Banks in Nigeria (2004-2008)



Source: Data Extracted from Central Bank of Nigeria Statistical Bulletin (2010)

2.6 Banking Sector Development in Nigeria: A Comparison (2000-2007)

Tables 2.1 and 2.2 show the banking sector development of some countries including Nigeria using the ratio of liquid liabilities of the banks to the GDP and the ratio of private credit extended by the deposit money banks to the GDP. The ratio of liquid liabilities to GDP, on average over the eight year period, reveals 21.73% for Nigeria compared with that of Mauritius (103.95%), Seychelles (106.74%), Cape Verde (69.50), South Africa (45.65%), Kenya (38.19%), Botswana (29.89%), average country in East Asia and Pacific (52.15%), Europe and Central Asia (37.53%), Latin America Caribbean (50.59%), Middle East and North Africa (64.99%), South Asia (48.38%), developing world (42.48%) and Sub-Saharan Africa (28.80%). One deduction from this index is that Nigeria's banking sector development was relatively low. This could be attributed to frequent crisis in the country's banking sector. The index shows that Nigeria's banking sector development is on the same pedestrian with the likes of Malawi (21.93%), Madagascar (21.04%) and Mozambique (22.73%). The ratio of private credit extended by DMBs to GDP shows a similar low performance of banking sector development in Nigeria. For instance, the credit-GDP ratio for Nigeria was 14.11% compared to that of Mauritius (64.31%), South Africa (66.71%), Cape Verde (40.30%), Kenya (23.75%) and Seychelles (24.29%). This index further shows Nigeria's banking sector development over the period to be on the same level with the likes of Mali (16.81%), Benin (13.21%), Togo (15.84%) and average Sub-Saharan African country (14.90%).

Table 2.1: Ratio of Liquid Liabilities to GDP (in Percentage)

	2000	2001	2002	2003	2004	2005	2006	2007	Average
Benin	25.70	27.50	26.40	25.50	24.50	24.90	27.90	27.90	26.29
Botswana	26.10	24.90	28.00	27.60	29.50	28.20	34.60	40.20	29.89
Burkina Faso	20.40	19.40	18.00	20.60	22.10	19.20	18.60	20.10	19.80
Burundi	19.30	19.80	21.90	25.10	24.60	26.80	32.10	36.00	25.70
Cameroon	13.90	15.10	16.50	17.00	16.70	16.80	17.20	18.10	16.41
Cape Verde	60.10	63.30	66.50	68.40	70.40	73.00	76.20	78.10	69.50
Chad	11.10	11.10	12.30	11.80	8.00	7.30	9.60	11.60	10.35
Cote d'Ivoire	22.30	22.40	25.90	25.80	22.70	23.50	24.10	25.80	24.06
Gabon	13.90	17.40	16.90	17.00	16.30	16.40	16.80	20.00	16.84
Guinea-Bissau	36.00	47.10	57.80	42.50	24.20	29.70	31.40	32.90	37.70
Kenya	37.50	36.40	37.80	39.50	39.00	38.40	39.80	37.10	38.19
Madagascar	19.10	20.40	24.80	22.20	21.80	20.00	19.50	20.50	21.04
Malawi	18.40	20.40	21.20	22.20	23.70	25.50	24.90	19.10	21.93
Mali	20.20	20.30	24.40	29.00	29.30	29.30	28.00	26.50	25.88
Mauritius	75.50	76.30	79.90	97.10	117.50	134.40	156.10	94.80	103.95
Mozambique	28.10	25.00	25.20	26.30	25.00	25.10	27.10	0.00	22.73
Niger	8.40	9.40	9.80	10.80	13.90	14.00	14.40	15.00	11.96
Nigeria	**17.50**	**25.10**	**26.80**	**24.80**	**24.40**	**17.40**	**17.30**	**20.50**	**21.73**
Senegal	22.50	23.60	25.00	28.10	32.00	32.50	33.80	33.10	28.83
Seychelles	87.90	96.70	100.90	108.60	117.20	127.20	117.00	98.40	106.74
Sierra Leone	15.30	16.00	16.60	18.10	17.80	19.00	18.90	19.60	17.66
South Africa	52.70	48.30	42.50	41.90	40.40	41.40	53.00	45.00	45.65
Tanzania	18.60	19.00	20.00	21.50	21.10	24.60	27.40	26.50	22.34
Togo	24.50	26.10	24.00	23.90	26.40	28.50	31.00	33.30	27.21
Uganda	14.20	15.30	16.70	17.70	17.70	17.90	18.40	20.30	17.28
Zambia	19.00	19.10	18.20	18.50	18.80	17.80	17.60	20.80	18.73
DEVELOPING COUNTRIES	**37.90**	**39.90**	**41.70**	**41.50**	**42.00**	**43.20**	**46.80**	**46.80**	**42.48**
East Asia & Pacific	49.00	51.00	51.30	51.80	52.10	49.60	54.20	58.20	52.15
Europe $ Central Asia	30.50	33.50	35.50	36.30	37.70	40.30	43.60	42.80	37.53
Latin America & Caribbean	47.00	49.50	51.50	49.40	48.70	49.20	55.30	54.10	50.59
Middle East & North Africa	59.10	63.40	64.30	64.70	64.30	70.30	62.30	71.50	64.99
South Asia	40.60	42.40	45.80	47.70	49.90	51.70	53.80	55.10	48.38
Sub-Saharan Africa	**25.50**	**26.50**	**27.60**	**28.50**	**29.20**	**30.90**	**32.50**	**29.70**	**28.80**

Source: World Bank Database on Financial Development and Structure. See Thorsten Beck and Asli Demirgüç-Kunt 2009. Financial institutions and markets across countries and over time: data and analysis. *World Bank Policy Research Working Paper* 4943.

Table 2.2: Ratio of Private Credit Extended by Deposit Money Banks to GDP (in Percentage)

	2000	2001	2002	2003	2004	2005	2006	2007	Average
Benin	10.60	10.40	10.50	12.50	14.00	15.10	16.20	16.40	13.21
Botswana	14.00	13.90	16.70	18.00	19.60	19.40	19.60	19.30	17.56
Burkina Faso	11.00	11.50	12.30	12.60	13.00	14.30	16.10	15.80	13.33
Burundi	16.80	19.70	21.10	23.60	21.00	19.40	18.30	20.80	20.09
Cameroon	7.70	8.20	8.40	8.90	8.90	9.00	9.10	8.90	8.64
Cape Verde	37.50	37.30	38.50	39.90	41.10	40.70	42.50	44.90	40.30
Chad	3.40	3.20	3.70	4.00	3.00	2.70	2.70	2.70	3.18
Cote d'Ivoire	14.90	15.00	14.60	14.00	13.70	13.70	13.50	14.10	14.19
Gabon	8.50	10.90	11.40	11.40	9.30	7.70	7.80	11.10	9.76
Guinea-Bissau	7.50	5.70	3.20	2.50	1.60	1.70	2.80	4.40	3.68
Kenya	25.60	24.10	23.50	23.10	23.20	23.80	24.30	22.40	23.75
Madagascar	8.00	8.00	8.70	7.90	8.50	9.00	9.30	9.40	8.60
Malawi	4.50	4.90	4.70	5.00	5.60	6.40	7.60	6.20	5.61
Mali	14.90	14.20	16.60	18.40	18.80	18.80	16.80	16.00	16.81
Mauritius	54.20	55.10	56.70	62.90	69.20	72.60	72.20	71.60	64.31
Mozambique	17.80	12.70	9.10	8.60	8.30	9.00	12.00	0.00	9.69
Niger	4.70	5.00	5.10	5.20	6.00	6.50	7.60	8.20	6.04
Nigeria	**10.40**	**14.90**	**16.10**	**14.60**	**15.30**	**12.20**	**12.10**	**17.30**	**14.11**
Senegal	16.50	17.80	17.90	18.30	19.30	20.50	22.00	20.80	19.14
Seychelles	15.10	17.50	18.90	23.30	28.00	31.70	29.80	30.00	24.29
Sierra Leone	1.90	1.90	2.10	3.00	3.90	4.30	4.00	4.50	3.20
South Africa	65.00	69.80	63.80	59.70	62.20	65.40	70.70	77.10	66.71
Tanzania	4.40	4.50	5.20	6.60	7.50	8.90	10.60	12.10	7.48
Togo	15.70	15.30	13.40	14.20	15.90	16.90	17.30	18.00	15.84
Uganda	5.20	5.00	5.00	5.30	5.50	5.40	5.90	7.40	5.59
Zambia	6.70	6.60	5.80	5.60	6.50	7.00	7.70	10.10	7.00
DEVELOPING COUNTRIES	**25.20**	**25.60**	**25.70**	**25.40**	**25.70**	**27.50**	**30.40**	**32.50**	**27.25**
East Asia & Pacific	34.50	34.50	34.20	34.60	34.90	36.10	40.30	42.50	36.45
Europe $ Central Asia	18.20	18.60	19.10	20.80	23.50	27.80	34.00	37.00	24.88
Latin America & Caribbean	37.90	38.40	37.90	34.60	33.40	33.40	37.70	40.10	36.68
Middle East & North Africa	36.70	38.30	36.60	39.50%	39.00	44.50	35.20	43.90	39.21
South Asia	21.40	21.70	23.30	24.30	26.70	30.70	34.30	33.60	27.00
Sub-Saharan Africa	**13.90**	**14.00**	**14.10**	**14.40**	**14.60**	**15.50**	**16.10**	**16.60**	**14.90**

Source: World Bank Database on Financial Development and Structure. See Thorsten Beck and Asli Demirgüç-Kunt 2009. Financial institutions and markets across countries and over time: data and analysis. *World Bank Policy Research Working Paper* 4943.

2.7 Operational Efficiency of the Deposit Money Banks in Nigeria (2001-2008)

One way of evaluating bank efficiency is by computing the accounting ratios, although this performance yardstick has some drawbacks as earlier identified. **Table 2.3** below shows the various accounting ratios for measuring operating efficiency of banks. The efficiency ratio[21] shows 54.86%, 58.50% and 56.37% efficiency levels in 2001-2003, 2004-2005 and 2006-2008 respectively. The slight decrease in the operating efficiency ratio of the banks in the post 2004/2005 bank consolidation relative to the reform period could point to internal problems in the sector.

Table 2.3: Efficiency Indicators of Deposit Money Banks in Nigeria (2001-2008)[22]

Efficiency Measures	2001	2002	2003	2004	2005	2006	2007	2008
Net Interest Margin	55.74	56.48	55.87	54.37	56.76	60.15	52.25	54.80
Yield on Earnings Assets	9.10	6.42	4.74	14.17	9.85	8.35	Na	Na
Return on Assets	4.73	3.47	2.67	3.12	1.85	1.61	3.89	3.95
Return on Equity	55.81	36.60	25.52	27.35	12.97	10.60	23.84	22.01
Efficiency Ratio	65.96	49.60	49.02	77.03	39.97	71.43	65.90	31.77

Source: Central Bank of Nigeria Annual Supervision Report (2005, 2006, 2008). Na stands for non-availability.

[21] Efficiency ratio is a measure of operating expenses against operating income (CBN,2006)

[22] Net interest margin is the net interest income on average earning assets. On the other hand, net operating income made on total assets is called return on asset. Similarly, return on equity is the net income made on shareholders' fund after preferred dividends have been subtracted, whereas, yield on earning assets is the sum of the rate paid on funds and the net interest margin. An increase in these ratios indicates a rise in the optimal utilization of the resources. So, they are related to efficiency.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter begins with a review of literature on market structure and efficiency to provide a general background explanation of efficiency and productivity and postulations of economic theorists concerning determinants of efficiency. This is followed by discussion of technological advancement and bank efficiency linkage as well as efficiency and productivity change concepts. In addition, issues on measuring efficiency and productivity change are reviewed. The chapter concludes with a review of methodological literature and empirical perspectives of efficiency/ inefficiency of banks, bank efficiency determinants, productivity and productivity change in banks, economies of scale of banks, consolidation impacts on efficiency, productivity change and economies of scale of banks as well as the gaps in the literature.

3.2 Market Structure and Efficiency

The market structure (that is, organization characteristics such as entry and exit conditions, concentration ratio, market share, nature of products and number of participants) under which a firm operates determine its behaviour or conduct (decisions regarding activities such as prices, sales, employment, advertising, research and development and technological innovations).[23] Firms under perfect competition will behave quite differently from firms which are monopolists, which also behave differently from firms under monopolistic competition, or oligopoly (Sloman, 2006). Basically, economists group industries into four distinct market structures- pure competition, pure monopoly, monopolistic competition, and oligopoly.[24]

[23] See Nyong (1999)
[24] For example, see McConnell and Brue (2005)

The behaviour of the firm will in turn affect its performance- prices, profits, efficiency, productivity change, etc. In many cases, it will also affect other firms' performance- prices, profits, efficiency, productivity change, etc. The collective behaviour of all the firms in the industry will affect the whole industry's performance. Therefore, there is causal chain running from market structure to the conduct and then the performance of the industry. This is called the Structure-Conduct-Performance (SCP) hypothesis.

In the long run, pure competition forces firms to produce at the minimum average total cost of production (ATC) and to charge a price (P) that is just consistent with that cost (that is, P=ATC). This is a highly favourable scenario from the consumer's perspective. It means that unless firms use the best available (least cost) production approaches and combinations of inputs, they will not survive. Stated differently, it implies that the minimum amount of resources will be used to produce any particular output. Least cost production must be employed to provide a society with the "right goods", the goods that the consumers want most. This is called allocative efficiency and the price charged in the pure competitive market equals the marginal cost (McConnell and Brue, 2005).[25] So, productive or technical efficiency as well as allocative efficiency occur in the long run in pure competition.

Monopoly is inefficient because its output is less than the output required for achieving minimum ATC and also because the monopolist's price is always higher than marginal cost (MC). Particularly, monopoly is associated with allocative inefficiency, a term referred to as dead-weight loss of non-competition (Harberger, 1954). However, early estimates of the dead weight loss in 1950s were small compared to intuitive estimates of the costs of non-competitive

[25] Note these two underlying factors- (1) Money price of any product is society's measure of the relative worth of an additional unit of that product. (2) Marginal cost of an additional unit of a product measures the value, or relative worth, of the other goods sacrificed to obtain it. Also, maximum willingness to pay for the last unit equals minimum acceptable price, and combined consumer surplus and producer surplus is at maximum when resources are efficiently allocated.

market. One explanation is that monopolies waste resources or increase cost by rent seeking- by securing/ retaining expenditures which add nothing to their output but clearly increase their costs. A second explanation is x-inefficiency, which arises when a firm's actual cost of producing any output is greater than the lowest possible cost of producing it (ATC).[26] X-inefficiency which is sometimes called technical inefficiency[27] reflects bad management by the firm's managers and directors. Since it is one of the causes of increasing costs, several authors have regarded it as cost inefficiency.[28] Without competitive pressure on profit margins, cost controls may become lax. The result may be overstaffing, extravagant spending on buildings and equipments, managers having goals, such as corporate growth, an easier work life, avoidance of business risk or no risk management and nepotism that conflict with cost minimization. X-inefficiency may also arise because a firm's workers are poorly motivated or supervised or less effort is made to update technology adopted and scrap old plant or branch. The firm may also not be inclined to promote research and develop new products, or develop new domestic and export markets. Also, firms may simply become lethargic and inert, relying on rules of thumb in decision making as opposed to relevant calculations of costs and revenues (Sloman, 2006; McConnell and Brue, 2005). X-inefficiency increases as competition decreases, thus x-inefficiency is more observable in monopoly, followed by oligopoly, monopolistic competition and least in pure competition. X-inefficiency makes average cost and marginal cost higher than what should be the minimum.

Historically, there were significant reductions of x-inefficiency in many countries in the early 1980s. With a world-wide recession, and a fall in both sales and profits, many firms

[26] The inefficiencies of monopoly may be offset or reduced by scale economies (even where this leads to natural monopoly) and, less likely, by technological progress, but they may be intensified by the presence of x-inefficiency and rent seeking expenditures.
[27] For example, see Sloman (2006) and Adewuyi and Bankole (2007).
[28] See Rao (2002)

embarked on cost-cutting programmes. Many out-of- date plants were closed down, and employment was severely affected. Those firms that survived the recession (many did not) tended to be more competitive and more efficient. Also, growth in international competition has caused significant reduction in x-inefficiency, as markets have increasingly become global in scale leading to removal of barriers to trade (Sloman, 2006).

Leibenstein (1966) introduced the theory of inefficiency generated from non-competition. Since it was not allocative and he was unable to characterize it as motivational or technical, he named it x-inefficiency. As a concept, it may be summarized as follows: "for a variety of reasons, people and organizations normally work neither hard nor effectively as they could. In situations where competitive pressure is light, many people will trade the disutility of greater effort for utility of little effort, or search for the utility of feeling less pressure and of better interpersonal relations" (Leibenstein, 1966).

Leibenstein (1966) uses what is termed micro-micro theory; which centres on "the interactive but somewhat constrained, economically bargained decision making 'atomistic' individuals within the firm". In examining the molecular make-up of the firm, which is treated as a maximizing "black-box" in neoclassical theory, he finds that the internal agents are non-maximizers. Invoking the Yerkes-Dodson law, at low pressure levels, individuals will not put much effort into carefully calculating decisions, but as pressure builds they move toward more maximizing behaviour. He identifies an inert area, probably due to the incomplete nature of labour contracts in which payment is specified without defining the required effort. Variation in effort is due to the discretion which employees have in choosing effort levels and discretion which top management has about working conditions because of information asymmetry. However, economic agents are rational decision makers, so higher costs may not be a symptom

of inefficiencies to the workers (although it is to the firm), but the effect of fully rational workers' preferences for leisure. According to Stigler (1976), "increased output due to (say) increased effort is not an increase in efficiency but a change in output", a scenario termed productivity growth.

It is possible for x-inefficiency to occur for years in competitive industries even after a management change increase output substantially without changing inputs. Therefore, it may be that internal pressure in competitive markets has greater influence than the external pressure. Leibenstein (1966) describes internal pressure as "inner prodding, be it religious, moral or cultural" which motivates an individual to minimize cost for his employer. He refers to it as a domino type effect by which he argues that if a top manager is x-inefficient for whatever reasons, those under him too will be x-inefficient because of this lack of motivation.

Empirically, one of the usual econometric problems of measuring x-inefficiency is missing variables. This problem may be encountered when analyzing internal and external pressures. Frantz (1990) claims that several economic studies measure external (market) pressure only. He further offers explanations that include internal constraints. However, Button and Weyman-Jones (1992) note that the Data Envelopment Analysis (DEA) can accurately measure x-inefficiency.

The rationale behind explicit link between market structure and efficiency was first proposed by Hicks (1935), who argued that monopoly gives managers a quiet life free from competition. This allows them to appropriate their share of monopoly rents through discretionary expenses or a reduction in their efforts, a theory Leibenstein identified, in 1966, as x-inefficiency. Competition potentially reduces inefficiencies in two ways. First, to avoid the personal cost of bankruptcy of the organization, managers now have incentives to increase their

work efforts. Second, the entry of other firms in the market enables owners to judge the performance of their organization vis-à-vis that of the rivals, and hence make a better judgement of the level of effort exerted by their managers and develop the yardstick for bringing about changes in management if necessary.

There are other three contrasting versions to SCP with its several dimensions. Demsetz (1973) proposes an alternative assumption, namely the Efficient Structure Hypothesis (ESP) which predicts a negative relationship between competition and cost efficiency. The main controversy here is that more efficient firms under competition operate at lower costs which directly increase their profits. These firms are able to capture larger market shares that may result in high levels of concentration, a term called Relative Market Power Hypothesis (RMP)[29] of the ESP. Since market concentration means lower competition, the relationship between competition and efficiency is inverse or negative. However, the greater efficiency may be in form of x-efficiency, in which some firms have superior management or production processes that allow them to operate at lower costs and subsequently reap higher profits. Thus, the ESP is also called X-efficiency Structure Hypothesis. Alternatively, the greater efficiency may be in the form of scale efficiency in which some firms despite having equal good management and technology, produce at more efficient scales than others (producing at output levels closer to the minimum ATC)[30] and therefore have lower unit costs (average costs) and higher unit profits. This is called the Scale Efficiency of the ESP or Scale Efficiency Hypothesis (SEP). All these three contrasting versions imply a negative association between competition (structure) and cost efficiency

[29] See Shepherd (1982), Berger (1995).
[30] The maximum efficient scale is the size beyond which no significant additional economies of scale can be achieved or the point where the long run ATC curve flattens (Sloman, 2006).

(performance).[31] That is, competition falls as market concentration rises and efficiency increases via low costs. So, these hypotheses negate SCP which indicates a positive relationship between competition and cost efficiency. It is apparent that there is possibility of bi-directional causality between competition and performance. However, the outcome varies when other performance indices are considered. For instance, considering profit, all the four hypotheses would end up with the same result of higher profit from increasing competition. Therefore, profit structure relationship is a spurious outcome (Lambson, 1987).

In monopolistic competition and oligopoly, neither productive nor allocative efficiency occurs in long-run equilibrium. These firms do not produce goods and services and offer them to market at price where ATC is at minimum point and the price does not equate marginal cost.

The efficiency criteria clearly favour pure competition where free entry and exit of sellers to and from the market place must hold: no individual seller can influence the market price; no collusion among sellers, production of homogenous product and existence of many sellers or producers or firms in the market. In reality, there is no pure competitive banking industry in the world, hence there may not be optimal utilization of resources in the industry, rather a varied level of inefficiency in the banking sector will occur. In many lines of banking activity, price is not equal to marginal cost and marginal cost for all bank services is not usually the same for all banks. Similarly, banks do not offer homogenous products but multi-product lines to their customers. Each banking service is often differentiated from the other and the product mix also varies among banks. Entry and exit into and from the market is always regulated by the sole monetary authority (regulatory constraint) while the components of inputs and outputs vary

[31] The link is such that lower cost means increased efficiency which in turn can make the firm raise its market share and which can lead to higher concentration implying falling competition. In most cases, market share and concentration move in the same direction, hence multicollinearity problem may arise when both are used as predictors.

based on theoretical approach (economic constraint). It is the regulatory policy and procedures that are the binding constraints. Collusion is unlikely to occur if there is a large number of relatively small firms; but with few relatively large firms, as in banking, the distinct possibility arises that collusion will occur (Ajayi and Ojo, 2006). In practice, the banking market is either an oligopoly or monopolistic competition. Where there are tendencies for monopoly to occur, the monetary authority quickly makes move to avoid it.

3.3 Technological Advancement and Bank Efficiency

This era of globalization is associated with massive adoption of information and communication technology (ICT) in financial institutions across continents to help achieve their goals and support decisions. Hilili (2005) opined that the Nigerian payment system is largely cash based. She observed further that while the country lags behind industrial countries; its use of electronic payment systems is gradually gaining prominence. However, among internet, cheque, debit cards and phone cards, cheque remains the preferred form of non-cash payment in Nigeria. Cheque possesses several attractive features to consumers- they are familiar, widely acceptable and relatively convenient. Hilili (2005) concluded that as at 2005, no single competing electronic payments method offers the same mix of attributes. She was of the opinion that the use of multipurpose stored-value instruments in particular has been low. The contributing factor to the slow growth in electronic payment devices usage, according to her, can largely be due to uncertainty over security, standards and compatibility issues associated with the new technologies.

According to Berger (2003), new information technology (IT) related services can be distinguished into four main categories- internet banking, electronic payments, security investments and information exchanges. Majority of banks in Nigeria have adopted most of these

IT related services, except that internet banking and provision of adequate information that can reduce asymmetric problems are still at infant stage. Adeola (1995) opines that with instantaneous access to information, identified constraints in markets can quickly be disseminated through a global network, thereby ensuring efficiency, competitiveness and strengthening domestic service quality. Information technology enhances workings of markets, reduces transaction and coordination costs within and across enterprises and institutions (Hanna, 1994).

Laudon and Laudon (1991) contend that managers cannot ignore information system or technology because it plays a critical role in contemporary organizations in the delivery of their services. Information technology directly affects how managers decide and plan what products and services are produced (Adewoye, 2007). Oyebisi et al. (2000) claim that only banks that overhaul the whole of their payment and delivery system operations and apply IT devices would likely survive and prosper in the new millennium. Uche and Ehikwe (2001) assert that most banks in Nigeria have been investing heavily in information technology because of the benefit of cost reduction, improved efficiency and the belief that failure to do that would endanger their future.

Advancement in technology assures the benefit of economies of scale in production, leads to development of new product and services and result in the creation of knowledge, thus instilling product quality and service efficiency (Selamat et al., 2009). Broadly, Kozak and Kowalski (2005) have pointed out four ways IT developments affect bank operations. First, it causes innovation in producing new banking services which result in achieving greater economies scale or fewer diseconomies of scale than the existing technologies, especially in electronic payments and credit scoring services. Second, improvements in IT may lead to

reduction in managerial diseconomies of scale. Information technology advances improve monitoring and control within large banks better than within small banks. These technologies may make it easier for managers of large multi-branch banks to monitor the conduct of their staff and by doing this reduces the agency problem. Third, IT deployments enable banks to start new depository services such as issuing Automated Teller Machines (ATMs) for payments, call centres and internet banking which give more opportunities to achieve scale economies and fewer diseconomies, rather than the same depository services provided through traditional branch networks. In a similar way, some IT products, such as securitization, derivatives,[32] and other off-balance sheet activities are more efficiently provided by large banks, which explain their dominance of the relevant markets. Fourth, improvements in IT allow large banks to control investment in risks more efficiently than small banks. Well-equipped IT based credit risk department of large banks is able to generate higher expected return on investments and is known to improve access to uninsured funding while saving on expensive equity capital.

Uche and Ehikwe (2001) observe that Nigerian banks now use ATMs to make cash available to customers all day round. Some banks also practise telephone banking and use smart card. International money transfer service, which was first introduced by First Bank of Nigeria Plc in February 1996, has continued to grow in leaps and bounds. Nigerian banks are increasingly participating in international banking operations which guarantee access to international banking networks for efficient fund transfers through open and amend letters of credit, retrieval of up to date information on the status of customers' transactions, among others. We note that they have also been increasingly updating their ICT.

[32] Securitization is a financial technique involving change of non-liquid assets into liquid stocks. It is also defined as the process of aggregating similar instruments, such as loans or mortgages, into a negotiable security. On the other hand, derivative is a security whose price or value is dependent or derived from one or more underlying assets.

Uche and Ehikwe (2001) assert that advances in IT undoubtedly help streamline back office operations of most banks, improve efficiency and lead to savings in costs. For instance, it is now possible for a bank staff to check a customer's balance, ascertain the correctness of his signature and make payment. According to them, the implication of this for the customer is that his waiting time in the bank is reduced and he is therefore served better. For the banks, they become more efficient and productive with respect to the processing of customer's needs. Increased cost of IT is at least in the long-run compensated for by increased efficiency and lower staff costs due to possible drastic reduction in staff strength. Besides, they opined that inadequate infrastructure like electricity and security networks in Nigeria will make IT adoption costly for banks, especially the smaller banks.

A pertinent argument in the literature is that the role of information technology on productivity growth is paradoxical.[33] The question is, why this paradox? Frischtak (1992) argued that it could be due to lagged factors, such as new technologies which need organization change and employees' training before the benefits of IT could be realized. In the process, some works would be duplicated and redundant; hence the benefits of IT might not be enjoyed immediately.

According to Pilat (2004), two effects of ICT on productivity and growth are feasible. First, as a capital good, investment in ICT contributes to overall capital deepening which provides productive equipment and software to business and therefore helps raise labour productivity. Investment in ICT equipment increases the amount of capital available for labour thus increasing economy wide labour productivity and is likely to increase economic growth. Second, greater use of ICT may help firms increase their overall efficiency and thus raise

[33] For instance, see Oliner and Sichel (1994), Lichenberg (1995), Ten Raa and Wolf (2001) for significant IT impacts on productivity growth and for otherwise, see Parsons et al. (1993), Bailey and Gordon (1988) , among others.

multiple factor productivity. Greater use of ICT also contributes to networks effects, such as lower transaction costs and more rapid innovation which will improve the overall efficiency.

The benefits of ICT for a firm include savings of inputs, general cost reductions, higher flexibility, improvement in product quality, among others (Spyros, 2004). Information and Communication Technologies (ICTs) are intended to help firms acquire the information needed to change the technology of production, optimize the acquisition and use of factor inputs ICTs, play key role in increasing the speed of generation and help in diffusion and use of new knowledge within plants (Milana and Zeli, 2002). The information stimulates the creation of new knowledge by giving firms and innovators fast access to knowledge as well as results in more effective use of time and closes communication gap.

According to Gupta and Collins (1997), there are four popular efficiency measures used in examining IT return. These include reduced operating expenses, which have cost efficiency implication; increased profitability, increased fee income as a percentage of total revenue (a performance ratio) and increased net-interest margin to average earning assets (another performance ratio).

Technological advancement enhances both productive and allocative efficiency (McConnell and Brue, 2005). Technological advancement as embodied in process innovation improves productive efficiency by increasing the productivity of inputs and by reducing average total cost while technological advancement as embodied in product (or service) innovation enhances allocative efficiency by giving society a more preferred mix of goods and services.

3.4 Concept of Efficiency and Productivity Change[34]

Efficiency is a long-run concept where there is market equilibrium, which maximizes economic surplus (producers' and consumers' surplus).[35] It is a concept that is based on predetermined attributes of firms and their customers such as profits, dividends, tastes, abilities and knowledge. Through the combined effects of individual cost-benefit decisions, these attributes give rise to the supply and demand curves for goods and services produced in an economy. However, an "efficient" product does not mean the same thing as "good" product in an economy. For instance, the market for a new product just introduced by a bank may be in equilibrium at a minimum of ₦10000 deposits, yet many poor people may be unable to afford it. Main while, permitting firms (for example, banks) to reach equilibrium is important because when economic surplus is maximized, it is possible to pursue every goal more fully. Efficiency is pertinent not because it is a desirable end in itself, but because it enables man to achieve all other goals to the fullest possible extent. Whenever a market is out of equilibrium, there is waste and this is bad for the firm and the economy at large (Frank and Bernanke, 2004).[36]

Farrell (1957) drew upon the work of Debreu (1951) and Koopmans (1951) to define a simple measure of firm efficiency that could account for multiple inputs. Farrell has proposed that the efficiency of a firm consists of two components: technical efficiency, which reflects the ability of a firm to obtain maximal output from a given set of inputs; and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices and the production technology. These two measures are then combined to provide a

[34] This section draws largely on the work of Coelli et. al. (2005)
[35] Private efficiency in the market is obtained where the marginal utility equates marginal cost for all producers and all consumers. On the other hand, social efficiency takes place in the market when marginal social benefit equals marginal social cost (See Sloman, 2006).
[36] Pareto optimality is required for equilibrium to lead to efficiency. A Pareto-optimal allocation of resources is achieved when it is not possible to make anyone better off without someone else worse off.

measure of total economic efficiency or cost efficiency.[37] Cost efficiency is ascertainable if input price information is available. Theoretically, a bank is fully efficient if it produces the output level and mix that maximize profits and minimize possible costs. Most of the sources of inefficiencies in banks may often be caused by inappropriate operations and financial inefficiencies.

Technical efficiency can be an input-oriented measure or output-oriented measure. The input- oriented measures address the question: "By how much can input quantities be proportionally reduced without changing the output quantities produced?" The output-oriented measure alternatively ask the question: "By how much can output quantities be proportionally expanded without altering the input quantities used?" Technical efficiency is always measured along a ray from the origin to the observed production point. Hence this measure holds the relative proportions of inputs (or outputs) constant. One advantage of this radial efficiency measure is that it is unit invariant. That is, changing the units of measurement (e.g., measuring quantity of labour in person hours instead of person years) does not change the value of the efficiency measure. A non-radial measure, such as the shortest distance from the production point to the production surface, seems intuitively appealing, but such a measure is not invariant to the units of measurement. However, input- and output-oriented technical efficiency explained is equivalent to the input output distance functions discussed in Shephard(1970) and Fare and Primont (1995).

Allocative efficiency can be discussed under three perspectives: cost-minimizing, revenue-maximizing and profit-maximizing perspectives (where both cost minimization and

[37] Farrell's (1957) original proposition of efficiency used the term price efficiency instead of allocative efficiency and the term overall efficiency instead of economic or cost efficiency. The terminology used in this work conforms to what is used most often in recent literature such as Kiyota (2009).

revenue maximization are assumed). Profit maximization can be accommodated in a number of ways. The principal difficulty is associated with the selection of the orientation in which to measure technical efficiency (input, output or both). One suggestion is presented in Fare, Grosskopf and Lovell (1994), in which Data Envelopment Approach is used to measure profit efficiency along with a hyperbolic measure of technical efficiency (which considers simultaneous expansion of outputs and contraction of inputs). This requires the use of directional distance functions. This function was introduced by Chambers, Chung and Fare (1996). Balk (1998) interpreted allocative efficiency as the difference between profit efficiency and productivity change using directional distance functions. An alternative approach is suggested by Kumbhakar (1987) in a Stochastic Frontier framework, which involves the decomposition of profit efficiency into three components: input-allocative efficiency, output-allocative efficiency and input-oriented technical efficiency. It is pertinent to point out here that no particular methodology has become widely used to date (Coelli et.al, 2005).

It is possible for a firm to be both technically and allocatively efficient but its scale of operation may not be optimal. Suppose the firm is using a variable-returns-to-scale (VRS) technology. Then, the firm involved may be too small in its scale of operation and might fall within the increasing returns to scale part of the production function. Similarly, a firm may be too large and it may operate within the decreasing returns to scale part of the production function. In both of these cases, efficiency of the firms might be improved by changing their scales of operation, i.e., to keep the same input mix while changing the size of operations. If the underlying production technology is a globally constant returns-to-scale (CRS) technology then the firm is automatically scale efficient.

Productivity is the ratio of output to input and is essentially a level concept. The measures of productivity can be used in comparing performance of firms at a given point of time. In contrast, productivity change refers to movements in productivity performance of a firm or an industry over time.

There are several simple and intuitive methods for measuring productivity change. Four popular approaches are often adopted. The first approach is to simply use the rate of change in output relative to change in input. Diewert (1992) has attributed this simple method to Hicks (1961) and Moorsteen (1961). Thus, this method is called Hicks-Moorsteen method. The second method is to extend the profitability method and measure productivity change using growth in profitability after making appropriate adjustments for movement in input and output prices over the base period (period s) and the current period (period t). The third method which was advocated in Caves, Christensen and Diewert (1982), hence named after them as the CCD method, measures productivity change by comparing the observed outputs in the base period and current period with the maximum level of outputs (keeping the output mix constant) that can be produced using inputs in the base and current period operating under the reference technology. The fourth and the most frequently used in current literature is the component-based approach in which the total factor productivity change is decomposed based on its sources. For instance, Balk (2001) after comparing and evaluating some of the earlier attempts in literature decomposed productivity change into efficiency change, technical change and scale change. Coelli et al.(2005) decomposed total factor productivity change further into four components namely technical efficiency change (relative to a CRS technology), technological change, pure technical efficiency change (relative to a VRS technology) and scale efficiency change.

3.5 Inputs and Outputs Identification for Measuring Efficiency and Productivity Change in Banks

Despite the large body of literature on efficiency and productivity measures of banks, there is no general consensus on how to define inputs and outputs of multi-product financial firms in ascertaining efficiency level. The two main issues relate to the role of deposits and whether inputs and outputs should be measured in physical or monetary units.

There are five basic approaches used in the literature for classifying the inputs and outputs. These include the production, intermediation, asset, value added and user cost approaches. These approaches are based on the application of production theory in economics to the behaviour of banking firms, given that banks use a combination of inputs to produce one or more outputs.

The production approach, being more concerned with technical efficiency of financial institutions, defines the bank activity as production of financial services for its customers. Input and output are measured in physical quantity (such as number of accounts and transactions processed). However, such detailed transactions flow data are typically proprietary and not generally available. Deposits are counted as output while inputs are physical units of labour and capital which are needed to process transactions (see Rao, 2002). Interests paid on deposits are not included in bank total costs or input costs (Ferrier and Lovell, 1990). The method has been subjected to modification. For instance, Berger and Humphrey (1991), Bauer et al. (1993) and Maggi and Rossi (2003) gave a modified production approach. Under this approach, interests paid on deposits, labour and capital are counted as inputs, while outputs are deposits, loans (performing and non-performing) and other financial services rendered by the bank, all

expressed in monetary terms. The production approach may be somewhat better for evaluating the efficiencies of branches of banks (Berger and Humphrey, 1998).

The intermediation approach views banks as intermediary between savers and investors. According to this approach, banks collect deposits/funds from savers and allocate these funds to investors or borrowers in the form of loans and other assets. Service flows are typically assumed to be proportional to the stock of financial values in the accounts such as the amount of loans and deposits in monetary terms (Berger and Humphrey, 1991).[38] Therefore, both deposits and interest paid on deposits are inputs while outputs are loans and other liquid assets. The intermediation approach can also be modified to suit the development in the economy. Drake (2003) provided a modified form of the intermediation approach due to the observed behaviour that banks in United Kingdom in the 21st Century have increasingly been generating more income from off-balance sheet operation and fee incomes. Consequently a new category of "other incomes" and earning assets, namely loans and liquid assets plus investment can be categorized as output while capital, labour and total shareholder funds are inputs.

The asset approach is a variant of the intermediation approach where liabilities are considered as inputs and assets as outputs while the user cost approach assumes that it is the net contribution to the bank revenue that defines inputs and outputs. In this case, deposits are counted as outputs while fixed assets may be inputs. The value added approach identifies any balance sheet item as output if it absorbs a relevant share of capital and labour, otherwise it is considered as an input or non relevant output. According to this approach, deposits are considered as output since they imply the creation of value while statutory reserve may be inputs. More explicitly, Berger and Humphrey (1991) stated that produced deposits (i.e. demand and saving deposits) could be considered as outputs while purchased funds (i.e fixed /time deposits)

[38] This is based on the money multiplier principle controlled by the central bank.

are considered as inputs. They argued that unlike produced deposits (deposits generated through the provision of liquidity, transactions, and payment services to depositors), purchased funds are acquired almost exclusively through interest payments. However, classification of demand and savings deposits should be done with caution. Osota (1995) argues that bank outputs should be measured by the value of their earning assets while other assets and liabilities should be treated as inputs. After all, deposits (purchased or produced) are the sources of banks' loanable funds.

From the foregoing, it becomes clear that deposits are either inputs or outputs depending on the method adopted. Largely, researchers adopt any of the methods based on data availability and theoretical considerations. In our perspective, the modified intermediation approach is more economic oriented since labour and capital are among the basic inputs of firms in production theory. This explains why economists would be more comfortable with deposit as input than output since deposits as well as equity are important 'raw materials' which banks work with to produce outputs such as loans, investments and liquid assets.

3.6 Methodological Review

Studies on efficiency and productivity measures in banks have used parametric and non-parametric methods. The methods used in the parametric approach were Stochastic Frontier Approach (SFA) also called Econometric Frontier Approach, Thick Frontier approach (TFA) and Distribution-Free Approach (DFA). On the other hand, the non –parametric researchers used Data Envelopment Analysis (DEA), Malmquist Index, Tornquist Index and Distance Functions. In parametric studies, SFA is often used. Berger and Humphrey (1997) reported that out of the 60 studies using parametric method, 24 used SFA. Amongst them were Ferrier and Lovell (1990), Greene [1990), Khumbhakar [1996), Battese and Coelli (1992), Bauer and Hancock (1993), Master (1996), and Berger and De Young (1997). Also, others like Rao (2002),

Manlagnit and Lamberte (2004) used SFA. In the non-parametric approach, DEA is the most widely used method as seen in the works of Sherman and Gold (1985), Rangan et. al. (1988), Elyasiani and Median (1990), Ferrier and Lovell (1990), English et al. (1993), Fixler [1993) and Brockett et al. [1997). Jemric and Vujcic (2002), Angelidis and Lyroudi (2006) and Deng, Liu and Wu (2007) among others also used DEA.

Briefly stated, the widespread usage of DEA for examining bank efficiency is because it requires no explicit specification of functional form. It is practically difficult to parametrically specify and estimate a production or cost function for the banking business because deregulation and advances in technology have brought many outputs other than the traditional output- loans (Harada and Ito, 2005). Also, DEA has the capacity to derive explicit efficiency for an individual firm, irrespective of sample size or time frame. So, the technique is better used when samples are small. However, its weakness over parametric methods is in terms of its having no estimated error on deviation from the frontier, hence overstating inefficiency. In our opinion, this weakness is immaterial because inefficiency is a problem and it is better to overstate a problem than to understate it. Although, both parametric and non-parametric approaches have their distinctive features, Coelli et al. (2005) found that there is no wide difference in the efficiency scores obtained using SFA and DEA.

3.7 Empirical Review

There is a large body of literature on efficiency issues in banks. This study reviews major literature on efficiency/ inefficiency of banks, bank efficiency determinants, productivity changes, economies of scale and efficiency/ productivity gains or losses from bank consolidation.

3.7.1 Efficiency and Inefficiency of Banks

Previous studies on efficiency of banks are mixed. Berger and Humphrey (1991) found that a substantial portion of the dispersion in US banks' costs were due to inefficiencies. In their findings, they reported that in overall, inefficiency accounted for 25% or more of average costs. Berger and Humphrey (1992) used TFA to compare bank cost efficiency and shifts in best-practice costs in the periods 1980-1984 and 1984-1988 using data for all US banks. They found that when the shifts were not adjusted for changes in business conditions, average costs increased for all banks in the 1980-84 interval, and decreased in average costs for all sizes of banks in 1984-1988 period. The increase in costs in 1980-84 was larger for the smaller banks. This might reflect the deregulation of deposit rates in the 1980-84 period, and the heavy reliance on deposits by smaller banks over larger banks. The decline in average costs in 1984 -88 (after most of the effects of deregulation should have been exhausted), might have reflected a decline in market rates that affected deposit rates and rates on purchased funds almost equally. When the shifts in average cost frontiers were adjusted for changes in the business conditions, an increase in costs was still found for the 1980-84 period, though a decrease was no longer found for the 1984-88 period. Similarly, Sobodu and Akiode (1995) found bank efficiency to be declining during deregulation in Nigeria using DEA on 1983-93 data. Their findings contrasted with Obafemi (2008) whose DEA approach revealed that liberalization improves bank efficiency in Nigeria, though such improvement is not sustained over time.

Tannewald (1995) also used the TFA as well as a hybrid of SFA to investigate the difference in operational efficiency among the banks in a Federal Reserve District in the US. He found a substantial dispersion in x–efficiency among the sampled banks with the peak of 51%. In Nigeria, Fadiran (2006) using DEA also found substantial inefficiency in the country's banking

sector. According to this study, the result implies poor quality of management in the banking industry. Kwan and Eisenbeis (1996) used SFA to examine inefficiencies among US banks. Their study found inefficiency to be more prominent among small banks. In addition, they found that inefficient firms tended to stay inefficient over time. Contrary to this, Jemric and Vujcic (2002) found small banks to be most efficient. In the same vein, Altunbas et al. (2000) used the SFA to assess x-efficiency of Japanese banks while controlling risk. They found that x-inefficiency scores were not sensitive to risk. Larger banks were found to be more x-inefficient in Japan.

Pastor, Perez and Quesada (1997) analyzed the productivity, efficiency and differences in technology in the banking systems of United States, Spain, Germany, Italy, Austria, United Kingdom, France and Belgium in 1992. Using the DEA non-parametric approach together with the Malmquist Index, they compared the efficiency and differences in technology of several banking systems. Their study adopted the value added theoretic approach. Deposits, productivity assets and loans were selected as banking output variables, 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, non-interest expenses, other than personnel expenses were employed as banking input. According to the results, France had the banking system with the highest efficiency level followed by Spain, while UK showed the lowest level of efficiency.

Coelli et al. (2005) have cautioned researchers using efficiency scores obtained from frontier efficiency techniques for cross border comparison of efficiency. According to them, the scores are derived on the basis of deviation within the sample. So, for such comparison to be reasonable, the cross border and other types of samples should be bound together. 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). By implication, the level of development of an economy and its financial sector as well as the level of government control has nothing really to do with efficiency of banks. However, the global recession (2007-2009) has reinforced Keynesian's postulate of the need for government regulation in every economy.

Hansan, 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 environmental conditions of each country. The results based on cross-country efficiency scores showed that the banks in Denmark, Spain and Portugal were relatively the most technically efficient and successful. On the other hand, the banks in France and Italy were found to be the least efficient institutions in the sample. This evidence contradicts the findings of Pastor et al. (1997). Efficiency scores of banks can be said to vary with time and depend on methodological approach.

Maudos et al. (2002) analyzed the cost and profit efficiency of European banks in ten countries for the period 1993- 1996. They used multiple regression analysis along with DEA and

split their sample into large, medium and small banks. Their results indicated that only medium sized banks were both cost and profit efficient. Lozano-Vivas, Pastor and Pastor (2002) examined banking efficiency in ten European countries in 1993 by adopting the value- added approach and analyzed the macroeconomic environment where the banks operated. Their results showed that banking efficiency was low in Europe during the year.

Furthermore, the banks in Italy and Netherlands were the only ones not capable of operating in a unified European banking system. Casu and Molyneux (2003) employed DEA to investigate whether the productivity efficiency of European banking systems had improved and converged towards a common European frontier between 1993 and 1997. The geographical coverage of the study was France, Germany, Italy, Spain and the United Kingdom. All data were reported in ECU as the reference currency. Their results indicated relatively low average efficiency levels. Nevertheless, a slight improvement was found in the average efficiency scores over the period of analysis for almost all banking systems in the sample, with the exception of Italy. Kwan and Eisenbeis (1996) examined the x-inefficiency in US banking firms and the relations of the X-inefficiency with the risk-taking and stock returns of the banks using SFA on 1986-1991 data. After controlling for scale differences, the average small size banks were found to be relatively less efficient than the average large banks. Smaller banks also exhibit higher variations in x-inefficiency than their larger counterparts. While on the average, x-inefficiency appears to be declining over time, the rank orderings of x-inefficiency were found to be quite persistent. Furthermore, less efficient banks were found to be associated with higher risk taking, and firm-specific x-inefficiencies are significantly correlated with individual stock returns for smaller banks.

Jemric and Vujcic (2002) estimated efficiency of banks in Croatia for the period 1995 to 2000, using DEA. They found that foreign-owned banks are on average most efficient, with the new banks being more efficient than the old ones, whereas in terms of global efficiency, smaller banks fared better. However, the large banks appear to be efficient when they allowed for variable returns to scale. They also found that there has been strong equalization in terms of average efficiency in the Croatian banking market, both between and within the peer groups of banks. On a different level, Cadet (2008) using SFA found foreign banks to be more cost efficient than domestic banks in developing countries.

Bwala (2003) investigated the relative operational efficiency of insured banks in Nigeria using TFA on quarterly data of the insured banks for 2000-2002. This analysis revealed that the least efficient banks' average costs were 262% more than those of the most efficient ones. While 92% of this difference was due to difference in the exogenous variables, the remaining 170% was due to inefficiency in the use of inputs (x-inefficiency).

Ekanem (2006) in his own study estimated nonhomothetic translog cost function for the banking industry in Nigeria using 1998-2005 annual data of four leading banks in Nigeria in the period under review, namely First Bank of Nigeria Plc, Union Bank of Nigeria Plc, United Bank for Africa Plc and Ecobank. His results revealed that capital and labour are complements; capital and total funds are substitutes and labour and total funds are also substitutes. The substitutability between capital and total funds confirms the existence of appropriate convexities in the use of the inputs.

Deny, Liu and Wu (2007) examined some of the shortcomings of extensively used DEA method of evaluating bank efficiency using supper-efficiency DEA on 14 Chinese commercial banks' input and output data in 1999- 2001. Their model overcomes the assumption of positive

input and output value inherent in DEA, that is, it takes into account the situation of negative input and output value. The model also enables researchers to rank all efficient units completely which DEA lacks. Their results showed that most of the banks in China were efficient except Guangdong Development Bank and Fijian Industrial Bank. They however found that there are scenarios the super- DEA model cannot explain. For instance, both the Industrial and Commercial Bank of China and Construction Bank of China were found to perform well and were both ranked the first on the list.

3.7.2 Determinants of Bank Efficiency

In the literature, efficiency of banks is usually expressed as a function of internal and external determinants. The internal determinants emanate from bank financial reports and are often called bank specific factors. Delis and Papanikolaou (2009) posited that they can also be called micro determinants of efficiency. The external determinants are variables that are not related to bank management but reflect the economic and legal environments that affect the operations and performance of financial institutions. The external variables are also referred to as the environmental variables. Coelli et al. (2005) define environmental variables as factors that could influence the efficiency of a firm, where such factors are not traditional inputs and are assumed not under the control of the manager. The external variables are sometimes distinguished from control variables that also describe the macroeconomic environment such as inflation, interest rates and gross domestic product and variables that represent market characteristics.[39]

A number of explanatory variables have been proposed for both internal and external determinants of efficiency according to the nature and purpose of each study. Coelli et al.

[39] External and control variables, here, mean almost the same thing but where such distinctions are made, the variables are classified. For instance, macroeconomic variables may be defined as control variables while external variables will be those that capture market characteristics.

suggested ownership differences, such as public/ private or corporate/ non-corporate, location characteristics, labour union power, and government regulations as some environmental determinants.

Studies dealing with internal determinants do employ variables such as size, capital, risk management or credit risk, market concentration, competition and market share.[40]

Delis and Papanikolaou (2009) adopted squared value of total assets for size, time dummy for reform periods on the basis of European Bank for Reconstruction and Development (EBRD) index of banking sector reform, credit risk, industry concentration, dummy for ownerships-public or foreign, investment to GDP ratio and short-time interest rate (to proxy the country specific macroeconomic and monetary conditions respectively) as the determining factors of bank efficiency in the newly acceded EU countries. Obafemi (2008) used ownership-public/ private, market share, quality of management, capital adequacy, capital-labour ratio and liquidity ratio as the determining factors of bank efficiency in Nigeria. On the other hand, Manlagnit and Lamberte (2004) adopted agency costs (proportion of fixed assets to total assets, in percentage, sufficiency of financial margin, in percentage); governance and bank performance (proportion of deposits to total liabilities, in percentage); and macroeconomic characteristics (banking density-population divided by number of commercial banks and real GDP growth rate, in percentage) as the efficiency correlates of banks in Philippi.

Drawing from the work of Fries and Taci (2005), Bonin et al. (2005), and Dietsch and Lozano-Vivas (2000), Košak and Zajc (2006) used numerous bank efficiency determinants. The determinants include country level variables (population density, financial deepening ratio); structure of banking industry (intermediation ratio, density of demand, Hirschman-Herfindahl index of market concentration, EBRD index of banking sector development, market share of

[40] Delis and Papanikolaou (2009) identified some of these variables.

state owned banks in each national banking market, proportion of foreign owned banks, population per bank in one thousands and total banking deposits per capita) and individual bank characteristics (ownership status of the individual bank, return on average equity, return on average assets and net interest margin). In the work of Fuentes and Vergara (2003), the determinants identified include ownership dummy-public or otherwise; Herfindahl index of market concentration (C4 and C12- share of the four and twelve largest number of shareholders respectively. This index is often used on total assets or deposits but here it is Herfindahl-property type, calculated over the entire group of shareholders for each bank);[41] market share and logarithm of interest earning assets (size); credit risk; logarithm of GDP (economic activity); foreign bank ownership dummy times size; public bank ownership dummy times size; foreign bank ownership dummy times risk; public bank ownership dummy times risk.

Suhaimi (2005) adopted IT stock expenditure; non-IT stock expenditure; number of ATM machines of the bank, efficient infrastructure (total expenditure on infrastructure, purchase of premises, building, IT and non-IT capital stock/ total assets); training expenditure, bank size; number of labour and total capital as K-economy determinants of cost efficiency. K-economy is defined as an economy that is based on knowledge or economy that is directly based on production, distribution and utilization of knowledge and information (OECD, 1996). Among the critical factors that contribute to the development of K-economy and act as indicators to the strengths and weaknesses of a country, are computer infrastructure, information structure, education and training, research and development (R&D), and technology (Suhaimi, 2005). Kiyota (2009) employed a lot of variables as efficiency determinants. These include funding

[41] This is also called geographic index that takes cognizance of variables such as shareholding, office, industrial, retail and leisure properties. Generally, Herfindahl index (HI), also known as concentration index, measures industry concentration. It is commonly used to support anti-trust claims. The index can be large or small, where a decrease indicates a loss in pricing power and/or increased competition in the industry while an increase suggests the opposite. It is also useful for scrutinizing merger and acquisition.

claims strategy (customer deposits/ loans + other earning assets); agency cost (fixed assets/ total assets); leverage ratio comprising deposits and short-term funding/ equity; lending rates (interest revenue/ average loan amount); deposit rates (interest expenses/ average deposit amount); natural logarithm of total assets; interest margin/ total assets; loan loss provisions/ total assets; equity/ total assets; net loans/ total assets; net interest expenses/ total assets; real GDP growth rate; governance indicator (rule of law whose score ranges from -2.5 to 2.5); real GDP per capita growth; domestic credit to private sector (% of GDP) and money and quasi money (M_2) as percentage of GDP.

3.7.3 Productivity and Productivity Change of Banks

. Several research efforts have employed Linear Programming method to measure changes in productivity or performance. This method is non-stochastic and does not allow for random error. The productivity changes are based on quantities of outputs and inputs without regard to prices, so there is no way to determine whether banks become more or less productive in an economic sense or respond more or less appropriately to market price signals. However, productivity change components may be useful for corporate decision and policy making.

Berg, Forsund and Jansen (1992) introduced the Malmquist Index as a measurement of productivity change in banking industry. They investigated the productivity change of the Norwegian banking industry during the deregulation period 1980-1989. Their results indicated that deregulation led to a more competitive environment. The increase in productivity was faster for larger banks, due to the increased antagonism they faced. Similar findings were reported by Lee et al. (2008) for banks in Singapore. Adopting the Malmquist DEA, they found some levels of total productivity growth associated with deregulation and scale efficiency improvement largely from merger amongst the local banks. In United States, Bauer, Berger and Humphrey

(1993) used a panel data set of 683 banks in the country with over $100 million in assets to estimate total factor cost productivity growth for the best- practice banks during 1977-1988. Over the period, their estimates ranged from an average annual growth rate of -2.28% to 0.16%. The poor productivity growth was attributed to higher costs of funding due to high market rates, elimination of deposit rate ceilings, and increased competition from non-bank financial intermediaries, which increased demand for funds and reduced the supply of deposits. Hence the banks increased the number of branches over the 1980s, in addition to paying higher deposit rates and providing the ATM innovation. The increase in deposit rates, increase in non-bank competition, and better convenience all made consumers of bank services better off, but because quality of service is difficult to account for in the estimation, the higher quality showed up as a decrease in productivity. Humphrey (1993) used the same data set to investigate the effect of shifts in cost function on costs from 1977 -1988. Measures were derived in three ways: from a simple time trend; from a time-specific index; and from annual shifts in cross-section cost functions. All the three methods yielded similar estimates, with shifts in the cost function implying cost increases averaging 0.8% to 1.4 % per year, and small banks (with assets of $100-$200 million) experiencing larger increases on average than large banks. Humphrey attributed the decline in cost productivity to deregulation of deposit rates. In support of this hypothesis, he found that in the pre-deregulation period (1977-1980) productivity increased, while during deregulation (1981-1982), productivity declined substantially, and in the post deregulation period ((1983-88), it showed little change.

Devaney and Weber (1996) investigated whether the market structure of U.S. rural banking markets affected the bank's productivity growth over 1990-1993. They used Linear Programming to calculate Malmquist productivity index, which decomposes productivity

changes into changes in efficiency, shifts in the production function and changes in the scale of operations. They found positive productivity growth at rural banks over 1990-93. Shifts in the production frontier were the driving force for their productivity growth. Wheelock and Wilson (1996) also used the Linear Programming approach to investigate bank productivity growth in USA. Change in productivity was decomposed into change in efficiency and frontier shifts components. They found that larger banks (assets over $300 million) experienced productivity growth over 1984-1993, while smaller banks experienced a decline. In the study, average inefficiency remained high in the industry, since banks were not able to adapt quickly to changes in technology, regulation, and competitive conditions.

Schure, Wagenvoort and O'Brien (2004) estimated the productivity of the European banking sector for the period 1993-1997. They found that larger commercial banks were more productive on average than smaller banks. However, Italian and the Spanish banks were found to be the least efficient. On the contrary, using the Malmquist Index, Pasiouras and Sifodaskalakis (2007) found total factor productivity (TFP) growth to be higher for smaller banks on average, although the difference is not significant compared with other groups. Also, they found that intermediate approach results indicate a small decrease (3%) in TFP whereas the production approach indicates an increase by 6.6% using dataset of 78 observations from 13 cooperative banks in Greece over the period 2000-2005. On the other hand, Casu, Girardone and Molyneux (2004), in an efficiency analysis of the European banking institutions for the period 1994-2000, found that Italian banks had an 8.9% productivity increase; Spanish banks had a 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 productivity of the Italian and Spanish banks was the cost reduction that these institutions managed to achieve.

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. They applied DEA to estimate the relative efficiency of commercial banks of different geographical areas (North America, Japan and Europe). The European banks were those 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, non-interest income plus other operating income. In parallel, the four input variables were property, salaries, other operating expenses and total deposits. All these values were expressed in billions of US dollars. Their results showed that commercial bank productivity across the world had grown significantly (19.6%) from 1989 to 1998. This outcome was principally due to relative efficiency improvement, with technological progress having a very moderate effect. Additionally, Sufian et al. (2007) adopted the Malmquist DEA and found that in the productivity change components, pure technical efficiency is more related to overall efficiency than scale efficiency in Malaysia.

3.7.4 Economies of Scale of Banks

Most of the previous researchers did not study scale efficiency of banks in isolation of other related issues. For instance, Rao (2002) estimated cost inefficiency, scale and scope economies and cost productivity growth rates of banks in United Arab Emirates (UAE) during 1998 (a bad year for the banks due to lower oil price) and 2000 (a good year for the banks as the oil prices were higher), using SFA. The sample adopted comprised of 35 banks, which constituted 81% of total bank assets in 1998 and 2000. Flexible Fourier (FF) and Translog cost functional forms were specified for estimation purposes. The translog form overestimated cost

inefficiency by 10 to 19% in the two years compared to FF form. The study provided evidence that substantial cost inefficiencies existed in UAE banks. Average small banks improved their scale economies in 2000, while large banks maintained constant returns to scale. The small–size banks performed well and improved their cost efficiency during the two periods, than large- size banks. There existed substantial scope economies in the UAE banks in 2000 relative to 1998. Cost productivity rate of average banks increased by 24% (when compared with the best-practice banks).In the same vein, Kasman (2002) evaluated the cost efficiency, scale economies and technological progress in Turkish banking for the period 1988-1998 using SFA. The Fourier-Flexible non parametric form of the cost function was used to characterize the efficient frontier for the Turkish commercial banks. The study showed that the Turkish banking system has a significant inefficiency problem. Although the average annual inefficiency decreased over the sampled period due to the financial liberalization, commercial banks in the sector operated more inefficiently than their US and European counterparts. The results suggested the existence of significant economies of scale for all groups in the sample and no evidence of diseconomies of scale even for larger banks. The results also indicated the existence of technological progress between 1988 and 1991.

Also, Maggi and Rossi (2003) investigated the efficiency of European and U.S Commercial banks over the period 1995-1998 using DFA and SFA. Scale and scope economies indicators, as well as measurement of x-efficiency were obtained from three cost functions: Fourier Flexible form, Translog and Box-Cox. The essence of the three cost functions specification was to check the stability and robustness of the evidence. In overall, the results showed substantial inefficiency in both European and U.S. commercial banks with some evidence of scale and scope economies. Box-Cox and translog cost function tend to behave in

similar manner as they both overestimated inefficiency. Box-Cox cost function however overestimated efficiency value more than the translog cost function. For Europe, they found an average inefficiency level of 32 per cent with the translog, 36 per cent with the Fourier Flexible, and 20 per cent with the Box-Cox specification. The cost inefficiency results for U.S. commercial banks suggest that the Box-Cox specification, as in the European case, overestimated the efficiency scores. Based on the Ramsey test conducted by the authors, they found the Fourier Flexible for U.S banks approximating the true function better than the other functional forms; hence their findings on scale economies were based on Fourier Flexible estimates.

Tachibanaki (1991) estimated a two output translog cost function using a sample of 61 Japanese banks. The authors found evidence of economies of scale for all sizes of banks in all three years of study. The proxies of outputs in this study were revenues produced by earning assets. It is therefore possible that these revenues-based measures of output may have been influenced by market power with respect to the setting of output prices. However, 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 US) 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 measures. Moreover, small banks in all the countries studied showed significant levels of economies of scale. Italian banks, along with French, UK and U.S.

ones were found less efficient compared with Japanese, Austrian, German, Danish, Swedish and Canadian 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 the four markets regarding economies of scale. But Italian banks have significant scale economies as a result of their success in lowering costs. Besides, Altunbas et. al. (2000) used the Fourier/translog cost function to investigate scale economies and x-efficiency in Japanese banking. They used a three-input three output model. The inputs include labour, capital and total funds. The outputs comprise total loans, total securities and off balance sheet items. The authors also tested for the impact of risk and quality factors on costs, scale economies and x-efficiency. The ratio of loan-loss provisions to total loans, financial capital, and ratio of liquid assets to total asset were included. Their data sample consists of 136 Japanese banks, covering the period 1993-1996. Their results show that economies of scale in the banking industry in Japan tended to be overstated when risk and quality factors are not incorporated.

Allen and Liu (2005) estimated scale economies of Canada's six largest banks and their cost efficiency for 1983-2003. They estimated pooled translog cost functions and incorporated technological and regulatory changes in the banks' cost functions, as well as time-varying bank-specific effects. They found that the banks have experienced technological progress and that regulatory changes have helped to reduce the production cost of banks. The banks could enjoy economies of scale of 6 to 20 per cent. Using SFA, the inefficiency of Canadian banks was about 10 per cent. The ranking of efficiency also suggested that larger banks seem to be more cost-efficient than smaller banks. In Nigeria, Osota (1995) examined the scale and scope economies of 63 sampled commercial banks in the country in 1994 using translog cost function specification

and found evidence of considerable scale economies across all categories of Nigerian commercial banks. But these economies were found to diminish with increases in bank size. His results also show that product diversification has cost-saving advantage for the banks, that is, economies of scope exist.

Sufian et al. (2007) also adopted the DEA to examine efficiency changes of finance and merchant banking institutions in Malaysia during and after consolidation periods and found that on average, 28.75% of finance and merchant banking institutions were operating at constant returns to scale; that is, scale efficient, while the majority of the banks were scale inefficient. Lee et al. (2008) however found scale efficiency improvement to emanate largely from merger among local banks in Singapore.

3.7.5 Effects of Consolidation on Efficiency and Productivity of Banks

Bank consolidation can be promoted by the individual bank or by the policy of the regulators.[42] Individual firm promoted consolidation is undertaken at the behest of the individual firm which involves raising capital internally or on the Stock Exchange if the firm is quoted on the Stock Exchange or engagement in a merger or acquisition, to enlarge its business and achieve other management objectives without any government policy inducement to that effect. Consolidation occasioned by policy sets the minimum capital criterion for banks as this has become a powerful measure for the government to promote consolidation. It is in this regard Sawada and Okazaki (2003) posited that if a voluntary consolidation does not enhance the performance of the participant banks, any performance enhancing effect of consolidation promoted by government policy is more questionable.

[42] Consolidation promoted by individual bank is always market induced. However, changes in the banking market can also prompt government to consider a policy-induced consolidation.

In the literature, the impacts of consolidation on firm level efficiency and productivity have been examined using three basic approaches. The first approach compares the operating performance (such as efficiency ratios, profitability, x-efficiency or cost efficiency, scale economies and scale efficiency as well as productivity changes) of the firms during and after consolidation.

Calomiries (1999) found that panel or cross-sectional analysis of banks may not be a very reliable measure of cost or economic efficiency during consolidation, hence greater emphasis should be placed on cross-regime comparisons to obtain accurate measures of efficiency gains during bank merger waves. In the light of this, Kadir et al. (2011) employed DEA to investigate the long-term effects of bank consolidation program on efficiency of banks in Malaysia over the period 1993-1999. Their study showed that, on average, consolidation impacts more on technical efficiency than scale efficiency because there was higher improvement in technical efficiency than in scale efficiency after consolidation. The second method assesses the impacts of size on cost efficiency which also covers economies of scale. Fiorentino et al. (2009), however, ran regression of dummy for merger (as a proxy for consolidation) on total factor productivity change indices obtained from SFA to investigate the effects of consolidation on productivity of banks in Italy and Germany. Their study found increase in productivity through consolidation. The third measures the efficiency gains on the basis of stock market performance for firms listed on the stock exchange. A firm is thought to be doing well when its shares outperform a given benchmark (the industry average or an index of firms of comparable size). The overall efficiency gains from a consolidation using this last approach are evaluated in terms of the sum of the market values of the bidder and the target. If the sum increases, the deal is supposed to create value, and vice versa, if it decreases. For instance, Somoye (2008) used bank market

capitalization on the Nigerian Stock Exchange (NSE) among other variables to conclude that the 2004/2005 consolidation in Nigeria has not significantly improved the overall performance of the banks.

While the balance of evidence suggests that in the absence of strongly concentrated banking markets, consolidation leads to welfare gains for clients, evidence of efficiency gains within consolidated banks seem to be much less clear-cut (Walkner and Raes, 2005). In a meta-examination, Rhoades (1994) considered thirty-nine empirical studies of bank consolidation and efficiency that were undertaken between 1980 and 1993. About half of the studies used an "operating performance" approach, observing the financial performance of banks following a merger or acquisition. The other half comprises "event studies", measuring the reaction of stock prices of acquirer and target banks, subsequent to a merger or acquisition announcement. The findings of the operating-performance studies pointed to a lack of improvement in bank efficiency or profitability as a result of mergers, while results of the event studies failed to find rising stock prices-when prices of bidders and targets are combined in response to mergers.

Pilloff and Santomero (1997) also found insignificant post-merger gains, either in share value gains or in an improvement in performance indicators as derived from accounting data. Investigating bank consolidation benefits for various industrialized countries, Amel et al. (2002) found economies of scale mainly for mergers and acquisition involving smaller banks, while convincing evidence for economies of scope or gains in managerial efficiency was not found. More recently, Sufian and Majid (2007) did not find evidence of more efficient acquirers compared to the targets and the acquiring banks' mean overall efficiency tended to improve from the merger with more efficient bank. Similarly, Huizinga et al. (2001) found that cost efficiency

improves for consolidating banks, both large and small bank mergers, often especially pronounced even when both banks portray poor pre-merger cost efficiency.

Any absence of efficiency gains from bank consolidation may be explained by various efficiency barriers in bank mergers and acquisitions. In respect of cross-border EU merger and acquisitions, Vander (2002) revealed that the typical problem is often characterized by the takeover of a poorly performing bank by a relatively efficient foreign bank. The paper found evidence of an increase in realized profits, but not in operational efficiency, at least in the short term. According to the author, different legal and tax systems, which prevent the full exploitation of synergies in cross-border bank consolidation may be responsible for the findings. In addendum, Walkner and Raes (2005) concluded that lack of progress in cross-border integration can be attributed to various factors, including national differences in market practices, regulation and taxation.

Away from cross-border integration, Berger et al.(1999) point out that the reason why cost efficiency was not improved by consolidation in the 1980s was that the gains of the consolidation were offset by coordination costs such as difficulty in managing large organizations, conflicts between different corporate cultures, and problems in integrating systems. According to Hughes et al. (2003), the key for successful banking mergers is efficient bank corporate governance structures. Their analysis finds that an increase in acquired assets improves the financial performance of banks with less entrenched management. On the other hand, an increase in acquired assets tends to worsen performance of banks with a more entrenched management, which may prefer to "build empires" rather than seek the most valuable acquisitions. The analysis suggests that acquisitions might allow an entrenched management to increase its consumption of agency goods (defined as perks) and also to avoid effort and risk.

The authors explain their result by suggesting that managers owning banks are better able to resist the pressure of market discipline, while a large share of outside owners can have an incentive to monitor management performance more sternly. Nature of accounting rules and measurement problems are other impediments to efficiency gains from consolidation. On account of measurement bottleneck, Haynes and Thompson (1999) using Cobb-Douglas production function method, found evidence of productivity gains from consolidation of building society banks, whereby the effect steadily increased over a period of six or more years subsequent to an acquisition. This is explained by the gradual dismissal of initial retained staff, which had received employment assurances for an immediate post-acquisition period. This observation shows also that a short-term oriented assessment such as is possibly reflected in share price changes might not always take longer term efficiency impacts into consideration. Similarly, Harata and Indo (2005) using DEA to analyze bank consolidation and efficiency of the Indonesian banking sector found that the measures of inefficiency and total factor productivity in the industry confirmed a recovery trend after the consolidation. The recovery was from the damage suffered by Indonesia during the Asian currency crisis of 1997-1998.

Banking mergers can also improve the sector's overall efficiency and resilience to economic shocks (Walkner and Raes, 2005). Beck et al. (2003) examined banks in 70 countries from 1980-1997 and found a higher resilience to economic shocks in more consolidated banking systems with better diversified banks, which were also easier to monitor. On the other hand, too concentrated banking system might be subject to other forms of idiosyncratic risks undermining the financial system such as in the case of scandals or fraud.

One area where consolidation can clearly bring efficiency gains is in the elimination of excess capacity, particularly as the alternative method is through bank defaults (Walkner and

Raes, 2005). As DeYoung and Whalen (1994) found, if failed banks are significantly less efficient than their peers, consolidation can be a means to eliminate relatively inefficient banks.

3.8 Summary of the Empirical Literature and the Observed Lacuna

Past studies on determination of efficiency level of banks have revealed about 0-25 per cent inefficiency score in the sector. Enquiries into question as to whether large, medium or small bank is the most efficient have continued to yield mixed results. This could be majorly attributed to the subjective classification of banks by individual researchers. Similarly, outcomes on whether bank efficiency rises or decline during period of deregulation remain mixed. So, evaluation of deregulation pattern of each country and its impacts on bank efficiency becomes necessary. Most studies have revealed foreign banks to be more efficient than domestic banks. However, domestic banks in developed countries have been found by most studies to be more efficient than the foreign banks, especially banks from the developing world which were unable to bring international best practices to bear on their operations. Cross country analysis of bank efficiency has also yielded ambiguous results. In our opinion, the ambiguity of cross country or even country specific analytical results are largely due to operational challenges in each bank and this points to the need for researchers to understand the management style and operational patterns of each bank over time so as to draw reasonable conclusion. This study noticed that parametric analytical techniques of efficiency are better than non-parametric analytical techniques in the cross country analysis because control variables can be used.

Also, researchers have continued to identify new factors influencing bank efficiency. This study has studied impacts of additional two new factors (bank listing on the Stock Exchange and universal banking policy) on bank efficiency.

Researchers have continued to work on the analytical techniques, both parametric and non-parametric so as to improve them. Some improvements have been made, for instance, in the use of Super-efficiency DEA in overcoming non-negativity assumption of input and output in DEA. However, this method cannot be used to distinctively rank firms that have almost the same performance. Therefore, more research efforts are still required in this area.

Only very small research works have been done on efficiency of banks in pre, during and post-consolidation periods. This is one pertinent lacuna that this study has sought to breach. This study also evaluated net assets as against total assets that is often used to classify bank size. Empirical evidence on inclusion of equity and equity price in the well-favoured financial intermediation model for estimating cost efficiency was also investigated.

Previous empirical works on productivity changes of banks have shown productivity declines of about 5 per cent and productivity growth of 25 per cent, on average. Findings on impacts of deregulation on productivity of banks, whether large or small banks are the most productive, and as to the question of which of the productivity indices is more related to overall productivity, have remained mixed. This present study has advanced knowledge not only in analyzing impacts of consolidation on productivity of banks (using "operating performance" approach) as well as productivity change differences among foreign and domestic banks in Nigeria but also add to the stock of the scanty literature in this field of study.

Studies have found significant level of economies of scale in banks. In order to avoid overshooting scale economies in the banking industry, Altunbas et al. (2000) have pointed out the need for incorporating risks and quality factors in the variable set. This is why this study adopted performing loans and advances as part of the output variables instead of total loans and advances used by some researchers, which is less qualitative. In addition, this study examined

trend of scale economies of DMBs over pre, during and post-consolidation periods to provide preliminary knowledge on the subject matter and bridge the gap in the literature.

CHAPTER FOUR

THEORETICAL FRAMEWORK AND METHODOLOGY

4.1 Introduction

This section provides the theoretical framework and examines model specification including variables definition, estimation technique, sources of data, sample characteristics and classification of sample by size.

4.2 Theoretical Framework

Among the theories explaining efficiency and productivity change of firms and the choice of inputs and outputs for analyzing efficiency and productivity change of banks that are identified in the literature, Coelli et al. (2005) approach and modified intermediation theory of Drake (2003) respectively appear to be the most comprehensive, systematic and relevant to our study. Their works form our theoretical background for analyzing efficiency and productivity change in deposit money banks in Nigeria.

The modified intermediation theory of Drake (2003) is a revision of financial intermediation theory. It is based on application of production function in economics to the operations of a bank. The core business of banking is the mobilization of deposits from the surplus units and the passing on of the sourced funds to the deficit (needy) units in form of loans and advances, termed intermediation theory. Therefore, deposit is the major input while loans and advances are the major outputs. The modified intermediation adds labour and total shareholders' fund to the input set while liquid assets and investments are added to the output set.[43] By expanding the modified intermediation method in this study, performing loans and advances, investments and liquid assets form the outputs; deposits, labour, fixed assets and equity capital are inputs; interest paid on deposits and other funds, personnel expenses,

[43] See Coelli et al. (2005) for measurement of inputs and outputs in monetary terms. Drake (2003) provides foundation for modifying intermediation theory.

depreciation of fixed assets and earnings per share are price of the inputs respectively. The loans and advances adopted here were those performing because of the huge bad debts in Nigerian banking system. The results of the unexpanded model in which equity capital and earnings per share are not inclusive are compared with those of the expanded model to find out whether there would be significant efficiency difference.

The simple neoclassical production function adapted for banks specifies a relationship between inputs and outputs, where q_i is producible outputs and x_i is input factors as shown in (4.1) below

$q_i = f(x_i)$ ..... (4.1)[44] ; i =1,……, n

4.2.1 Efficiency of Deposit Money Banks

The input-oriented measure of technical efficiency (TE) of a bank can be expressed in terms of input-distance function x_i $d_i(x_i, q_i)$ as:

TE = 1/ $d_i(x_i, q_i)$ …….. (4.2)

The bank is technically efficient if it is on the frontier, in which case TE= 1 and $d_i(x_i, q_i)$ is also equal to 1. The deposits are mobilized at a cost to the bank and this is often called interest. With price data available, both allocative and technical efficiency can be measured to obtain cost efficiency. If we assume p_i represents the vector of input prices, x_i represents the observed vector of inputs associated with point x_i^ and x_i* represent the input vector associated with the technically efficient point K and the cost-minimizing input vector at K′ respectively in figure 4.1; then the cost efficiency (CE) of the bank is defined as the ratio of input costs associated with input vectors, x and x*, associated with points, W and K′ in figure 4.1

[44] Imposition of an explicit functional form for the technology and inefficiency terms is not required for using non-parametric approach which this study adopts. (See Seinford and Thrall, 1990)

$CE = p_i' x_i^* / p_i' x_i = 0T / 0W$ …… (4.3)

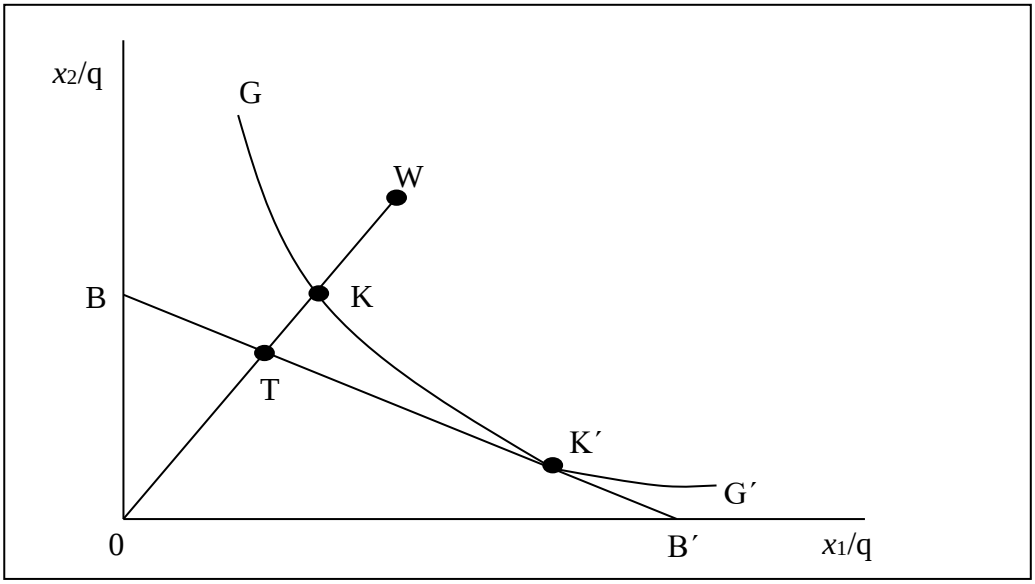


Figure 4.1: Technical, Allocative and Cost Efficiencies
Source: Coelli et al. (2005) with Symbolic Modification by Author

If the input price ratio represented by the slope of the isocost line, BB′, in figure 4.1, is also known, then allocative efficiency (AE) and technical efficiency measures can be computed using the isocost line as shown in equations (4. 4) and (4.5)

$AE = p_i' x_i^* / p_i' x_i \wedge = 0T / 0K$ …… (4.4)

$TE = p_i' x_i \wedge / p_i' x_i = 0K / 0W$ …… (4.5)

These equations follow from the observation that the distance TK represents the reduction in production costs that would occur if production were to occur at the allocatively (and technically) efficient point K′, instead of at the technically efficient, but allocatively inefficient point K.

The product of technical and allocative efficiency gives the cost efficiency. Thus, equation (4.3) can be re-written as

$CE = TE \times AE = (0K/0W) \times (0T/0K) = (0T/0W)$ …… (4.6)

All these three measure (that is, CE, TE and AE) are bounded by zero and one.[45]

Figure 4.1 is based on constant returns to scale technology; one output and two inputs assumption to enable us draw a 2-dimension graph. By adopting the non-constant returns to scale, figure 4.1 could be adjusted by changing the axes labels to x_1 and x_2 and assuming that the isoquant represents the lower bound of the input set associated with the production of a particular level of output. The efficiency measures are then defined analogously to those above.

Assuming a technically inefficient bank operating at point F in figure 4.2, scale efficiency can be computed adopting an input orientation[46]. Productivity of bank F (as reflected in the slope of the ray from the origin) could be improved by moving from point F to L on the VRS frontier (that is, removing technical inefficiency), and it could be further improved by moving from point L to point C (that is, eliminating scale inefficiency). The ratio of the slope of the ray 0F to the slope of the ray 0L is equal to the ratio of IL/IF, and the ratio of the slope of the ray 0L to the slope of ray 0H (which also equals to the slope of ray 0C) is equal to the ratio IH/IL. Thus, these productivity differences can be computed using distance measures. That is, the technical efficiency of bank F relates to the distance from the observed data point to the VRS technology and is equal to the ratio in equation (4.7).

[45] This result means that cost efficiency is always less than or equal to technical efficiency.
[46] An output-oriented scale efficiency measure can be defined in similar manner.

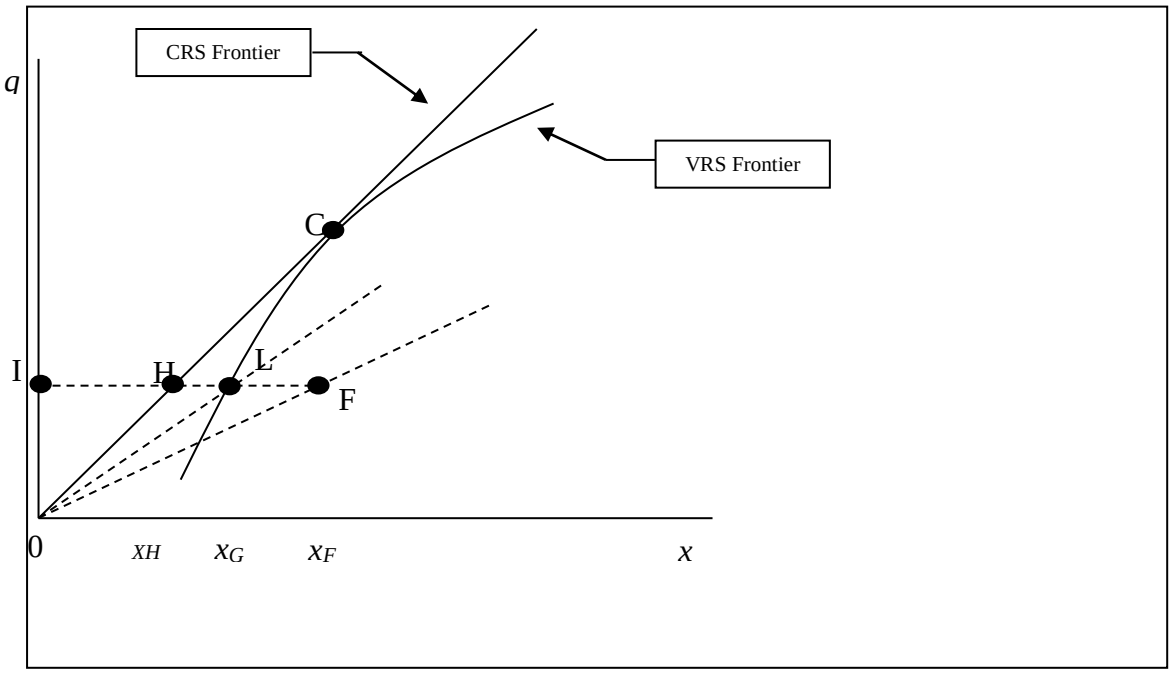


Figure 4.2: Scale efficiency

Source: Coelli et al. (2005) with Symbolic Modification by Author

$TE_{VRS} = IL/IF$ …… (4.7)

Besides, the scale efficiency (SE) of bank F relates to the distance from the technically efficient data point, L, to the constant returns to scale (CRS) or cone technology and is equal to

SE =IH/IL …… (4.8)

In DEA literature, the SE measure is usually not obtained directly, but is computed indirectly by noting the distance from the observed data point to the CRS technology (which is often called a "CRS TE score")

TE_{CRS}=IH/IF …… (4.9)

Equation (4.9) can be adopted to compute the SE score residually as

SE = TE_{CRS} / TE_{VRS} = (IH/IF)/ (IL/IF) =IH/IL …… (4.10)

Following Fare, Grosskopf and Roos (1998), Coelli et al (2005) define an input-oriented measure of scale efficiency for a firm (bank in this case) operating at a given input vector, x_i, and an output vector, q_i as:

$SE(x_i, q_i) = d_i(x_i, q_i \,|VRS) / d_i(x_i, q_i \,|CRS) = TE_{CRS} / TE_{VRS}$ …….. (4.11)

4.2.2 Productivity of Deposit Money Banks

Adopting the output oriented method, total factor productivity (TFP) change can be decomposed into four sources. Based on CRS technology, TFP change is decomposed into efficiency change and technical change as:

Efficiency change = $d^t_0(q_t,x_t)/ d^s_0(q_sx_s)$ …… (4.12)

And

Technical change = $[d^s_0(q_t,x_t)/ d^t_0(q_tx_t) \times d^s_0(q_s,x_s)/ d^t_0(q_sx_s)]^{0.5}$ …… (4.13)

Where period t is the current period and period s is the base period. The output distance is measured in terms of CRS reference technology that is common to both periods. The value of TFP change greater than 1 connotes TFP growth from period s to period t while a value less than 1 shows a TFP decline.

Adopting VRS technology as the reference common technology to the two periods, TFP change can further be broken down into pure efficiency change in equation (4.14) and scale efficiency change in equation (4.15). The pure technical efficiency is assumed to involve the ratio of two CRS distance functions (measured relative to the arguably true VRS frontier). For scale efficiency change, both CRS and VRS reference technologies are needed.

Pure efficiency change= $d^t_{0v}(q_t,x_t)/ d^s_{0v}(q_sx_s)$ …… (4.14)

Scale efficiency change = $d^t_{0c}(q_t,x_t)/ d^s_{0c}(q_s x_s) \div d^t_{0v}(q_t,x_t)/d^s_{0v}(q_s,x_s)$ …… (4.15)

4.3 Model Specification[47]

This study adopts a non-parametric approach, Data Envelopment Analysis modeling because of the few data points, especially given the categorization of the banks into large, medium and small sizes.

By assumption, there are **N** inputs and **M** outputs for each of **I** banks. For the i-th bank, these are represented by the column vector x_i and q_i, respectively. The **N × I** input matrix, **X,** and the **M × I** output matrix, **Q**, represent the data for all **I** banks.

4.3.1 Technical Efficiency/ Inefficiency

Using the duality in Linear Programming, an envelopment form of the DEA model can be derived:[48]

Min $_{ø,\lambda}$ Ø,

Subject to $-q_i + Q\lambda \geq 0$,

$Øx_i - X\lambda \geq 0$, ……(4.16)[49]

$\lambda \geq 0$,

Where Ø is a scalar and λ is a I × 1 vector of constants. The value of Ø obtained is the efficiency score for the i-th bank. It satisfies $Ø \leq 1$, with a value of 1 indicating a point on the frontier and hence a technically efficient bank (Farrel, 1957, Coelli et al., 2005). All non-parametric methods including DEA use ranked or weighted data. Here, λ is used for ranking the

[47] The model specification on DEA here draws largely from the work of Coelli et al. (2005)
[48] Ratio and multiplier formulation can also be used but the envelopment form is preferable because it has infinite number of solutions whereas the former involves more constraints than the latter.
[49] For the i-th bank, the measured output slacks are equal to zero if $Q\lambda - q_i = 0$ and the measured input slacks are equal to zero if $Øx_i - X\lambda = 0$ (for the given optimal values of Ø and λ)

data set; $Q\lambda$ is projected output vector; $X\lambda$ stands for the projected input vector; and $Øx_i$ is the efficient or minimized input for producing a given output. [50]

The production technology associated with our Linear Programming specification in equation (4.16) can be defined as $H = \{ (x, q) : q \leq Q\lambda, x \geq X\lambda \}$. Fare et al.(1994) show that this kind of technology defines a production set that is closed and convex, and exhibits constant returns to scale and strong disposability.[51] Therefore, we consider DEA models that correspond to production technologies having less restrictive properties. That is, the Constants Return to Scale (CRS) Linear Programming problem is modified to account for Variable Returns to Scale (VRS) by adding the convexity constraint: $I1'\lambda = 1$ to equation (4.16) to form :

$$\begin{aligned} &\text{Min}_{ø,\lambda}\ Ø, \\ &\text{Subject to } -q_i + Q\lambda \geq 0 , \\ &\qquad Øx_i - X\lambda \geq 0 , \qquad (4.17) \\ &\qquad I1'\lambda = 1, \text{ (where I1 is an } I \times 1 \text{ vector of ones)} \\ &\qquad \lambda \geq 0 , \end{aligned}$$

This approach forms a convex hull of intersecting facet that envelope the data points more tightly than the CRS conical hull and thus provides technical efficiency scores that are greater than or equal to those obtainable using the CRS model. The convexity constraint ($I1'\lambda = 1$) essentially ensures that an inefficient bank is only "benchmarked" against banks of similar size. This convexity restriction is not imposed in CRS case. Hence, the interpretation of technical efficiency/ inefficiency is done within the scope of CRS case. In CRS DEA, a bank may be

50 'Min' is used because of the input oriented approach that is adopted. Inputs are minimized given the output level to obtain an efficiency score.

51 The assumption of strong disposability means that a firm can always costlessly dispose off unwanted inputs (and outputs)

benchmarked against banks that are substantially larger (smaller) than it. In this instance, the λ-weights sum to a value less than (greater than) one.

4.3.2 Scale Efficiency/Inefficiency

The next stage involves estimating the scale efficiency of the banks. A difference in CRS and VRS technical efficiency (TE) scores indicates the presence of scale inefficiency. In order to determine whether the bank is operating at constant returns to scale (scale efficient point) , increasing returns to scale (economies of scale) or decreasing returns to scale (diseconomies of scale), an additional DEA problem with non-increasing returns to scale (NIRS) is imposed, as in equation (4.18)[52]:

$$\begin{aligned} &\text{Min}_{\o,\lambda}\ \text{Ø}, \\ &\text{Subject to } -q_i + Q\lambda \geq 0 , \\ &\qquad \text{Ø}x_i - X\lambda \geq 0 , \qquad \text{(4.18)} \\ &\qquad I1'\lambda \leq 1 \\ &\qquad \lambda \geq 0 , \end{aligned}$$

The difference between equations (4.17) and (4.18) is that $I1'\lambda = 1$ restriction in equation (4.17) is now substituted with $I1'\lambda \leq 1$, which ensures that the i-th bank is not “benchmarked” against banks that are substantially larger than it, but may be compared with banks smaller than it.

[52] If NIRS TE equals VRS TE, the bank is operating under DRS and if the two are not equal, the bank’s economies of scale is IRS. However, if CRS TE = VRS TE, the bank’s operation is CRS (See Coelli et al., 2005 for more explanations)

4.3.3 X-efficiency or Cost Efficiency

By considering a CRS cost minimization, the input-oriented DEA model, defined in equation (4.16) is conducted to obtain technical efficiency. The next step requires the solution of the following cost minimization DEA:

$\text{Min}_{\lambda, x_{i^*}} \quad p_i' x_{i^*}$

Subject to $-q_i + Q\lambda \geq 0$,

$x_{i^*} - X\lambda \geq 0$, ……………………………………………………. (4.19)

$\lambda \geq 0$,

Where p_i is a N × 1 vector of input prices for the i-th bank and x_{i^*} (which is calculated by the LP) is the cost-minimizing vector of input quantities for the i-th bank, given the input prices Pi and the output levels q_i, and all other notations are as previously defined under equation (4.16)

The total cost efficiency (CE) of the i-th bank is calculated as

$CE = \quad p_i' x_{i^*} / p_i' x_i$ …………………………………………………..(4.20)

Equation (4.20) implies that cost efficiency is the ratio of minimum cost to observed cost, for the i-th bank.

4.3.4 Allocative Efficiency

The (input-mix) allocative efficiency (AE) is then calculated residually as

AE = CE/ TE[53] ………………………………………………………(4.21)

The procedure implicitly includes any slacks in the allocative efficiency measure. This is often justified on the grounds that the slacks reflect inappropriate input mixes (Ferrier and Lovell, 1990).

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[53] These three measures (TE, AE and CE) can take values ranging from 0 to 1, where a value of 1 connotes full efficiency. Cost efficiency is the product of allocative and technical efficiency.

4.3.5 Productivity Change

Productivity change is decomposed into six models, which are specified in equations (4.22) to (4.27) in which total factor productivity (TFP) change is broken down into four components. First, based on Constant Returns to Scale (CRS) technology, TFP change is broken down into two: technical efficiency change in equations (4.22) and (4.23) and technological change in equations (4.24) and (4.25). Using VRS technology, technical efficiency change helps us obtain scale efficiency change (CRS technical efficiency change/ VRS technical efficiency change) in equation (4.26) and pure efficiency change in equation (4.27).[54] Both time series and cross-sectional data are pooled together for estimation given the adoption of duality in Linear Programming. By using output oriented approach, the outputs are maximized given the input level to obtain the TFP change indices.

$$\{d_o^t(q_t, x_t)\}^{-1} = \text{Max}_{\o,\lambda}\ \text{Ø},$$

$$\text{Subject to} \quad -\text{Ø}q_{it} + Q_t\lambda \geq 0,$$

$$x_{it} - X_t\lambda \geq 0, \quad \ldots\ldots (4.22)$$

$$\lambda \geq 0,$$

$$\{d_o^s(q_s, x_s)\}^{-1} = \text{Max}_{\o,\lambda}\ \text{Ø},$$

$$\text{Subject to} \quad -\text{Ø}q_{is} + Q_s\lambda \geq 0,$$

$$x_{is} - X_s\lambda \geq 0, \quad \ldots\ldots (4.23)$$

$$\lambda \geq 0,$$

$$\{d_o^t(q_s, x_t)\}^{-1} = \text{Max}_{\o,\lambda}\ \text{Ø},$$

$$\text{Subject to} \quad -\text{Ø}q_{is} + Q_t\lambda \geq 0,$$

$$x_{is} - X_t\lambda \geq 0, \quad \ldots\ldots (4.24)$$

$$\lambda \geq 0,$$

[54] See Fare et al. (1994) and Coelli et al. (2005) for more information.

$\{d_o^s(q_t, x_t)\}^{-1} = \text{Max}_{ø,\lambda}\ Ø,$

Subject to $-Øq_{it} + Q_s\lambda \geq 0$,

$x_{it} - X_s\lambda \geq 0$, ……. (4.25)

$\lambda \geq 0$,

$\{d_o^t(q_t, x_t)\}^{-2} = \text{Max}_{ø,\lambda}\ Ø,$

Subject to $-Øq_{it} + Q_t\lambda \geq 0,$

$x_{it} - X_t\lambda \geq 0$, ……. (4.26)

$I1'\lambda = 1$

$\lambda \geq 0$,

And

$\{d_o^s(q_s, x_s)\}^{-2} = \text{Max}_{ø,\lambda}\ Ø,$

Subject to $-Øq_{is} + Q_s\lambda \geq 0$,

$x_{is} - X_s\lambda \geq 0$, ……. (4.27)

$I1'\lambda = 1$

$\lambda \geq 0$,

Where d_o, 't' and 's' represent distance of each data point relative to a common technology, current period and base period, respectively. All other notations are as previously defined. Movement terminates at the common or reference technology irrespective of whether **s** is the base period. The letter $\mathbf{d_o}$ shows the reference technology.[55] The CRS frontier was adopted

[55] For instance, the notation $do^s(q_t\ x_t)$ represents the distance from the period t observation to the period s technology.

because VRS frontier suffers computational difficulties when DEA-based distance functions are used due to infeasibilities in some inter-period VRS calculations.[56]

4.3.6 Differences Between Measured Mean Efficiency of Related Groups

The statistical significance of measured means efficiency of the pre-consolidation, consolidation and post-consolidation periods is tested using the Friedman's analysis of variance (ANOVA) test. This approach is a non-parametric ANOVA which was propounded by Friedman in 1937 (Field, 2009). Unlike parametric ANOVA, its adoption becomes necessary because of the few data points leading to small degree of freedom. While parametric ANOVA uses data assumed to have normal distribution, the Friedman's ANOVA ranks the data. Once the sum of ranks has been calculated for each group, the test statistic, F_r is computed as follows:

$$F_r = \left[\frac{12}{Nk(k+1)} \sum_{i=1}^{k} R_i^2 \right] - 3N(k+1) \qquad (4.28)$$

Where R_i is the sum of ranks of each group, N is the total sample size and k is the number of groups or conditions (in this case 3). When N is large, bigger than about 10, the test statistic has a chi-square distribution with the degree of freedom being k-1 (Field, 2009).

The paired-sample t test is adopted for testing the difference between measured mean efficiency of domestic and foreign banks. The null hypothesis is $\mu_1 = \mu_2$ implying $\mu_1 - \mu_2 = 0$, which means that the expected mean efficiency of both banks are the same. The test statistic, t is calculated as follows (Gosset, 1908);

$$\text{Paired Sample t} = \frac{\left(\bar{X}_1 - \bar{X}_2\right) - \left(\mu_1 - \mu_2\right)}{\sqrt{\left(\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}\right)}} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}} \qquad (4.29)$$

[56] VRS frontier has been proved to be internally consistent. However, there is ungoing controversy on whether CRS frontier is consistent or not but it has remained the most reliable technology (Coelli et al., 2005)

Where $\bar{X}_1$, $\bar{X}_2$ are measured mean efficiency of domestic and foreign banks, S_1^2, S_2^2 are computed variance of measured mean efficiency of domestic and foreign banks while N_1 and N_2 are the sample sizes of the banks.

4.3.7 Cost Efficiency Correlates

At least four basic methods have been described in the literature in explaining efficiency correlates (Coelli et al., 2005). The most popular method which accommodates both continuous and categorical variables is the two-stage method which involves solving a DEA problem in a first-stage analysis, involving only the traditional inputs X_i and outputs q_i. In the second stage, the efficiency scores (θ_i) for all banks i = 1,……..,n from the first stage are regressed upon the determining factors using censored (Tobit) regression. Simar and Wilson (2007) point out two major problems associated with estimates using this method. First, θ_s are serially correlated in a complicated and unknown way, since they depend on the inputs and outputs of the first –stage analysis and also depend on the error term of the second stage regression. Thus, the error term depends on the first stage inputs and outputs of the intermediation process. Second, this means that the error term of the censored regression is also correlated with the determining factors. In dealing with this problem, this study applied maximum likelihood in the random effects Tobit regression which makes correlation problems disappear asymptotically.

The Tobit model is a special case of censored regression that was first studied by Tobin (1958). Because he related his study to the literature on probit analysis, his model was nicknamed the tobit model (Tobin's probit) by Goldberger (1964). The merit of random effect model over fixed effect and between effect models is that its estimator is a weighted average of both fixed and between effects. If there is a reason to believe that some omitted independent variables may be constant overtime but vary between cases (fixed effects) and others may be

fixed between cases but vary over time (between effects), both fixed and between effects can be included by using random effects (Princeton, 2007).[57] The tobit model is stated as:

$$\theta_i = \beta' x + \mu_i \quad \text{if RHS>0 but not above 1}$$
$$\theta_i = 0 \text{ otherwise} \qquad (4.30)$$

Where θ_i is efficiency score obtained by DEA analysis; β and x_i are vectors of unknown parameters and explanatory variables respectively; μ_i are residuals that are independently and normally distributed with zero mean and common variance σ^2.

Explicitly, the tobit panel regression model is expressed as:

$$\theta_{it} = \beta_0 + \beta_1 TASSET_{it} + \beta_2 RISK_{it} + \beta_3 COMP_{it} + \beta_4 PBT_{it} + \beta_5 DUMFOR_{it} + \beta_6 DUMUNI_{it} + \beta_7 DUMNQ_{it} + \mu_{it} \qquad (4.31)$$

And

$$\theta_{it} = \beta_0 + \beta_1 NASSET_{it} + \beta_2 RISK_{it} + \beta_3 COMP_{it} + \beta_4 PBT_{it} + \beta_5 DUMFOR_{it} + \beta_6 DUMUNI_{it} + \beta_7 DUMNQ_{it} + \mu_{it} \qquad (4.32)$$

Where θ_{it} is the cost efficiency of the i^{th} bank in period t obtained from DEA; $TASSET_{it}$ is total assets of bank i in period t; $RISK_{it}$ is credit risk (ratio of non-performing loans and advances to total loans and advances) of bank i in period t; $COMP_{it}$ is competition (ratio of deposits of bank i in period to total deposits of the sampled banks in period t); PBT_{it} is profit before tax of bank i in period t; $DUMFOR_{it}$ denotes dummy for foreign or domestic ownership of bank i in period t; $DUMUNI_{it}$ is dummy for indirect or direct adoption of universal banking policy by bank i in period t; $DUMNQ_{it}$ is dummy for unquoted or quoted bank i in period t on the NSE and $NASSET_{it}$ denotes net assets of bank i in period t.[58] The choice of these variables is based on the theoretical review in section 3.2 and the purpose of this study.

The correlates of cost efficiency have the following a priori expectation: first, total assets- a measure of total worth and size of bank, is expected to have a non-linear impact on cost

[57] Stata 9 software which this study used for analysis is yet to have command for a conditional fixed-effect model, as there does not exist a sufficient statistic allowing the fixed effects to be conditioned out of the likelihood. However, the semi-parametric estimator for fixed effect tobit models developed by Honore (1993) gives unconditional fixed effects estimates that are biased.

[58] See appendix for definition of the variables and those used for computing the efficiency, scale economies and productivity change scores

efficiency. That is, cost efficiency increases with size to a certain point and decreases thereafter (Delis and Papanikolaou, 2009). This would be so because banks often transit from defensive restructuring (that is, cost cutting) during early period of banking reform to deeper restructuring (that is, innovation), as the reform advances (Anita and Taci, 2005). Total assets often receive boost from the reforms.

Credit risk is the risk that a party to a loan agreement will not be able or willing to service interest or repay the principal (Nnanna, 2003). Mishkin (2007) simply defines credit risk as the risk arising because borrowers may default. This risk can adequately approximate management quality because good managers tend to reduce the risk by managing the problem of adverse selection and moral hazard.[59] We adopted an ex-post credit risk index (ratio of non-performing loans and advances to total loans and advances) instead of loan loss provision used by some researchers such as Rogers and Sinkey (1999) and Delis and Papanikolaou (2009). Shahimi et al. (2005) found that ex-ante credit risk (loan loss provisions) is not an accurate or direct measure of credit or default risk on loans offered by banks. Credit risk is expected to have negative effect on cost efficiency.

Competition reduces efficiency level.[60] This study uses the ratio of individual bank's deposits to total sampled banks' deposits to proxy competition.[61] It is expected that competition in the banking industry would positively impact cost efficiency.

Since cost reduction can raise profit, we expect a positive relationship between cost efficiency and profitability. Empirical work on this proposition is scanty in the literature. Among

[59] See Mishkin (2007) for comprehensive discussion on adverse selection and moral hazard problems in financial institutions.
[60] See the literature review on market structure and efficiency in **3.2**
[61] See Era Dabla-Norris and Holger Floerkemeier (2007) among others for similar proxy.

the few existing literature, however, Sufian and Noor (2009) found positive impact of profitability on efficiency of banks in the Middle East/ North Africa and Asian countries.

Foreign ownership dummy is expected to have positive effect on cost efficiency. The dummy takes the value of 1 for foreign ownership of a bank in a given year and 0 for domestic ownership of a bank in a given year. Delis and Papanikolaou (2009) gave four important reasons why foreign ownership may have an impact on efficiency of banks. First, the capital brought in by foreign investors decrease fiscal cost of banks' restructuring (Tang et al., 2000). Second, foreign banks may bring expertise in risk management and a better culture of corporate governance, rendering banks more efficient (Bonin et al., 2005). Third, foreign banks presence increases competition which can drive domestic banks to cut their costs and improve efficiency (Claessens et al., 2001). Fourth, domestic banks received benefits from technological spillovers brought about by their foreign competitors.

The dummy for universal banking policy takes the value of 1 for indirect adoption of universal banking policy by a bank in a given year and 0 for direct adoption of universal banking policy by a bank in a given year. Indirect adoption of universal banking policy in Nigeria in 2001-2010 involved engagement in non-core banking activities through designated subsidiaries of the banks and maintenance of consolidated and bank accounts at the end of the financial year to capture it. Whereas, direct adoption of the universal banking policy involved doing non-core banking operations directly as part of banking operations without establishing non-core banking subsidiaries and maintenance of only bank account at the end the financial year to capture activities. The dummy is expected to have negative impact on cost efficiency because of likely contagion effect from the operations of the subsidiaries.

Legal structure of the banks takes dummy value of 1 for unquoted bank in a given year on the NSE and 0 dummy for a quoted bank in a given year on the NSE. This dummy is assumed to have a non-linear relationship with cost efficiency because the few unquoted banks are foreign banks which are assumed to be more efficient.

Finally, net assets (net worth) which is the difference between a firm's assets (what it owns or is owed) and its liabilities (Mishkin, 2007) is expected to have a non-linear impact on cost efficiency for the same reason given for total assets. The impacts of total assets and net assets on cost efficiency are tested separately in equations (19) and (20) because both variables can correlate. The twin of total assets and net assets were used as proxies for consolidation as these variables rise when capital consolidation policy is implemented.[62]

[62] Capital base of a bank is measured by the amount of its shareholders' fund. In accounting, shareholders' fund is always equal to net assets.

4.4 Estimation Techniques

The DEA will be adopted for estimating efficiency scores and DEA-Malmquist for obtaining total factor productivity change estimates. These non-parametric methods are non-stochastic but can be used profitably in a broad variety of circumstances when parametric methods which are stochastic are impracticable or impossible to use. Parametric methods are not likely to be successful if few data points are available due to limited degrees of freedom (Jerome, 2004, Coelli et al., 2005). Besides, the major weakness of parametric or econometric approach is the imposition of an explicit functional form for the technology, and for the distribution of inefficiency terms (Seinford and Thrall, 1990). Therefore, it confounds the effects of misspecification of functional form (of both technology and inefficiency) with inefficiency. The non-parametric or programming approach does not require any assumption about the functional form hence it is less prone to this specification error. While parametric methods distinguish the effects of noise from the effects of inefficiency, non-parametric methods combine noise and inefficiency together (Lovell, 1993). As earlier noted, this weakness is unimportant because inefficiency problem is better overstated than understated. However, it is observed that the Tobit semi-parametric approach that is adopted in this work for investigating the efficiency correlates overcame the weaknesses.

Malmquist DEA was adopted for computing the TFP change as against Fischer or Tornqvist index, which are parametric approaches, because it does not require making profit maximization or cost minimization assumptions. It also does not require information on input and output prices (See Grifell- Tatje and Lovell, 1996). It also allows for decomposition of TFP change into several useful components such as technical efficiency change, pure technical efficiency change, technological change and scale efficiency change (See Coelli et al., 2005).

4.5 Sources of Data

The data used were sourced from the audited Annual Reports and Accounts of the banks for the periods 2001-2008. The banks chosen recorded above 75% of the banking industry's total assets in Nigeria over the periods.[63] Also, only fifteen banks fitted the specification requiring a balanced sample.

[63] Based on our sample data and the data obtained from Central Bank of Nigeria Statistical Bulletin (2006 and 2008). Also, it is believed in the literature that 70-80 per cent sample size can adequately represent the population.

4.6 Sample Characteristics

Below are summaries of relevant features of the samples selected for the study in **Table 4.1**:

Table 4.1 Composition of the Sample, their Origin and Structure

S/N (a)	Bank (b)	Date of Incorporation (Operational Date) (c)	Registered as Public Limited Company (d)	Nigerian Stock Exchange Listing Date (e)	Ownership Since 2001 (f)	Number of Subsidiaries as at 2008/2009 (g)	Post 2004/05 Merger and Acquisition Components/Units (h)
1.	Union Bank of Nigeria (UBN) Plc	1917 (1917)	1970	1970	Domestic	12	Acquired erstwhile Broad Bank of Nigeria Limited, former Union Merchant Bank and former Universal Trust Bank Plc in 2005 (4)
2.	First Bank of Nigeria (FBN) Plc	1894	1970	1971	Domestic	10	Acquired former MBC Int. Bank and erstwhile FBN Merchant Bankers in 2005 (3)
3.	United Bank for Africa (UBA) Plc	February 23, 1961	1970	1970	Domestic	17	Merged with erstwhile Standard Trust Bank Plc on 1 August 2005 and also acquired former Continental Trust Bank Limited on 31 December 2005 (3)
4.	Zenith Bank Plc	May 30, 1990 (June 16, 1990)	May 20, 2004	October 21, 2004	Domestic	11	Stand alone
5.	Access Bank Plc	Feb. 8, 1989 (May 1, 1989)	March 24, 1998	November 18, 1998	Domestic	12	Merged with former Capital Bank International Limited and erstwhile Marina International Bank Limited with effect from 1 November 2005 (3)
6.	Wema Bank Plc	May 2, 1945	April 1987	February 1991	Domestic	5	Acquired erstwhile National Bank of Nigeria Limited and former Lead Bank Plc in December 2005 (3)
7.	Guaranty Trust Bank Plc	July 20, 1990 (February 11, 1991)	April 2, 1996	September 9, 1996	Domestic	10	Stand alone
8.	Oceanic Bank International Plc	March 26, 1990 (June 12, 1990)	March 2004	June 25, 2004	Domestic	10	Acquired former International Trust Bank (2)

9.	Equatorial Trust Bank Limited	Jan. 30, 1990 (March 1, 1990)	-	Not listed on NSE	Domestic	-	Combined business operations with erstwhile Devcom Bank Limited on January 1, 2006 (2)
10.	Afribank Plc	January 4, 1960	October 7, 1992	-	Domestic	8	Merged with former Afribank Merchant Bankers (2)
11.	Diamond Bank Plc	December 20, 1990	February 2005	February 2005	Domestic	08	Merged with Lion Bank and AIB International Bank in 2005 (3)
12.	Fidelity Bank Plc	Nov. 19, 1987 (June 3, 1988)	August 10, 1999	May 17, 2005	Domestic	04	Merged with former FSB International Bank plc and former Manny Bank Plc with effect from January 1, 2006 (3)
13.	Ecobank Nigeria Plc	October 7, 1986 (April 24, 1989)	1986	April 24, 2006	Foreign	-	On February 29, 2008, the bank acquired the restructured business of African International Bank Limited (2)
14.	Standard Chartered Bank Limited	May 6, 1999 (September 15, 1999)	-	Not listed on NSE	Foreign	-	Stand alone
15.	Citibank Nigeria Limited (formerly called Nigeria International Bank Limited)	1984	-	Not listed on NSE	Foreign	-	Stand alone

Source: Compiled by Author from the Internal and External Records of the Banks (2001-2008).

In **Table 4.1**, the summary of the composition, history and structure of the sample was given. The oldest bank in the sample is First Bank Nigeria Plc while Standard Chartered Bank Limited is the youngest. A bank is classified as domestic when at least 50 per cent of the shareholdings are owned by Nigerian citizens and organizations; otherwise, it is referred to as foreign bank. So, only three banks are foreign while the remaining 12 are domestic. Apart from the old generation banks – Union Bank, First Bank, UBA, Wema Bank and Afribank, other banks were established during or after the Structural Adjustment Programme (SAP) periods in Nigeria. The deregulation of entry barriers promoted by SAP was meant to promote competition in the market. Before then, the three largest banks – First Bank, Union Bank and UBA dominated the market (Asogwa, 2005). As at December, 2008, all the sampled banks were public limited liability companies except Equatorial Trust Bank Limited, Standard Chartered Bank Limited and Citibank Nigeria Limited.

While some of the banks recapitalized in 2005 through merger and acquisition, some of the banks raised their funds largely through the Stock Exchange and did not stand alone.
The table shows the number of subsidiaries owned by the banks, although this number varies over time and would likely further vary with banking policy shifts such as abolition of universal banking policy, classification of banks and the offshore banking directive by the Central Bank.

4.7 Classification of Samples By Size

The samples are classified by size under two categories – total assets (gross worth) and net assets (net worth). The latter classification is a deviation from the norm. The author believes that classification based on total asset which is popular in empirical literature is not enough and such classification may be superfluous. For instance, a banker that is on the management trainee

level who amasses wealth through credits would appear big outwardly but is in actual fact small in terms of his real financial worth. The grouping follows thus as shown in **Table 4.2- 4.4**:

Table 4.2 Pre-Consolidation Period (2001-2003)

Grouping	**Total Assets Size (₦' Billion)**	**Net Asset (₦' Billion)**
Big bank	≥ 150	≥10
Medium bank	50 to < 150	5 to < 10
Small bank	< 50	< 5

Source: Author's Classification

Table 4.3 Consolidation Period (2004-2005)

Grouping	**Total Assets Size (₦' Billion)**	**Net Asset Size (₦' Billion)**
Big bank	≥ 200	≥30
Medium bank	100 to < 200	10 to < 30
Small bank	< 100	< 10

Source: Author's Classification

Table 4.4 Post Consolidation Period (2006-2008)

Grouping	Total Assets Size (₦' Billion)	Net Asset Size (₦' Billion)
Big bank	≥ 500	≥100
Medium bank	200 to < 500	35to < 100
Small bank	< 200	< 35

Source: Author's Classification

This classification of banks takes care of changes in the banking market after a comprehensive study of the growth and developments in the sector. Therefore, such categorization would be adequate.[64] In the pre-consolidation period (2001-2003), banks with total assets greater than or equal to 150 billion naira or net assets greater than or equal to 10 billion naira are regarded as big banks, whereas banks that had total assets that range between 50 billion naira and less than 150 billion naira or net assets ranging between 5 billion naira and less than 10 billion naira are classified as medium banks. The small banks are those ones that had less than 50 billion naira total assets or less than 5 billion naira net assets.

During consolidation period (2004-2005), the referred big banks are those with total assets equal or above 200 billion naira or net assets of 30 billion naira or above it. Banks with total assets that range between 100 billion naira and less than 200 billion naira or net assets that range between 10 billion naira and less than 30 billion naira are categorized as medium banks. The classified small banks are those with total assets less than 100 billion naira or net assets less than 10 billion naira.

[64] It draws from the norm in the literature (for instance, see Rao (2002) and Kiyota (2009)

The big banks in the post-consolidation period (2006-2008) are those with total assets that exceed or equal to 500 billion naira or net assets of 100 billion naira or above it. Those banks that had total assets that fall in the range of 200 billion naira and less than 500 billion naira or net assets in the range of 35 billion naira and less than 100 billion naira are regarded as medium banks. The small banks had total assets less than 200 billion naira or net assets less than 35 billion naira.

CHAPTER FIVE

DATA ANALYSIS AND DISCUSSION OF FINDINGS

5.1 Introduction

This chapter presents and interprets the empirical results, synthesizes results with objectives and draws out the economic implications of the results. The results compiled, presented and interpreted are basically of three categories. They are DEA findings of technical, allocative and cost efficiencies and scale economies, across banks and periods; Malmquist DEA results on productivity change, and random effects Tobit regression results on impacts of some bank specific variables on efficiency. The results of Friedman's ANOVA Mean Rank and paired-sample test on differences of measured average efficiency are included in the first two categories.

5.2 Pre-Consolidation Period Efficiency Results

Efficiency outcomes for the pre-consolidation period are discussed in the following sections:

5.2.1 Measured Average Frontier Efficiency of the Deposit Money Banks Grouped by Total Assets Size (2001-2003)[65]

Tables 5.1, 5.2, 5.3 and 5.4 present the summaries of measured mean efficiency of the deposit money banks based on intermediation theory for 2001-2003 period. The results in **Table 5.4** reveal that the technical efficiency of the big banks is 0.852 while their allocative and cost efficiencies are 0.883 and 0.741, respectively. The respective technical, allocative and cost

[65] Cost efficiency scores computed are not equal to the product of technical and allocative efficiency in some cases due to approximations of averages. This applies to other tables in this chapter and in appendix 6-13. However, cross-sectional results before computing the averages revealed their equality as expected.

efficiencies of the medium banks are 0.888, 0.975 and 0.867. For small banks, the technical, allocative and cost efficiencies are 0.863, 0.978 and 0.844 respectively.

Thus, the x-inefficiency of the banks in these periods is 0.259, 0.133 and 0.156 respectively on average for big, medium and small banks. These results imply that on average, medium size banks are more technically, allocatively and cost efficient than big and small banks in Nigeria during the pre-consolidation periods. Also, the small banks exhibit higher technical, allocative and cost efficiencies compared to the big banks in the periods. This could be alluded to by increasing research into new banking products and services as well as better welfare packages for the employees by the medium- and small-sized banks. In addition, the medium-sized banks had core competencies and were more focused. Most of the medium-sized banks were mainly investment banks and this gave them leverage in the industry. Only few of these medium-sized banks had subsidiaries and they attracted high quality staff (right professionals) to drive their businesses.

Table 5.1 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2001)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	3	0.884	0.703	0.603
Medium	50 to < 150	2	0.852	0.981	0.839
Small	< 50	10	0.890	0.980	0.870

Source: Author's Computation

Table 5.2 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2002)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	3	0.806	0.958	0.765
Medium	50 to < 150	6	0.924	0.988	0.914
Small	< 50	6	0.848	0.979	0.830

Source: Compiled by Author

Table 5.3 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2003)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	3	0.865	0.988	0.855
Medium	50 to < 150	7	0.889	0.956	0.848
Small	< 50	5	0.851	0.975	0.832

Source: Compiled by Author

Table 5.4 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2001-2003)

Classification	Total Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	9	0.852	0.883	0.741
Medium	50 to < 150	15	0.888	0.975	0.867
Small	< 50	21	0.863	0.978	0.844

Source: Compiled by Author

An inclusion of equity capital and its price into the intermediation model revealed an overstated technical efficiency and an understated allocative efficiency during the periods (2001-2003) whether the inputs or the input prices are negative or not **(See Appendix 6**). However, such an inclusion does not alter cost efficiency scores except where the required data is negative.[66] Specifically, the technical efficiencies are overstated by 0.132, 0.111 and 0.072 respectively for big, medium and small banks while the allocative efficiencies are underestimated by 0.128, 0.107 and 0.134, respectively.

5.2.2 Average Frontier Efficiency of the Money Deposit Banks Classified by Net Assets (2001-2003)

Tables 5.5-5.8 display the measured mean efficiency of the banks based on net assets size grouping for 2001-2003 period. The results are not really different from those obtained in tables 5.1-5.4 except that on average, the big banks are more technically efficient (0.843) than

[66] Super efficiency DEA has some solutions to this problem, although with some drawbacks. Robust solution to this problem is not yet found.

the small banks (0.841). This might be due to a higher number of competent staff in the big sized banks compared to the small sized banks.

Appendix 7 shows similar observations to those explained in table 5.4, an overstated technical efficiency and an understated allocative efficiency. By extending the intermediation model under net assets sized grouping of the banks, medium-sized banks on average remained more efficient than small and big banks in the pre-consolidation period. Also, small banks are more cost efficient than the big banks in the period.

Table 5.5 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2001)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	2	0.827	0.794	0.645
Medium	5 to < 10	3	1.000	0.840	0.840
Small	< 5	10	0.860	0.973	0.838

Source: Author's Computation

Table 5.6 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2002)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	3	0.806	0.958	0.765
Medium	5 to < 10	7	0.916	0.979	0.897
Small	< 5	5	0.844	0.990	0.836

Source: Author's Computation

Table 5.7 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2003)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	4	0.895	0.965	0.862
Medium	5 to < 10	6	0.899	0.961	0.863
Small	< 5	5	0.820	0.982	0.807

Source: Author's Computation

TABLE 5.8 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2001-2003)

Classification	Net Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	9	0.843	0.906	0.757
Medium	5 to < 10	16	0.938	0.927	0.867
Small	< 5	20	0.841	0.982	0.827

Source: Author's Computation

5.3 Consolidation Period Efficiency Results

The efficiency outcomes for consolidation period are presented and discussed under the following sub-headings:

5.3.1 Efficiency of the Deposit Money Banks Categorized by Total Assets Size (2004-2005)

The measured average efficiency scores of the banks categorized by total assets during the period of consolidation (2004 -2005) are presented in **Tables 5.9 – 5.11.** Although the trend of the efficiency scores for the two years alternated due to the peculiarity of each year, on average, big sized banks tended to be technically more efficient than medium and small banks. Also, averagely, small banks exhibited more allocative and cost efficiencies than their big- and medium-sized counterparts in the reference period.

Specifically, on average, the big banks recorded technical, allocative and cost efficiencies of 0.923, 0.924 and 0.855 while the medium banks' efficiencies are 0.901, 0.979 and 0.883, respectively. The small banks' respective efficiencies on the other hand are 0.904, 0.989 and 0.895. The average x-inefficiencies of the big, medium and small banks are 0.145, 0.117 and

0.105, respectively. The results could be due to the fact that restructuring of big and medium sized-banks came with a lot of challenges during consolidation. Because of their large capital base, they needed to do a lot of works in terms of defining their growth pattern. There was need to restructure the perceived inefficient aspects of their operations as opposed to initiating a direct growth. They had to restructure first before growth could arise. To the small-sized banks, restructuring represents a well-focused organic growth.

The findings are not different for the extended model as reported in **Appendix 8**.

Table 5.9 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2004)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥200	3	0.964	0.990	0.954
Medium	100 to < 200	2	0.966	0.975	0.943
Small	< 100	10	0.887	0.982	0.873

Source: Author's Computation

Table 5.10 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2005)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥200	5	0.882	0.857	0.755
Medium	100 to < 200	3	0.835	0.983	0.822
Small	< 100	7	0.920	0.995	0.916

Source: Author's Computation

TABLE 5.11 2-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2004-2005)

Classification	Total Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥200	8	0.923	0.924	0.855
Medium	100 to < 200	5	0.901	0.979	0.883
Small	< 100	17	0.904	0.989	0.895

Source: Author's Computation

Also, the results of the extended model show an overstated technical efficiency and an understated allocative efficiency.

5.3.2 Frontier Efficiency of the Deposit Money Banks Sized by Net Assets (2004-2005)

Tables 5.12, 5.13 and 5.14 show measured mean efficiency of the banks in the 2004 and 2005 period using net assets for sizing the banks. On average, the implication of the results of these **Tables** and **Appendix 9** is similar with those reported under **5.3.1.** This implies that categorizing banks either by total assets or net assets will not affect their efficiency level during consolidation periods. Big banks are technically more efficient than medium and small banks in the reference period probably because they are not under duress to recapitalize. This in turn may make them trade off allocative and cost efficiencies because of the feeling that they are in 'comfort zone'. The small banks that are however under tension to raise capital from the public will be out to impress their current and prospective customers by launching and re-launching public friendly products at reduced costs. No wonder our findings show that, on average, they

exhibit more allocative and cost efficiencies than the big and medium banks during the consolidation period. These findings should form the basis for further investigations.

Table 5.12 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2004)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥30	2	0.997	0.995	0.992
Medium	10 to < 30	5	0.931	0.980	0.913
Small	< 10	8	0.881	0.981	0.866

Source: Author's Computation

Table 5.13 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2005)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥30	5	0.917	0.910	0.834
Medium	10 to < 30	9	0.863	0.961	0.832
Small	< 10	1	1.000	1.000	1.000

Source: Author's Computation

Table 5.14 2-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2004-2005)

Classification	Net Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥30	7	0.957	0.953	0.913
Medium	10 to < 30	14	0.897	0.971	0.873
Small	< 10	9	0.941	0.991	0.933

Source: Author's Computation

5.4 Post –Consolidation Period Efficiency Results

Explained in the subsequent sections below are the results of efficiency for the post-consolidation period.

5.4.1 Efficiency of the Deposit Money Banks Sized by Total Assets (2006-2008)

Tables 5.15 – 5.18 show the measured mean efficiency of the banks in the post consolidation period (2006-2008). The results in **Table 5.18** show that on average, the technical, allocative and cost efficiencies of the big banks are 0.862; 0.947 and 0.813 respectively.

Table 5.15 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2006)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	4	0.868	0.953	0.825
Medium	200 to < 500	3	0.802	0.943	0.753
Small	< 200	8	0.859	0.949	0.818

Source: Author's Computation

Table 5.16 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2007)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	5	0.902	0.897	0.805
Medium	200 to < 500	5	0.822	0.929	0.767
Small	< 200	5	0.829	0.975	0.805

Source: Author's Computation

Table 5.17 Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2008)

Classification	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	9	0.816	0.991	0.810
Medium	200 to < 500	2	0.506	0.998	0.505
Small	< 200	4	0.833	0.894	0.736

Source: Author's Computation

Table 5.18 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2006-2008)

Classification	Total Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	18	0.862	0.947	0.813
Medium	200 to < 500	10	0.710	0.957	0.675
Small	< 200	17	0.840	0.939	0.786

Source: Author's Computation

For medium banks, the technical, allocative and cost efficiencies are 0.710, 0.957 and 0.675, respectively. But the respective technical, allocative and cost efficiencies of the small banks are 0.840, 0.939 and 0.786. So, the x-inefficiencies of the big, medium and small banks are 0.197, 0.325 and 0.214, respectively. This means that on average, the big banks are more technically and cost efficient than medium and small banks in the period after recapitalization. However, the medium banks are more allocatively efficient than big and small banks, on average. This could be largely accounted for by the outcome of restructuring in the big-sized banks. The medium-sized banks continually invested in information technology, committed themselves to professionalism and had renewed loyalty to their customers.

The results of the extended model in **Appendix 10** show a slight difference from the above. On average, big banks are both allocatively efficient (0.838) and cost efficient (0.813) more than medium (0.621 allocatively efficient, 0.605 cost efficient) and small banks (0.754 allocatively efficient, 0.702 cost efficient) in the post-consolidation era. But technically, medium banks are relatively more efficient (0.981) than big (0.973) and small banks (0.930), on average.

5.4.2 Efficiency of the Deposit Money Banks Sized by Net Assets (2006-2008)

Sizing the banks on the basis of net assets in the post consolidation period as shown in **Tables 5.19-5.22**, we obtain results that are more consistent with theoretic expectations. On average, **Table 5.22** shows that the big banks are more technically, allocatively and cost efficient than the medium and small banks with the big banks having 0.853 technical efficiency, 0.964 allocative efficiency, 0.821 cost efficiency; medium banks having 0.832 technical efficiency, 0.927 allocative efficiency, 0.762 cost efficiency and small banks having 0.774 technical efficiency, 0.948 allocative efficiency and 0.733 cost efficiency. These results also show that the small banks are more allocatively efficient than the medium banks whereas the latter are more technical and cost efficient than the former. Also, the x-inefficiencies of the banks are 0.179, 0.238 and 0.267 for big, medium and small banks, respectively.

Table 5.19 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2006)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	2	0.865	0.994	0.861
Medium	35 to < 100	4	0.798	0.952	0.757
Small	< 35	9	0.870	0.937	0.817

Source: Author's Computation

Table 5.20 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2007)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	4	0.878	0.908	0.793
Medium	35 to < 100	4	0.885	0.924	0.812
Small	< 35	7	0.817	0.954	0.782

Source: Author's Computation

Table 5.21 Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2008)

Classification	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	9	0.816	0.991	0.810
Medium	35 to < 100	3	0.812	0.904	0.717
Small	< 35	3	0.636	0.953	0.600

Source: Author's Computation

Table 5.22 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2006-2008)

Classification	Net Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	15	0.853	0.964	0.821
Medium	35 to < 100	11	0.832	0.927	0.762
Small	< 35	19	0.774	0.948	0.733

Source: Author's Computation

The results of **Appendix 11, Table 5.22B** reveals similar theoretic congruence in outcomes for the expanded model. The big banks are found to be more technically, allocatively and cost efficient than the medium and small banks in the post consolidation period. Different from others, the results of this appendix also reveal medium banks to be more technically, allocatively and cost efficient than small banks in Nigeria.

Generally, the results in **Tables 5.1 – 5.22** can be summarized as largely showing small banks to be more cost efficient than medium and big banks, and medium banks to be more cost efficient than big banks, but big banks take the lead in post consolidation period efficiency. These results are similar to those obtained in the literature to cite Kwan and Eisenbeis (1996) and Jemric and Vujcic (2002). However, most past studies did not consider pre, during and post consolidation periods simultaneously. Our findings could be attributed to specialization characteristics of the small banks over the medium and big-sized banks. It was observed that big-sized banks, apart from having subsidiaries had a lot of commitments which could have made them to lose focus. The big banks were also seen to have problems with management of their credit portfolio as well as lacking sound corporate governance. In the post-consolidation period,

it was observed that there was a lot of investments by the big sized banks in the areas of technology and scale of operations, with major focus on efficiency. Emphasis was placed on employing specialists to man the business lines and investments were made based on strong management decisions. Some of the investments paid up in the short run, hence probable reason for the improvement in their efficiency after consolidation.

5.5 Statistical Test of Differences Between and Among Periods

The following sections discuss the statistical difference of efficiency and productivity changes of the banks over the reference periods and between domestic and foreign banks.

5.5.1 Statistical Differences of Pre, During and Post-Consolidation Period Measured Efficiency of the Deposit Money Banks Sized by Total Assets

The Friedman's ANOVA test results shown in **Table 5.23** rank the efficiency of the banks during consolidation period first (2.89 points) followed by pre-consolidation efficiency (1.67 points) and post-consolidation efficiency last (1.44 points). The Chi-square statistic value is 10.889 with significance value of 0.004.

Table 5.23 Statistical Difference of Pre, During and Post Consolidation Period Efficiencies of the Deposit Money Banks Sized by Total Assets

Periods	B (TE)	M (TE)	S (TE)	B (AE)	M (AE)	S (AE)	B (CE)	M (CE)	S (CE)	Friedman's ANOVA Mean Rank
Pre	0.852	0.888	0.863	0.883	0.975	0.978	0.741	0.867	0.844	1.67
During	0.923	0.901	0.904	0.924	0.979	0.989	0.855	0.883	0.895	2.89
Post	0.862	0.710	0.840	0.947	0.957	0.939	0.813	0.675	0.786	1.44
Chi-square stat.: 10.889					Chi-square asymp. sig.: 0.004					

Source: Author's Computation

Note: B = Big Banks; M = Medium Banks; S = Small Banks; TE = Measured Average Technical Efficiency; AE = Measured Average Allocative Efficiency; CE = Measured Average Cost Efficiency.

This implies that the differences in efficiency ranks or weights of the banks across the three periods (pre, during and post) are significant at both 1% and 5% level. It can also be concluded that the periods have significant impacts on efficiency of the banks. Improved efficiency in the consolidation period could be due to increased competition in the banking sector, intensified oversight functions of the regulators, higher investment in human capital, internal restructuring of the banks and general focus of efficiency growth. Thus, the consolidation period was a challenging period to the banks which stimulated them to take decisions that fostered their efficiencies. In the pre-consolidation period, it was observed that the oversight functions of the regulators were minimal such that many banks engaged in sharp practices in spite of their inadequate capital base. The post consolidation era was seen to have witnessed unhealthy competition (with about 25 per cent of the deposit money banks competing to be number one in 2008)[67], poor corporate governance, supervisory laxity on the part of the regulators was on the increase as well as partial/ inaccurate declaration of accounting

[67] These banks included UBA, erstwhile Oceanic Bank, First Bank, Zenith Bank, former Intercontinental Bank and Union Bank.

information to the public and shareholders. These problems persisted till 2008 and might explain reasons why efficiency was lower in the banking sector in the post-consolidation epoch.

The results of the extended model (**See Appendix 12, Table 5.23B**) are similar in terms of the efficiency ranks with post consolidation bank efficiency ranked last with 1.33 points, pre-consolidation bank efficiency, second with 2.00 points and efficiency during bank consolidation coming first with 2.67 points. The Chi-square statistic value is 8.000 with significance value of 0.018. This means that the differences in efficiency ranks of the banks across the three periods are significant at 5% level but not significant at 1% level. This suggests that efficiency results of the extended model (in the appendices) on the basis of total assets sizing of the banks are less significant compared to the non-extended model (in the body of the report).

5.5.2 Statistical Differences of Pre, During and Post-Consolidation Period Measured Efficiency of the Deposit Money Banks Sized by Net Assets

Table 5.24 shows the Friedman's ANOVA test results on efficiency of the deposit money bank sized by net assets over the three classified periods. The ranked results are similar to those obtained in table 5.23, with post-consolidation average efficiencies of the banks ranked least (1.50 points) followed by the pre-consolidation efficiency (1.72 points) and efficiency during consolidation ranked highest (2.78 points). The Chi-square statistic value is 8.629 with significance value of 0.013. This connotes that the differences in efficiency weights of the banks over the pre, during and consolidation eras are significant at both 1% and 5% level.

Table 5.24 Statistical Differences of Pre, During and Post-Consolidation Period Measured Efficiency of the Deposit Money Banks Sized by Net Assets

Periods	B (TE)	M (TE)	S (TE)	B (AE)	M (AE)	S (AE)	B (CE)	M (CE)	S (CE)	Friedman's ANOVA Mean Rank
Pre	0.843	0.938	0.841	0.906	0.927	0.982	0.757	0.867	0.827	1.72
During	0.957	0.897	0.941	0.953	0.971	0.991	0.913	0.873	0.933	2.78
Post	0.853	0.832	0.774	0.964	0.927	0.948	0.821	0.762	0.733	1.50
Chi-square stat: 8.629				Chi-square asymp. sig.: 0.013						

Source: Author's Computation

Note: B, M, S, TE, AE and CE are same as defined under table 5.23.

For the extended model, similar results are obtained **(See Appendix 13, Table 5.24B**). In this result, average efficiency of the banks in the post-consolidation period is ranked least with 1.33 points, followed by efficiency of the banks in the pre-consolidation epoch which ranked second with 1.89 points and efficiency of the banks during consolidation ranked first with 2.78 points. The test statistic is 9.556 with significance of 0.008, implying significant statistical difference in efficiency ranks of the banks over the three grouped periods at both 1% and 5% level.

5.5.3 Measured Mean Efficiency of the Domestic Banks (DBs) and Foreign Banks (FBs)

The results of the measured average efficiencies of the domestic and foreign deposit money banks in pre, during and post-consolidation periods are presented in **Tables 5.26 – 5.28**. Specifically, **Table 5.25** reveals that, on average, foreign deposit money banks in Nigeria are more technically efficient (0.908), allocatively efficient (0.990) and cost efficient (0.900) than

their domestic counterparts with corresponding 0.867, 0.948 and 0.820 technical, allocative and cost efficiencies. Similar results are reported on **Table 5.26** for the banks' measured efficiency during the consolidation period. The foreign money deposit banks are more technically efficient (0.972), allocatively efficient (0.998) and cost efficient (0.970) than the domestic banks which are 0.884 technically efficient, 0.956 allocatively efficient and 0.846 cost efficient, on the average. The results of the post-consolidation period in **Table 5.27** are also not different. On average, foreign banks recorded 0.894 technical efficiency, 0.942 allocative efficiency, and 0.838 cost efficiency compared to domestic banks' 0.810 technical efficiency, 0.951 allocative efficiency and 0.769 cost efficiency. From the above, the x-inefficiencies of the domestic banks are 0.180 in the pre-consolidation period, 0.154 in the consolidation period and 0.231 in the post-consolidation period. The foreign banks recorded x-inefficiencies of 0.1 in the pre-consolidation era, 0.03 during the consolidation period and 0.162 in the post consolidation period. These results are not surprising because foreign banks in Nigeria do less publicity. Consequently, their relative marketing expenses tend to be less than that of domestic banks. In essence, foreign banks in Nigeria minimize cost apart from adopting international best practices.

Table 5.25 Pre-consolidation Period Measured Average Efficiency of the Deposit Money Banks by Foreign or Domestic Ownership (2001-2003)

Periods	No. of DBs	Measured Average TE of DBS	Measured Average AE of DBS	Measured Average CE of DBS	No. of FBs	Measured Average TE of FBs	Measured Average AE of FBs	Measured Average CE of FBs
2001	12	0.879	0.903	0.790	3	0.904	0.998	0.902
2002	12	0.858	0.976	0.837	3	0.917	0.987	0.906
2003	12	0.864	0.965	0.832	3	0.903	0.983	0.891
2001-2003	36*	0.867	0.948	0.820	9*	0.908	0.990	0.900

Source: Author's Computation
Note: * Pooled frequency

Table 5.26 Consolidation Period Measured Average Efficiency of the Deposit Money Banks by Foreign or Domestic Ownership (2004-2005)

Periods	No. of DBs	Measured Average TE of DBS	Measured Average AE of DBS	Measured Average CE of DBS	No. of FBs	Measured Average TE of FBs	Measured Average AE of FBs	Measured Average CE of FBs
2004	12	0.906	0.980	0.888	3	0.943	0.995	0.939
2005	12	0.863	0.933	0.805	3	1.000	1.000	1.000
2004-2005	24*	0.884	0.956	0.846	6*	0.972	0.998	0.970

Source: Author's Computation
Note: * Pooled frequency

Table 5.27 Post-Consolidation Period Measured Average Efficiency of the Deposit Money Banks by Foreign or Domestic Ownership (2006-2008)

Periods	No. of DBs	Measured TE for DBs	Measured Average AE of DBs	Measured Average CE of DBs	No. of FBs	Measured Average TE of FBs	Measured Average AE of FBs	Measured Average CE of FBs
2006	12	0.818	0.938	0.766	3	0.979	0.992	0.972
2007	12	0.827	0.935	0.770	3	0.949	0.929	0.884
2008	12	0.785	0.981	0.772	3	0.753	0.904	0.659
2006-2008	36*	0.810	0.951	0.769	9*	0.894	0.942	0.838

Source: Author's Computation
Note: * Pooled frequency

Table 5.28 Summary of Measured Average Efficiency of the Deposit Money Banks by Foreign or Domestic Ownership (2001-2008)

Periods	No. of DBs	Measured Average TE of DBs	Measured Average AE of DBs	Measured Average CE of DBs	No. of FBs	Measured Average TE of FBs	Measured Average of FBs	Measured Average CE of FBs
2001-2008	96*	0.850	0.951	0.807	24*	0.918	0.974	0.894

Source: Author's Computation
Note: * Pooled frequency

In summary, **Table 5.28** shows the efficiency of the domestic and foreign banks over the eight years (2001-2008). The table shows that the foreign banks are relatively more technically (0.918), allocatively (0.974) and cost (0.894) efficient than their domestic counterparts which have 0.850 technical efficiency, 0.951 allocative efficiency and 0.807 cost efficiency. This also shows that the x-inefficiency of the domestic bank is 0.193 while that of the foreign bank is 0.106. These findings are in line with the major empirical findings for some developing countries (for instance, see Jemric and Vujcic (2002) for banks in Croatia; Shanmugam and Das (2004) for banks in India; Manlagnit and Lamberte (2004) for Philippine banks and Fries and Taci (2005) for transition economies. However, the contrary has been the case for major empirical results on this issue for most developed countries. For example, Kosak and Zajc (2006) found that foreign owned banks on average are less efficient than domestic banks in some European Union member countries. Our findings could be due to the fact that the few foreign banks had well structured operations with a link to group operations offshore, more robust risk management framework, effective corporate governance, higher investment in human capital development and adherence to bank's ethical standard and professionalism.

5.6.1 Statistical Differences in Efficiency of the Domestic and Foreign Deposit Money Banks Before, During and After Consolidation

The results of the Friedman's ANOVA test reported in **Table 5.29** are similar to our previous tests of significance. The measured average efficiency of the domestic and foreign banks during the consolidation period is weighted first with 3.00 points, succeeded by pre-consolidation measured efficiency with 1.83 points and post-consolidation measured efficiency ranked last with 1.17 points. The Chi-square test statistic is 10.333 with significance of 0.006.

This connotes that the differences in efficiency weights of the domestic and foreign banks in the pre, during and post consolidation periods are significant at both 1% and 5% level. The results make economic sense as performance tends to improve in regulation period more than any other period.[68]

Table 5.29 Statistical Differences of Pre, During and Post-Consolidation Period Measured Efficiency of the Domestic and Foreign Deposit Money Banks

Periods	DBs (TE)	FBs (TE)	DBs (AE)	FBs (AE)	DBs (CE)	FBs (CE)	Friedman's ANOVA Mean Rank
Pre	0.867	0.908	0.948	0.990	0.820	0.900	1.83
During	0.884	0.972	0.956	0.998	0.846	0.970	3.00
Post	0.810	0.894	0.951	0.942	0.769	0.838	1.17
Chi-square stat: 10.333			Chi-square asymp. sig.: 0.006				

Source: Author's Computation

Note: DBs = Domestic Banks; FBs = Foreign Banks; TE; AE and CE are same as defined under table 5.23.

5.6.2 Statistical Differences in Measured Mean Efficiency of the Domestic and Foreign Deposit Money Banks

Table 5.30 shows the results of a paired–samples t test computed to compare the mean efficiency scores of the domestic banks to those of the foreign banks. The result reveals no significant difference in the efficiency scores of the two grouped banks at 5% level (t sig. 0.089, $p > 0.05$). But there is a significant difference in the efficiency scores at 10% level for the results to be consistent with a-priori expectation. The insignificance of the result at 5%

[68] Putting ownership aside, the summary of the results showed cost efficiencies of 0.836 in pre-consolidation period, 0.871 during consolidation and 0.783 in post-consolidation period. Similarly, for the extended model in the appendix, cost efficiencies for pre, during and post-consolidation periods are 0.814, 0.871 and 0.745, respectively.

level could be due to some vagaries in the data. For instance, some domestic banks distorted their financial reports in some years under consideration and paid fines to Nigerian Accounting Standard Board (NASB).

Table 5.30 Statistical Differences in Measured Mean Efficiency of the Domestic and Foreign Deposit Money Banks (2001-2008)

BANKS	TE	AE	CE
Domestic Banks	0.850	0.951	0.807
Foreign Banks	0.918	0.974	0.894
t stat: -3.127		*t sig. (2 tailed) 0.089*	

Source: Author's Computation

Note: TE; AE and CE are same as defined under table 5.23.

5.7 Trend of Economies of Scale of the Deposit Money Banks (2001-2008)

The annual measured economies of scale of the fifteen sampled deposit money banks are reported in **Appendix 14 (Table 5.25B-5.32B).** In 2001, six of the fifteen banks were found to be scale efficient (operated at constant returns to scale) while another six banks were found to experience diseconomies of scale, that is, operated at decreasing returns to scale. The remaining three banks enjoyed economies of scale, meaning that they operated at increasing returns to scale. Similar results were found in 2002 and 2003. Specifically, in the pre-consolidation periods (2001-2003), 18 (40%) observations were for scale efficiency, 18 (40%) observations for diseconomies of scale and 9 (20%) observations for economies of scale. However, during the consolidation periods (2004-2005), the value of observations in the diseconomies of scale reduced to 33.33 per cent whereas economies of scale observations

increased to 26.67 per cent while scale efficiency observations remain at 40 per cent representing 10, 8 and 12 observations respectively. Precisely in 2004, five banks experienced scale efficiency with four and six banks experiencing diseconomies of scale and economies of scale, respectively. Whereas in 2005, seven banks out of the fifteen banks were scale efficient, six and two banks enjoyed diseconomies of scale and economies scale, respectively.

In comparative terms, the results of the post-consolidation period (2006-2008) were worse. The value of observations with diseconomies of scale increased to 48.89 per cent with scale efficient observations reduced to 33.33 per cent and that of economies of scale fell to 17.78 per cent, representing 22, 15 and 8 observations, respectively. Specifically, eight banks operated at diseconomies of scale, six banks were scale efficient and only one bank enjoyed economies of scale in 2006. In the succeeding year, nine banks operated at diseconomies of scale, whereas five banks were scale efficient and only one bank enjoyed economies of scale. In 2008, five banks were faced with diseconomies of scale with four banks experiencing scale efficiency and six banks enjoying economies of scale.

The results showed that banks in Nigeria performed most in terms of scale economies during consolidation period, with performance in pre-consolidation and post consolidation periods following closely in that order. These results are consistent with the ones reported previously on technical, allocative and cost efficiencies. The expectation of consolidation yielding scale economies is thus upheld.

Of the 120 observations for the eight years, 50 observations (41.67%), 45observations (37.50%) and 25 observations (20.83%) are for diseconomies of scale, scale efficiency and economies of scale, respectively. This means that there was a high proportion of diseconomies of scale in the banking sector in 2001-2008. This might be as a result of the difficulty of

efficiently controlling and coordinating the banks' operations as they became relatively large. Osota (1995) found similar result that scale economies decrease with increase in bank size in Nigeria. However, 20.83% per cent of banks having economies of scale is a promising outcome in the industry in terms of taking advantage of increased size. This result is in line with previous studies such as Kasma (2002) for Turkey, Maggi and Rossi (2003) for US and Europe and Allen and Liu (2005) for Canadian banks, showing potential or significant level of economies of scale.

Besides, the three foreign owned banks representing 20 per cent of the sampled banks recorded 15 out of 45 observations of scale efficiency over the eight years. On average, foreign banks recorded 66.67 per cent observations of scale efficiency while domestic banks accounted for 33.33 per cent observations. Therefore, foreign banks are found to be more scale efficient than domestic banks in Nigeria. This was not unexpected as the foreign banks leveraged on the strength, product development, skills and risk management structures of their parent company and foreign institutional investors with a major stake.

5.8 Productivity Change of the Deposit Money Banks and their Statistical Differences (2002-2008)

Table 5.31 presents the Malmquist Index results of measured average productivity change of the banks. The technical efficiency change (measured relative to a constant returns to scale technology) in the banking industry for the period (2001-2008) is 0.979 while the technological change amounts to 1.049. The value of the pure technical efficiency change (measured relative to a variable returns to scale technology), scale efficiency change and total factor productivity change are 0.992, 0.987 and 1.027 respectively.

The results of **Table 5.32** show that technical efficiency change rises most during consolidation (1.013), with performance in pre-consolidation period with (0.994) coming second and post-consolidation era with (0.950) being the last. Similar results are found for pure technical efficiency change and scale efficiency change. The period of consolidation recorded 1.006 pure technical efficiency change (PTEC) and 1.007 scale efficiency change (SEC). In the pre-consolidation era, PTEC is 0.989 and SEC equals 1.006, whereas, post-consolidation period recorded 0.989 PTEC and 0.964 SEC.

Table 5.31 Malmquist Index Summary of Measured Average Productivity Change of the Deposit Money Banks (2002-2008)

Year	Technical Efficiency Change (TEC)	Technological Change (TC)	Pure Technical Efficiency Change (PTEC)	Scale Efficiency Change (SEC)	Total Factor Productivity Change (TFPC)
2002	0.985	1.093	1.007	0.978	1.077
2003	1.002	1.034	0.971	1.033	1.037
2004	1.054	0.863	1.039	1.015	0.910
2005	0.971	1.230	0.973	0.998	1.195
2006	0.951	1.033	1.025	0.928	0.982
2007	1.005	1.003	0.986	1.019	1.008
2008	0.933	1.127	0.946	0.944	1.007
MEAN	**0.979**	**1.049**	**0.992**	**0.987**	**1.027**

Source: Author's Computation

Table 5.32 Productivity Change of the Deposit Money Banks Before, During and After Consolidation and their Statistical Differences (2002-2008)

Periods	Technical Efficiency Change (TEC)	Technological Change (TC)	Pure Technical Efficiency Change (PTEC)	Scale Efficiency Change (SEC)	Total Factor Productivity Change (TFPC)	Friedman's ANOVA Mean Rank
Pre	0.994	1.064	0.989	1.006	1.057	2.40
During	1.013	1.047	1.006	1.007	1.053	2.40
Post	0.950	1.054	0.986	0.964	0.999	1.20
Chi-square stat.: 4.800			Chi-square asymp. sig.: 0.091			

Source: Author's Computation

Technological progress was recorded more during pre-consolidation period with the value of 1.064, followed by post-consolidation period with 1.054 and period of consolidation with 1.047 being the least. Total factor productivity growth rose faster during pre-consolidation period with the value, 1.057 and succeeded by consolidation period with 1.053. There was total factor productivity decline in the post-consolidation period with 0.999.

Based on Friedman's ANOVA ranking, as shown in **Table 5.32**, productivity changes before and during consolidation periods are the same with 2.40 weights each. Post-consolidation productivity changes are ranked last with 1.20 weights. Therefore, we conclude that total factor productivity changes including technical efficiency change, technological change, pure technical efficiency change and scale efficiency change are more or less the same before and during consolidation, and that the productivity changes are lesser in periods after consolidation. The gain of consolidation in terms of productivity growth was not immediately felt possibly because of the immediate effects of restructuring. The Chi-square test statistic is

4.800 with significance of 0.091. This means that the differences in the productivity change weights of the banks over the three periods are significant at 10% level.

Our findings can be compared with Humphrey (1993) whose studies found an increase in productivity during pre-deregulation period, a little change in productivity in post-deregulation era and substantial fall during deregulation era. Productivity change was found to be the same during pre-consolidation and consolidation periods. This is evident in the absence of any significant change in the quality of staff during these two periods as the spate of downsizing by most banks during the consolidation period shown. However, Fiorentino et al. (2009) have found positive impact of consolidation on productivity of banks in Germany and Italy.

The outcomes of **Table 5.33** are that the technical and pure technical efficiency changes of the domestic banks are higher than those of the foreign banks over the period 2001-2008. While domestic banks recorded 0.983 TEC and 0.996 PTEC, foreign banks recorded 0.968 TEC and 0.976 PTEC respectively. However, foreign banks outperformed their domestic rivals in technological change (TC), scale efficiency change (SEC) and total factor productivity change. Foreign banks recorded 1.085 TC, 0.992 SEC and 1.069 TFPC as against 1.043 TC, 0.987 SEC and 1.024 TFPC obtained by domestic banks. In all, these differences are not significant at 5% level (t sig. 0.454, $p > 0.05$). Thus, there is no significant difference between the productivity changes of the domestic and foreign banks. This could be substantiated by the usage of similar banking technology by both foreign and domestic banks as they both sourced their software applications from abroad.

Table 5.33 Productivity Changes of the Domestic and Foreign Banks and their Statistical Differences

Banks	TEC	TC	PTEC	SEC	TFPC
Domestic	0.983	1.043	0.996	0s.987	1.024
Foreign	0.968	1.085	0.976	0.992	1.069
t stat: -0.828;			t sig.: (2 tailed): 0.454		

Source: Author's Computation

5.9 Correlates of Cost Efficiency Results and Interpretation

This section presents and interprets the outcomes of impacts of the explanatory variables on cost efficiency of the banks. The log likelihood of 6.7752 of model 1 on **Table 5.34** and 7.3208 of model 2 on **Table 5.35** show that both models are of good fit and that all the coefficients of the explanatory variables (total assets, net assets, profitability, competition, indirect adoption of universal banking policy and non-listing of a bank on the stock exchange) in the models are simultaneously different from zero at both 1% and 5% level. The Likelihood Ratio (LR) Chi-Square test is 24.17 for model 1 and 25.26 for model 2 with the p-value (i.e. probability of obtaining the chi-square statistic value) of 0.0005 and 0.0003 respectively, meaning that at least one of the regression coefficients in the model is significantly different from zero since both values are less than 0.05 or 0.01.

Table 5.34 Estimated Random Effects Tobit Regression Coefficients of the Efficiency Correlates (Model 1)

EFFI	Coefficient	Std. Error	Z	P>|Z|	[95% Conf. interval]	
TASSET	-2.63e-11	9.41e-11	-0.28	0.779	-2.11e-10	1.58e-10
RISK	-0.4797	0.1506	-3.18	0.001	-0.7750	-0.1845
COMP.	0.1017	0.3638	0.28	0.780	-0.6114	0.8148
PBT	-1.91e-09	2.92e-09	-0.65	0.513	-7.64e-09	3.81e-09
DUMFOR	0.0964	0.0490	1.97	0.049	0.0004	0.1924
DUNUNI	0.0015	0.0504	0.03	0.977	-0.0973	0.1003
DUMNQ	0.0273	0.0478	0.57	0.567	-.0663	0.1210
Constant	0.9030	0.0488	18.50	0.000	0.8073	0.9986
N = 120; Log Likelihood = 6.7752; LR Chi 2(6) = 24.17; Prob. > Chi 2 = 0.0005						

Response Variable: Cost efficiency scores obtained using DEA.
Source: Author's Computation

The Z-test shows that only the coefficient of risk (-0.4797) and foreign ownership dummy (0.0964) as well as constant term (0.9030) are statistically significant at 5% level. Given all the predictors in the model, the confidence interval provides an upper and lower range where the "true" coefficient may lie.[69]

[69] Since both models are fitted, either of them can be interpreted. But we adopted model 1 for interpreting all the predictors except net assets (in model 2).

Table 5.35 Estimated Random Effects Tobit Regression Coefficients of the Efficiency Correlates (Model 2)

EFFI	Coefficient	Std. Error	Z	P>|Z|	[95% Conf. interval]
NASSET	5.16e-10	4.76e-10	1.08	0.278	-4.17e-10 1.45e-09
RISK	-0.5330	0.1458	-3.66	0.000	-0.8187 -0.2473
COMP.	0.2236	0.3765	0.59	0.553	-0.5144 0.9616
PBT	-4.86e-09	2.77e-09	-1.76	0.079	-1.03e-08 5.65e-10
DUMFOR	0.0957	0.0487	1.96	0.050	0.0002 0.1911
DUNUNI	-0.0119	0.0497	-0.24	0.812	-0.1093 0.0856
DUMNQ	0.0346	0.0472	0.73	0.463	-0.0579 0.1270
Constant	0.9017	0.0485	18.60	0.000	0.8067 0.9967
N = 120; Log Likelihood = 7.3208; LR Chi 2(6) = 25.26; Prob. > Chi 2 = 0.0003					

Response Variable: Cost efficiency scores obtained using DEA.
Source: Author's Computation

Thus, we are 95% confident that the "true" coefficient of total assets lies between -2.11e-10 and 1.58e-10. This means that the relationship between total asset representing bank size (and hence capital consolidation) and cost efficiency is very small and non-linear. That is, bank size increases efficiency to a certain point after which it decreases it. Similar findings have been obtained in other studies; for example, Fries and Taci (2005) studies of banks in 15 East European countries and Delis and Papanikolaou (2009) studies of banks in newly admitted European Union countries. This outcome could be traced to instability in the Nigerian banking sector. Largely, management of banks in Nigeria suffers from unstable policies. For example, most banks in Nigeria tend to cut costs in early period of consolidation reform when their sizes are boosted and after which they deviate to other ventures depending on the trend of the market and engage in "short cuts" to increase revenue and profits. So, the banks can grow bigger with increasing inefficiency. These findings are also true for net assets. On average, efficiency of the banks will lie between -4.17e-10 and 1.45e-09 due to a unit increase in net

assets when other predictors are not on hold. Although, the impact of net asset on efficiency is also non-linear, the results show that net asset measurement of bank size may be a better index because its coefficient is more significant. Also, the insignificant infinitesimal negative impact of total assets and net assets on cost efficiency point to the fact that efficiency does not hinge on size but on some other factors such as operational structure, technology, quality of management (corporate governance and risk management) and staff quality.

Specifically, a unit increase in credit risk level reduces cost efficiency by 0.48 on average. This reduction in efficiency is significant and it is the most significant variable in the model. At 95% confidence interval, the "true" coefficient of credit risk lies in the range of -0.78 and -0.18 which connotes that efficiency will fall within the range of 0.18 and 0.78 given the influence of other predictors. The negative impact of credit risk on efficiency and its high level of significance underscore the gravity of increasing credit risk contribution to bank failures in Nigeria. However, findings of past studies on this issue are mixed; for instance, while both Hughes and Mester (1993) and Delis and Papanikolaou (2009) reported results similar to ours, Altunbas et al. (2000) suggest that efficiency is not very sensitive to credit risk. These findings would most likely be dependent on the nature of banking business in each country.

Given the other predictors, we are 95% confident that the "true" coefficient of competition lies within the range of -0.61 and 0.81. So, competition increases efficiency for a while after which it reduces it. That is, competition exhibits non-linear relationship with cost efficiency in negation of our expectation. This can be attributed to unhealthy competition in deposit mobilization in the Nigerian banking market and instability of the banking market. The unhealthy competition brought about aparty to corporate governance, lapses in risk

management, lack of professionalism and distortion of financial reports in the Nigerian banking market in the periods considered.

Similarly, at 95% confidence interval, the "true" coefficient of profit before tax lies within -7.64e-09 and 3.81e-09. It means that given other explanatory variables, the impact of profit before tax on efficiency is also non-linear and infinitesimal like the total assets and net assets. The non-linearity outcome contradicts our expectation and earlier findings of Sufian and Majid (2007) in respect of Singaporean banks and Sufian and Noor (2009) on banks in Middle East/ North Africa and Asian countries, all of which reveal a positive impact of profitability on efficiency. The reduction in efficiency as profit before tax increases outgrows the increase in efficiency. This may likely underscore the window dressing nature of annual reports of most banks in Nigeria. They often report bogus profits without necessarily being efficient.

Foreign ownership dummy is positive and significant at 5% level, confirming our expectation. An increase in foreign ownership by one unit raises cost efficiency from zero to 0.9994 whereas a unit increase in domestic ownership makes cost efficiency to be 0.9030 from zero. Therefore, foreign banks are more cost efficient than domestic banks. This finding is true for some developing countries and is consistent with numerous results of past studies such as Shanmugam and Das (2004) on banks in India, Manlagnit and Lamberte (2004) on Philippine commercial banking system, Jemric and Vujcic (2002) on banks in Croatia and Delis and Papanikolaou (2009) on newly admitted European Union banking markets. This can be alluded to by technological innovations and international best practices brought into developing countries' financial markets and newly developed financial markets by foreign owned institutions, which promote efficiency. However, some studies have shown that operations of

foreign banks in some developed countries' banking industry are less cost efficient than domestic banks operations. Few among those studies are Berger et al. (2000), Hasan and Hunter (1996) and Chang, Hasan and Hunter (1998), all in US banking industry. Similarly, Torsten (2010) found that foreign banks are not necessarily more efficient than their domestic counterparts in Central American region. It seems that foreign banks in US are not first-tier foreign banks that would provide the reputation benefits, international best practice, and competitive edge needed to increase efficiency.

Without keeping other variables in abeyance, we are 95% confident that the "true" coefficient of indirect adoption of universal banking policy dummy and unquoted banking structure dummy lie within the range of -0.097 and 0.1003 and -0.066 and 0.121 respectively implying that they can shift the constant term upward or downward. Based on these results, universal banking policy and non-quotation of a bank on the stock market have non-linear effect on efficiency. Therefore, it is clumsy to state whether indirect adoption of universal banking policy promotes efficiency more than direct adoption of the policy and whether unquoted banks are more efficient than quoted banks. This is because indirect adoption of universal banking policy increases efficiency for some time and later reduces efficiency as observed for unquoted banks too. These findings call for further studies. The outcomes could be attributed to contagion effects of universal banking policy and the fact that shareholders do not always bother about quoted firm's efficiency level or about how their profits are made but how much profits they make.

5.10 Synthesis of Objectives and Results

The four objectives pursued in this study were achieved through the analysis of Data Envelopment Analysis (DEA) results using DEA (computer) program 2.1 and random effects Tobit regression using STATA 9. The significance of efficiency differences across identified periods of pre, during and post consolidation and across domestic and foreign banks are tested using Friedman's ANOVA Rank test and paired samples t test of difference of means using SPSS 17.0 version. The fact that maximum likelihood is used in the Tobit regression means that any serial correlation disappears asymptotically so that the estimates will be consistent.

Objective One: To estimate efficiency and the x-inefficiency scores of the banks over time, with emphasis on size, capital consolidation and foreign or domestic ownership.

The efficiency scores indicate medium banks as having the highest level of cost efficiency, followed by small banks with big banks being the least efficient in periods prior to announcement of consolidation. When consolidation began, small banks were found to be the most cost efficient, and were followed by medium banks with big banks coming last. After completion of consolidation, big banks were the most efficient, with medium banks coming last after small banks. However, when net assets are used for sizing the banks instead of total assets, it was found that medium banks were more efficient than small banks in a few years after consolidation with big banks still being the most cost efficient using this classification. The opposite holds for the x-inefficiency ranking of the banks

Banks were more cost efficient in period of consolidation than at any other time. Also, foreign banks exhibited higher cost efficiency than their domestic counterparts.

Objective Two: To determine the trend of economies of scale in the banking industry

The Data Envelopment Analysis (DEA) results show higher economies of scale in the banking industry during the period of consolidation than in any other periods. Foreign banks were found to be more scale efficient than domestic banks.

Objective Three: To compute the total factor productivity change mix in the banking industry over the reference period

The DEA Malmquist index shows the technical efficiency change and technological change to be 0.979 and 1.049, implying a decline of 0.021 and a growth of 0.049, respectively, with pure technical efficiency change being 0.992, scale efficiency change of 0.987 and total factor productivity change being 1.027 over the period 2001-2008. While productivity growth before and during consolidation were similar, productivity decline ensued in a few years after consolidation.

Objective Four: To assess the impacts of some bank specific variables on cost efficiency

The random effects Tobit regression confirmed that foreign banks were more cost efficient than domestic banks. It also corroborated the paradoxical behaviour of impacts of size on efficiency. Total assets or net assets representing size and hence capital consolidation have non-linear effect on efficiency. Indirect adoptions of universal banking policy, non-quotation of a bank on stock market, competition and profitability have non-linear effect on efficiency. Credit risk was the most significant factor that had a negative impact on efficiency in the model.

5.11 Economic Implications of Results

Empirical analysis of efficiency and productivity change are of great relevance for monetary policy implementation and regulation of the banking sector by the Central Bank. The changes in efficiency of banks before, during and after consolidation could reflect efficiency response to policy shifts. Using statistical test to verify the significance of the changes ensured that the results from the study represent true economic responses. The result of higher efficiency level during consolidation period compared to other periods could have come on the back of cost saving during consolidation and aggressive innovation and service improvement that might be costly as the reform progressed. This finding is similar to previous evidence of Fries and Taci (2005). Other factors may include the tendency for quiet life pattern of board and management shortly after consolidation, tendency towards window dressing of information disclosed in reports, unhealthy competition in the market, corrupt and sharp practices, constant changes in policies as well as dearth of clear-cut direction on the part of the board and management.

The results showed that total and net assets, competition, profitability and non-quotation of banks on the stock market have non-linear effect on efficiency. This means that these variables led to increase in efficiency at a point in time and decrease in efficiency at another period. By implication, size, deposit competition, profitability differences and bank listing on the Stock Exchange are not the key variables of interest when addressing x-inefficiency problem in Nigeria's banking industry. It is rather the level of credit risk of each bank and their ownership. The economic implication of significant rising cost efficiency of the few foreign banks compared to the domestic banks in Nigeria is potentially germane. Although there are mixed evidences on this issue in past studies depending on whether the foreign banks

originate from a developing or developed country. In this study, only one of the foreign banks emanated from a developed country. So, country of origin of a foreign bank is not what really matters for achieving high efficiency level but what matters is whether a foreign bank can bring international best practices and expertise to bear on their operations.

Several policies have been implemented in the past to enhance quality banking, profitability, efficiency and financial stability. One of these policies was the universal banking that became operational in Nigeria in 2001. From the results obtained, impact of indirect or direct adoption of the policy on efficiency is insignificant and mixed. Therefore, the repeal of the policy regime at the end of 2010 was long overdue. Adopting universal banking policy might have made the banks lose focus through their diversification. However, it is not wrong to diversify but efforts should be geared towards ensuring increase in efficiency when banks specialize. It is a known fact that specialization reduces waste of resources.

CHAPTER SIX

SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Summary of Findings

This study examined effects of consolidation on efficiency and productivity changes of deposit money banks in Nigeria over the period 2001-2008. Nigerian governments have since 1952 made various reform efforts aimed at increasing efficiency and stabilizing the banking sector to enable it to positively influence the real sector and the economy at large. The 2004/2005 consolidation and subsequent reforms in the Nigerian banking industry were a land mark. Broadly, the reforms aimed at ushering in rising profitability, efficiency, competition, economies of scale and ensure quality in banking, financial system stability and evolution of a healthy financial sector. However, empirical evidence on efficiency and productivity of banks from developed and developing countries have produced mixed results. This study provided an opportunity of joining the debate, using Nigerian data. It however made further contribution on bank's size classification by evaluating net assets as an alternative measure of bank size other than total assets. Expansion of intermediation theory was also addressed.

The descriptive analysis of the DEA results, while classifying the banks on the basis of total assets or net assets and considering periods shortly before, during and after consolidation, revealed a number of interesting issues. First, shortly before and during consolidation, classification of banks by either total assets or net assets yielded similar results in terms of cost efficiency across small, medium and big banks. In a three-year period before consolidation, medium banks (with total assets of ₦50 billion to < ₦150 billion or net assets of ₦5 billion to < ₦10 billion) were the most cost efficient. This was followed by small banks (with total assets

less than ₦50 billion or net assets less than ₦5 billion). Big banks (with total assets above ₦150 billion or net assets above ₦10 billion) were the least cost efficient. The reverse was the case for their x-inefficiencies. During consolidation period, small banks (with total assets less than ₦100 billion or net assets less than ₦10 billion) were the most cost efficient. Following was the medium banks (with total assets of ₦100 billion to < ₦200 billion or net asset of ₦10 billion to < ₦30 billion). Big banks (with total assets of over ₦200 billion or net assets greater than ₦30 billion) were the least cost efficient and the contrary held for their x-inefficiencies. However, shortly after consolidation, classification of banks based on total or net assets yielded different outcomes in terms of cost efficiency. With total assets classification, big banks (with total assets above ₦500 billion) were the most cost efficient. They were followed by the small banks (with total assets less than ₦200 billion) and medium banks with least efficiency (having total assets of ₦200 billion to < ₦500 billion). Whereas, net assets grouping of the banks revealed an ascending order comparison, big banks (having net assets of over ₦100 billion) were the most cost efficient, followed by medium banks (with net assets of ₦35 billion to < ₦100 billion) and the small banks being the least cost efficient (having net assets below ₦35 billion). The reverse was the case for their x-inefficiency movements. It should be noted that some variations in efficiencies based on net assets or total assets classification did not make the conclusions above cumbersome because the Tobit regression placed more weight on net assets classification.

Second, with total assets or net assets classification of bank, allocative and technical efficiency comparison varied widely among big, medium and small banks shortly before and after consolidation. Both efficiencies did not fluctuate during consolidation. This underlies the fact that the consolidation period was a serious period of control when the activities of the

banks were brought under searchlight. It appears there are some degrees of stability in the sector during consolidation. It is noteworthy that there is dearth of these analytical distinctions relative to the identified periods in the literature.

The period of consolidation witnessed high efficiency, followed by that in three years before consolidation with that of three years after consolidation being the least. These results were statistically significant. Fries and Taci (2005) found results similar to ours for reform periods and as the reform progresses further, while the results of Shanmugam and Das (2004) were consistent with that of the period of reform.

An extension of the financial intermediation model to include equity capital as input and earnings per share as price of equity (that is, a measure of shareholders' return) did not in any way change cost efficiency, except where the input or its price was negative and the analytical package did not recognize negative value. Besides, whether the input was positive or negative, such an inclusion into the model tended to overstate technical efficiency and understate allocative efficiency.

In the pre-consolidation and consolidation periods, foreign banks in Nigeria were more technically, allocatively and cost efficient than domestic banks. However, in the post-consolidation era, domestic banks were more allocatively efficient than foreign banks even though the latter were more technically and cost efficient than the former. Overall, foreign banks were more technically, allocatively and cost efficient than domestic banks. Similar findings for overall period abound in the literature. Among some of the past findings for the overall periods which are consistent with our outcomes are Manlagnit and Lamberte (2004), Jemric and Vujcic (2002) and Delis and Papanikolaou (2009).

Also, there was a high level of diseconomies of scale in the Nigerian banking sector over the period. This was high in the pre-consolidation, low during consolidation, and was higher in the post-consolidation. The contrary were held for economies of scale over the three identified periods. Only forty per cent of the banks were scale efficient (operate at constant returns to scale) before and during consolidation. The post-consolidation period recorded thirty-three per cent of the banks as having scale efficiency. Overall, 20.83 per cent of the banks benefited from economies of scale over the period. This evidence of scale economies was adjudged to be potential in the banking industry. Maggi and Rossi (2003) and Allen and Liu (2005) found similar results for US/Europe and Canada respectively. In addition, foreign banks recorded more scale efficiency than domestic banks.

Total factor productivity change, a mixture of technical efficiency change, technological change, pure technical efficiency change and scale efficiency change was averagely ranked the same before and during consolidation. It was however, weighted lower in the post-consolidation phase. Quite interesting, these ranks were statistically significant. But there was no significant difference in the productivity change of domestic and foreign banks.

The results of the random effects Tobit regression were similarly interesting. Both total assets and net asset impacted cost efficiency positively and negatively. That is, consolidation had non-linear effect on cost efficiency. Profitability, competition, indirect adoption of universal banking policy and non-quotation of a bank on stock exchange exhibited non-linear impact on efficiency too. Two of the unquoted banks were foreign banks and they exhibited high level of efficiency compared to other banks. So, the non-linear effect of non-quotation of banks on efficiency could be due to this component. Corroborating our initial evidence on efficiency of foreign banks, the Tobit regression showed outcome of significant efficiency of

foreign banks compared to domestic banks. Also, it revealed that credit risk is the most significant factor to watch out for when aiming at cost efficiency of banks. Credit risk was found to have negative impact on cost efficiency. This is consistent with the findings of Hughes and Mester (1993) and Delis and Papanikolaou (2009).

6.2 Policy Implications and Recommendations

The study found a number of interesting results which have excellent policy implications.

1) The syndrome of too-big-to-fail does not apply in Nigerian banking system because cost efficiency of banks has been found to be falling shortly after consolidation instead of rising. It was a case of efficiency loss in the face of rising size. Hence there is a need for cross examination of the banks by the regulators, preferably bi-annually or yearly. The examination should not be dependent on symptoms of crisis in the sector but rather it should be a routine exercise.

2) The quality of efforts exerted by bank workers and management during consolidation would have strong implications for efficiency as banks were found to be more efficient during consolidation period. Workers and management should ensure that the same quality of efforts and expertise are brought to bear on their work at all time, and not just during consolidation. Regulators should also be mindful of possible compromise of efforts and expertise in post-consolidation period. In order to increase productivity at all times, robust training opportunities both within and outside the country as well as local and foreign attachments should be part of staff retention policy of the banks. They should also leverage on technological advancements by integrating their products and processes to increasingly provide self banking service to customers.

3) Foreign ownership of banks in Nigeria, like in most other countries, is not inimical to stability and health of the financial system. The few foreign banks studied were found to be more technically, allocatively, cost and scale efficient than their domestic counterparts. Therefore, interested individual or corporate investors from abroad that can bring international best practices to bear on their banking operations; drive continually for greater efficiency; lead change; offer unique, highly valued products and set standards for other banks to follow should be permitted to invest in the country. In addition, the strong foreign banks should be encouraged to acquire the weak and failing banks.

4) Profits and dividends declaration by banks in Nigeria to wealth holders may not mean that the banks are sound. Regulators and stakeholders should be concerned with how the profits are made, what the bank really stands for and whether it is doing the right thing as required by law and ethics. This study has found that profitability does not always mean that costs are minimized or resources are maximally utilized. When banks are doing wrong things, the customers and workers should not keep mute but should sincerely lodge their complaints to the regulatory authorities to enable them carry out necessary investigations. To stem the tide of unethical practices and minimize asymmetric problems in the financial sector, we suggest the following: (a) the regulators should, at all times, mandate banks to make full declaration of all relevant information in their annual financial and similar reports; (b) any party found aiding or abetting deceptive information through professional practice(s) or any other means should be brought to justice, of which relevant parties are the external auditors; (c) the regulators should sponsor bill(s) in the national assembly that will wholly deal with

issues that have led to bank crisis in the past and those that can affect the banks' stability in the future.

5) The role of credit risk control in ensuring banking stability is a pertinent one in Nigeria as this was found to be the most significant determining factor of cost efficiency in the model. Since its effect on cost efficiency was negative, corporate governance should be strengthened. Also, regulators should timely organize conference and forum on risk management for designated bank executives. Banks on their own should strengthen their infrastructure and develop robust risk management capabilities.

6) Unhealthy competition is a threat to banking stability in Nigeria as the study revealed a non-linear effect of competition on cost efficiency of the sector. Therefore, regulators should fortify their oversight functions on control of unhealthy competition in the area of deposit mobilization, establishment of branches and similar activities.

6.3 Conclusion

This study employed data on banks that retained their identity after the 2004/2005 consolidation of banks in Nigeria. The reason for this choice was to allow for consistent data analysis over the period 2001-2008. The study utilized both deductive analysis of DEA and Malmquist DEA and inductive analysis of random effects Tobit regression. The significance of the deductive analyses was tested using paired-samples t test and Friedman's ANOVA test.

One striking outcome was that banks were more efficient during the period of consolidation than in the pre-consolidation and post-consolidation eras. Thus, internal issues such as corporate governance, management style and quality as well as sharp practices in the banks must be paramount to regulators in making policies that would guarantee robust health of the banks. This study has further supported the argument that foreign banks are more

efficient than domestic banks in developing countries and non-linear impact of total assets on efficiency. Net assets index has been proven to be superior to total assets in measuring bank size impact on efficiency. So, it would not be out of place to prefer net assets index to the popular total assets size classification. Small banks were the most efficient banks in Nigeria during consolidation. It is imperative, therefore, to have banks categorized into small, medium or big size to meet different needs of the society such as small scale financing of businesses and mobilization of small savings. Since equity capital is a major capital used by banks in financing projects like branch expansion, working capital, information technology and regional expansion, we concurred with the argument that includes equity capital as an input and earnings per share as its price in the intermediation model. Such attempt will not alter cost efficiency but will exaggerate technical efficiency and underestimate allocative efficiency. In addition, the invalidation of universal banking policy regime in Nigeria at the end of 2010 is long overdue as the policy has had insignificant non-linear effect on efficiency.

6.4 Limitations of the Study and Suggestions for Future Research

The greatest problem encountered in this study is in the area of data availability. For instance, Nigeria Stock Exchange which is expected to stock annual financial reports of quoted firms has only a few of them in their custody. Also, Central Bank of Nigeria has personalized those reports. With this, it may be rational to submit that published reports of the Central Bank could be guesstimates. Other professional bodies also did not have the reports in their libraries. Thus, the reports constituting the sources of the data were obtained from all these organizations and from the banks' headquarters offices. This eventually prolonged the period of the research. Researchers in Nigeria often circumvent this hurdle by using data compiled by some organizations like the World Bank and Bankscope. However, these organizations do not have

all the data needed for research in this area. Future researchers investigating similar issues in Nigeria should begin data collection in earnest. Government agencies should stop hoarding and hiding data from researchers. Intensive database building should be paramount to Nigerian government. The country must evolve from some of these Dark Ages practices.

The quality of research in this area would be in doubt if it is true that banks fabricate their reports. So, the Central Bank must ensure that information disclosed in audited financial reports which they approve before being passed on to the public are free from window dressing and fabrication.

Although, the fifteen of the twenty-five deposit money banks operating in the country as at 2008 appeared to be a good number, future research with a time frame from 2006 should use all the existing banks provided policy shifts in the country do not make it practically impossible. This is because frequent policy shifts often cause some instability in the banking industry as new banks evolve and some old banks are distressed. The sample was representative enough because they shared above 75 per cent of the industry's total assets. Two banks were dropped because of not having annual accounting data for some periods due to alterations in accounting year. The Central Bank would have to sustain the enforcement of uniform accounting year policy which they began in 2010. Otherwise, some researchers may resolve to employing extrapolated data. In overcoming differentials in accounting period and its frequent changes in 2001-2008, we prorated all the data to 12 months except fixed assets and depreciation which are not annual performance variables but valued amounts as at the period of accounting.

There are tendencies for frequent changes in inter-temporal performances of banks due to changes in the business environment and policy. Future researchers should increase the

threshold periods for computing the measured mean efficiency for pre-consolidation and post-consolidation periods if practicable.

Additionally, this study classified the banks' size using some ranges of total assets and net assets while considering development in the sector. This was done because this is the tradition in the literature. Therefore, comparison of efficiency of banks according to their sizes is dependent on individual researcher's classification. In order to ensure uniformity of comparison in future research, regulators across the globe need to classify their banks into sizes, possibly yearly. This will make research on efficiency and productivity changes of banks as well as other related issues across sizes more standardized. Also, future researchers should deflate the accounting data used if they find a suitable price or quantity index for doing so. Any deflator selected must relate to the services that constitute the aggregate as closely as possible. While Consumer Price Index (CPI) is not suitable for banking information and data, implicit gross domestic product (GDP) deflator drawn from national accounts data does not cover all information in banks' financial reports that are used in this research area. However, future researchers can compute their own price or quantity index. The manual of Organization for Economic Cooperation and Development (OECD) on the construction of quality adjusted price index numbers provides some useful guides.

REFERENCES

Adedipe, B. 2006. Bank consolidations: breasting the tape, facing new challenges. *Zenith Economic Quarterly* 5.

Adeola, F. 1995. The new GATT implications for Uruguay round for and services. *First Bank of Nigeria Bi-Annual Review.*

Adewoye, J.O. 2007. Impact of information technology investments on banking: operations in Nigeria. *International Business Management* 1.4:70-78.

Adewuyi, A.O. and Bankole, A.S. 2007. Economic policy and technical efficiency in Nigeria's manufacturing sector. *The Nigerian Journal of Economic and Social Studies* 49.1: 1-26.

Ajayi, S.I. and Ojo, O.O. 2006. *Money and banking: analysis and policy in the Nigerian Context.* Second Edition.

Allen, L. and Rai, A. 1996. Operational efficiency in banking: an international comparison. *Journal of Banking and Finance* 20:655-672.

Allen, J. and Liu, Y. 2005. Efficiency and economies of scale of large Canadian banks. *Bank of Canada Working Paper* 13:1-24.

Allen, F., Carletti, E., Cull, B., Qian, J. and Senbet, L. 2010. The African Financial Development Gap. *Unpublished Paper.*

Altunbas, Y, Liu, M.H., Molyneux, P. and Seth, R. 2000. Efficiency and risk in Japanese banking. *In Drake (2003) Mullineau and Murinde* Edition12.

Amel, D., Barnes, C., Panetta, F. and Salleo, C. 2002. Consolidation and efficiency in the financial sector: a review of the international evidence. *Bank of Italy Working Papers* 464.

Angelidis, D. and Hyroudi, K. 2006. Efficiency in the Italian banking industry: data envelopemnt analysis and neural networks. *International Research Journal of Finance and Economics* 5.

Arua, N. 2007. Nigerian banks and globalization. *Union Digest* 11.1 and 2: 43-59.

Asogwa, R.C. 2005. Assessing the benefits and costs of financial sector reforms in Nigeria: an event study analysis. *Selected Papers for the 2005 Annual Conference of the Nigerian Economic Society*: 489- 521.

Balk, B.M. 1998. *Industrial price, quantity and productivity indices: the microeconomic theory and an application*. Boston: Kluwer Academic Publishers.

Bauer, P., Berger, A.N., and Humphrey, D.B. 1993. Efficiency and productivity growth in US banking. *In Fried, H.O., Lovell, C.A.K. and S.S. Schmidt (Eds). The Measurement of Productive Efficiency: Techniques and Applications.* Oxford University Press. Pp. 386-413.

Bauer, P.W. and Hancock, D. 1993. The efficiency of the Federal Reserve in providing check processing services. *Journal of Banking and Finance* 17:287-311.

Battese, G.E and Coelli, T.J. 1992. Frontier production functions, technical efficiency and panel data: with application to paddy farmers in India. *Journal of Productivity Analysis* 3:153-169.

Beck, T., Demirgüç-Kunt, A., and Levine, R. 2003. Bank concentration and crises. *The World Bank, Policy Research Working Paper Series* 3041.

…….. 2009. Financial institutions and markets across countries and over time: data and analysis. *World Bank Policy Research Working Paper* 4943.

Berg, S.A., Forsund, F. and Jansen, E. 1992. Malmquist indices of productivity during the deregulation of Norwegian banking *Scandinavian Journal of Economics* 94:211-228.

Berger, A.N. 1993. Distribution free estimates of efficiency in the U.S. banking industry and tests of the standard distributional assumptions. *The Journal of Productivity Analysis* 4:261-292.

---------- 1995. The profit-structure relationship in banking test of market-power and efficiency-structure hypotheses. *Journal of Money, Credit and Banking* 27.2:404-431.

---------- 2003. The economic effects of technological progress: evidence from the banking industry. *Journal of Money, Credit, Banking* 35.2: 141-176.

----------, Hanweck, G.A. and Humphrey, D.B. 1987. Competitive viability in banking *Journal of Monetary Economics* 20: 501-520.

---------- and DeYoung, R. 1997. Problem loans and cost efficiency in commercial banks. *Journal of Banking and Finance* 21: 849-870.

----------, DeYoung, R., Genay, H. and Udell, G.F. 2000. Globalization of financial institutions: evidence from cross-border banking performance. *Brooking-Wharton Paper on Financial Services* 3: 23-158.

---------- and Humphrey, D.B. 1992. Measurement and efficiency issues in commercial banking. *In Grilliches (Ed). Measurement Issues in the Services Sectors. National Bareau of Economic Research*.University of Chicago Press. Pp. 245-279.

---------- and ----------1997. Efficiency of financial institutions: international survey and directions for future research. *European Journal of Operational Research* 98:175-212.

----------and Mester, L.J. 1999. What explains the dramatic changes in cost and profit performance of the U.S. banking industry? *Federal Reserve Board Finance and Economic Discussion Series Paper* 13.

----------, Demsetz, R.S. and Strahan, P.E. 1999. The consolidation of the financial services industry: causes, consequences, and implications for the future. *Journal of Banking and Finance* 23: 135-194.

Bonin, J.P., Hasan, I. and Wachtel, P. 2005. Bank performance, efficiency and ownership in transition countries. *Journal of Banking and Finance* 29: 31-53.

Brockett, P.L., Charnes, A., Cooper, W.W., Huang, Z.M. and Sun, D.B. 1997. Data transformation in DEA cone- ratio envelopment approaches for monitoring bank performances. *European Journal of Operaitonal Research* 98: 251-269.

Button, K. and Weyman-Jones, T. 1992. Ownership structure, institutional organization and measured x-efficiency. *American Economic Review*.

Bwala, S.M. 2003. An empirical investigation of the operational efficiency of insured banks in Nigeria. *Nigeria Deposit Insurance Corporation Quarterly*13: 55-72.

Cadet, R.L. 2008. Cost and profit efficiency of banks in Haiti: do domestic banks perform better than foreign banks? *Munich Personal RePEc Archive* 11953.

Calomiris, C.W. 1999. Gauging the efficiency of bank consolidation during a merger wave. *Journal of Banking and Finance* 23.

Casu, B., Giradone, C. and Molyneux, P. 2004. Productivity change in European banking: a comparison of parametric and non-parametric approaches. *Journal of Banking and Finance* 28: 2521-2540.

Central Bank of Nigeria. 2004. Monetary, credit, foreign trade and exchange policy guidelines for fiscal 2004/2005. *Monetary Policy Circular* 37.

---------- 2005. *Banking Supervision Annual Report.*

----------2006. *Banking Supervision Annual Report*

----------2008. *Banking Supervision Annual Report*

----------2006. *Statistical Bulletin* 17.

----------2008. *Statistical Bulletin* 17.

----------2010. *Statistical Bulletin* 17.

Chambers, R.G., Chung, Y and Fare, R. 1996. Benefit and distance functions. *Journal of Economic Theory* 70: 407-419.

Chang, E.C., Hasan, I. and Hunter, W.C. 1998. Efficiency of multinational banks: an empirical investigation. *Journal of Applied Financial Economics* 8: 689-696.

Chen, Y. 2001. Three Essays on Bank Efficiency. Ph.D. Thesis. Department of Finance. Drexel University. ix + 205pp.

Claessens, S., Demirguc-Kunt, A. and Huizinga, H. 2001. How does foreign entry affect domestic banking markets? *Journal of Banking and Finance* 25: 891-911.

Coelli, T.J., Rao, D.S.P., O' Donnell, C. J and G.E. Battese 2005. *An Introduction to Efficiency and Productivity*. 2nd ed. New York: Springer.

Debreu, G. 1951. The coefficient of resource utilization. *Econometrica* 19:273-292.

Delis, M.D., and Papanikolaou, N.I. 2009. Determinants of bank efficiency: evidence from semi-parametric methodology. *Munich Personal RePEc Archive Paper* 13893.

Demsetz, H. 1973. Industry structure, market rivalry and public policy. *Journal of Law and Economics* 16:1-9.

Deng, C., Liu, T. and Wu, J. 2007. Efficiency analysis of China's commercial banks based on DEA: negative output investigation. *China-USA Business* Review 6.2:50-56.

Devaney, M. and Weber, W. 1996. Productivity growth, market structure, and technological change: evidence from the rural banking sector. *Southeast Missouri University mimeo.*

DeYoung, R. and Whalen, G. 1994. Banking industry consolidation: efficiency issues. *Presented at the Jerome Levy Economics Institute Conference*. April 14-16.

Dietsch, M. and Lozano-Vivas, A. 2000. How the environment determines banking efficiency: a comparison between French and Spanish industries. *Journal of Banking and Finance* 24: 985-1004.

Drake, L. 2003. Cost and efficiency in banking: A survey of the evidence from the U.S., U.K.and Japan. *Handbook of international Banking.* A.W.Mullineux and V. Murinde ed. Chapter 12.

Ebong, B.B. 2006. Banking sector reforms: opportunities and challenges. *Union Digest* 10.1 and 2: 1-9.

Elyasiani, E., and Mehdian, S.M. 1990. Efficiency in the commercial banking industry: a production frontier approach. *Applied Economics* 22:539-551.

English, M., Grosskopf, K.H. and Yaisawarny, S. 1993. Output allocative and technical efficiency of banks. *Journal of Banking and Finance* 17:349-366.

Etim, S.O. 1999. Impact of borrowers origin and sectoral activities on debt recovery efforts in the Nigerian banking Industry. *Union Digest* 5 (2): 78-93.

Fadiran, T. P. 2006. The effect of management quality on banks' survival. M.Sc. Project. Department of Economics. University of Ibadan.

Fare, S., Grosskopf, S. and Lovell, C.A.K. 1994. *Production Frontiers*. Cambridge: Cambridge University Press.

Fare, R., and Primont, D. 1995. *Multi-Output Production and Duality: Theory and Applications*. Boston: Kluwer Academic Publishers

Farrell, M.J. 1957. The measurement of productive efficiency. *Journal of the Royal Statistical Society*. Series A. CXX 3:253-290.

Favero, C. and Papi, L. 1995. Technical efficiency and scale efficiency in the Italian banking sector: a non- parametric approach. *Applied Economics* 27:385-395.

Fernandez, A.I., Gascon, F. and Gonzalez, E. 2002. Economic efficiency and value maximization in banking firms. *Working paper*.

Ferrier, G.D. and C.A.K. Lovell 1990. Measuring cost efficiency in banking. Econometric and linear programming evidence. *Journal of Econometric*s 6:229-245.

Field, A. 2009. *Discussing statistics using SPSS*. 3rd ed. Los Angelis: SAGE.

Fiorentino, E., De Vincenzo, E., Heid, F., Karmann, A. and Koetter, M. 2009. The effects of privatization and consolidation on bank productivity: comparative evidence from Italy and Germany. *Banca D'Italia Eurosistema Working Papers 72*

Fixler, D.J. 1993. Measuring financial service output and prices in commercial banking. *Applied Economics* 25:983-993.

Frank, R.H. and Bernanke, B.S. 2004. *Principles of economics*. Second Edition. Irwin: McGraw Hill.

Frantz, R. 1990. X-inefficiency: Past, present and future. In Weiermair and Perlman. *Studies in Economic Rationality*. Ann Arbor: University of Michigan.

Fries, S. and Taci, A. 2005. Cost efficiency of banks in transition: evidence from 289 banks in 15 post-communist countries. *Journal of Banking and Finance* 29: 55-81.

Fuentes, R. and Vergara, M. 2003. Explaining bank efficiency: bank size or ownership structure? *Unpublished Paper*.

Goldberger, A.S. 1964. *Econometric theory*. New York: Wiley.

Gosset, W.S. 1908. The probable error of the mean. *Biometrica* 6: 1-25.

Greene, W.H. 1990. A gamma-distributed stochastic frontier model. *Journal of Econometrics* 46:141-163.

Grifell–Tatje, E. and Lovell, C.A.K. 1996. Deregulation and productivity decline: the case of Spanish savings banks. *European Economic Review* 40(6): 1281-1303.

Gupta, U.G. and Collins, W 1997. The impact of information systems on the efficiency of banks: an empirical investigation. *Industrial Management and Data Systems.* MCB University Press 97/1: 10-16.

Hanna, N. 1994. Exploiting information technology for development. *World Bank Discussion* 246

Harada, K. and Ito, T. 2005. Rebuilding the Indonesian banking sector: economic analysis of bank consolidation and efficiency. *JBICI Review* 12: 32-60.

Harberger, A. 1954. Monopoly and resource allocation. *American Economic Review*

Hasan, I. and Hunter, W.C. 1996. Efficiency of Japanese multinational banks in the United States. *In Chen, A.H. (editor). Research in Finance Greenwich*. JAI Press. Pp 157-173.

Haynes, M. and Thompson, S. 1999. The productivity effects of bank mergers: evidence from the UK building societies. *Journal of Banking and Finance* 23: 825-846.

Hicks, J. 1935. The theory of monopoly. *Econometrica*.

Honore, B.E. 1993. Orthogonality conditions for Tobit models with fixed effects and lagged dependent variables. *Journal of Econometrics* 59.1-2: 35-61.

Hughes, J.P. and Mester, L.J. 1993. A quality and risk adjusted cost-function for banks: evidence on the 'too-big-to-fail' doctrine. *Journal of productivity analysis* 4: 293-315.

----------, Lang, W.W., Mester, L.J., Moon, C.G., and Pagano, M.S. 2003. Do bankers sacrifice value to build empires? Managerial incentives, industry consolidation, and financial performance. *Journal of Banking and Finance* 27: 417-447.

Huizinga, H.P., Nelissen, J.H.M. and Vander Vennet, R. 2001. Efficiency effects of bank mergers and acquisitions in Europe. *Tinbergen Institute Discussion Paper* 088/3.

Humphrey, D.B 1993. Cost and technical change: effects from bank deregulation. *Journal of Productivity Analysis* 4:5-34.

Hunter, W.C. and Timme, S.G. 1995. Core deposits and physical capital: a re-examination of bank scale economies and efficiency with quasi-fixed inputs. *Journal of Money, Credit and Banking* 27:165-185.

Idialu, J.U. 2007. Measuring the efficiency of Nigerian banks using a DEA approach. *Journal of Academics, Association of Nigerian Academics* 2(3).

Idialu, J.U. and Yomere, G.O. 2010. Stochastic frontier analysis of the efficiency of Nigerian banks. *Indian Journnal of Economics and Business* 9 (1).

Jemric, I. and B. Vujcic 2002. Efficiency of banks in Croatia: A DEAB approach. *Croatian National Bank Working Papers.* 1-13.

Jerome, A. 2004. Technical efficiency in some privatized enterprises in Nigeria. *African Journal of Economic Policy* 11(1):17-34

Jondrow, J., Lovell, C.A.K., Materov, I.S. and Schmidt, P. 1982. On estimation of technical inefficiency in the stochastic frontier production function model. *Journal of Econometrics* 9: 233-238.

Kadir, H.A., Masinaei, R. and Rahmani, N. 2011. Long-term effects of bank consolidation program in a developing economy. *Journal of Asia Pacific Business Innovation and Technology Management* 1: 20-30.

Kama, U. 2006. Recent reforms in the Nigerian banking industry: issues and challenges. *Central Bank of Nigeria Bullion* 30.3: 65-74.

Kasman, A. 2002. Cost efficiency, scale economies and technological progress in Turkish banking. *Central Bank Review* 1: 1-20.

Khumbhakar, S.C. 1996. A parametric approach to efficiency measurement using a flexible profit function. *South Economic Journal* 473-487.

Kiyota, H. 2009. Efficiency of commercial banks in Sub-Saharan Africa: a comparative analysis of domestic and foreign banks. *A paper presented at the Centre for the Study of African Economies Conference on Economic Development in Africa.* March 22-24, 2009. University of Oxford, United Kingdom.

Koopmans, T.C. 1951. An analysis of production as an efficient combination of activities. *In T.C. Koopmans, (Ed.) Activity Analysis of Production and Allocation.* Cowles Commission for Research in Economics. Monograph 13. New York: Wiley.

Košak, M. and Zajc, P. 2006. Determinants of bank efficiency differences in the new European Union member countries. *Unpublished Paper.*

Kozak, S.J. and Kowalski, K.Z. 2005. Effect of technology on consolidation level and efficiency of banking system. *Proceedings of the International Conference on*

Information and Communication Technology in Management. 23-25 May 2005. Meleka: Malaysia.

Kumbhakar, S.C. 1987. The specification of technical and allocative inefficiency of multi-product firms in stochastic production and profit frontiers. *Journal of Quantitative Economics* 3: 213-223.

Kwan, S.H. and Eisenbeis, R.A. 1996. An analysis of inefficiencies in banking: a stochastic cost frontier approach. *Federal Reserve Bank of San Francisco Economic Review* 2:17-26.

Lambson, V.E. 1987. Is the concentration-profit correlation partly an artifact of lumpy technology? *American Economic Review* 77:731-733.

Laudon, D.P. and J.P. Laudon 1991. *Business Information System: a Problem Solving Approach.* New York: HBJ College Publishers.

Lee, B.L., Worthington, A.C. and Leong, W.H. 2008. Malmquist indices of pre and post-deregulation productivity, efficiency and technological change in the Singaporean Banking Sector. *Economics Division, Ministry of Trade and Industry of Singapore Working/ Discussion Paper* 228.

Leibenstein, H. 1966. Allocative efficiency versus x-efficiency. *American Economic Review* 56:392-415.

Lichtenberg, F.R. 1995. The output contribution of computer equipment and personnel: a firm-level analysis. *Economics of Innovation and New Technology* 3.4: 201-217.

Lovell, C.A.K. 1993. Productive frontiers and productive efficiency. *In Fried, H.O., Lovell, C.A.K. and S.S. Schmidt, (Ed.). The Measurement of Productive Efficiency*. New York: Oxford University Press.

McConnell, C.R. and Brue, S.L. 2005. *Economics: Principles, Problems and Policies.* 16th Edition. Irwin: McGraw-Hill.

Maggi, B. and Rossi, S.P.S. 2003. An efficiency analysis of banking systems: a comparison of European and United States large commercial banks using different functional forms. *Department of Economics. University of Vienna Working Paper* 306:1-40.

Manlagnit, M.C. and Lamberte, M.B. 2004. Evaluating the impacts of competition policy reforms on the efficiency of Philippine commercial banks. *Philippine Institution for Development Studies Discussion Paper Series* 2004-2046: 1-45.

Maudos, J., Pastor, J., Perez, F.and Quesada, J. 2002. Cost and profit efficiency in European banks. *Journal of International Financial Markets, Institutions and Money* 12.1: 33-58.

Master, L.J. 1996. A study of bank efficiency taking into account risk-preferences. *Journal of Banking and Finance* 20:1025-1045.

Mishkin, F.S. 2007. *The economics of money, banking and financial market*. 8th ed. New York: Addison Wesley.

Nnanna, O.J. 2003. Today's banking risks and current regulatory and supervisory framework. *Central Bank of Nigeria Bullion* 27.3. 30-44.

Norris, E. and Floerkemeier, H. 2007. Bank efficiency and market structure: what determines banking spreads in Armenia? *IMF Working Paper* 07/134.

Nyong, M. 1999. Market structure, conduct and performance in the Nigerian banking industry: New evidence, new insights. *Nigeria Deposit Insurance Corporation Quarterly* 9.3: 63-85.

Obafemi, F.N. 2008. *The efficiency of the Nigerian banking industry: a data envelopment analysis approach*. Ph.D Thesis. Dept. of Economics. University of Calabar.

Olaosebikan, B. 2009. *Surveying efficiencies of Nigerian banks before and after the minimum capital requirement increase.*Honours Project. Illinois Wesleyan University.

OECD. 1996. *The knowledge based economy*. Paris.

Osota, R. 1995. Economies of scale and scope in commercial bank in Nigeria. *Nigeria Deposit Insurance Corporation Quarterly* 5.2: 38-52.

Pasiouras, F. and Sifodaskalakis, E. 2007. Total factor productivity change of Greek cooperative banks. *University of Bath School of Management Working Paper Series* 2007.13

Pilloff, S.J. and Santomero, A.M. 1997. The value effects of bank mergers and acquisitions. *Wharton Working Paper Series* 7.

Princeton University. 2007. *Data and statistical services*. Retrieved Sept. 25, 2010, from http://www.data@princeton.edu.

Rangan, N., Aly, H.Y., Pasurka, C. and Grabowski, R.1988. The technical efficiency of US banks. *Economics Letters* 28.2: 169-175.

Rao, A. 2002. Estimation of efficiency, scale and scope and productivity measures of UAE banks. *A paper presented at the European Conference of Financial Management Association International (FMAI-USA).* 6 June 2002. Copenhagen: Denmark.

----------2005. Cost frontier efficiency and risk-return analysis in an emerging market. *International Review of Financial Analysis* 14: 283-303.

Resti, A. 1997. Evaluating the cost efficiency of the Italian banking system: what can be learnt form the joint application of parametric and non-parametric techniques. *Journal of Banking and Finance* 21:221-250.

Rhoades, S.A. 1994. A summary of merger performance studies in banking, 1980-93, and an assessment of the 'operating performance' and 'event study' methodologies. *Federal Reserve Board Staff Studies* 167.

Rogers, K. and Sinkey, J.F. 1999. An analysis of nontraditional activities at U.S. commercial banks. *Review of Financial Economics* 8: 25-39.

Sawada, M. and Okazaki, T. 2003. Effects of bank consolidation promotion policy: evaluating the bank law in 1927 Japan. *Research Institute of Economy, Trade and Industry Discussion Paper Series* 04-E-004.

Schure, P. Wagenvoort, R. and O'Brien, D. 2004. The efficiency and the conduct of European banks: Developments after 1992. *Review of Financial Economics* 13 .4: 371-396.

Seinford, A.B.L.M. and Thrall, R.M. 1990. Recent developments in data envelopment analysis: the mathematical approach to frontier analysis. *Journal of Econometrics* 46: 7-38.

Sensarma, R. 2006. Are foreign banks always the best? Comparison of state-owned, private and foreign banks in India. *Economic Modeling* 23: 717-735.

Shahimi, S., Ismail, A. and Ahmad, S. 2005. A panel data analysis of fee income activities in islamic banks. *Universiti Kebangsaan Malaysia Working Paper in Islamic Economics and Finance* 510.

Shanmugam, K.R. and Das, A. 2004. Efficiency of Indian commercial banks during the reform period. *Applied Financial Economics* 14: 681-686.

Sherman, H.D. and Gold, F. 1985. Bank branch operating efficiency: Evaluation with data envelopment analysis. *Journal of Banking and Finance* 9:279-315.

Shephard, R.W. 1970. *Theory of cost and production functions.* Princeton: Princeton University Press.

---------- 1982. The elements of market structure. *Review of Economics and Statistics* 54:25-37.

Shih, S.H.M. 2003. An investigation into the use of mergers as a solution for the Asian banking sector crisis. *The Quarterly Review of Economics and Finance* 43: 31-49.

Simar, L. and Wilson, P.W. 2007. Estimation and inference in two stage, semi-parametric models of productive efficiency. *Journal of Econometrics* 136: 31-64.

Sloman, J. 2006. *Economics.* 6th Edition. Pearson: Prentice Hall.

Sobodu, O.O. and Akiode, P.O. 1995. Financial reforms and the Nigerian banking system: Analysis of intertemporal changes in efficiency. *African Journal of Economic Policy* 2.2

Somoye, R.O.C. 2008. The performance of commercial banks in post-consolidation period in Nigeria: an empirical review. *European Journal of Economics, Finance and Administrative Sciences* 14.

Staikouras, C., Mamatzakis, E. and Koutsomanoli-Filippaki, A. 2007. Cost efficiency of the banking industry in the south eastern European region. *International Financial Markets, Institutions and Money.*

Stigler, G. 1976. The existence of x-efficiency. *American Economic Review.*

Sufian, F. and Majid, M.A. 2007. Deregulation, consolidation and banks efficiency in Singapore. Evidence from event study window approach and Tobit analysis. *International Review of Economies* 54.2: 261-283.

---------- and ---------- 20007. The efficiency of merchant banks and finance companies in an emerging market: determinants and policy issues. *Business, Finance and Economies in Emerging Economies* 2.1. Retrieved Dec. 1, 2010, from http://www.ccmf-uwi.org.

---------- and M.A. Noor. 2009. The determinants of islamic banks' efficiency changes: empirical evidence from the Middle East/ North Africa and Asian banking sectors. *International Journal of Islamic and Middle Eastern Finance and Management* 2.2: 120-138.

Suhaimi, R. 2005. Cost efficiency and K-economy of commercial banks in Malaysia. *Unpublished Paper*.

Tang, H. Zoli, E. and Klytchnikova, I. 2000. Banking crises in transition economies. Fiscal costs and related issues. *World Bank Policy Research Working Paper* 2484.

Tobin, J. 1958. Estimation of relationships for limited dependent variables. *Econometrica* 26: 24-36.

Torsten, W. 2010. Bank efficiency amid foreign entry: evidence from the Central American Region. *International Monetary Fund Working Paper* 10/95.

Vander, V.R. 2002. Cross-border mergers in European banking and bank efficiency. *Universiteit Gent Working Paper* 152.

Walkner, C. and Raes, J. 2005. Integration and consolidation in EU banking-an unfinished business. *European Economy European Commission Economic Papers* 226.

Wheelock, D.C. and Wilson, P.W. 1996. Technical progress, inefficiency and productivity change in U.S. banking. *Federal Reserve Bank of St. Louis mimeo.*

World Bank. 2007. *Financial Development and Structure Database.*

Yeh, Q. J. 1996. The application of data envelopment analysis in conjunction with financial ratios for bank performance evaluation. *Journal of the Operational Research Society* 47:980-988.

APPENDIX

Appendix 1

Table 3.1 Summary of Selected Studies on Cost Efficiency and X-inefficiency of Banks

Authors/Years	Case Study/Data coverage	Methodology and Estimation techniques	Major Findings
Berger and Humphrey (1992)	U.S. (1980-1988)	Thick Frontier Approach (TFA)	Deregulation of deposit rates causes increase in average cost in banks especially the smaller ones, hence less efficient while during post-deregulation periods, their average cost fall only when changes in business condition is not adjusted for in the shifts in best practice cost.
Sobodu and Akiode (1995)	Nigeria (1983-1993)	Data Envelopment Analysis (DEA)	Efficiency of banks decline more during periods of deregulation.
Favero and Papi (1995)	Italy (1991)	DEA	Efficiency of banks is mainly determined by productivity specialization by bank size and less by their locations.
Kwan and Eisenbeis (1996)	U.S. (1986-1991)	Stochastic Frontier Approach (SFA)	On average, smaller banks are less efficient than bigger ones and the former are prone to higher risks. The stock returns of smaller banks correlate with their x-inefficiencies.
Altunbas et al. (2000)	Japan (1993-1996)	SFA	X-inefficiency scores are not sensitive to risk and big banks are more x-inefficient than small ones.
Jemric and Vujcic (2002)	Croatia (1995-2000)	DEA	Averagely, foreign- owned banks are more efficient than indigenous banks; new banks are efficient than old ones and small banks are efficient than large ones. Large banks are efficient when constant return to scale is not assumed.
Kasman (2002)	Turkey (1988-1998)	SFA	Significant inefficiency problem in the Turkish banking industry than that of the U.S. and European counterparts.
Maudos et.al. (2002)	Ten European Countries (1993-1996)	Multiple Regression and DEA	Among large, medium and small banks, only medium sized banks are cost and profit efficient.
Rao (2002)	United Arab Emirates (UAE) (1998 and 2000)	SFA	Substantial cost inefficiencies exist in the banks. Average small banks are cost efficient than large ones.

Bwala (2003)	Nigeria (2000-2002)	TFA	There is a high level of x-inefficiency of insured banks in Nigeria.
Maggi and Rossi (2003)	U.S. and Europe (1995-1998)	Distribution-Free Approach (DFA) and SFA	There is substantial inefficiency in both U.S. and European banks.
Allen and Liu (2005)	Canada (1983-2003)	SFA	Inefficiency of the banks is about 10 per cent.
Fadiran (2006)	Nigeria (2000-2004)	DEA	Substantial inefficiency in the banks implying poor quality of management.
Den, Liu and Wu (2007)	China (1999-2001)	Super-efficiency DEA	Non-negativity assumption of input and output in DEA are overcome and most banks in the country are efficient.
Obafemi (2008)	Nigeria (1984/85, 1994/95, 1999/2000, 2003/2004)	DEA	Liberalization improves efficiency of banks, though such improvement is not sustained. Also inefficiency of the sector is largely accounted for by the size of market share.
Idialu (2007)	Nigeria (1999-2004)	DEA	A significant inefficiency level in the banking sector.
Idialu and Yomere (2010)	Nigeria (2000-2004)	SFA	Inefficiency in the banking sector ranged from 0-19 per cent of total cost.
Olaosebikan (2009)	Nigeria (1999-2005)	DEA	Efficiency improves in a period associated with increase in minimum capital requirement but fluctuates prior to this period.

Source: Compiled by Author

Appendix 2

Table 3.2 Summary of Selected Studies on Determinants of Bank Efficiency

Authors/Years	Case Study/Data coverage	Methodology	Major Findings
Fuentes and Chile (2003)	Chile (1990-2000)	Regression	Banks that are established as open corporations in Chile tend to show higher level of efficiency than offices of international banks. The result survives after controlled by size, market concentration, credit risks and economic activity. Banks that have higher property concentration show higher level of efficiency.
Manlagnit and Lamberte (2004)	Philippi (1990-2002)	Tobit Regression	Agency costs, governance and bank performance and macroeconomic characteristics have significant impact on efficiency.
Suhaimi (2005)	Malaysia (1995-2003)	Two-way Fixed Effects	Training expenditure and bank size significantly reduce cost efficiency. Information and Communication Technology (ICT) significantly increase cost efficiency. Efficient infrastructure, knowledge labour and ICT expenditure were found to be weakly exogenous. This finding favours neoclassical theory and rejects new growth theory. Also, the inverse effect of bank size on efficiency is during the transition period of bank consolidation process.
Kosak and Zajc (2006)	Eight new EU member countries (Slovakia, Poland, Slovenia, Hungary, Latvia, Lithuania, Estonia, Czech Republic (1996-2003)	Fixed Effect Generalized Least Square Regression (FGLS)	Bank profitability indicators (return on average equity and return on average assets), deposit per capita and population per bank have positive impacts on efficiency. But European Bank for Reconstruction and Development (EBRD) index of banking sector development is an insignificant determinant. Market concentration, intermediation ratio and density of demand have negative effects on bank efficiency.
Obafemi (2008)	Nigeria (1984/85, 1994/95, 1999/2000, 2003/2004)	Tobit Regression	Market share is the most important determinant of efficiency. Quality of management and capital adequacy are insignificant determinants of bank efficiency.
Delis and Papanikolaou (2009)	New acceded EU countries (1997, 2000, 2001,2003-2005)	Tobit Regression and Regression run with bootstrap method	Efficiency determinants are enhanced using bootstrap method.
Kiyota (2009)	29 Sub-Saharan African (SSA) countries	Tobit Regression	Among foreign banks, non-SSA foreign banks appear to be more efficient than SSA foreign banks. Medium sized or relatively large banks tend to be most cost efficient.

Source: Compiled by Author

Appendix 3

Table 3.3 Summary of Selected Studies on Productivity Change of Banks

Authors/Years	Case Study/Data coverage	Methodology and Estimation Techniques	Major Findings
Berg, Forsund and Jansen (1992)	Norwey (1980-1989)	Malmquist Index	Deregulation leads to a more competitive environment and large bank productivity increase more than that of small banks because the former faces increased antagonism.
Bauer, Berger and Humphrey (1993)	U.S. (1977-1988)	TFA	Annual cost productivity growth rates vary between -2.28 per cent and 0.16 per cent.
Humphrey (1993)	U.S. (1977-1978)	TFA	During pre-deregulation of deposit rates era, productivity increase; fall substantially in periods of deregulation and change by little units in post deregulation periods.
Wheelock and Wilson (1996)	U.S. (1984-1993)	Linear Programming	Productivity growth of large bank increases while that of small banks decline.
Fernandez, Gasan and Gonzalez (2002)	18 countries across the world (1989-1998)	DEA	Commercial bank productivity across the world has grown by 19.6 per cent.
Rao (2002)	UAE (1998 and 2002)	SFA	Average banks grow by 24 per cent.
Schure, Wagenvoort and O'Brien (2004)	Europe (1993-1997)	SFA	Large commercial banks are more productive on average than small banks.
Sufian and Majid (2007)	Malaysia (2000-2004)	Malmquist DEA	In the productivity change components, pure technical efficiency is more related to overall efficiency than scale efficiency.
Pasiouras and Sifodaskalakis (2007)	Greece (2000-2005)	Malmquist Index	Intermediate approach results indicate a small decrease (3%) in total factor productivity (TPF) whereas the production approach indicates an increase by 6.6%. Also, TPF growth is higher for smaller banks on average, although the difference is not significant compare to other groups.
Lee et al. (2008)	Singapore (1995-2005)	Malmquist DEA	There are some levels of TFP growth associated with deregulation and scale efficiency improvement largely from merger among the local banks.

Source: Compiled by Author

Appendix 4

Table 3.4 Summary of Selected Studies on Scale Economies, Diseconomies and Scale Efficiency of Banks

Authors/Years	Case Study/Data coverage	Methodology, Estimation techniques and Cost function	Major Findings
Osota (1995)	Nigeria (Jan-Dec. 1994)	Seemingly Unrelated Regressions (SDR) on Hybrid translog cost function	Considerable scale economies exist across all size categories of commercial banks but the economies decrease with increases in banks size. Scope economies also exist in the banks.
Altunbas et. al. (2000)	Japan (1993-1996)	SFA on Fourier/Translog cost function	Scale economies of banks are overstated when risk and quality factors are not incorporated.
Kasman(2002)	Turkey (1988-1998)	SFA on Fourier Flexible cost function	Significant economies of scale exist in all groups of banks.
Rao (2002)	UAE (1998 and 2000)	SFA on Fourier Flexible	Small-size banks improve their scale economies while large-size banks do not.
Maggi and Rossi (2003)	U.S. and Europe (1995-1998)	DFA and SFA on Fourier Flexible form, Translog and Box-Cox	Some evidence of scale and scope economies in banks.
Allen and Liu (2005)	Canada (1983-2003)	Fixed–effects model, SFA, SUR and Dynamic OLS on pooled translog cost function	Potential scale economies exist in banks. They can enjoy 6-20 per cent scale benefits.
Sufian and Majid (2007)	Malaysia (2000-2004)	Malmquist DEA	On average, 28.75% of finance and merchant banking institutions are operating at constant return to scale while others are scale inefficient.
Lee et al. (2008)	Singapore (1995-2005)	Malmquist DEA	There is scale efficiency improvement in the banking sector and this emanates largely from merger among local banks.

Source: Compiled by Author

Appendix 5

Table 4 Variables Definition and their Characteristics*

	Variable	Name	Description
a. **Efficiency Scores Computation**			
Outputs	q_1	Performing loans and advances	Sum of loans and advances that performed in the account year
	q_2	Investments	Short and long term investment
	q_3	Liquid assets	Sum of cash and other interest yielding assets
Inputs	x_1	Deposits	Sum of all deposit accounts
	x_2	Physical capital	Sum of fixed assets
	x_3	Employees	Number of employees
	x_4	Equity capital	Total shareholders' fund
Input Prices:	p_1	Price of funds	Interest expenses on deposits and other funds
	p_2	Price of physical capital	Depreciation of fixed assets
	p_3	Personal expenses	Sum of all payments to employees including gratuities and pensions for banks that have such facilities
	p_4	Price of equity	Earnings per share
b. **Cost Efficiency Correlates**			
Explained	θ_{it}	Cost efficiency	Frontier efficiency computed for bank i in year t
Explanatories	$TASSET_{it}$	Total size	Total assets of bank i in year t
	$RISK_{it}$	Credit risk	Ratio of non-performing loans and advances to total loans and advances of bank i in year t
	$COMP_{it}$	Competition	Deposit market share of bank I in year t
	PBT_{it}	Profitability	Profit before tax of bank I in year t

	$DUMFOR_{it}$	Foreign or domestic ownership	Dummy for foreign or domestic ownership of bank i in period t. Foreign ownership dummy = 1 and domestic ownership dummy = 0.
	$DUMUNI_{it}$	Universal banking policy adoption	Dummy of 1 for indirect adoption of universal banking policy by bank i in period t and 0 for direct implementation of the policy by bank i in year t.
	$DUMNQ_{it}$	Quoted or unquoted banking structure	Dummy of 1 for unquoted bank i in period t on the NSE and 0 for quoted bank i in period t on the NSE
	$NASSET_{it}$	Net worth (size)	Total assets less total liabilities of bank i in period t.

Note: * in naira value except x_3 and its description as well as the dummies.

Appendix 6- 13 are for extension of financial intermediation model (including equity capital and equity price into inputs and input prices model respectively)

Appendix 6

Pre-consolidation Period Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets for an Extended Intermediation Model (2001-2003)

Table 5.1b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2001)^{E}

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	3	1.000	0.603	0.603
Medium	50 to < 150	2	1.000	0.839	0.839
Small	< 50	10	0.968	0.896	0.870

Source: Author's Computation
Note: E = Extended model

Table 5.2b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2002)^{E}

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	3	0.959	0.800	0.765
Medium	50 to < 150	6	1.000	0.914	0.914
Small	< 50	6	0.924	0.731	0.663

Source: Compiled by Author
Note: E = Extended model

Table 5.3b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2003)^{E}

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	3	0.992	0.862	0.855
Medium	50 to < 150	7	0.998	0.850	0.848
Small	< 50	5	0.913	0.906	0.832

Source: Compiled by Author
Note: E = Extended model

Table 5.4b 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2001-2003)[E]

Groups	Total Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥150	9	0.984	0.755	0.741
Medium	50 to < 150	15	0.999	0.868	0.867
Small	< 50	21	0.935	0.844	0.788

Source: Compiled by Author

Note: E = Extended model

Appendix 7

Pre-Consolidation Period Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets for an Extended Intermediation Model (2001-2003)

Table 5.5b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2001)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	2	1.000	0.645	0.645
Medium	5 to < 10	3	1.000	0.840	0.840
Small	< 5	10	0.968	0.864	0.838

Source: Author's Computation
Note: E = Extended model

Table 5.6b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2002)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	3	0.959	0.800	0.765
Medium	5 to < 10	7	0.981	0.914	0.897
Small	< 5	5	0.935	0.693	0.836

Source: Author's Computation
Note: E = Extended model

Table 5.7b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2003)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	4	0.994	0.867	0.862
Medium	5 to < 10	6	0.970	0.891	0.863
Small	< 5	5	0.945	0.851	0.807

Source: Author's Computation
Note: E = Extended model

Table 5.8b 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2001-2003)[E]

Groups	Net Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥10	9	0.984	0.771	0.757
Medium	5 to < 10	16	0.984	0.882	0.867
Small	< 5	20	0.949	0.803	0.760

Source: Author's Computation

Note: E = Extended model

Appendix 8

Consolidation Period Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets for an Extended Intermediation Model (2004-2005)

Table 5.9b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2004)[E]

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥200	3	1.000	0.954	0.954
Medium	100 to < 200	2	1.000	0.943	0.943
Small	< 100	10	0.936	0.932	0.873

Source: Author's Computation
Note: E = Extended model

Table 5.10b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2005)[E]

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥200	5	1.000	0.755	0.755
Medium	100 to < 200	3	0.908	0.900	0.822
Small	< 100	7	0.927	0.987	0.916

Source: Author's Computation
Note: E = Extended model

Table 5.11b 2-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2004-2005)[E]

Groups	Total Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥200	8	1.000	0.855	0.855
Medium	100 to < 200	5	0.954	0.922	0.883
Small	< 100	17	0.932	0.960	0.895

Source: Author's Computation
Note: E = Extended model

Appendix 9
Consolidation Period Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets for an Extended Intermediation Model (2004-2005)

Table 5.12b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2004)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥30	2	1.000	0.992	0.992
Medium	10 to < 30	5	0.995	0.917	0.913
Small	< 10	8	0.923	0.937	0.866

Source: Author's Computation
Note: E = Extended model

Table 5.13b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2005)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥30	5	1.000	0.834	0.834
Medium	10 to < 30	9	0.912	0.913	0.832
Small	< 10	1	1.000	1.000	1.000

Source: Author's Computation
Note: E = Extended model

Table 5.14b 2-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2004-2005)[E]

Groups	Net Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥30	7	1.000	0.913	0.913
Medium	10 to < 30	14	0.954	0.915	0.873
Small	< 10	9	0.962	0.969	0.933

Source: Author's Computation
Note: E = Extended model

Appendix 10
Post-Consolidation Period Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets for an Extended Intermediation Model (2006-2008)

Table 5.15b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2006)[E]

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	4	1.000	0.825	0.825
Medium	200 to < 500	3	1.000	0.753	0.753
Small	< 200	8	0.941	0.773	0.750

Source: Author's Computation
Note: E = Extended model

Table 5.16b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2007)[E]

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	5	0.951	0.853	0.805
Medium	200 to < 500	5	0.944	0.815	0.767
Small	< 200	5	0.935	0.861	0.805

Source: Author's Computation
Note: E = Extended model

Table 5.17b Measured Mean Efficiency of the Deposit Money Banks Classified by Total Assets (2008)[E]

Groups	Total Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	9	0.968	0.837	0.810
Medium	200 to < 500	2	1.000	0.296	0.296
Small	< 200	4	0.914	0.627	0.552

Source: Author's Computation
Note: E = Extended model

Table 5.18B 3-Year Measured Mean Efficiency of the DMBS Classified By Total Assets (2006-2008)[E]

Groups	Total Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥500	18	0.973	0.838	0.813
Medium	200 to < 500	10	0.981	0.621	0.605
Small	< 200	17	0.930	0.754	0.702

Source: Author's Computation

Note: E = Extended model

Appendix 11
Post-Consolidation Period Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets for an Extended Intermediation Model (2006-2008)

Table 5.19b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2006)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	2	1.000	0.861	0.861
Medium	35 to < 100	4	1.000	0.757	0.757
Small	< 35	9	0.947	0.777	0.757

Source: Author's Computation
Note: E = Extended model

Table 5.20b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2007)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	4	0.938	0.853	0.793
Medium	35 to < 100	4	0.950	0.858	0.812
Small	< 35	7	0.942	0.829	0.782

Source: Author's Computation
Note: E = Extended model

Table 5.21b Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2008)[E]

Groups	Net Assets Size (₦'Billion)	Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	9	0.968	0.837	0.810
Medium	35 to < 100	3	0.971	0.743	0.717
Small	< 35	3	0.914	0.290	0.215

Source: Author's Computation
Note: E = Extended model

Table 5.22b 3-Year Measured Mean Efficiency of the Deposit Money Banks Classified by Net Assets (2006-2008)[E]

Groups	Net Assets Size (₦'Billion)	Pooled Frequency	Technical Efficiency (TE)	Allocative Efficiency (AE)	Cost Efficiency (CE)
Big	≥100	15	0.969	0.850	0.821
Medium	35 to < 100	11	0.974	0.786	0.762
Small	< 35	19	0.934	0.632	0.585

Source: Author's Computation

Note: E = Extended model

Appendix 12
Statistical Differences of Pre, During and Post-Consolidation Period Efficiency of the Deposit Money Banks Sized by Total Assets for an Extended Intermediation Model

Table 5.23b Statistical Differences of Pre, During and Post Consolidation Period Efficiency of the Deposit Money Bank Sized By Total Assets [E]

	B (TE)	M (TE)	S (TE)	B (AE)	M (AE)	S (AE)	B (CE)	M (CE)	S (CE)	Friedman's ANOVA Mean Rank
Pre	0.984	0.999	0.935	0.755	0.868	0.844	0.741	0.867	0.788	2.00
During	1.000	0.954	0.932	0.855	0.922	0.960	0.855	0.883	0.895	2.67
Post	0.973	0.981	0.930	0.838	0.621	0.754	0.813	0.605	0.702	1.33
Chi-square stat: 8.000						Chi-square *asymp. sig.: 0.018*				

Source: Author's Computation

Note: B = Big Banks; M = Medium Banks; S = Small Banks; TE =Measured Average Technical Efficiency; AE = Measured Average Allocative Efficiency; CE = Measured Average Cost Efficiency and E = Extended model

Appendix 13
Statistical Differences of Pre, During and Post-Consolidation Period Efficiency of the Deposit Money Banks Sized by Net Assets for an Extended Intermediation Model

Table 5.24b Statistical Differences of Pre, During and Post Consolidation Period Efficiency of the Deposit Money Bank Sized By Net Assets [E]

	B (TE)	M (TE)	S (TE)	B (AE)	M (AE)	S (AE)	B (CE)	M (CE)	S (CE)	Friedman's ANOVA Mean Rank
Pre	0.984	0.984	0.949	0.771	0.882	0.803	0.757	0.867	0.760	1.89
During	1.000	0.954	0.962	0.913	0.915	0.969	0.913	0.873	0.933	2.78
Post	0.969	0.974	0.934	0.850	0.786	0.632	0.821	0.762	0.585	1.33
Chi-square stat.: 9.556				Chi-square *asymp. sig.: 0.008*						

Source: Author's Computation

Note: B, M, S, TE, AE and CE are same as defined under table 5.23b.

Appendix 14

Economies of Scale of the Deposit Money Banks (2001-2008)

Table 5.25b Economies of Scale of the Deposit Money Banks in 2001

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	0.673	0.984	0.683	DRS
2.	First Bank of Nigeria Plc	0.980	1.000	0.980	DRS
3.	United Bank for Africa Plc	1.000	1.000	1.000	CRS
4.	Zenith Bank Limited	1.000	1.000	1.000	CRS
5.	Access Bank Plc	0.977	1.000	0.977	IRS
6.	Wema Bank Plc	0.821	0.903	0.909	DRS
7.	Guaranty Trust Bank Plc	1.000	1.000	1.000	CRS
8.	Oceanic Bank International Limited	1.000	1.000	1.000	CRS
9.	Equatorial Trust Bank Limited	0.862	0.880	1.000	IRS
10.	Afribank Plc	0.704	0.881	0.799	DRS
11.	Diamond Bank Limited	0.830	0.936	0.887	DRS
12.	Fidelity Bank Plc	0.695	0.702	0.991	DRS
13.	Ecobank Nigeria Plc	0.711	0.726	0.980	IRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited (formerly known as Nigeria International Bank Limited	1.000	1.000	1.000	CRS
	Mean	**0.884**	**0.934**	**0.946**	

Source: Author's Computation

Note: CRSTE = Technical Efficiency from CRS DEA
VRSTE = Technical Efficiency from VRS DEA
SCALE = Scale Efficiency = CRSTE/VRSTE
DRS = Decreasing Returns to Scale
IRS = Increasing Returns to Scale
CRS = Constant Returns to Scale
DEAP = Data Envelopment Analysis (Computer) Program

Table 5.26b Economies of Scale of the Deposit Money Banks in 2002

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	0.747	1.000	0.747	DRS
2.	First Bank of Nigeria Plc	0.991	1.000	0.991	DRS
3.	United Bank for Africa Plc	0.681	1.000	0.681	DRS
4.	Zenith Bank Limited	1.000	1.000	1.000	CRS
5.	Access Bank Plc	1.000	1.000	1.000	CRS
6.	Wema Bank Plc	0.793	0.826	0.960	DRS
7.	Guaranty Trust Bank Plc	1.000	1.000	1.000	CRS
8.	Oceanic Bank International Limited	1.000	1.000	1.000	CRS
9.	Equatorial Trust Bank Limited	0.886	0.890	0.972	IRS
10.	Afribank Plc	0.710	0.866	0.820	DRS
11.	Diamond Bank Limited	0.836	0.861	0.971	DRS
12.	Fidelity Bank Plc	0.677	0.951	0.712	IRS
13.	Ecobank Nigeria Plc	0.751	0.813	0.923	IRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.870**	**0.947**	**0.919**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Table 5.27b Economies of Scale of the Deposit Money Banks in 2003

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	0.919	1.000	0.919	DRS
2.	First Bank of Nigeria Plc	0.913	1.000	0.913	DRS
3.	United Bank for Africa Plc	0.762	1.000	0.762	DRS
4.	Zenith Bank Limited	0.986	1.000	0.986	DRS
5.	Access Bank Plc	1.000	1.000	1.000	CRS
6.	Wema Bank Plc	0.839	0.839	1.000	CRS
7.	Guaranty Trust Bank Plc	1.000	1.000	1.000	CRS
8.	Oceanic Bank International Limited	1.000	1.000	1.000	CRS
9.	Equatorial Trust Bank Limited	0.838	0.846	0.991	IRS
10.	Afribank Plc	0.714	0.731	0.978	DRS
11.	Diamond Bank Limited	0.681	0.714	0.953	DRS
12.	Fidelity Bank Plc	0.710	0.925	0.768	IRS
13.	Ecobank Nigeria Plc	0.708	0.745	0.950	IRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.871**	**0.920**	**0.948**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Table 5.28b Economies of Scale of the Deposit Money Banks in 2004

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	1.000	1.000	1.000	CRS
2.	First Bank of Nigeria Plc	0.993	1.000	0.993	DRS
3.	United Bank for Africa Plc	0.899	0.938	0.959	DRS
4.	Zenith Bank Plc	0.932	1.000	0.932	DRS
5.	Access Bank Plc	0.848	1.000	0.848	IRS
6.	Wema Bank Plc	1.000	1.000	1.000	CRS
7.	Guaranty Trust Bank Plc	1.000	1.000	1.000	CRS
8.	Oceanic Bank International Plc	0.823	0.876	0.940	DRS
9.	Equatorial Trust Bank Limited	0.915	0.968	0.944	IRS
10.	Afribank Plc	0.698	0.705	0.990	IRS
11.	Diamond Bank Limited	0.868	0.889	0.976	IRS
12.	Fidelity Bank Plc	0.892	1.000	0.892	IRS
13.	Ecobank Nigeria Plc	0.830	0.900	0.923	IRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.913**	**0.952**	**0.960**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Table 5.29b Economies of Scale of the Deposit Money Banks in 2005

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	1.000	1.000	1.000	CRS
2.	First Bank of Nigeria Plc	0.768	1.000	0.768	DRS
3.	United Bank for Africa Plc	0.826	0.833	0.991	DRS
4.	Zenith Bank Plc	0.815	1.000	0.815	DRS
5.	Access Bank Plc	0.738	0.845	0.873	IRS
6.	Wema Bank Plc	0.937	0.938	0.999	DRS
7.	Guaranty Trust Bank Plc	1.000	1.000	1.000	CRS
8.	Oceanic Bank International Plc	1.000	1.000	1.000	CRS
9.	Equatorial Trust Bank Limited	0.763	0.771	0.990	IRS
10.	Afribank Plc	0.703	0.731	0.962	DRS
11.	Diamond Bank Limited	0.802	0.814	0.984	DRS
12.	Fidelity Bank Plc	1.000	1.000	1.000	CRS
13.	Ecobank Nigeria Plc	1.000	1.000	1.000	CRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.890**	**0.929**	**0.959**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Table 5.30b Economies of Scale of the Deposit Money Banks in 2006

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	1.000	1.000	1.000	CRS
2.	First Bank of Nigeria Plc	0.784	1.000	0.784	DRS
3.	United Bank for Africa Plc	0.958	1.000	0.958	DRS
4.	Zenith Bank Plc	0.730	1.000	0.730	DRS
5.	Access Bank Plc	0.866	1.000	0.866	DRS
6.	Wema Bank Plc	0.588	0.589	1.000	CRS
7.	Guaranty Trust Bank Plc	0.694	1.000	0.694	DRS
8.	Oceanic Bank International Plc	1.000	1.000	1.000	CRS
9.	Equatorial Trust Bank Limited	0.706	0.775	0.911	DRS
10.	Afribank Plc	0.886	0.932	0.951	IRS
11.	Diamond Bank Plc	0.712	0.963	0.740	DRS
12.	Fidelity Bank Plc	0.888	0.888	1.000	CRS
13.	Ecobank Nigeria Plc	0.937	1.000	0.937	DRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.850**	**0.943**	**0.905**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Table 5.31b Economies of Scale of the Deposit Money Banks in 2007

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	0.918	1.000	0.918	DRS
2.	First Bank of Nigeria Plc	1.000	1.000	1.000	CRS
3.	United Bank for Africa Plc	0.821	1.000	0.821	DRS
4.	Zenith Bank Plc	0.773	0.965	0.801	DRS
5.	Access Bank Plc	1.000	1.000	1.000	CRS
6.	Wema Bank Plc	0.729	0.951	0.767	DRS
7.	Guaranty Trust Bank Plc	0.788	1.000	0.788	DRS
8.	Oceanic Bank International Plc	1.000	1.000	1.000	CRS
9.	Equatorial Trust Bank Limited	0.722	0.743	0.971	DRS
10.	Afribank Plc	0.696	0.740	0.940	DRS
11.	Diamond Bank Plc	0.750	0.847	0.886	DRS
12.	Fidelity Bank Plc	0.727	0.754	0.965	IRS
13.	Ecobank Nigeria Plc	0.846	0.912	0.927	DRS
14.	Standard Chartered Bank Limited	1.000	1.000	1.000	CRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.851**	**0.927**	**0.919**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Table 5.32b Economies of Scale of the Deposit Money Banks in 2008

S/N	BANK	CRSTE	VRSTE	SCALE	NOTATION
1.	Union Bank of Nigeria Plc	0.670	0.704	0.951	DRS
2.	First Bank of Nigeria Plc	0.934	1.000	0.934	DRS
3.	United Bank for Africa Plc	0.452	1.000	0.452	DRS
4.	Zenith Bank Plc	0.813	1.000	0.813	DRS
5.	Access Bank Plc	1.000	1.000	1.000	CRS
6.	Wema Bank Plc	0.809	1.000	0.809	IRS
7.	Guaranty Trust Bank Plc	1.000	1.000	1.000	CRS
8.	Oceanic Bank International Plc	0.785	0.794	0.988	DRS
9.	Equatorial Trust Bank Limited	0.680	1.000	0.680	IRS
10.	Afribank Plc	0.593	0.695	0.853	IRS
11.	Diamond Bank Plc	0.687	0.702	0.979	IRS
12.	Fidelity Bank Plc	1.000	1.000	1.000	CRS
13.	Ecobank Nigeria Plc	0.418	0.472	0.886	IRS
14.	Standard Chartered Bank Limited	0.842	1.000	0.842	IRS
15.	Citibank Nigeria Limited	1.000	1.000	1.000	CRS
	Mean	**0.779**	**0.891**	**0.879**	

Source: Author's Computation

Note: CRSTE, VRSTE, SCALE, DRS, IRS and CRS are same as defined under table 5.25b

Appendix 15

Bank Level Malmquist Index Summary of Measured Average Productivity Change (2002-2008)

Table 5.33b Productivity Change of Each of the Deposit Money Banks (2002-2008)

S/N	BANK	TEC	TC	PTEC	SEC	TFPC
1.	Union Bank of Nigeria Plc	0.999	1.027	0.975	1.025	1.027
2.	First Bank of Nigeria Plc	0.993	1.082	1.000	0.993	1.074
3.	United Bank for Africa Plc	0.893	1.153	1.000	0.893	1.030
4.	Zenith Bank Plc	0.971	0.994	1.000	0.971	0.965
5.	Access Bank Plc	1.003	1.163	1.000	1.003	1.167
6.	Wema Bank Plc	0.998	0.950	1.014	0.984	0.948
7.	Guaranty Trust Bank Plc	1.000	1.026	1.000	1.000	1.026
8.	Oceanic Bank International Plc	0.966	1.086	0.999	0.967	1.049
9.	Equatorial Trust Bank Limited	0.967	0.967	1.020	0.948	0.934
10.	Afribank Plc	0.976	1.020	0.949	1.028	0.995
11.	Diamond Bank Plc	0.973	1.069	0.951	1.024	1.041
12.	Fidelity Bank Plc	1.053	0.979	1.048	1.005	1.031
13.	Ecobank Nigeria Plc	0.927	1.050	0.928	0.999	0.973
14.	Standard Chartered Bank Limited	0.976	1.074	1.000	0.976	1.048
15.	Citibank Nigeria Limited	1.000	1.131	1.000	1.000	1.131
		0.979	**1.049**	**0.992**	**0.987**	**1.027**

Source: Author's Computation

Note: TEC= Technical Efficiency Change; TC= Technological Change; PTEC= Pure Technical Efficiency Change; SEC= Scale Efficiency Change; TFPC= Total Factor Productivity Change.