GLOBALISATION AND EFFICIENCY OF DEPOSIT MONEY BANKS (DMBs) IN NIGERIA

By

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Declaration

I declare that this dissertation entitled Globalisation and Efficiency of Deposit Money Banks (DMBs) in Nigeria has been carried out by me in the Department of Business Administration. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any institution.

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Certification

This dissertation entitled GLOBALISATION AND EFFICIENCY OF DEPOSIT MONEY BANKS (DMBs) IN NIGERIA by Hauwa Bayero TIJJANI meets the regulations governing the award of the degree of Master of Science (M.Sc) in Business Administration of the Ahmadu Bello University Zaria, and is approved for its contribution to knowledge and literary presentation.

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Dedication

This dissertation is dedicated to my parents Alhaji Tijjani Abdullahi Bayero and Hajia Rakiya Tijjani Bayero for their love, encouragement and support.

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All praise be to Allah lord of the world the most Beneficent, the most Merciful, may the peace and blessings of Allah be with His beloved servant, Prophet Muhammad (SAW), and members of his household. I thank Allah for the gift of life, health and the wisdom and ability to conduct this research work.

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Abstract

Globalisation stimulates competition in the banking sector which makes the concept of efficiency more important to banks in order to remain viable. The main objective of this study is to determine the impact of globalisation on the efficiency of Deposit Money Banks (DMBs) in Nigeria. Secondary source of data was used by the study, panel data was retrieved from the NSE factbook and CBN annual reports and statement of accounts on a sample of eight DMBs from 2002 to 2013. The Data Envelopment Analysis (DEA) technique was used to estimate efficiency scores of the banks using the DEA Programme, Malmquist productivity index was also computed across selected banks and Hadri Langrange Multiplier Unit root test was conducted on the panel data to determine their stationarity, in addition Random Effects Generalised Least Square regression analysis was used to test the hypotheses. The results of the DEA revealed that Zenith bank had the highest Technical Efficiency change of 1.85 in the period of the study. From the Hadri Langrange Multiplier Unit root test that was conducted pure technical efficiency change, scale efficiency change and liberalisation were found stationary at levels and technical efficiency change and total factor productivity change were found stationary at the first difference. The test of hypotheses revealed a significant positive effect of globalisation on technical efficiency change and total factor productivity change with p-values of 0.09 and 0.09 respectively at 10% level of significance. Pure technical change and scale efficiency changes were not significant as the p-values are 0.43 and 0.09 respectively. The study therefore concludes that globalisation has a significant positive impact on efficiency of DMBs in Nigeria within the period of the study. The study recommends that DMBs should also ensure that they continue to take advantage of the potentials they can gain from globalisation through continous improvements in their technical efficiency and productivity.

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List of abbreviations

AE	Allocative Efficiency
CBN	Central Bank of Nigeria
CRS	Constant Returns to Scale
CE	Cost Efficiency
DEA	Data Envelopment Analysis
DMBs	Deposit Money Banks
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
LIB	Liberalisation
NSE	Nigerian Stock Exchange
PTEch	Pure technical efficiency change
SAP	Structural Adjustment Programme
SCP	Structure Conduct Performance
SEch	Scale Efficiency change
TEch	Technical Efficiency change
VRS	Variable Returns to Scale

CHAPTER ONE
INTRODUCTION

1.1 Background to the study

The banking sector of any economy is one of the most important sectors. The sector represents the most active, most influential and responsive to changes in the economy especially as it has to respond to the dynamics as imposed by globalisation. It also plays a significant role in the economic development of all countries. The efficiency of banks is therefore of paramount importance in the development process of a country (Ikehide, 2000).

Efficiency is a major success determining factor in today's business environment because of its highly dynamic and competitive nature. Efficiency in banking is the ability of a bank to use small amount of inputs to produce maximum outputs (Mehdian, Perry & Rezvanian, 2007). Efficiency in banks can be classified into various forms namely; technical, pure technical and scale efficiencies (Afsharian, kryvko & Reichling, 2011). Technical efficiency has to do with obtaining the maximum level of loans, financial assets and net commission income from a given set of equity, liabilities and deposits. Pure technical efficiency deals with a gain, an optimal utilization of inputs to generate output, In other words, it is the ratio of technical efficiency to

scale efficiency. Scale efficiency deals with choosing the optimum size of bank to generate certain production level (Bikker, 1999). Managers must develop strategies in order to be viable and succeed in this highly unpredictable environment. Innovation is regarded as an important factor that influences individual business success. It has improved the impact of banks on the populace, and also expanded the horizon of banking business in developed nations. The fact that the business of banking is similar everywhere presupposes homogeneity in banking services, thus globalisation is easily amenable to the banking sector (Umaru, Hamidu & Musa, 2013).

Globalisation is seen as the removal of artificial barriers restricting trade and investment and ensuring free movement of goods and services and investment around the world, so as to create a global economy (Usman, 2004). It has led to increased interconnectedness and interdependency among national economies. Shrinkage in distance and location between countries facilitated by rapid advances in Information and Communication Technology (ICT) enable free movement of goods and services and investment has become apparent. This has created a global village with single global market place which forces countries to establish new policies and in turn business firms are forced to review or change their mode of operations. Banks, especially in today's era of globalisation have been forced to adopt new strategies to enable them enhance their performance and enable them compete successfully in the global arena (Usman, 2004).

On the other hand, globalisation is viewed as a conspiracy by a few individuals or countries to create a one world government that will dominate the field of international finance thereby creating a centralized banking system through the use of a single currency (Gary, 1992). This is facilitated by rapid advances in electronic banking technology and the willingness of consumers to accept a single card for worldwide use there by promoting a cashless society and the recent international banking laws that have enabled foreign banks to take over local banks (Gary, 1992).

Globalisation, therefore, is a phenomenon which banks operating in the twenty first century cannot ignore because globalisation provides an array of opportunities for banks through increased access to new markets. These benefits notwithstanding expose banks to stiff competition from other banks from around the world that may be stronger and more financially stable. Therefore, banks must adopt strategies that will enable them reap the benefits of global market and minimise the threat from the global market.

Increased integration among national economies has made the concept of banking efficiency more important. The globalisation of financial services has revolutionised and changed the entire banking industry business models, thus, changes in attitudes and perception of the work force and new competitions have become apparent. Since globalisation exposes banks to competitive pressure both locally and globally, banks therefore need not only be profitable but efficient in order to compete in this changing environment (Gul, Irshad & Zaman, 2011).

Nigeria became relatively integrated into the global economy with the adoption of the Structural Adjustment Program (SAP) in 1986 (Makinde, 2013). Some measures were introduced under the SAP which characterised the deregulation era of the Nigerian banking industry. These measures were aimed at relaxing some of the strict banking regulations to enhance their efficiency and stability. It also entails the provision of a sound legal and regulatory framework that will enable private sector participation in the economy at large, thus ensuring a sound financial system which guarantees safety and public confidence. They include the establishment of the Nigerian Investment Promotion Commission (NIPC) which was established with the aim of relaxing market restrictions on foreign participation in banking activities. Interest rates and exchange rates were also deregulated to encourage foreigners to invest and to guarantee investors'

confidence and the establishment of the Nigerian Deposit Insurance Corporation (NDIC) (CBN, 2001).

The capitalisation of banks was imposed to enable banks operate effectively so that they participate in the global financial marketplace and alsoto meet up with the world best practices of globalisation. The introduction of the new capital base brought about heavy investments in Information Technology infrastructure. Similarly, the capitalisation exercise has led to mergers and acquisitions which further stimulate competition due to the fact that even the not big banks have become big. This level of competition has implications for access to finance, allocation of capital funds, among others (Obaseki, 2000).

Financial reforms were focused on liberalisation of banking business thus ensuring competition and safety of the system and proactively positioning the industry to perform the role of a catalyst for economic development of the country as well as repositioning their operations so that they can cope with the challenges of an increasingly globalised banking system (Iganiga, 2010). Even though liberalisation of the Nigerian banking industry was aimed at increasing efficiency, however the deregulation of interest rates had been accompanied by declining banks credit because lending rates are high leading to high interest rates spread thus culminating in crowding investors sourcing loans from these institutions, it has also intensified the competitive arena for banks and it has also forced those banks that cannot successfully compete out of business. This is evident considering the number of banks that have been operating has been decreasing since these policies were adopted.

On the basis of the background, the study is undertaken to assess the impact of globalisation on technical efficiency change, pure technical efficiency change, scale efficiency change and total factor productivity change of DMBs in Nigeria.

1.2 Statement of the Problem

Globalisation has increased both integration and domination among economies of the world through trade liberalisation and multilateral trade agreements among others (Aseidu, 2002). Trade liberalisation has created both opportunities for growth, domination of African economies and by way trickle down challenges for banks. Banks today are able to operate in what was previously regarded as non-accessible domestic and foreign markets. Some changes were also made in the Nigerian banking industry as a result of globalisation. The removal of restrictions could improve the quality, pricing and availability of banking services by bringing in new and better skills, management techniques, training procedures, technology and products. This could stimulate competition and thus result in increased efficiency for banks because competition is seen as an important tool for efficiency in production and allocation of goods and services in banking.

Liberalisation of the domestic banking industry has resulted in the inflow of foreign investors into the domestic banking industry and hence new types of competitors have emerged. These latest developments arising as a result of globalisation has led to intensified competition therefore, banks have to be efficient in order to remain viable and profitable. Though, huge profits declared by banks may be suggestive of their efficiency, but newspaper and other reports

indicate series of exploitative charges by Nigerian banks, therefore, whether the profit declared is efficiency driven is still not clear.

Studies have been conducted at various levels to determine the effect of globalisation on efficiency of banks. Most of these studies were conducted in America, Asia, Europe and China only a few in African countries. Studies like those of Mehdian, *et al.,* (2007), Wezel (2010), Pawloska (2003) Pasiouras (2006) and Asongu (2012), among others. These studies have attempted to study the efficiency of banks in the period of globalisation. However, due to the mixed findings reported by these studies, it is still not clear whether the level of globalisation has any significant effect on efficiency of banks despite several studies that have attempted to study such effects.

Furthermore, it will be wrong to make genaralisations on the findings from these studies without considering the peculiarities of the Nigerian economy. Very few studied the effect of globalisation on the efficiency of Nigerian banks. Obafemi (2012) and Obafemi, Ayodele and Ebong (2013) evaluated the technical efficiency of commercial and merchant banks in Nigeria liberalisation period, Ajisafe and Akinlo (2014) considered the efficiency of commercial banks in Nigeria and Oyedele (2014) studied the Nigerian banking sector both pre and post-consolidation periods among others. All the earlier mentioned works, suffer a number of methodological setbacks such as limited time frame, small sample size and inability to conduct stationarity tests on time series data, among others. Unless these issues are taken into consideration, such inadequacies in the method used could render the results statistically inconsistent and thus unreliable. In addition, to the best of our knowledge, none of the studies has looked at the level of globalisation and its effect on technical efficiency, pure technical efficiency, scale efficiency and total factor productivity of DMBs in Nigeria. This study is

therefore designed to fill the gap in the literature by studying the effect of globalisation on the technical efficiency, pure technical efficiency, scale efficiency and total factor productivity of DMBs in the Nigerian banking sector.

1.3 Research Questions

In order to address the problem of the study, the following questions were raised:

i To what extent does globalisation impact on technical efficiency change of Deposit Money Banks (DMBs) in Nigeria?

ii To what extent does globalisation have an impact on pure technical efficiency change of DMBs in Nigeria?

iii To what extent does globalisation have an impact on scale efficiency change of DMBs in Nigeria?

iv To what extent does globalisation have an impact on total factor productivity of DMBs in Nigeria?

1.4 Objectives of the Study

The broad objective of this study is to determine the impact of globalisation on the efficiency of Deposit Money Banks (DMBs) in Nigeria. The specific objectives of this study are to:

i Assess the impact of globalisation on technical efficiency change of DMBs in Nigeria.

ii Determine the impact of globalisation on pure technical efficiency change of DMBs in Nigeria.

iii Examine the impact of globalisation on scale efficiency change of DMBs in Nigeria.

iv Determine the impact of globalisation on total factor productivity change of DMBs in Nigeria.

1.5 Research Hypotheses

In line with the objectives, the following hypotheses were formulated for testing:

H_{01}: Globalisation has no significant impact on technical efficiency change of DMBs in Nigeria.

H_{02}: Globalisation has no significant impact on pure technical efficiency change of DMBs in Nigeria.

H_{03}: Globalisation has no significant impact on scale efficiency change of DMBs in Nigeria.

H_{04}: Globalisation has no significant impact on total factor productivity change of DMBs in Nigeria.

1.6 Scope of the study

The study focused on the effect of globalisation on technical, pure technical, scale efficiency change and total factor productivity change of Nigerian banks. This is because the banking sector is the most active sector in the Nigerian economy and also the most regulated sector and banks are the first to comply with government policies. In addition, any shock in the banking sector affects the economy as a whole. The study made use of liberalisation as a proxy for globalisation, this is because liberalisation deals with both cause and effect of globalisation (Asongu, 2012;

Sufian & Habibullah, 2012; Afaha & Oluchukwu, 2012; Adelokwokan and Maku, 2013). Equity, financial liabilities and deposits as bank inputs, and loans, financial assets and net commission on income as bank output are used to determine the sources of technical, pure technical and scale efficiency changes and the total factor productivity index of these banks. The study covers the period of twelve years from 2002 to 2013. The choice of this period is due to the fact that it is within the period that withdrawal of public sector funds from banks began and it is also the period in which globalisation played a significant influence in the scope of economic activities in the country, it is also within this period that the 25billion naira minimum capitalisation was introduced.

1.7 Significance of the Study

This study shall provide empirical evidence on how globalisation affects the efficiency of Nigerian banks by providing enhanced understanding of how it stimulates competition in the banking arena and thus making the concept of efficiency of paramount importance to them in this era of increasing globalisation of markets and institutions. To this end it provides empirical evidence on the impact globalisation has on allocative, technical, scale efficiency and total factor productivity change of these banks thus enabling them to make decisions on how to improve their efficiency. It also provide evidences of the sources of efficiency changes in these banks thus, the results of that are generated at the end of this study will serve as an eye opener for these banks to take corrective measures that could ensure improvements in their efficiency levels.

Banking business is universal, since globalisation presents both opportunities and threats to businesses in general, managers, specifically bank managers need to recognise how to gain from these opportunities and minimise the threats. This study will serve as a guide to bank managers in understanding how technical, pure technical and scale efficiencies and the total factor

productivity index have been affected by liberalisation thus making them more informed in their strategies should they be faced with similar issues in the future.

In addition, the findings from the study will benefit the Nigerian government in formulating policies that will ensure the health of the financial system especially the banking sector with regards to the global economy. The results from this study will serve as a guide to policy makers in formulating policies with a view to ensuring a sound financial system.

Even though, several studies have been conducted at various levels and in different countries using different approaches to determine the effects of globalisation on banking efficiency, to the best of our knowledge, none of these studies has studied the effects of globalisation on the technical, pure technical and scale efficiencies and the total factor productivity of DMBs operating in the Nigerian banking sectors as utilised in this study. This study will therefore contribute to existing body of knowledge and thus enhance the understanding of the effects of globalisation on banking efficiency because globalisation provides opportunities and serve as a source of competitive advantage.

1.8 Limitations of the Study

The limitation of this study is that the study focused on only one independent variable which is liberalisation and its effect on efficiency. However, there are other factors that could have effect on efficiency such as the level of technology and foreign or domestic ownership among others.

1.9 Definition of key terms

i. Data Envelopment Analysis (DEA) is linear programming method that is used to determine the efficiency of decision making units (banks) based on a set of inputs and outputs.

ii. Globalisation is seen as the increased interaction among countries through trade and financial flows and advances in information and computing technology resulting in a more integrated global world.

iii. Liberalisation is defined as those government policies that are adopted with the aim of opening the economy and removing those barriers that restrict trade and investment thus ensuring free flow of goods and services.

iv. Scale efficiency measures the ability of a bank to achieve maximum output using the scale of its operations.

v. Technical efficiency is the ability of a bank to generate maximum output using a given set of inputs.

CHAPTER TWO
LITERATURE REVIEW/ THEORETICAL FRAMEWORK

2.1 Introduction

This chapter discusses literatures pertinent to the topic. The concept of bank efficiency and measures of efficiency are reviewed, and it also discusses the dependent variables for the study which are the technical, pure technical and scale efficiencies, the concept of globalisation, the drivers of globalisation and the effects of globalisation on business are also discussed. Empirical studies conducted on the independent variable, globalisation and the dependent variables which includes the allocative efficiency, technical efficiency, scale efficiency and total factor productivity change of banks are also reviewed. The section ends with the theoretical framework for the study.

2.2 Concept of Bank Efficiency

Banking efficiency is an important concept at both micro and macro levels because it deals with how effective resources are allocated (Hussein, 2000). According to Mester (2003) efficiency is a measure of the deviation between actual performance and desired performance. Efficiency is thus measured relative to an objective function such as profit maximisation, output maximisation and cost minimisation among others. While this definition of efficiency looked at it from the view point of the firm performance, another definition by Tahir and Haron (2008) viewed it from the aspect of output maximisation, according to them, efficiency is the optimum output that can

be produced using any given amount of input. According to them, a bank is said to be efficient, when it allocates its resources in such a way as to use minimum input to produce the maximum quantity of output. This suggests that efficiency is a measure of how managers allocate resources or utilise the resources of the organisation in order to get maximum outputs. In another definition, Sherma and Zhu (2006) viewed it as the ratio of output to input, according to them the higher the output reflects relatively greater efficiency and optimum efficiency is achieved if the greatest output is achieved given a unit of an input. Another definition by Koopman as cited in Ouattara (2012) states that 'the efficiency of a firm is measured by its economic performance that is the ability to make its operations profitable either through cost reduction or output maximisation'. In simple accounting terms efficiency refers to the capability of a bank or company in their usage of assets, which is measured relatively to how a specific amount of assets would generate revenue using accounting-based financial ratio (Wild, Shaw & Chiappetta, 2009).

It is evident that efficiency is a relative term and any definition given to it depends on the view point from which it is looked at, while some researchers looked at it from the view point of performance, others look at it in terms of profitability and others see it from the view point of cost minimization. In this study however efficiency is viewed as the ability of a bank to use small amount of inputs to produce maximum outputs.

2.3 Efficiency Measurement

Efficiency measurements are the ways and techniques that are used in measuring the efficiency of firms or business units. There are various ways in which efficiency can be measured. They include the use of the conventional method using the simple cost and profit analysis that can be implemented using simple financial ratios such as Return on Assets, Return on equity, capital asset ratio, cost to income ratio, as well as Capital adequacy, Asset quality, Management

Competence, Earnings power and Liquidity (CAMEL) approach among others to determine their efficiency as used in the study of Ajisafe and Akinlo (2014), Das and Drine (2011) among others. However, there is still disagreement with regards to the relative importance of ratio analysis in providing appropriate analysis on the long run efficiency of banks because it does not consider management actions and investment decisions that will affect future performance, it also fails to take into account the interactions between different factors.

In addition, there are parametric and non-parametric approaches used in measuring the efficiency of firms. The parametric approach includes the use of the Stochastic Frontier Analysis (SFA) and the Thick Frontier Approach (TFA). The Stochastic Frontier Approach (SFA) according to Aigner, Lovell, and Schmidt as cited in Ehimare (2013) specifies a functional form for the cost, profit or production relationship among inputs, outputs and environment factors and allows for random error. The SFA employs a composed error model in which inefficiencies are assumed to follow an asymmetric distribution, usually the half- normal. This approach was used in the study of Bonin *et al.,* (2003), Kablan (2007), Wezel (2010) and Mokhtar, Abdullahi and Al-Habshi, (2006). The Thick Frontier Approach (TFA) specifies a functional form and assumes that deviations from predicted performance values within the highest and lowest performance quartiles of observations represent random error, while deviations in predicted performance between the highest and lowest average cost quartiles represent inefficiencies. It uses the same functional form for the frontier cost function as SFA, but it is based on a regression that is estimated using only the ostensibly best performers in the data.

While the non-parametric approach uses the Data Envelopment Analysis (DEA). Mehdian *et al.,* (2007) were of the view that the DEA allows for the decomposition of the Overall Efficiency index (OE) into a subset of efficiency measures thus making it possible to identify the sources of

overall efficiency or inefficiency. The OE index for each bank is computed as the ratio of minimum cost of producing a given output to the total cost incurred. It is a composite measure of Allocative Efficiency (AE), Overall Technical Efficiency (OTE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE). The DEA allows for the measurement of bank efficiency based on two models, they include the Constant Return to Scale (CRS) and Variable Return to Scale (VRS). The constant return to scale occurs when a proportional increase in all inputs results in the same proportional increase in output. The variable return to scale can be an increasing return or deceasing return to scale. Increasing returns to scale occur when a proportional increase in all inputs results in more than a proportional increase in output, while decreasing returns to scale exists when a proportional increase in all inputs results in a less than proportional increase in output.

In bank efficiency studies, various approaches have been used by researchers to determine the efficiency of banks such as the production approach, the asset approach or intermediation approach, the value added approach and the user cost approach. The production approach sees banks as operating units that use their resources to provide products and services, it uses number of employees, fixed assets, equity and financial liabilities as inputs and loans, financial assets, deposits and net commission on income as outputs (Afsharian *et al.,* 2011). But this approach does not provide a clear picture of the core activities of DMBs as financial intermediaries that collect funds from surplus units and allocate them to deficit units. The asset or intermediation approach sees banks as serving an intermediary role between savers and lenders. It uses equity, financial liabilities and deposits as inputs and loans, financial assets and net commission on income as bank output. While the value added approach measures bank outputs in terms of value. In this case the intermediation process is treated in terms of those items with substantial value

added that is, those items with large expenditure on labour and physical capital serve as the outputs and those requiring a small amount of physical labour and capital are used as inputs. The user cost approach however defines the financial product as an input or output according to its net contribution to the bank's revenue (Irsova and Havranek, 2010).

Efficiency in banking has been studied using different dimensions. They include operational efficiency often referred to as X-efficiency which measures deviation from the cost efficient frontier that represents the maximum attainable output for a given level of inputs (Bonin *et al.,* 2003). It is seen as the differences in the managerial ability to control cost for a given level of production (Chen, as cited in Das & Drine 2011). Scope efficiency refers to the relationship between average cost and production of diversified output varieties. A bank is said to have scope efficiency, when it operates in different diversified locations (Aikaeli, 2008).

Cost efficiency tells us how close to cost minimisation the bank is that is how much of the frontier profit the subject earns, all things being equal. It refers to the manager's ability to minimise cost given a certain level of outputs. Cost efficiency is the product of technical and allocative efficiency as used by Das and Drine (2011), Mokhtar *et al.,* (2006). However, using costs alone in evaluating efficiency may not be sufficient to make inferences about banks overall performance as it does not take revenues into account. Another measure of efficiency according to Ehimare (2013) is the Profit efficiency which considers both cost minimisation and revenue maximization, it thus, can be seen as the ability to use given inputs to generate maximum outputs and also using the minimum cost in achieving those outputs. Profit efficiency reflects the goal of profit maximisation by adding both cost and revenue issues that result from varying inputs as well as outputs. Therefore, it describes the economic goals of banks of profit maximisation through increase in revenue as well as reduced costs.

In addition, Revenue efficiency indicates whether a bank achieves maximum level of revenue using a given quantity of inputs. The revenue efficiency of a bank comprises of technical and allocative efficiencies. It takes place when a bank charges higher prices for higher quality services which in turn results in higher revenues if these banks have the market power to extract some of the consumer surplus that arises. But it has been criticised on the basis that it does not consider additional costs incurred in producing higher quality services. Thus, it focuses on one side of the overall financial position of a bank.

Allocative efficiency however, deals with the extent to which resources are being allocated for maximum results, it reflects cost efficient mix of inputs given their prices. Allocative efficiency considers the manner in which banks integrates prices and other conditions of competition in the goal of the cost minimisation. It measures the capacity of a bank to use the optimal combinations of inputs to the most profitable activities. It can also be seen as how the mix of inputs affects the production process (Said & Bouri; 2013). Afsharian *et al.,* (2011) views allocative efficiency as the ability to choose the optimal production mix regarding its prices.

The technical efficiency has to do with how the firm utilises the smallest inputs to produce the desired output. It measures the capacity of a bank to produce the maximum of outputs for a given level of inputs (Falkina; Davel; Hawkins; Llewellyn; Luus; Masilelal; Parr; Pienaar & Shaw 2004). It also has to do with the ability of the decision making unit to acquire maximum output with a given set of inputs and bank's technology. Janoudi, (2014) refers to it as the ability of a firm to obtain the maximum level of outputs given a set of inputs. Koopman (1951) views technical efficiency as a situation where by an increase in any output requires a reduction in at least one other output or an increase in at least one other input.

Scale efficiency describes the ability to choose the optimum input size. It refers to the relationship between the level of output and the average cost. When there is a decrease in the returns to scale of a bank, it implies that the bank is too large to gain the advantages from scale. When the return to scale is increasing, it implies that the bank is too small for its scale of operations. However a constant return to scale indicates scale efficiency of a bank which measures its ability to choose an optimal size (Afsharian, Kryvko & Reichling, 2011). Scale efficiency in the words of Igor and Boris (2001) is defined as the ratio of the overall technical efficiency score measured by the Constant Returns to Scale (CCR) model and pure technical efficiency score measured by the Variable Returns to Scale (VRS) model. It also refers to the relationship between the level of output and the average cost.

This study will focus on three measures of efficiency and they include the technical, pure technical, and scale efficiencies and the total factor productivity change using the DEA specifically the intermediation approach which sees banks as intermediaries between the surplus and the deficit units will be used to compute the efficiency scores. This is because the DEA enables us to measure efficiency using the Constant Returns to Scale model (CCR) and the Variable Returns to Scale (VRS) (Igor & Boris, 2001). In addition, the SFA performs better when the sample is large, therefore, the DEA is more suitable for this study.

2.4 Concept of Globalisation

Globalisation has been perceived as a controversial concept. Its proponents commend the gains of an integrated international market where goods, labour, capital and ideas can flow freely and thus stimulate economic development at all levels of society. Globalisation is about shrinking the whole world into a village like environment through technological advancement and the artificial breakdown of barriers restricting the free flow of goods and services and capital across the globe

which has also resulted to a more closely linked global economy through the exchange of goods, services, information and knowledge. Globalisation has also been associated with less restrictive trade regimes resulting in more openness of the economy with an increase in the volume of trade and international transactions.

Globalisation was viewed by Alexander (2010) as the 'process of increased interdependency between production and markets of different countries around the world as a result of changes in trade of goods and services, capital flows and technology'. It also epitomizes modernisation of the world through trade, banking, communication and transport among others. Globalisation has shortened geographical distance which makes interaction and economic relationships easier for buyers and sellers. It is seen as an attempt to promote capitalism at a global scale through trade liberalisation and Foreign Direct Investment (FDI) among others.

Gul (2003) viewed globalisation from three dimensions. Firstly, internationalisation which is seen as the increased economic transactions or activities across national boundaries, secondly technological revolution in terms of advances in information and communication technology which promotes actors to operate locally regardless of distance and location. Lastly, liberalisation described as those government policies adopted to enhance the integration of the world economies into a global economy. Such policies are aimed at liberalising trade, investment and production and in the setting of rules and institutions that will facilitate transnational activities.

However, the critics of globalisation viewed it as having negative effects on the world by expanding inequalities, culture and new modes of exploitation and domination. They argue that it is the spread of global capitalism that allows powerful corporations to overtake local enterprises

and further widen the gap between the very wealthy and the very poor (Robinson, 2007). It has also been explained as the strategy to retain economic power by the world super powers through increased liberalisation facilitated by multilateral trading arrangements, the Bretton Woods Institutions, the International Monetary Fund (IMF) and the World Bank. According to them opening up of industralised economies through various structural adjustment programs and market friendly policies such as the removal of tariffs and import duties among others would result in rapid economic development. In addition, globalisation has also been attributed to capital account liberalisation. This is because opening up the capital account and allowing free flow of capital poses serious threat to the financial stability if sound macroeconomic policies are not adopted. It has also been argued that with globalisation countries with relatively low skilled labour are bound to face unemployment because it increases the mobility of labour (Obaseki, 2000).

Nigeria embraced globalisation with the introduction of the SAP in 1986 with its inherent policies such as trade liberalisation, devaluation of national currency, deregulation of the economy particularly in the area of foreign exchange and interest rate regime, privitisation and commercialisation, among others. It was anticipated that with the introduction of SAP the Nigerian economy will move from a monobased economy that is an economy dependent on crude oil to an economy that supports growth through the production of diversified products and also to reduce dependency on imports. However, it is believed that the objectives of SAP have not been achieved according to Economic Freedom Report (2014) Nigeria is rated as one of the least free economies in the world with an economic freedom score of 54.3. Similarly, the economy is still dependent on a single product even though there was substantial increase in the flow of foreign direct investment in recent years. Nigeria being a developing country,

globalisation through liberalisation of trade poses serious challenges to the industrial development of the country due to the fact that the economy is still dependent on the importation of goods and services rather than producing its own locally made goods. In addition, globalisation seeks to retrench rather than strengthen the economy, this is because Nigeria enters the global market at a competitive disadvantage owing to the fact that the economy depends solely on a single product, its weak currency, mounting debt profile and shrinking indigenous industrial space (Omolade, Morakinyo & Ifeacho, 2013).

2.4.1 Measures of Globalisation

There are different dimensions used by researchers to measure globalisation. They include KOF index developed by Dreher (2006) which measures globalisation from the political, economic and social dimensions. According to the KOF index, economic globalisation is characterised as the long distance flows of goods, capital and services as well as information and perceptions that accompany market exchanges consisting of both actual flows such as variables trade, FDI, portfolio investment and income payments to foreign nationals where all the variables are expressed as a ratio of Gross Domestic Product (GDP) and restrictions which covers hidden import barriers, mean tariff rate, taxes on international trade as a percentage of current revenue and capital account restrictions. Political dimension of globalisation however, is the diffusion of government policies which covers variables such as the number of embassies in a country, the number of membership in international organisations, the number of United Nations (UN) peace missions the country participated in and the number of treaties signed with other nations. And lastly the social sub index expressed as the spread of ideas, information images and people it combines data on personal contacts, information flows and cultural proximity. It includes data on variables such as international telecom traffic measured in minutes per person, the degree of

international tourism both incoming and outgoing, the percentage of foreign population as a percentage of total population, the number of international letters sent and received as well as government and workers' transfers received and paid, share of internet users, the fraction of households who have a television and the international newspapers traded and the number of McDonald's restaurants per capita, the number of IKEA in a country per capita and the value of imported and exported books all taken as a percentage of GDP as used by Salvatore (2010) and Karadagli (2012).

Another measure of globalisation is the financial liberalisation index which captures six different aspects of liberalisation including credit controls, interest rate controls, entry barriers, regulations, privitisation and international transactions (Abiad & Mody, 2005). However Svaleryd and Vlachos as cited in Hanh-Pham (2010) developed the Sachs- warner index used in measuring liberalisation. According to them a country is said to be open if it does not satisfy any of these criteria; average tariffs are not higher than Forty (40) percent, non-tariff are more than Forty (40) percent of imports, the economic system is considered socialist, major exports are monopolised by the state and black market exchange rate premium exceed twenty (20) percent. However, it serves as a measure of a wide range of policy and not only trade policy and thus, it does not give an accurate measure of how open an economy is in terms of the level of trade.

Globalisation also measured in terms of the volume of a country's foreign assets and liabilities as a percentage of Gross Domestic Product (GDP), openness to Foreign Direct Investment which is calculated as a ratio of total FDI inflows to GDP, openness to trade (Trade openness) which is measured as the sum of exports and imports taken as a ratio of GDP, among others as used in the study of Asongu (2012), Sufian and Habibullah (2012), Afaha and Oluchukwu (2012) and Adelokwokan and Maku (2013).

For the purpose of this study, globalisation is seen as the increased interaction among countries through trade and financial flows and advances in information and computing technology resulting in a more integrated global market. Globalisation will be measured using liberalisation which is the sum of imports and exports as a ratio of GDP. This is due to the fact that taking these measures will enable us determine the degree of openness of the Nigerian banking sector. It is also argued that globalisation is associated to liberalisation and greater openness. This was influenced by the fact that the more open the economy is the higher the intensity of competition which also has its implications on efficiency.

2.4.2 Driving Forces of Globalisation

Four factors are opined as the driving forces of globalisation (UNCTAD, 2002). These factors includes; economic liberalisation which enables most of the governments to adopt policies that are aimed at removing barriers and ensuring almost free movement of goods and services, capital and investment between nations there by allowing forces to play themselves. According to Hailu (2006), liberalisation can be viewed as those economic agreements and economic integration arrangements between countries aimed at encouraging international trade and investment. It can be in the form of bilateral trade agreements, regional economic integration and economic freedom of countries which are aimed at removing those restrictions that tend to discourage the free movement of goods and services between countries of the world.

It is also seen as the deregulation of the economy or the removal of barriers to trade such as lowering interest rates, removal of tariff and non-tariff barriers which enables investors to invest in a given country. Liberalisation also called trade liberalisation has to do with dismantling the existing barriers to free flow of goods and services across national borders. It allows foreign

investors not only to distribute their goods for domestic production but also to export them to those countries where such production facilities are lacking (Ho, Ahmad & Dahan, 2013).

Technology is another factor that is driving the globalisation process. Advances in computing technology have made it possible to meet demand for financial instruments. It has also shortened distance between buyers and sellers of goods and services and made business easier and more efficient. ICT is seen as one of the core competitive strategies for the globalisation of business activities, it basically covers the use of electronic technology for business needs at all levels (Alexander, 2010). Agbolade (2011) sees ICT as the automation of processes, controls and information using computers, telecommunications, software and other gadgets that ensure smooth and efficient running of activities.

Foreign Direct Investment (FDI) is another driver of globalisation which is usually carried out by multinational enterprises who exercise control over their foreign affiliates. According to Dunning (2000) FDI is an investment that is carried out by Multinational Enterprises (MNEs) to take advantage of cheap labour, natural resources, market and economies of scale. According to him there are four motives behind the internationalisation of firms and they include; natural resource seeking is when the company finds it cheaper to produce its products in a foreign company, efficiency seeking has to do with reorganising their overseas holdings in response to broader economic changes, strategic asset seeking in which firms invest abroad to build strategic assets and market seeking which has to do with finding new buyers of their products. FDI provides a country with the needed capital for investment, managerial skills and technology transfer which aid in the growth of that country (Aseidu, 2002).

FDI can be seen as long term investment by a foreign company in a domestic economy with a lasting interest and control in the management of the enterprise (International Monetary Fund [IMF], 1999 and Adeoye, 2009). Kumar (2007) opines that foreign direct investment may be in the form of purchase of stock (new equity capital), as well as re-invested earnings by a wholly owned company incorporated abroad and lending of funds to a foreign subsidiary or branch.

Another driver of globalisation is competition which is a result of the wider coverage that companies or businesses have which gives them more access to markets. Competition forces businesses to explore new ways that will enable them enhance efficiency. This includes shifting some of their activities abroad to reduce cost by taking advantage of either cheap labour or raw materials and even markets.

2.5 Effects of Globalisation on Business

The effects of globalisation on business are broadly classified into two which includes the global market opportunities and the global market threats. Increase in the market potential, trade and investment and access to resources are said to be the global market opportunities that firms gain from globalisation. On the other hand, increased access to markets further increases the level of competition and uncertainty for business firms. This is termed the global market threats (Thoumrungroje, 2004).

Globalisation through liberalisation has created hypercompetitive markets as it enables firms to be in different geographic markets across the globe which intensifies the competitive pressure for firms operating in such markets. Similarly, developments in ICT, privatisation and deregulation of trade and investments have provided firms with the opportunity to have access to markets at lower costs and exploit cheap resources; it has also made it possible for firms to outsource. In

addition, globalisation has also made it possible for firms to reach out and serve many untapped markets across the globe.

Technological changes have also made it easier to transact business. Globalisation exposes firms to new ideas and products, greater specialisation and expanded opportunities for mergers and acquisition leading to growth in size and power of corporations and their increased competiveness and efficiency in the utilisation of productive resources among others. Consequently, firms operating in the global market arena are likely to face some challenges. The rapid advances in ICT provide consumers with quick and easy access to information at a lower cost this enables them to become aware of alternative products (Makinde, 2013).

2.6 Empirical Studies on Globalisation and Bank Efficiency

Several studies have examined the effect of globalisation on technical, pure technical, scale efficiency and total factor productivity change in the banking sector of different countries and at different periods using various methodological approaches. Some of these studies revealed an increase in the efficiency of banks due to globalisation while others revealed a decline in efficiency. Mehdian *et al.,* (2007) studied the effects of globalisation and deregulation on the efficiency and productivity growth of small and large banks in the US between 1990 and 2003 using the Malmquisit productivity index. They found that technical and scale efficiencies in both small and large banks were positively and significantly affected by globalisation. This study did not focus on the large banks alone that are more affected by globalisation due to their scope of business. However, in a study that concentrated on more large banks, Wezel (2010) investigates the efficiency of domestic and foreign banks in Central American Region during 2002 to 2007 using the Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). The results of the DEA showed that foreign banks are more efficient than domestic banks and that

foreign banks exhibit higher levels of allocative efficiency than local banks. Scale efficiency was also found to be higher than that of their local counterparts.

Pawlowska (2003) employed the Data Envelopment Analysis (DEA) to investigate technical efficiency, scale efficiency and productivity of Polish Commercial Banks after merger and acquisition processes using panel data of banks from 1997 to 2001 found that merger and acquisitions significantly improved the technical and scale efficiency measure and productivity indices of these banks and foreign owned banks were more technically efficient than domestic banks. Bonin *et al.,* (2003) studied the effect of foreign ownership on banking efficiency using data from 1996 to 2000. They utilised the stochastic frontier estimation procedures to compute profit and cost efficiency scores and the results revealed that the banking sector in these countries became more efficient and competitive and that foreign ownership generates higher efficiency.

Pasiouras (2006) studied the technical and scale efficiency of the Greek commercial banking industry over the period 2000 to 2004 using the DEA. The results of the analysis revealed that banks that have expanded their operations abroad appear to be more efficient than the ones operating only at national level. However, the analysis would have been more robust if they considered a longer time period and if they had compared the efficiency of domestic banks with that of foreign banks. But in the same Europe, Figueira and Nellis (2007) examined the efficiency of banks operating in Portugal applying the DEA and Malmquist index on data covering the period 1992 to 2003 and their findings showed that technological change have been the main reason for improved efficiency of banks. This study excluded a number of banks in the sample which could have resulted in a more generalisable result.

In the Europe related nations, Ayranci (2011) studied the relative efficiency of the Turkish commercial banking sector using the Data Envelopment Analysis (DEA) approach on data set from 1990 to 2000. The result of the analysis revealed that efficiency was not significantly increased by liberalisation. On the contrary, the findings of the study would have been different if the researcher considered both internal and external factors associated with efficiency. In a study conducted by Afsharian *et al.,* (2011), they analysed the efficiency of publicly traded European banks from 2005 to 2009 using DEA and the results revealed an increase in pure technical efficiency. Also Roman and Sargu (2012) utilised the DEA methodology to analyse the cost, allocative, technical, pure technical and scale efficiencies of banks during the period of financial crises from 2002 to 2009 and to determine the efficiency of foreign banks and their domestic counterparts. The results of the analysis revealed that the efficiency of Romanian banks did not significantly improve. The results would have been more accurate if more information on the sample were collected and analysed.

Zhao, Casu and Ferrari (2006) conducted a study on the impact of regulatory reforms on the performance of commercial banks in India. The results of the analysis revealed that foreign ownership has positive impact on bank efficiency. This study did not look at efficiency in specific forms, as such Ali and Afzal (2011) examined the technical, pure technical and scale efficiency in neighbouring Pakistani during the period of post financial reforms using data from 2004 to 2009. They employed non-parametric DEA approach in their analysis and found that technical efficiency of Pakistani banks decreased after liberalisation of the financial sector. Small banks were found to be more technical and scale efficient than medium and large banks. Sufian and Habibullah (2012) studied the link between the level of globalisation and technical, pure technical and scale efficiency of Indonesian banks from 1999 to 2007 using bank level and

macroeconomic data. They applied the non-parametric DEA and the empirical results revealed that inefficiency in the Indonesian banking sector stems largely from scale rather than from pure technical efficiency issues. Relatively capitalised banks with lower liquidity levels were also found to exhibit higher levels of efficiency. The study therefore concluded that globalisation has a significant positive influence on bank efficiency.

Another study was conducted by Das and Drine (2011) on financial liberalisation and banking sector efficiency in India using the Fourier flexible functional form and stochastic cost frontier methodologies. They studied the cost efficiency of twenty seven public sector banks, seventeen private banks and sixteen foreign banks both pre reform period (1980 to 1988) and post reform period (1992 to 2007) and found that the banking sector witnessed decline efficiency during the post reform period and that public sector banks were most efficient followed by domestic, private sector and foreign banks. But this study focused on only the cost efficiency of these banks neglecting other forms of efficiency.

Hope Laurenceson and Qin (2008) utilised secondary data for the period 2001 to 2006 and applied the DEA approach to determine the efficiency of Chinese banks after liberalisation and found that Chinese banks with foreign investment appear to be more efficient than those without. In a wider study, Sufian and Habibullah (2011) examined the effect of economic globalisation on bank efficiency in China from 2000 to 2007 using the DEA method. The empirical results suggest that inefficiency in the Chinese banking sector stems largely from scale rather than pure technical inefficiencies. Similarly, increased globalisation has significant positive influence on bank efficiency levels. Another study by Sufian (2010) looked at a new approach to modeling bank efficiency using the DEA on quarterly data to construct efficiency frontiers on the

Malaysian banking sector. The findings of the study revealed a progressive increase in efficiency during the period of the study particularly after the post-merger period in 2001.

An Arabian study by Cook, Hababou and Roberts (2001) applied a non-parametric approach to examine the impacts of financial liberalisation on the technical, scale and scope efficiency of banking system in Tunisia. Using DEA approach they analyzed panel data on ten Tunisian banks covering the period 1992 to 1997 and found that foreign ownership is associated with greater efficiency. The result of the analysis would have been more robust if the researchers had broadened the time frame of the study. But Hammad (2007) studied the technical efficiency of sixteen banks in Palestine under the dominance of globalisation from 2002 to 2005 using the DEA and found that there are differences among banks in relation to their technical scores and the average pure technical efficiency score was 96.3%. It was also found that local banks had higher averaged score of technical efficiency than foreign banks but the difference was statistically insignificant. A better understanding of the impact might have been seen if the period of the study was extended.

In the same vein, Al- Shammari, Turen and El-Soud (2014) studied the relative efficiency of seven commercial banks in Bahrain over the period 2008 to 2012 using the DEA. The study found that economic and financial reforms have positive impact on the efficiency of banks in Bahrain showing an increasing trend in the performance of banks as a result of IT innovation, competition and better supervision. A wider scope would have provided a more accurate result on how efficient these banks were during the period.

Asongu (2012) conducted a study on low and middle income African countries using panel data spanning from 1981 to 2008 in 29 African countries. He found that openness both trade and

financial have insignificant positive impact on bank efficiency. But the study only utilised a sample of 29 African countries, the results would have been more generalised if data on a larger sample was collected and analysed. In a sub-continental study, Kablan (2007) examined the efficiency of banks in West African Economic Union (WAEMU) from 1993 to 1996 after the banking system reforms was introduced. He applied the DEA to assess the technical efficiency and SFA to analyze the cost efficiency of banks and the study found that the efficiency of banks increased as a result of banking sector reforms.

Adams and Agbemade (2012) examined the impact of financial liberalisation on the efficiency of twenty two banks in Ghana. Using data from banking survey for the period 2003 to 2007, they applied the Herfindahi and Hirschman index. The result of their analysis showed that liberalisation led to decline in efficiency. However, a wider scope would have provided a more comprehensive study of banking efficiency. Ncube (2009) analysed the cost and profit efficiency of banks in South Africa using the SFA model from 2000 to 2005. The results of the analysis revealed that South African banks have significantly improved their cost and profit efficiencies from 2000 to 2005.

Obafemi (2012) studied the technical efficiency of sixty seven commercial and merchant banks in Nigeria from 1984 to 2004 applying the DEA approach to derive efficiency scores of the various banks both pre and post liberalisation. The results showed that liberalisation increased efficiency of banks in Nigeria. But the results would have been more robust if the Stochastic Frontier Analysis (SFA) was used. This would have provided a link between endogenous and exogenous variables. In the same vein, Obafemi *et al.,* (2013) examined the efficiency of banks in the Nigerian banking sector from 1984 to 2004 on a cross section of commercial and merchant banks. They employed a two stage DEA approach to examine the sources of technical efficiency

in the Nigerian banking sub sector. The result revealed that Nigerian banking industry was not efficient both in pre and post liberalisation era. But the study failed to establish the stationarity of the data as the data are time series in nature to avoid spurious regression result.

In another study, Ajisafe and Akinlo (2014) examined the efficiency of commercial banks in Nigeria using a sample of fifteen (15) commercial banks for the period 1990 to 2009. They applied the pooled least square estimate and dynamic panel Generalised Method of Moment (GMM) on secondary data from annual reports and statement of accounts. The result of the analysis revealed a positive significant relationship between the degree of competition brought about by liberalisation and efficiency of commercial banks in Nigeria. But this study used ROA and ROE to measure the efficiency of banks and these measures have been critised on the basis that it does not provide an accurate measure of efficiency. A study by Odeleye (2014) looked at the efficiency of Nigerian banking sector both pre and post consolidation era using earnings per share, dividend per share, deposit, profit after tax and loans and advances as proxy for consolidation and total assets for efficiency. He utilised the Generalised Methods of Moments (GMM) to combine both time series and cross sectional data on 20 banks operating in Nigeria between 1999 and 2011. The results revealed that the consolidation exercise had a positive impact on efficiency. However, the use of total asset as a measure of efficiency does not provide a clear picture on how efficient a bank is.

In summary, from the review of studies it is evident that most of these studies conducted suffer from methodological drawbacks such as limited time frame and small sample size among others. It is also clear that even though studies conducted in Nigeria looked at the efficiency of banks during the period of globalisation, none of these studies took a look at the effect level of

globalisation will have on efficiency of Nigerian DMBs. Thus, there is a gap in the literature which this study intends to fill.

2.7 Theoretical Framework

The theoretical framework of the study provides a review of theories that are pertinent to the topic which are discussed in this section. Two theories were found relevant to this study. These are the Structure Conduct Performance (SCP) paradigm and Dynamic Efficiency theory.

2.7.1 Structure Conduct Performance (SCP) Paradigm

The Structure Conduct Performance (SCP) paradigm was first introduced by Mason in 1939 as a method of analyzing markets and firms. It was later developed by Bain (1951) who applied it to industrial organisations and was later applied to banking industry by Gilbert (1984). According to the SCP, market concentration fosters collusion among large firms in the industry which subsequently leads to higher profits thus, changes in market concentration may have a positive influence on a firm's financial performance. SCP recognised that the consequent positive relationship between market concentration and performance was as a result of anti-competitive behavior of firms with large market share. It shows the way the market is operating by explaining different forces which restrict or expand the scope of a firm's operations in the market.

It also helps to interpret different sources of productivity and efficiency gains or losses and SCP provides a rational basis for analyzing the market behavior (Seelantha, 2010).

The SCP paradigm is widely used in the banking industry to determine the correlation between market structures and bank achievement. The theory states that market concentration level has a direct impact on competition which forces the banking industry to be efficient. It further asserts that profits and outputs prices would be higher with greater concentration in a given market due to ease of collusion in a more concentrated market.

2.7.2 Dynamic Efficiency Theory

The Dynamic Efficiency Theory developed by Hayek (1976) is a buildup on the Static Efficiency theory. It was developed as a result of several criticisms of the traditional Pareto criteria of allocative efficiency that failed to provide an explanation of the changing nature of real life institutions and as such could not be applied to these institutions. The Dynamic Efficiency theory postulates that an individual, a company, an institution or an entire economic system will be more efficient if it gingers entrepreneurial creativity. The theory also states that it is important to continually search and create new ways of minimising the amount of waste rather than prevent waste. Dynamic efficiency is seen as the ability to encourage entrepreneurial alertness to valuable knowledge the existence of which has not previously been suspected. It is the process during which market participants become aware of mutually beneficial opportunities for trade and grasping these opportunities more to correct earlier errors.

This study adopts the SCP and Dynamic efficiency theory as the theoretical underpinning for the study. This is due to the fact that the Dynamic efficiency theory best explains the activities of

firms (banks) in a situation where there is intense competition among business units due to the entrance of new competitors which increasingly necessitates the need for innovation in order to minimise wastes. It is also seen as an important tool in analyzing the performance of institutions. The SCP is also useful in explaining the relationship between market concentration which fosters competition among banks and thus forcing them to be efficient.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter discusses the methodology that was used for the purpose of this study that is, the various ways in which the research is intended to be carried out. It also discusses the research design that was adopted by the study. The population, sample size and sampling technique that were utilised for the study are also discussed. It also discusses the sources and method of data collection, variables measurement and the techniques used in analyzing data for the study.

3.2 Research Design

The study adopted the causal research design. The causal research design is used to measure the impact a specific change will have on existing norms and assumptions. The causal effect exists when a change in the independent variable leads to an average change in the dependent variable. This design is considered most appropriate because it is aimed at identifying the cause and effect among the independent and dependent variables.

3.3 Population of the study

The population of the study consists of fifteen Deposit Money Banks in Nigeria listed in the banking sector of the Nigerian Stock Exchange (NSE) as at 31st December, 2013 (NSE, 2013). This is because DMBs dominate the banking sector and they play the intermediation role of collecting funds from surplus units to deficit units which are used for further investment. Thus, they play a pivotal role in the level of economic activities in the country by promoting growth in other sectors through their credit policy. The table below consists of a list of the DMBs operating in Nigeria that were listed under the banking sector of the Nigerian stock exchange fact book as at 31st December 2013.

Table 3.1 Population of the study

S/N	Banks	Location of head office
1	Access Bank PLC	Lagos
2	Diamond Bank PLC	Lagos
3	Eco Bank Nigeria PLC	Lome
4	Fidelity Bank	Lagos
5	First Bank of Nigeria PLC	Lagos
6	First City Monument Bank (FCMB)	Lagos
7	Guaranty Trust Bank PLC	Lagos
8	Skye Bank	Lagos
9	Stanbic IBTC	Lagos
10	Sterling Bank PLC	Lagos
11	Union bank of Nigeria PLC	Lagos
12	United Bank for Africa	Lagos
13	Unity Bank	Lagos
14	Wema Bank PLC	Lagos
15	Zenith Bank PLC	Lagos

Source: NSE Fact book (2013).

3.4 Sample Size and Sampling Technique

This study focused on all DMBs in Nigeria listed in the NSE fact book as at 31st December 2013. However for a bank to be part of the sample, the following criteria were set by the study:

i. Data must be available for the whole period of the study.
ii. The data must cover the period of the study.

Table 3.2 provides the filtered population of the study. The banks were filtered using the two criteria stated above.

Table 3.2 Filtered population of the study

S/N	Banks	Filter/ criteria
1	Access Bank PLC	Not applicable (N/A)
2	Diamond Bank PLC	N/A
3	Eco Bank Nigeria PLC	Filter (ii)
4	Fidelity Bank	Filter (ii)
7	First Bank of Nigeria PLC	N/A
6	First city Monument Bank	N/A
5	Guaranty Trust Bank PLC	Filter (ii)
8	Skye Bank	Filter (ii)
9	Stanbic IBTC	N/A
10	Sterling Bank PLC	Filter (ii)
12	Union bank of Nigeria PLC	N/A
13	United Bank for Africa	N/A
11	Unity Bank	Filter (i)
14	Wema Bank PLC	Filter (ii)
15	Zenith Bank PLC	N/A

Source: Author's compilation obtained from the NSE Fact book (2013).

From Table 3.2 above, an application of the first criteria resulted in one bank that was exempted from the sample leaving us with a total number of fourteen banks. An application of the second criteria yielded a total number of six banks that were exempted from the sample which gives us a total sample size of eight banks and they constitute the sample of this study. The table below consists of a list of banks that make up the sample of the study.

Table 3.3 Sample of the study

S/N	Name of bank
1	Access Bank PLC
2	Diamond bank
3	First bank of Nigeria plc
4	First City Monument bank (FCMB)
5	Stanbic IBTC
6	Union bank
7	United bank for Africa (UBA)
8	Zenith bank

Source: Author's compilation (2015)

3.5 Methods and Sources of Data Collection

The study utilised secondary data from NSE fact book, annual reports and financial statement of banks and the Central Bank of Nigeria (CBN) statistical Bulletin and annual reports and statements of account for the years under study.

3.6 Measurement of Variables

Globalisation which is the independent variable was measured using liberalisation as proxy which is the sum of exports and imports taken as a ratio of GDP. This is because globalisation has been attributed to liberalisation and greater openness (Asongu 2012; Sufian & Habibullah 2012; Afaha & Oluchukwu 2012; Adelokwokan & Maku 2013). For our dependent variable which is banking efficiency, it is decomposed into technical, pure technical, scale efficiencies and total factor productivity change (Afsharian *et al.,* 2007). Different approaches have been used by researchers in measuring banking efficiency such as the production approach, intermediation approach, asset approach among others (Afsharian *et al.,* 2011; Bikker *et al.,* 2008). However, this study utilised the intermediation approach. This is because the intermediation approach is considered more superior due to the fact that it covers the activities of banks as financial intermediaries between depositors/ savers and lenders. Berger & Humphrey (1997) found that the intermediation approach is more relevant for financial institutions.

The intermediation approach treats banks as financial intermediaries that collects funds from savers and investors and channel these funds for further investment. It uses equity, financial liabilities and deposits as inputs and loans, financial assets and Net commission on income as bank output (Berger & Humphrey, 1997; Afsharian *et al.,* 2011).

3.7 Technique of Data Analysis and Justification

The study utilised the non- parametric Data Envelopment Analysis (DEA) developed by Farell (1957), later an extension of the model was provided by Charnes, Cooper and Rhodes (1978) and they applied it to the banking sector. The DEA is a linear programming approach used to determine the efficiency of scores for each bank. This is because the DEA is seen as a tool that is

used in determining relatively efficient production frontier based on given inputs and outputs of Decision Making Units (DMUs). It also identifies the most efficient units and indicates the inefficient units in which real efficiency improvement is possible (Igor & Boris, 2001). The Data Envelopment Analysis program (DEAP) was used to estimate changes in technical efficiency, pure technical efficiency, scale efficiency and total factor productivity index. In addition the Hadri Lagrange Multiplier unit root test was also conducted on the data to determine their order of integration (stationarity). This is necessary in order to determine the trend in the panel data and to take care of outliers in the data so as to avoid spurious regression results. The Malmquist index was computed in order to determine the sources of productivity change over time. The results from the DEA were regressed with the independent variable (liberalisation) using the random effects Generalised Least Squares (GLS) regression to determine the extent of the impact. This is because the data utilised in the study is a time series cross sectional data (panel) and corrections have been made for auto correlation hence the random effects generalised least square was found more appropriate. Similarly, it will provide an understanding on whether the level of globalisation has any effect on the efficiency of these banks.

3.8 Model Specification

Two models were utilised by this study, they include the DEA model and the regression analysis model. The regression model tests the effect of the independent variable on the dependent variables but the DEA model was used to derive the efficiency scores. These models are specified below.

3.8.1 Data Envelopment Analysis (DEA) model

The DEA model is used in measuring the efficiency of Decision Making Units (DMUs) based on a set of inputs and outputs. This model is specified thus:

$$Z_0 = \frac{\sum_{R=1}^{S} Ur\ Yri}{\sum_{i=1}^{m} Vi\ Xic} \quad \text{----------(1)}$$

Subject to the constraints:

$$\frac{\sum_{r=1}^{s} Ur\ Yri}{\sum_{i=1}^{m} Vi\ Xij} \leq 1 \quad \text{For j=1, 2, n} \quad \text{----------(2)}$$

Ur, Vi, ≥ 0 for r=1, m; and i=1 ----------(3)

Where:

Z_o = Efficiency score of oth decision making unit.

Yrj= the amount of output r from bank j

Xij = the amount of input i to bank j

Ur = weight chosen for output r

Vi= weight chosen for input i

n = number of banks

s = the number of outputs

m = the number of inputs

From the model above a bank with an efficiency score of less than one is operating at increasing returns to scale, if the value is equal to one it implies that it is operating at constant returns to scale while a value of greater than one implies that the bank is operating at decreasing returns to scale.

3.8.2 Fixed-Effects and Random-Effects Models

This model is used to test the hypotheses of the study. Thus the model is useful in explaining how or the extent of the impact the independent variable (liberalisation) has allocative, technical, pure technical, scale efficiency and total factor productivity change of DMBs in Nigeria. The model is thus specified as follows:

Let consider the following model

$$y_{it} = \alpha + x_{it}\beta + v_i + \varepsilon_{it} \quad \text{.....1}$$

Where $y_{it} =$ Dependent variable, $\alpha =$ Constant term, x_{it} = Independent variables, v_i = Residual, $\varepsilon_{it} =$ White noise term, i = Units, t = Time. The model of this study is thus specified as:

$$TEch_{it} = \alpha + Lib_{it}\beta + v_i + \varepsilon_{it} \quad \text{..... 2}$$

$$PTEch_{it} = \alpha + Lib_{it}\beta + v_i + \varepsilon_{it} \quad \text{.....3}$$

$$SEch_{it} = \alpha + Lib_{it}\beta + v_i + \varepsilon_{it} \quad \text{..... 4}$$

$$TFPch_{it} = \alpha + Lib_{it}\beta + v_i + \varepsilon_{it} \quad \text{..... 5}$$

Where:

$TEch_{it} =$ technical efficiency change

$PTEch_{it} =$ pure technical efficiency change

$SEch_{it} =$ scale efficiency change

$TFPch_{it}$ = Total factor productivity change

α = Constant term

Lib_{it} = liberalisation

v_i = Residual

ε_{it} = White noise term

i = banks

t = Time

As a basis for acceptance or rejection of the null hypothesis a 10 percent level of significance was used. This is because 10 percent is the maximum amount of type 1 error that is acceptable. The higher the alpha the greater the chances of type 2 error but as it decreases type 1 error increases.

CHAPTER FOUR
DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents, analyses and discuses the data collected for the study. The chapter begins with the discussion of the results from the DEA which was used to generate the efficiency scores of the banks. In addition, the results of the Hadri Lagrange Multiplier unit root tests were also presented and interpreted and the Generalised Least Squares (GLS) regression results were also presented and analyzed. The chapter also involves the testing of the hypotheses formulated in order to determine the relationship between the independent and dependent variables. The chapter ends with the discussion of major findings of the study and a presentation of the policy implications of the research findings.

4.2 Data presentation and Analysis

The results of the DEA, Malmquist productivity index conducted using the DEAP, the Hadri Lagrange unit root tests carried out on the panel data, the Random effects generalized least square regression and test of hypotheses are presented below.

4.2.1 Distribution of Average Efficiency Indexes

The result in Table 4.1 presented the distribution of the average efficiency indexes of some selected banks in the study area namely, Zenith bank, Union bank, UBA, IBTC, First bank, FCMB, Diamond bank and Access bank over the period of 2002-2013 when they are considered as financial intermediaries using equity, financial liabilities and deposits as inputs in order to produce loans, financial assets and net commission income as outputs. In this regards, the intermediation model was considered in assessing the efficiency indexes of the banks. Specifically, the analysis was based on 12 observations with banks representing the units or observations. That is, for each year the banks' data on their operations as financial intermediaries were pooled together and the Data Envelopment Analysis Programme (DEAP) was used to estimate the efficiency indexes under varying assumptions regarding the scale of production (constant and variable returns to scale).

Table 4.1 Distribution of average efficiency indexes of the banks under consideration in the study area from 2002 -2013

	Efficiency indexes			
Year	**TE**	**AE**	**CE**	**SE**
2002	1	0.65	0.65	1
2003	0.96	0.99	0.96	0.964
2004	0.92	0.92	0.88	0.758
2005	0.85	0.86	0.78	0.763
2006	0.87	0.81	0.76	0.806
2007	0.9	0.86	0.81	0.806
2008	0.81	0.77	0.63	0.891
2009	0.7	0.37	0.23	0.86
2010	0.9	0.91	0.81	0.973
2011	0.9	0.48	0.48	0.986
2012	0.76	0.87	0.65	0.957

2013	0.81	0.89	0.79	0.927
Total	**0.87**	**0.78**	**0.70**	**0.89**

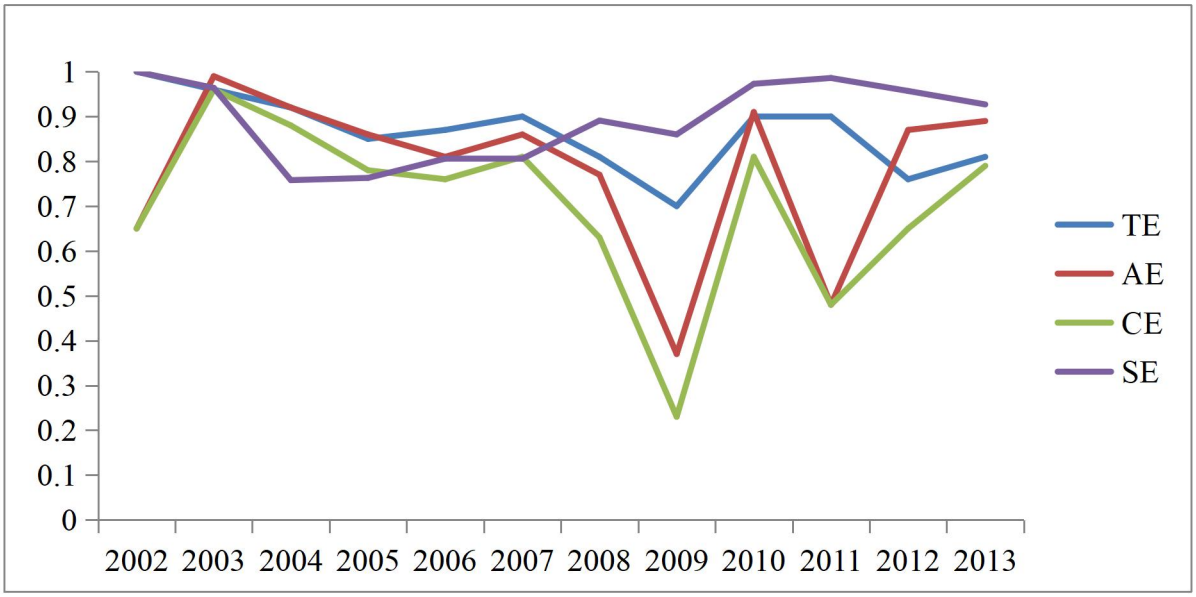
Note: TE = Technical efficiency, AE = Allocative Efficiency, CE = Cost Efficiency, SE = Scale Efficiency

From Table 4.1, it was found that the level of efficiency of the observed banks as measured by technical efficiency, allocative efficiency, cost efficiency and scale efficiency, was high but with no systematic pattern. Based on technical efficiency index, it was found that the banks were, on average, fully efficient in maximizing their outputs given the available inputs in 2002 while they were found to be less technically efficient in 2009. By pooling the data, it was noted that the banks had an average technical efficiency index of 0.87; this implies that banks, on average, could still have increased their level of output by about 13% with the inputs available during those periods. It is important to point out that, over the period under consideration, banks were found to have performed less in terms of minimizing their cost of production while maximizing their outputs. In effect, their cost efficiency index was found to be 0.7; this implies that they could still have reduced their cost of production by 30% using the same technology and inputs. The managers of the banks were found to be more skillful in terms of selecting the appropriate size of the banks, although, not fully; this is because their scale efficiency index was 0.89 which implies that they could still have reduced their banking operation by 11% which in turn could have enhanced their technical efficiency. In terms of allocative efficiency, they were found to have their greatest allocative efficiency in 2003 and 2004 with an allocative index of 0.99 and 0.92 respectively. The implication of the finding is that over those two periods, the selected banks only had 1% and 2% room for improvements in order to optimally allocate their resources.

Figure 4.1 shows the trend in the efficiency indexes of the banks for the period under study. It reveals the time series plots of the estimated efficiency indexes of the selected banks. As

previously noted, there was no systematic pattern in the data which reflected the inconsistency of the banks to maintain their performance over time.

Figure 4.1 Time-series plot of efficiency indexes



It can be seen that there was an upward spikes around 2002 and 2003 while in 2009 and 2011 the spikes were downward sloping. However, the efficiency indexes tended to increase from 2012

except in their technical efficiency which decreased somewhat steadily which could be as a result of the adoption of improved technologies in recent years and training of staffs.

4.2.2 Distribution of Malmquist Productivity Indexes across the Selected Banks

The finding in Table 4.2 was based on the panel data since the cross-sectional data of various years (2002-2013) of the selected banks were pooled together to form a cross-sectional-time series data also known (panel data). The results are about the distribution of the efficiency changes across the selected banks under study. In this regards, based on the DEAP, changes in technical efficiency, pure technical efficiency, scale efficiency and total factor productivity indexes were estimated and the results presented in Table 4.2.

Table 4.2: Malmquist Index Summary of Firm Means

Firm	**TEch**	**PTEch**	**SEch**	**TFPch**
Zenith	1.85	1.00	1.00	1.85
Union	1.04	0.88	1.00	0.92
UBA	1.02	1.00	1.00	1.02
IBTC	1.31	1.00	1.00	1.31
First bank	1.01	1.00	0.97	0.98
FCMB	1.20	1.00	1.00	1.20
Diamond	1.04	0.88	1.00	0.92
Access	1.00	1.00	0.97	0.97
Total	**1.16**	**0.97**	**0.99**	**1.11**

Note: TEch = Technical Efficiency Change, PTECh = Pure Technical Efficiency Change, SECh = Scale Efficiency Change and TFPCh = Total Factor Productivity Change

The result showed that Zenith bank, over the period of study, had the highest technical efficiency change. In other words, Zenith bank improved its level of output than the other banks while Access bank was found to have had the smallest change in technical efficiency over time. By

taking the differences in their scale of operation, Zenith bank, Union bank, IBTC FCMB and Diamond bank were observed to have achieved over the period of study an average of about 100% improvement in their technical efficiency. Only First bank and Access banks were found with less than 100% change in scale efficiency. Zenith bank was found to be the most efficient bank among the eight banks considered in the study. This is because they were found to have the greatest technical efficiency index. Moreover, they had 100% positive change in their pure technical and scale efficiency. The implication is that, on average, they had truly improved in terms of maximizing their outputs over time and to select the optimal scale of production. In terms of pure technical and scale efficiency changes, it could be noted that the banks did not perform well overtime which is evident from the results produced by their efficiency index.

4.2.3 Distribution of Malmquist Productivity Indexes across the period of study

Table 4.3 reveals the distribution of Malmquist productivity indexes across the period of study.

Table 4.3: Malmquist Index Summary of Annual Means

Year	TEch	PTEch	SEch	TFPch
2003	0.881	0.991	0.962	0.84
2004	3.173	0.926	0.728	2.139
2005	0.678	0.84	1.012	0.577
2006	1.053	1.146	1.097	1.323
2007	1.741	0.969	0.913	1.539
2008	1.004	1.024	1.212	1.246
2009	0.915	0.861	0.965	0.761
2010	0.693	1.113	1.171	0.903
2011	1.084	1.062	1.014	1.167
2012	0.732	0.646	0.97	0.458
2013	2.87	1.223	0.96	3.37
Total	1.158	0.969	0.992	1.113

Note: TEch = Technical Efficiency Change, PTECh = Pure Technical Efficiency Change, SECh = Scale Efficiency Change and TFPCh = Total Factor Productivity Change

The distribution of the Malmquist indexes from 2003 to 2013 revealed that the banks recorded their highest change in technical efficiency in 2004 while the smallest change was recorded the year after, that is, in 2005. But put together, the average technical efficiency and total factor productivity index changes for the entire period were estimated to be 1.158 and 1.13 respectively; this implies that, on average, the banks became more productive even though they had pure technical and scale efficiency change of less than 1.

4.3 Results of the Hadri Lagrange Multiplier Unit Root Test

The dataset under study was a panel data and therefore productivity, technical efficiency, pure technical efficiency and scale efficiency change were used as the dependent variables while liberalisation was used as the independent variable. Consequently, given the time-dimension of the variables of the models, unit root test analysis was performed on the time-dependent variables (time-series) in order to overcome the problem of spurious (false) regression as one of the key assumptions in regression analysis involving time series is the (covariance) stationarity of the data. Specifically, a time series is said to be covariance stationary if its first two moments (E (y_t), E (y_{t-1}) and V (y_t), V (y_{t-1}), Cov (y_t, y_{t-1})) are constant over time; and the autocovariance Cov (y_t, y_{t-h}) only vary with the lag h and not with t, that is, they are constant through time. The Hadri Lagrange Multiplier unit root test analysis was therefore carried out using Stata 12 version of programme since it is generally recognised to be the benchmark method in testing the presence of a unit root in panel data over other methods. The test was performed in two stages without considering the time factor and with the time factor. Table 4.4 provides a summary of the stationarity tests that was carried out.

Table 4.4: Hadri Lagrange Multiplier unit root test analysis of panel data at level

	Without Trend	With Trend
Tech		
Test-statistic	2.191	2.599***
P-value	0.014**	0.005
PTEch		
Test-statistic	-1.376	-0.894
P-value	0.916	0.814
SEch		
Test-statistic	-1.641	0.037
P-value	0.950	0.485
TFPch		
Test-statistic	2.202**	2.569***
P-value	0.014	0.005
Lib		
Test-statistic	-1.349	-0.885
P-value	0.911	0.812

*Note: ***P<0.01 and **P<0.05. TEch = Technical Efficiency Change, PTECh = Pure Technical Efficiency Change, SECh = Scale Efficiency Change, TFPCh = Total Factor Productivity Change and Lib = Liberalisation*

The results from Table 4.4 revealed that the null hypothesis that indicate that all the panels (DMBs) were stationary in terms of pure technical efficiency change, scale efficiency change and liberalisation was accepted as the p-values were all greater than 0.1. However, technical efficiency change and total factor productivity index change were found to contain a unit root since the null hypothesis was rejected in favor of the alternative that suggests that some panels contain a unit root, that is, they were non stationary. In order, to overcome the problem, the first difference (difference between the variable at a given period and that of the same variable at lag 1) of technical efficiency change and total factor efficiency index change were subjected to the same test and the result showed that they were stationary. Thus, the first difference of technical efficiency change and total factors productivity index change were used in place of technical efficiency change and total factors productivity index change for the regression analysis.

4.4 Random Effects Generalised Least Square Results

In order to model the effect of liberalisation on the efficiency and productivity change, the two most common models of panel data were estimated namely, the Generalised Least Squares (GLS) Fixed effects and random effects models. The absence of correlation across the panels (banks) suggested that the random effects model was appropriate and its result was therefore considered and presented in Table 4.5. This finding is contrary to the study of Afsharian *et al.,* (2011) who observed that the banks were correlated and therefore the GLS Fixed effects model was used in examining the effect of efficiency on performance in European commercial banks. Table 4.5 presents the results of the random effects generalised least square regression estimates for the variables under study.

Table 4.5: Random effects generalised least squares regression estimates of liberalisation on banks' efficiency indexes

Variables	**DTech**	**PTEch**	**Sech**	**DTFPch**
Constant				
Coefficients	-120.36	0.61	0.59	-144.99
Standard Error	71.03	0.47	0.61	85.16
T-value	-1.69	1.31	0.97	-1.70
P-value	0.09	0.19	0.33	0.09
Liberalisation				
Coefficients	**218.48**	**0.79**	**0.87**	**263.19**
Standard Error	127.99	0.85	1.10	153.46
T-value	1.71	0.94	0.79	1.72
P-value	0.09	0.35	0.43	0.09
R^2	0.152	1	1	0.153
Wald statistic	2.91*	0.88	0.62	2.94*

*Note: *P<0.1. DTEch = First Difference Technical Efficiency Change, PTECh = Pure Technical Efficiency Change, SECh = Scale Efficiency Change and DTFPCh = First Difference of Total Factor Productivity Change*

Evidence in Table 4.5 showed that modeling pure technical efficiency change and scale efficiency change using liberalisation as independent variable was insignificant; this implies that the relationship between liberalisation and pure technical efficiency change and scale efficiency change were not important. This could be justified by the poor fitness of the model as only 1% of variation in the pure technical efficiency change and scale efficiency change was explained by the model. On the other hand, the model for the first difference of technical efficiency change and total factors productivity index change were found to be statistically significant at 10% level of probability. The coefficient of determination which represents the goodness of fit revealed that 15.2% and 15.3% of variation in the first difference of technical efficiency change and total factors productivity index change was explained by the model respectively. This implies that liberalisation was significantly important in predicting changes in technical efficiency and total factor productivity index. Moreover, the implication of the finding is that important variation in technical efficiency change and total factor productivity change were still left unexplained. This could be as a result of the simple regression model considered for the analysis as other factors could influence these variables.

The effect of liberalisation on the first difference of technical efficiency change and total factor productivity change was positive and statistically significant at 10% level of probability. Specifically, if liberalisation increases by 1, the change in the first difference of technical efficiency change will increase by 218.48 while that of the first difference in total factor productivity index will increase by 263.19. In other words, there was a positive effect of liberalisation on productivity and efficiency over time among the selected banks and over the period of study.

4.5 Test of Hypotheses

Four tests of hypothesis were considered for the study and the result are presented in Table 4.6.

Table 4.6: Test of hypotheses

Null hypotheses	T-value	P-value
Globalisation has no significant impact on technical efficiency change of DMBs in Nigeria	1.71	0.09*
Globalisation has no significant impact on pure technical efficiency change	0.94	0.35
Globalisation has no significant impact on scale efficiency change	0.79	0.43
Globalisation has no significant impact on total factor productivity change	1.72	0.09*

*Note: *P<0.1*

The first hypothesis tested is globalisation has no significant impact on technical efficiency change. The result of the test was significant at 10% level of probability as the p-value of 0.9 under the null hypothesis was found to be less than the theoretical 0.1. The conclusion is that there is positive and significant impact of globalisation on technical efficiency change.

The second hypothesis tested states that globalisation has no significant impact on pure technical efficiency change. The result of the test was insignificant as the p-value of 0.35 under the null hypothesis was found to be greater than the theoretical 0.1. The conclusion is that there is no statistically significant effect of globalisation on pure technical efficiency change.

The third hypothesis tested was globalisation has no significant impact on scale efficiency change. The result of the test was insignificant as the p-value of 0.43 under the null hypothesis was found to be greater than the theoretical 0.1. The conclusion is that there is no statistically significant effect of globalisation on scale efficiency change.

The final hypothesis tested was globalisation has no significant impact on total factor productivity index change. The result of the test was significant at 10% level of probability given as p-value of 0.9 under the null hypothesis was found to be less than the theoretical 0.1. The conclusion is that there is positive and significant effect of globalisation on total factor productivity index change.

4.6 Discussion of Major Findings

This study is on the effect of globalisation on the banking efficiency using a sample of eight DMBs in Nigeria from 2002 to 2013. The findings of the hypotheses testing are presented below: Hypotheses one revealed that there is positive and significant effect of globalisation on technical efficiency change of DMBs in Nigeria. This implies that globalisation affects the technical efficiency change of DMBs within the period of the study. The study therefore fails to accept the null hypothesis which states that globalisation has no significant impact on TEch of DMBs in Nigeria. This finding is consistent with that of Cook *et al.,* (2001), Pawlowska (2003), Zhao *et al.,* (2006), Sufian and Habibullah (2011), Sufian and Habibullah (2012), Obafemi (2012), Sufian (2010) who found a relationship between globalisation and technical efficiency and contradicts those of Adams and Agbemade (2012), Obafemi *et al.,* (2013), who found an insignificant negative impact of globalisation on technical efficiency.

The results from the second hypothesis revealed that globalisation has no significant impact on pure technical efficiency of DMBs in Nigeria. This means that the level of globalisation does not affect the pure technical efficiency change of banks within the period. We therefore fail to reject the null hypothesis which states that globalisation has no significant impact on PTEch of DMBs in Nigeria. This finding is consistent Roman and Sargu (2012) who studied the efficiency of banks in Romania and found an insignificant impact of liberalisation on efficiency and

contradicts Afsharian *et al.,* (2011), Sufian and Habibullah (2011), Ali and Afzal (2011), Sufian and Habibullah (2012) who found a positive relationship between liberalisation and efficiency of banks.

The finding from the test of hypothesis three shows that globalisation has no significant impact on scale efficiency change of DMBs in Nigeria. This implies that globalisation is not significant in inducing change in scale efficiency in the period of the study. The study therefore fails to reject the null hypothesis which states that globalisation has no significant impact on SEch of DMBs in Nigeria. This finding is consistent with those of Roman and Sargu (2012), and contradicts the findings of Figueira and Nellis (2007), Pasiouras (2006), Sufian and Habibullah (2012) and Cook *et al.,* (2001) who studied the efficiency of banks in Portugal, Greek, China and Tunisia respectively and found a positive and significant effect of globalisation on scale efficiency.

Hypothesis four revealed that globalisation has a positive and significant impact on total factor productivity change of DMBs in Nigeria; this implies that managers are able to achieve gain benefits from their scale of operations given the level of globalisation in the country. Hence, the study failed to accept the null hypothesis which states that globalisation has no significant impact on TFPch of DMBs in Nigeria. This finding is consistent with Afsharian *et al.,* (2011), Mehdian *et al.,* (2007), Pawloska (2003) who found a positive and significant effect of globalisation on efficiency of banks but contradicts Ali and Afzal (2011) who found a negative impact of globalisation on efficiency.

4.7 Policy Implications of the Findings

The level of globalisation in the country affects to a large extent the operations of banks specifically how efficient they are in terms of utilising the resources to get the best out of the sector. It also has direct effect on the level of competition among DMBs in the country. This study provides an insight into the predictor variable (liberalisation) which plays an important role in predicting change in the technical, pure technical, allocative and total factor productivity change of DMBs in Nigeria. The findings from this study will serve as a measure for DMBs to ensure that they continue to reap the benefits from globalisation and also in providing a sound macroeconomic environment for banks to operate.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of findings

The study was on the impact of globalisation on the efficiency of DMBs operating in Nigeria from 2002 to 2013. The study uterlised the DEA to determine the efficiency scores of these banks in terms of their TEch, PTEch, SEch and TFPch, and the random effects GLS regression was used to determine the impact. The findings of the study revealed a significant positive impact of globalisation on TEch of DMBs in Nigeria. The study also found that globalisation has no significant impact on PTEch and SEch of DMBs in Nigeria. The study also found a significant positive impact of globalisation on TFPch of DMBs in Nigeria within the period the study was conducted.

5.2 Conclusions

An attempt was made to determine the impact of globalisation on efficiency of DMBs using a sample of eight DMBs in Nigeria from 2002 to 2013. Based on the analyses it was found that globalisation has a significant positive impact on TEch of DMBs within the period of the study, hence there was a significant improvement in the technical efficiency of these banks within the period of the study. But for PTEch it was found that globalisation did not have a significant impact. This implies that banks were not fully efficient in terms of new technology adoption, hence the effect was not significant.

In addition, it was also found that globalisation has no significant impact on SEch of DMBs within the period of the study. This implies that banks operating in the country did not achieve efficiency from their scale of operations, hence the impact was not significant. Globalisation was also found to have a positive and significant impact on the TFPch of DMBs within the period. This implies that banks were found to be productive within the period of the study as their productivity indexes have proven. In view of these findings, the study therefore concludes that globalisation has significant impact on the efficiency of banks in Nigeria. This is evident from the analysis as the coefficient of liberalisation and TEch and TFPch was 218.48 and 263.19 respectively, while for PTEch and SEch their coefficient was less with a value 0.79 and 0.87 respectively. This study conforms to previous studies like those of Zhao *et al.,* (2006), Mehdian *et al.,* (2007), Sufian and Habibullah (2011) and Sufian and Habibullah (2012) among others.

The level of globalisation in the country affects to a large extent the operations of banks, this is because globalisation stimulates competition and hence, efficiency is an important and critical factor for the success of banks in this rapidly changing environment. In addition, the level of globalisation of a country affects to a large extent how efficiently the financial system and in particular DMBs operate due to the fact that an open economy which encourages foreign

investors to invest becomes more competitive as more and more players come in. This implies that DMBs have to be efficient in order to succeed in this market.

5.3 Recommendations

Based on the findings the following recommendations were put forward by the study:

i. The management of DMBs should pay more attention to scale efficiency because the findings revealed a no effect of globalisation on scale efficiency. However, globalisation should have an effect in the scope of activities of these banks due to the fact that it enables banks to open more branches and hence, they should be able to achieve efficiency from their scale of operations.

ii. The DMBs should ensure that they improve on their PTE. This can be done through improvements in the level of IT facilities used by these banks and also ensuring adequate usage of the facilities.

iii. DMBs should also ensure that they continue to take advantage of the potentials they could gain from globalisation through continous improvements in their technical efficiency and productivity.

5.4 Suggestions for Further Research

This study focused on only liberalisation and how it affects efficiency, further research in this area could focus on other factors such as level of technological advancement and ownership structure which could also affect the efficiency of banks. A comparison can also be made on the differences in efficiency levels between foreign and domestic banks that are operating within the country. Also, a wider sample that covers the entire banking industry in Nigeria can also be considered.

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Appendix I
Bank Data

FIDELITY BANK

year	loans	Deposits	Assets	liabilities	equity	net comm
2002	6817805	15789243	10189640	2695720	227854	0
2003	7175055	16888123	10284650	2961091	2380952	0
2004	9735682	19339616	10144530	4562901	3519624	5483322
2005	38922290	20572061	13500726	6984398	6984398	3145622
2006	38661271	81592759	47009082	12811873	14419141	4265221
2007	70237512	176681327	55402081	10315557	28639148	7788047
2008	230713051	379728968	86363569	14878673	34493778	29839060
2009	215112075	356137293	70275740	10251000000	28068000000	43491275
2010	1.58516E+11	327351000	180670000	13115000000	33173000000	7899000000
2011	2.55257E+11	561089000	180670000	16535000000	49529000000	12024000000
2012	3.455E+11	716749000	215291000	26354000000	53990000000	21421000000
2013	4.26076E+11	806320000	288709000	30286000000	62183000000	18698000000

DIAMOND BANK

year	loans	Deposits	fin assets	fin lia	equity	net comm
2002	0	4482680	17146796	13612446	5564255	7,533,145
2003	15490851	41090814	18930008	12396191	5206636	6,073,270
2004	145124444	42280386	20849950	18674633	6751094	7364164
2005	40822966	74776559	22762844	22535204	20709850	4957010

2006	77929985	144569685	52297157	35145044	30787900	6641490
2007	96384940	211634824	103984689	428542390	16055980	10421915
2008	231445158	403710120	187624407	76185995	116983008	17745049
2009	296537785	449020259	158673479	36298243	19925589	24731795
2010	294920909	378733006	60827955	50453404	21330080	15751751
2011	297857785	544282581	126477184	84309335	21240081	22744229
2012	523374606	823090787	180663486	9307881	25854765	24342844
2013	585953062	1093784492	313177782	84876550	30317843	25035068

FIRST BANK

year	loans	Deposits	fin assets	fin lia	equity	net comm
2002	61918000000	1.68175E+11	1.86978E+11	75922000000	17747000000	0
2003	56046000000	1.99294E+11	2.30497E+11	88145000000	25040000000	0
2004	78040000000	2.07181E+11	1.02878E+11	61133000000	36242000000	40747000000
2005	1.14673E+11	2.65378E+11	94363000000	61482000000	42293000000	43621000000
2006	1.75657E+11	3.90846E+11	1.43473E+11	76166000000	4.79149E+11	57400000000
2007	2.19185E+11	5.81827E+11	1.98745E+11	95322000000	3.37468E+11	26435000000
2008	4.37768E+11	6.61624E+11	1.16034E+12	1.52187E+11	82944000000	80945000000
2009	6.84107E+11	1.07184E+12	6.51075E+11	2.25E+12	94151000000	1.16173E+11
2010	1.01741E+12	1.33077E+12	4.58787E+11	1.53942E+11	86211000000	35475000000
2011	1.02249E+12	1.24403E+12	3.23479E+11	1.85302E+11	62964000000	24547000000
2012	1.12885E+12	1.78378E+12	4.21209E+11	2.77618E+11	65901000000	49785000000
2013	1.76913E+12	2.92908E+12	1.02482E+12	3.58193E+11	4.67272E+11	54085000000

ACCESS BANK

year	loans	Deposits	Assets	liabilities	equity	net comm
2002	4248697	6475336	5464076	2846462	1464248	0
2003	6505420	9308990	9542669	10505057	2035820	0
2004	11461571	22724035	8647765	4204613	2702830	2745858
2005	16183353	32607703	16753091	35398022	14071924	3929248
2006	54111173	110879330	46263777	32149259	8616500	2503256
2007	107750578	205234734	158433251	89438470	4618425	10987554
2008	244595621	351789279	689485610	511248673	22465797	17091361
2009	360387649	409349424	134434647	52601405	13157186	7703062
2010	403178957	440542115	89825872	77912700	36343977	11180546
2011	490877501	522599666	190299168	204525479	39675618	15234905
2012	554592199	1093979220	179283452	66558680	176628255	19266497
2013	735300741	1217176793	408857398	113387911	172477671	26305198

UNION BANK

year	loans	Deposits	Assets	liabilities	equity	net comm
2002	45486000000	2.04347E+11	1.66452E+11	33801000000	30302000000	0
2003	54560000000	2.24347E+11	1.76285E+11	64036000000	32730000000	0

2004	7.8733E+11	2.41585E+11	2.03372E+11	79733000000	19260000000	7539000000
2005	7.8684E+11	2.00511E+11	2.17657E+11	1.46267E+11	22404000000	8470000000
2006	1.27202E+12	3.20957E+11	3.05852E+11	2.38223E+11	34085000000	31965000000
2007	1.49376E+12	4.17406E+11	2.68034E+11	98851000000	96630000000	41154000000
2008	2.44845E+12	6.49334E+11	3.09247E+11	1.37433E+11	56755000000	26211000000
2009	3.36812E+12	7.82043E+11	2.84842E+11	3.04036E+11	55808000000	20278000000
2010	1.78654E+12	5.98922E+11	58271000000	3.20652E+11	32754000000	32408000000
2011	1.4052E+11	3.99234E+11	1.19235E+11	2.01526E+11	33822000000	9748000000
2012	36982000000	4.82005E+11	1.42938E+11	1.82929E+11	4.45387E+11	8903000000
2013	2.10118E+11	4.79956E+11	53141000000	2.03669E+11	4.59848E+11	8677000000

ZENITH BANK

year	loans	deposits	Assets	liabilities	equity	net comm
2002	20144168	50688381	65628625	32184281	8469524	12118935
2003	27290021	61574455	77140805	37160966	11427335	17844230
2004	53391209	131095341	77140805	44920930	156743	13797311
2005	1.25663E+11	2.33413E+11	88177000000	58182000000	19566000000	12028085
2006	2.01971E+11	3.92864E+11	2.0382E+11	1.10934E+11	32641000000	20927170
2007	2.23007E+11	5.68012E+11	2.27443E+11	6311000000	43596000000	31567440
2008	3.96772E+11	1.16446E+12	6.29039E+11	1.61324E+11	28976000000	41680000000
2009	6.69261E+11	1.11133E+12	3.40415E+11	1.16899E+11	35921000000	49830000000
2010	6.6786E+11	1.28952E+12	5.05208E+11	1.14828E+11	24060000000	39885000000
2011	8.27035E+11	1.57729E+12	4.57462E+11	1.4773E+11	76946000000	36590000000
2012	8.95354E+11	1.80201E+12	2.17337E+11	1.30165E+11	76946000000	44211000000
2013	1.12656E+12	2.07986E+12	4.37497E+11	201265	90897000000	47116000000

STANBIC IBTC

year	loans	deposits	Assets	liabilities	equity	net comm
2002	1.00249E+13	8.91007E+12	8.92089E+12	7.5991E+12	4.93415E+12	2.07709E+12
2003	9.01685E+12	8.1815E+12	9.60438E+12	8.44297E+12	4.88602E+12	2.52274E+12
2004	9.47986E+12	1.05436E+13	1.49729E+13	1.04598E+13	5.79442E+12	1.60839E+12
2005	1.34874E+13	1.08858E+13	1.83329E+13	9.3472E+12	1.42752E+13	3.04751E+12
2006	5.00677E+13	5.70733E+13	1.84219E+13	1.47182E+13	3.15155E+13	5.61434E+12
2007	7.96357E+13	7.24552E+13	8.48361E+13	1.28446E+14	7.24217E+13	1.88726E+13
2008	99010000000	98914000000	1.216E+11	1.66756E+11	20549000000	8387000000
2009	1.10967E+11	1.70411E+11	83681000000	83096000000	21488000000	7387000000
2010	1.64203E+11	1.87595E+11	22476000000	1.05407E+11	22660000000	10236000000
2011	2.30707E+11	2.95905E+11	92630000000	1.69548E+11	23267000000	10706000000
2012	2.66344E+11	3.59503E+11	1.24411E+11	1.36059E+11	1875000000	10978000000
2013	2.89747E+11	4.19032E+11	2.03357E+12	1.58321E+11	2653000000	11688000000

UBA

year	loans	deposits	Assets	liabilities	equity	net comm
2002	40135000000	1.31866E+11	1.03314E+11	55403000000	9357000000	0

2003	46076000000	1.42427E+11	92615000000	41994000000	13767000000	0
2004	56136000000	1.51929E+11	90209000000	19533000000	19533000000	9355000000
2005	38029000000	1.48095E+11	3.7649E+11	15793000000	19188000000	24217000000
2006	72596000000	6.22807E+11	57836000000	47784000000	14095000000	7012000000
2007	3.20229E+11	8.97651E+11	5.18301E+11	34884000000	45755000000	44424000000
2008	4.0554E+11	1.25804E+12	6.87524E+11	69424000000	74119000000	58345000000
2009	5.43289E+11	1.15109E+12	4.98801E+11	59113000000	74074000000	1.11653E+11
2010	5.69312E+11	1.11906E+12	3.30554E+11	1.22705E+11	76241000000	82458000000
2011	5.96457E+11	1.21646E+12	3.52408E+11	2.67494E+11	61803000000	82970000000
2012	5.70714E+11	1.46113E+12	5.70714E+11	1.94694E+11	2.20317E+11	75393000000
2013	7.96942E+11	1.79738E+12	6.46677E+11	1.03217E+11	2.59538E+11	85922000000

FCMB

year	loans	deposits	Assets	liabilities	equity	net comm
2002	6004320	8564393	6915229	3948329	2231425	1778615
2003	5833978	9215514	6553081	3166730	2558586	938538
2004	7905359	18019379	13231713	2776015	2757044	1414448
2005	11436232	26857412	33742941	16461730	7216216	2760566
2006	19070768	70296796	74747491	8687293	8052307	5431205
2007	83577134	187990701	139137040	39907212	9979274	13720470
2008	186565206	251580103	140718390	59355053	23758274	40844550
2009	236844499	272624017	127661663	56326461	19757861	4061693
2010	323531060	334897851	63767744	58775648	26266623	8080801
2011	319020875	412030645	41642744	61436000	26638704	7457082
2012	350489990	644268545	120210262	11158862	23270703	13330396
2013	450532965	715214192	199700305	142251989	15213161	13981393

LIB

year	
2002	0.41
2003	0.51
2004	0.57
2005	0.58
2006	0.56
2007	0.53
2008	0.61
2009	0.51
2010	0.54
2011	0.64
2012	0.58
2013	0.59

Appendix II

DEA output

Results from DEAP Version 2.1

Instruction file = m-ins.txt

Data file = m.txt

Output orientated Malmquist DEA

DISTANCES SUMMARY

year = 1

firm no.	crs te rel to tech in yr ********** t-1	t	t+1	vrs te
1	0.000	1.000	1.055	1.000
2	0.000	1.000	1.138	1.000
3	0.000	1.000	1.636	1.000
4	0.000	1.000	1.124	1.000

5	0.000	1.000	1.367	1.000
6	0.000	1.000	1.119	1.000
7	0.000	1.000	1.138	1.000
8	0.000	1.000	2.357	1.000
mean	0.000	1.000	1.367	1.000

year = 2

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	1.007	1.000	0.635	1.000
2	0.695	0.825	0.572	0.965
3	1.274	1.000	1.457	1.000
4	1.027	1.000	0.278	1.000
5	1.016	1.000	0.762	1.000
6	1.119	1.000	0.347	1.000
7	0.695	0.825	0.572	0.965
8	1.126	1.000	1.143	1.000
mean	0.995	0.956	0.721	0.991

year = 3

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	106.597	1.000	50.687	1.000
2	7.907	1.000	1.831	1.000
3	7.184	1.000	3.072	1.000
4	0.965	0.311	0.355	1.000
5	0.894	0.326	0.354	0.505

6	1.541	0.694	0.879	1.000
7	7.907	1.000	1.831	1.000
8	1.801	0.412	0.621	1.000
mean	16.850	0.718	7.454	0.938

year = 4

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	0.433	0.483	0.407	0.515
2	1.188	1.000	1.039	1.000
3	5.086	1.000	19.670	1.000
4	0.306	0.457	0.273	1.000
5	0.296	0.437	0.861	0.499
6	0.484	0.495	0.368	1.000
7	1.188	1.000	1.039	1.000
8	0.144	0.166	0.236	0.488
mean	1.141	0.630	2.986	0.813

year = 5

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	0.657	0.526	0.433	0.526
2	1.082	1.000	2.268	1.000
3	14.538	1.000	4.395	1.000
4	0.659	0.641	0.244	1.000
5	0.538	0.439	0.186	0.706
6	1.116	0.723	0.429	1.000

7	1.082	1.000	2.268	1.000
8	0.563	0.460	0.417	1.000
mean	2.529	0.724	1.330	0.904

year = 6

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	6.644	1.000	3.316	1.000
2	2.825	1.000	0.927	1.000
3	12.268	1.000	1.508	1.000
4	0.228	0.152	0.171	1.000
5	0.432	0.186	0.205	0.288
6	1.177	0.651	0.717	1.000
7	2.825	1.000	0.927	1.000
8	2.797	1.000	1.404	1.000
mean	3.650	0.749	1.147	0.911

year = 7

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	0.975	1.000	1.160	1.000
2	2.695	1.000	1.630	1.000
3	1.068	1.000	2.647	1.000
4	0.378	0.346	0.331	0.370
5	0.545	0.746	0.719	0.941
6	0.543	0.404	0.369	1.000
7	2.695	1.000	1.630	1.000

8	1.073	1.000	1.578	1.000
mean	1.247	0.812	1.258	0.914

year = 8

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	0.709	0.667	0.956	0.667
2	1.399	1.000	1.935	1.000
3	1.116	1.000	3.137	1.000
4	0.259	0.242	0.412	0.243
5	0.367	0.406	0.633	0.654
6	0.489	0.446	0.705	1.000
7	1.399	1.000	1.935	1.000
8	0.861	0.812	1.159	1.000
mean	0.825	0.697	1.359	0.820

year = 9

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	1.306	1.000	3.534	1.000
2	0.972	1.000	3.555	1.000
3	1.423	1.000	1.984	1.000
4	0.200	0.275	0.849	0.276
5	0.652	1.000	1.154	1.000
6	0.511	0.877	1.093	1.000
7	0.972	1.000	3.555	1.000
8	0.483	0.821	1.026	0.905

mean	0.815	0.872	2.093	0.898

year = 10

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	0.862	1.000	0.844	1.000
2	0.328	0.658	0.372	0.658
3	1.344	1.000	3.113	1.000
4	0.459	0.830	0.836	0.932
5	0.901	1.000	1.235	1.000
6	135.981	1.000	122.941	1.000
7	0.328	0.658	0.372	0.658
8	91.300	1.000	79.429	1.000
mean	28.938	0.893	26.143	0.906

year = 11

firm	crs te rel to tech in yr			vrs
no.	**********			te
	t-1	t	t+1	
1	1.192	0.835	0.815	1.000
2	0.070	0.115	0.073	0.118
3	1.643	1.000	1.043	1.000
4	11.573	1.000	1.319	1.000
5	1.186	0.986	0.954	1.000
6	4.289	1.000	1.131	1.000
7	0.070	0.115	0.073	0.118
8	1.053	0.781	0.705	0.879
mean	2.634	0.729	0.764	0.764

year = 12

firm no.	crs te rel to tech in yr ********** t-1	t	t+1	vrs te
1	201554.056	1.000	0.000	1.000
2	0.286	0.247	0.000	0.247
3	2.379	1.000	0.000	1.000
4	13.793	1.000	0.000	1.000
5	0.757	0.674	0.000	1.000
6	1.019	1.000	0.000	1.000
7	0.286	0.247	0.000	0.247
8	0.830	0.744	0.000	1.000
mean	25196.676	0.739	0.000	0.812

[Note that t-1 in year 1 and t+1 in the final year are not defined]

MALMQUIST INDEX SUMMARY

year = 2

firm	effch	techch	pech	sech	tfpch
1	1.000	0.977	1.000	1.000	0.977
2	0.825	0.861	0.965	0.855	0.710
3	1.000	0.882	1.000	1.000	0.882
4	1.000	0.956	1.000	1.000	0.956
5	1.000	0.862	1.000	1.000	0.862
6	1.000	1.000	1.000	1.000	1.000
7	0.825	0.861	0.965	0.855	0.710
8	1.000	0.691	1.000	1.000	0.691
mean	0.953	0.881	0.991	0.962	0.840

year = 3

firm	effch	techch	pech	sech	tfpch
1	1.000	12.954	1.000	1.000	12.954
2	1.212	3.378	1.036	1.170	4.094
3	1.000	2.221	1.000	1.000	2.221
4	0.311	3.337	1.000	0.311	1.039
5	0.326	1.899	0.505	0.644	0.618
6	0.694	2.528	1.000	0.694	1.756
7	1.212	3.378	1.036	1.170	4.094
8	0.412	1.955	1.000	0.412	0.806
mean	0.674	3.173	0.926	0.728	2.139

year = 4

firm	effch	techch	pech	sech	tfpch
1	0.483	0.133	0.515	0.937	0.064
2	1.000	0.805	1.000	1.000	0.805
3	1.000	1.287	1.000	1.000	1.287
4	1.468	0.766	1.000	1.468	1.125
5	1.341	0.790	0.987	1.359	1.059
6	0.713	0.879	1.000	0.713	0.626
7	1.000	0.805	1.000	1.000	0.805
8	0.404	0.757	0.488	0.828	0.306
mean	0.850	0.678	0.840	1.012	0.577

year = 5

firm	effch	techch	pech	sech	tfpch
1	1.091	1.217	1.022	1.068	1.327
2	1.000	1.021	1.000	1.000	1.021
3	1.000	0.860	1.000	1.000	0.860
4	1.402	1.312	1.000	1.402	1.840

5	1.005	0.788	1.416	0.710	0.793
6	1.460	1.442	1.000	1.460	2.105
7	1.000	1.021	1.000	1.000	1.021
8	2.766	0.929	2.051	1.349	2.570
mean	1.256	1.053	1.146	1.097	1.323

year = 6

firm	effch	techch	pech	sech	tfpch
1	1.900	2.842	1.900	1.000	5.400
2	1.000	1.116	1.000	1.000	1.116
3	1.000	1.671	1.000	1.000	1.671
4	0.238	1.985	1.000	0.238	0.472
5	0.423	2.348	0.408	1.036	0.992
6	0.900	1.746	1.000	0.900	1.572
7	1.000	1.116	1.000	1.000	1.116
8	2.172	1.757	1.000	2.172	3.815
mean	0.884	1.741	0.969	0.913	1.539

year = 7

firm	effch	techch	pech	sech	tfpch
1	1.000	0.542	1.000	1.000	0.542
2	1.000	1.705	1.000	1.000	1.705
3	1.000	0.842	1.000	1.000	0.842
4	2.267	0.987	0.370	6.127	2.238
5	4.018	0.814	3.268	1.229	3.270
6	0.620	1.105	1.000	0.620	0.685
7	1.000	1.705	1.000	1.000	1.705
8	1.000	0.874	1.000	1.000	0.874
mean	1.242	1.004	1.024	1.212	1.246

year = 8

firm	effch	techch	pech	sech	tfpch
1	0.667	0.958	0.667	1.000	0.638
2	1.000	0.926	1.000	1.000	0.926
3	1.000	0.649	1.000	1.000	0.649
4	0.702	1.056	0.655	1.071	0.741
5	0.545	0.968	0.694	0.785	0.527
6	1.104	1.095	1.000	1.104	1.210
7	1.000	0.926	1.000	1.000	0.926
8	0.812	0.820	1.000	0.812	0.666
mean	0.832	0.915	0.861	0.965	0.761

year = 9

firm	effch	techch	pech	sech	tfpch
1	1.500	0.954	1.500	1.000	1.431
2	1.000	0.709	1.000	1.000	0.709
3	1.000	0.674	1.000	1.000	0.674
4	1.136	0.654	1.136	0.999	0.742
5	2.461	0.647	1.530	1.609	1.593
6	1.966	0.607	1.000	1.966	1.193
7	1.000	0.709	1.000	1.000	0.709
8	1.011	0.642	0.905	1.117	0.649
mean	1.304	0.693	1.113	1.171	0.903

year = 10

firm	effch	techch	pech	sech	tfpch
1	1.000	0.494	1.000	1.000	0.494
2	0.658	0.374	0.658	1.000	0.246

3	1.000	0.823	1.000	1.000	0.823
4	3.013	0.424	3.383	0.891	1.276
5	1.000	0.884	1.000	1.000	0.884
6	1.141	10.444	1.000	1.141	11.914
7	0.658	0.374	0.658	1.000	0.246
8	1.218	8.550	1.105	1.102	10.411
mean	1.077	1.084	1.062	1.014	1.167

year = 11

firm	effch	techch	pech	sech	tfpch
1	0.835	1.301	1.000	0.835	1.086
2	0.175	1.035	0.179	0.976	0.181
3	1.000	0.726	1.000	1.000	0.726
4	1.205	3.389	1.073	1.123	4.084
5	0.986	0.987	1.000	0.986	0.973
6	1.000	0.187	1.000	1.000	0.187
7	0.175	1.035	0.179	0.976	0.181
8	0.781	0.130	0.879	0.888	0.102
mean	0.626	0.732	0.646	0.970	0.458

year = 12

firm	effch	techch	pech	sech	tfpch
1	1.198	454.400	1.000	1.198	544.500
2	2.152	1.352	2.099	1.025	2.908
3	1.000	1.510	1.000	1.000	1.510
4	1.000	3.234	1.000	1.000	3.234
5	0.684	1.077	1.000	0.684	0.737
6	1.000	0.949	1.000	1.000	0.949
7	2.152	1.352	2.099	1.025	2.908

8	0.953	1.111	1.138	0.838	1.059
mean	1.174	2.870	1.223	0.960	3.370

MALMQUIST INDEX SUMMARY OF ANNUAL MEANS

year	effch	techch	pech	sech	tfpch
2	0.953	0.881	0.991	0.962	0.840
3	0.674	3.173	0.926	0.728	2.139
4	0.850	0.678	0.840	1.012	0.577
5	1.256	1.053	1.146	1.097	1.323
6	0.884	1.741	0.969	0.913	1.539
7	1.242	1.004	1.024	1.212	1.246
8	0.832	0.915	0.861	0.965	0.761
9	1.304	0.693	1.113	1.171	0.903
10	1.077	1.084	1.062	1.014	1.167
11	0.626	0.732	0.646	0.970	0.458
12	1.174	2.870	1.223	0.960	3.370
mean	0.961	1.158	0.969	0.992	1.113

MALMQUIST INDEX SUMMARY OF FIRM MEANS

firm	effch	techch	pech	sech	tfpch
1	1.000	1.845	1.000	1.000	1.845
2	0.881	1.041	0.881	1.000	0.917
3	1.000	1.017	1.000	1.000	1.017
4	1.000	1.314	1.000	1.000	1.314
5	0.965	1.012	1.000	0.965	0.977
6	1.000	1.202	1.000	1.000	1.202
7	0.881	1.041	0.881	1.000	0.917
8	0.973	0.995	1.000	0.973	0.969
mean	0.961	1.158	0.969	0.992	1.113

[Note that all Malmquist index averages are geometric means]

Appendix III

Hadri LM unit root test output

Hadri LM test for techch		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Not included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		sequentially
LR variance: (not used)		
Statistic	p-value	
z 2.1905	0.0142	

Hadri LM test for pech		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Not included	Asymptotics: T, N	-> Infinity

Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		
Statistic	p-value	
z -1.3760	0.9156	

Hadri LM test for sech		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Not included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		
Statistic	p-value	
z -1.6410	0.9496	

Hadri LM test for tfpch		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Not included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		
Statistic	p-value	
z 2.2018	0.0138	

Hadri LM test for lib		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Not included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		
Statistic	p-value	
z -1.3493	0.9114	

Hadri LM test for techch		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		
Statistic	p-value	
z 2.5993	0.0047	

Hadri LM test for pech		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		

Statistic	p-value
z -0.8941	0.8144

Hadri LM test for sech		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		

Statistic	p-value
z 0.0374	0.4851

Hadri LM test for tfpch		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		

Statistic	p-value
z 2.5693	0.0051

Hadri LM test for lib		
Ho: All panels are stationary	Number of panels	= 8
Ha: Some panels contain unit roots	Number of periods	= 11
Time trend: Included	Asymptotics: T, N	-> Infinity
Heteroskedasticity: Not robust		Sequentially
LR variance: (not used)		
Statistic	p-value	
z -0.8848	0.8119	

Appendix IV

Random effects GLS regression output

* Effect of liberalisation on technical efficiency change	
. xtreg Dtechch lib,re	
Random-effects GLS regression Number of obs =	87
Group variable: firm Number of groups =	8
R-sq: within = 0.0318 Obs per group: min =	10
between = 0.1528 avg =	10.9
overall = 0.0335 max =	11
Wald chi2(1) =	2.91
corr(u_i, X) = 0 (assumed) Prob > chi2 =	0.0878
Dtechch Coef. Std. Err. z P>|z| [95% Conf.	Interval]
lib 218.4768 127.9854 1.71 0.088 -32.37003	469.3236
_cons -120.3552 71.02637 -1.69 0.090 -259.5643	18.85396
sigma_u 10.192441	
sigma_e 68.001152	
rho .02197227 (fraction of variance due to u_i)	
* Effect of liberalisation on productivity efficiency change	
. xtreg Dtfpch lib,re	
Random-effects GLS regression	87

Number of obs =	
Group variable: firm Number of groups =	8
R-sq: within = 0.0321 Obs per group: min =	10
between = 0.1531 avg =	10.9
overall = 0.0338 max =	11
Wald chi2(1) =	2.94
corr(u_i, X) = 0 (assumed) Prob > chi2 =	0.0863
Dtfpch Coef. Std. Err. z P>|z| [95% Conf.	Interval]
lib 263.1905 153.4569 1.72 0.086 -37.57961	563.9605
_cons -144.9902 85.16013 -1.70 0.089 -311.901	21.92056
sigma_u 12.117553	
sigma_e 81.537073	
rho .02160887 (fraction of variance due to u_i)	

* Effect of liberalisation on pure technical efficiency change
. xtreg pech lib,re

Random-effects GLS regression Number of obs =	88
Group variable: firm Number of groups =	8
R-sq: within = 0.0104 Obs per group: min =	11
between = 0.0007 avg =	11.0
overall = 0.0101 max =	11
Wald chi2(1) =	0.88
corr(u_i, X) = 0 (assumed) Prob > chi2 =	0.3488

pech Coef. Std. Err. z P>|z| [95% Conf.	Interval]	
lib .7945656 .8480686 0.94 0.349 -.8676184	2.45675	
_cons .6141342 .468726 1.31 0.190 -.3045519	1.53282	
sigma_u 0		
sigma_e .48447303		
rho 0 (fraction of variance due to u_i)		
. * Effect of liberalisation on scale	efficiency change	
. xtreg sech lib,re		
Random-effects GLS regression	Number of obs =	88
Group variable: firm	Number of groups =	8
R-sq: within = 0.0082	Obs per group: min =	11
between = 0.0067	avg =	11.0
overall = 0.0072	max =	11
	Wald chi2(1) =	0.62
corr(u_i, X) = 0 (assumed)	Prob > chi2 =	0.4307
sech Coef. Std. Err.	z P>|z| [95% Conf.	Interval]
lib .8650837 1.0978	0.79 0.431 -1.286565	3.016732
_cons .5913926 .6067521	0.97 0.330 -.5978195	1.780605
sigma_u 0		

sigma_e .61688243	
rho 0 (fraction	of variance due to u_i)