T.C.

ANKARA YILDIRIM BEYAZIT UNIVERSITY

THE INSTITUTE OF SOCIAL SCIENCES

EFFICIENCY OF COMMERCIAL BANKS IN THE GAMBIA: AN EMPIRICAL ANALYSIS

Ph.D. THESIS

BUBACAR MALANG FATTY

DEPARTMENT OF BANKING AND FINANCE

Ankara, 2020

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Ankara, 2020

ONAY SAYFASI

Bubacar Malang FATTY tarafından hazırlanan "Efficiency of Commercial Banks In The Gambia: An Empirical Analysis" adlı tez çalışması aşağıdaki jüri tarafından oy birliği / oy çokluğu ile Ankara Yıldırım Beyazıt Üniversitesi Sosyal Bilimler Enstitüsü Bankacılık ve Finans Anabilim Dalı'nda Doktora tezi olarak kabul edilmiştir.

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……

DECLARATION

I hereby declare that all information in this thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work; otherwise I accept all legal responsibility. Date (02.07.2020)

Signature

Bubacar Malang FATTY

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ABSTRACT

Efficiency of Commercial Banks in The Gambia: An Empirical Analysis

This study examines the efficiency (OTE) of commercial banks (CBs) in The Gambia, from 2009 to 2017 by utilizing the non-parametric Data Envelopment Analysis (DEA) method, under the assumption of constant returns to scale and variable return to scale, based on intermediation and production approaches. The study further investigates the influence of internal (bank-specific characteristics) and external (macroeconomic) factors on efficiency measures using the Tobit regression method. The DEA results under both intermediation and production approaches show that commercial banks in the Gambia are not fully efficient during the study period. Generally, under the intermediation approach, the study found that Guaranty Trust Bank (Gambia) Ltd is the most efficient bank in the Gambia, while BSIC bank found to be less efficient bank during the same period. However, under the production approach, the results indicate that Standard Chartered Bank (Gambia) Ltd ranked as the most efficient bank, while Eco bank (Gambia) Ltd appeared as a less efficient bank during the research period. The research showed that the commercial banks in the Gambia were more efficient under the production approach than the intermediation approach. On the other hand, the Tobit regression results under the intermediation approach indicated that Profitability has a positive and significant relationship with overall technical efficiency measures, while Bank Size, Capital Adequacy, Earning and Inflation have a negative and significant correlation with efficiency measures. However, under the production approach, the results demonstrated that Market Power, earnings and GDP have a positive and significant relationship with efficiency measures, while Bank Size and Liquidity have a negative and significant relationship with efficiency measures. This indicates that banks' specific characteristics and macroeconomic factors are the driving and important factors that influence the efficiency of commercial banks in the Gambia and that the banks have more room to improve their efficiency level.

Keywords: Commercial Banking, DEA, Technical Efficiency, Tobit Regression, The Gambia

ÖZET

Gambiya'daki Ticari Bankalarin Etkinliği: Ampirik Bir Analiz

Bu çalışma, 2009-2017 yılları arasında Gambiya'daki ticari bankaların (GTB) genel teknik etkinliği/verimliliğini (GTV), arabuluculuk ve üretim yaklaşımlarına dayalı olarak, ölçeklere sürekli dönüş ve ölçek değişken getirisi varsayımı altında parametrik olmayan Veri Zarflama Analizi (VZA) yöntemini kullanarak incelemaktadır.Çalışma ayrıca Tobit regresyon yöntemini kullanarak iç (bankaya özgü özellikler) ve dış (makroekonomik) faktörlerin verimlilik ölçüleri üzerindeki etkisini araştırmaktadır. Hem aracılık hem de üretim yaklaşımlarındaki DEA sonuçları, Gambiya'daki ticari bankaların çalışma döneminde tam olarak verimli olmadıklarını göstermektedir. Genel olarak, aracılık yaklaşımı kapsamında, çalışma, Guaranty Trust Bank (Gambia) Ltd'nin çalışma döneminde Gambiya'daki en verimli banka olduğunu bulundu, BSIC bankasının da aynı dönemde daha az verimli banka olduğunu bulundu. Bununla birlikte, üretim yaklaşımı altında, sonuçlar analiz döneminde Standard Chartered Bank (Gambia) Ltd'nin en verimli banka olduğunu gösterirken, Eco bank (Gambia) Ltd ise aynı dönemde daha az verimli bir banka olarak ortaya çıktığını göstermektedir. Bu nedenle, bulgu, çalışma süresi boyunca Gambiya'daki ticari bankaların ortalama verimsizliğinin, ölçek tarafından yürütülen ve her iki yaklaşımdaki operasyonların verimsizliğiyle ilişkili olmayan dezavantajlı durumlarla ilişkili olduğunu göstermektedir. Araştırmada, 2009'dan 2017'ye kadar Gambiya'daki ticari bankaların üretim yaklaşımında, aracılık yaklaşımından daha verimli olduğunu gösterdi. Diğer taraftan, aracılık yaklaşımı altındaki Tobit regresyon sonuçları, Kârlılığın genel teknik verimlilik önlemleri ile pozitif ve önemli bir ilişkiye sahip olduğunu, Banka Büyüklüğü, Sermaye Yeterliliği, Kazanç ve Enflasyon'un ise verimlilik ölçütleri ile negatif ve anlamlı bir korelasyona sahip olduğunu göstermiştir. Bununla birlikte, üretim yaklaşımı altında, sonuçlar Pazar Gücü, kazanç ve GSYİH'nın verimlilik önlemleri ile pozitif ve önemli bir ilişkiyi gösterirken, Banka Büyüklüğü ve Likidite'nin verimlilik önlemleri ile negatif ve anlamlı bir ilişkisi olduğunu göstermiştir. Bu, bankaların belirli özelliklerinin ve makroekonomik faktörlerinin Gambiya'daki ticari bankaların verimliliğini etkileyen itici ve önemli faktörler olduğunu ve bankaların verimlilik seviyelerini artırmak için daha fazla alana sahip olduklarını göstermektedir.

Anahtar Kelimeler: Gambiya, DEA, Teknik Verimlilik, Tobit Regresyonu, Ticari Bankacılık,

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ACRONYMS

AE	Allocative Efficiency
AGIB	Arab Gambia Islamic Bank
BBWA	Bank of British West Africa
BCC	Banker, Charnes and Cooper
CB	Colonial Bank
CB	Commercial Bank
CBG	Central Bank of the Gambia
CBs	Commercial Banks
CCBs	Conventional Commercial Banks
CCR	Charnes, Cooper and Rhodes
CRS	Constant Returns-to-Scale
DEA	Data Envelopment Analysts
DFA	distribution-free Approach
DMU	Decision Making Unit
DMUs	Decision Making Units
DRS	Decreasing Returns to Scale
e.g.	(*Exempli Gratia*): For example
EQASS	Equity over total Assets
et al.	(*et alia*): and Others
FDH	Free Disposable Hull
FDH	Free Disposable Hull Analysis
FEM	Frontier Efficiency Measures
FIB	First International Bank
FSD	Financial Supervision Department
FX	Foreign Exchange
GCDB	Gambia Commercial and Development Bank
GDP	Gross Domestic Product
GMD	Gambian Dalasi
GSB	Government Saving Bank
GTB	Guaranty Trust Bank
i.e.	(*id est*): that is
IB	Islamic Bank

IBCI	International Bank for Commerce and Industry
IBWA	International Bank for West Africa
ICB	International Commercial Bank
ICB	Islamic Commercial Bank
II_TA	Interest income over total Assets
IMF	International Monetary Found
INF	Inflation
IRS	Increasing Returns to Scale
MIB	Meridian International Bank
MP	Market Power
MPSS	Most Productive Scale Size
NAWEC	National Water and Electricity
NIRS	Non – Increasing Returns to Scale
OLS	Ordinary Least Squares
OTE	Overall Technical Efficiency
PHB	Platinum Habib Bank
PTE	Pure Technical Efficiency
ROA	Return on Assets
ROE	Return on Equity
SCB	Standard Chartered Bank
SE	Scale Efficiency
SFA	Stochastic Frontier Approach
TBL	Trust Bank Ltd
TE	Technical Efficiency
TFA	The thick frontier approach
TFA	Thick Frontier Approach
TL_TA	Total Loans divided by total Assets
US	United States of America
VIF	Variance Inflation Factor
VRS	Variable Returns-to-Scale

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CHAPTER 1

INTRODUCTION

1.1. Background of the Research

The banking sector around the world has undergone far-reaching changes in the past two or three decades. The government deregulation, financial innovations, information revolution, and rapid growth of communication technology with the globalization of markets and financial institutions have generated a banking environment that is so competitive and modified the technology of bank production. Based on these developments and rapid changes in the current banking industry the banks are trying to stay efficient to face this competitive environment, and the Gambian banking sector is not an exception to these changes. The efficiency of banks is desirable because it helps them to compete with one another and achieve higher performance of return relative to cost, and to contribute to economic development effectively, while inefficient banks encounter less chance to survive in a competitive market. This problem has increasingly focused on controlling bank costs and providing products and services more efficiently(Spong, Sullivan, & DeYoung, 1995). Thus, the successes of commercial banks depend largely on the ability to operate efficiently (Mester, 1997). An efficient bank is crucial for the growth and stability of the entire economy, thus, the existence of a sound banking system and the efficient use of bank resources are necessary for the effective operation of the financial system (Hussein, 2001). Therefore, measuring the efficiency of banks became a concern for all stakeholders, to remain dominant compared to other financial institutions.

The efficiency of a bank could be described as the correlation between what a bank (or a decision-maker) produces and what it could produce, assuming that the available resources are sufficiently used (Hoyo et al., 2004). As stated by Kumbhakar and Lovell (2000) “Efficiency represents the degree of success which producers achieve in allocating the available inputs and the outputs they produce, to achieve their goals, namely: to attain a high degree of efficiency in revenue, or profit”. Moreover, the efficiency of the bank can be divided into Allocative Efficiency and Technical Efficiency (TE). Allocative efficiency refers mainly to the degree in which resources were been allocated to generate largest

anticipated returns, and a bank can be technically efficient if it yields a given amount of outputs (i.e. loans, deposits) using the minimum possible amount of inputs (i.e. labour, capital, and other operating costs) (Falkena et al., 2004). To achieve technical efficiency means producing the maximum efficiency at the lowest cost. Technical efficiency is further broken down into two efficiencies, namely pure technical efficiency and efficiency of scale to describe the core source of inefficiency. One of the most important methods used to measure the efficiency of banks is Data Envelopment Analysis (DEA) method. The theoretical development of DEA was initiated by Farrell (1957), but the model was developed by Charnes, Cooper, and Rhodes (1978).

The term DEA is referred to as a mathematical programming algorithm to evaluate the performance of a series of homogeneous units called decision-making units (DMUs) that convert multiple inputs to multiple outputs. This technique forms an empirical production frontier or envelope and estimates and measures the efficiency of the created frontier (Coelli, 1996). In other words, DEA includes the construction of a non-parametric production frontier depending on actual input-output realizations in the sample against which the efficiency of each DMU in the sample is measured. (Coelli, 1996). There is extensive literature review in this field in the United States, Europe, and Asia, but few empirical studies have been observed in Africa broadly and in the Gambia particularly. Therefore, to fill this gap, this study measures the technical efficiency of commercial banks in the Gambia, which is further decomposed into pure technical efficiency and scale efficiency. Also, the study highlights the main determinants of technical efficiency measures of the Gambian banking sector.

1.2. Research Problem

The Gambian banking industry has undergone fundamental changes in the past two to three decades and has undergone major financial sector reforms during the structural adjustment program. The current structure of the banking sector became developed after the Central Bank of the Gambia presented a comprehensive reform of the financial sector in 2005. Financial reform has been conducted to enhance financial liberalization, development of financial institutions, and the stability of the financial industry. As a result, CBG is enabling new foreign private banks to enter the Gambian banking sector. A Sum of 12 banks operated in The Gambia before 2008, and in 2009 the number increased to the sum of 14

banks, 13 were commercial banks (CCB), and an Islamic bank (CBG, 2011), and in 2013 the number decreased to 12 due to mandatory capital.

The Gambia with no capital markets and with a population of 2.101 million (2017 census of World Bank) whom not more than 25 percent have bank accounts. The entry of New Banks to Improve Financial Inclusion, but also the Competition and Efficiency of Commercial Banks in The Gambia will increase. Indeed, weaker banks can lose efficiency and leave the sector naturally, while stronger banks can benefit from increased size and efficiency. Many observers argued that the country is over-banked though no empirical study has ever been made extensively to the effect of these changes. Therefore, the efficiency measuring of commercial banks in the Gambia is timely and more relevant. To respond to this need, this study aims to evaluate the overall technical efficiency of commercial banks in the Gambia from 2009 to 2017. Also, this study will define the association between efficiency measures and characteristics of the banks (i.e Profitability and Market Power, Bank's Size, Liquidity, Capital Adequacy, Earning) and macroeconomics variables (i.e. GDP and Inflation).

1.3. Research Objectives

Banks around the world are contributing to economic growth through their role as financial intermediaries. The banking sector in The Gambia has undergone fundamental changes over the past two decades, as the country is small and has very limited natural resources. The focus should, therefore, be on banking, finance, and port trading (Sillah, 2005). Nonetheless, no empirical study has ever been made extensively to examine the efficiency of commercial banks in the Gambia. Thus, this research aims to measure the overall technical efficiency of the Gambian banks from 2009 to 2017 by using Data Envelopment Analysis (DEA) method. In particular, the goals of this research are:

1. To examine the overall technical efficiency[1] of commercial banks in the Gambia from 2009-2017.
2. To examine the banks' specific characteristics and macroeconomic factors determine the overall technical efficiency measures of commercial banks in the Gambia from 2009-2017.

[1]Overall Technical Efficiency , is a decomposing of technical , pure technical and scale efficiency

1.4. Research Questions

Explaining the research objectives; the following research questions have been asked:

1. What is the overall technical efficiency of commercial banks in the Gambia from 2009-2017?
2. What are the banks' specific characteristics and macroeconomic factors that determine the overall technical efficiency measures of Commercial banks in the Gambia from 2009-2017?

1.5. Significance of the Research

Assessing a bank's performance by measuring efficiency is important for some reasons: Firstly: the results will reveal the technical efficiency of commercial banks in The Gambia based on current economic situations. Secondly: it helps bank management to improve managerial performance, and to use the banks' resources efficiently. Third, it assists investors in making useful investment decisions on whether to participate in financial activities. Fourthly, regulators are also interested in banking efficiency since the performance of the banking sector has a significant impact on other parts of the economy i.e. tax revenue and employment. Last but not the least, this will expand the literature on the efficiency of banks, particularly in the Gambian banking sector.

1.6. Motivation of the Research

Measuring the efficiency of commercial banks is very important, for following motives: First; the financial sector is considered as a major player in modern economies, as a producer of financial services and as an employer and main contributor to national GDP. Second; the banking sector plays crucial functions in channeling funds between savers and investors, engaging in financing private sector trade and investment. The banking system must be sound and efficient to effectively play its role and to stay competitive. Therefore, evaluating the efficiency of these banks will encourage them to improve their performance level. Based on that, this study is motivated to measure the technical efficiency of commercial banks in the Gambia from 2009 to 2017, by using Non-parametric DEA method. Then further evaluates the factors that determine the efficiency measures.

1.7. Organization of the Research

This thesis is organized as follows: Chapter 1 focused on the study background, in which the problem, the research objectives, the research questions, the significance and the motivation of the research were discussed. Chapter 2 discussed a comprehensive literature review of efficiency in the banking sector. The same chapter also explained efficiency theories in the context of commercial banking as well framework of research is explained. Chapter 3 focuses mainly on the role of commercial banks in The Gambia for the conventional and Islamic banking industry. In chapter 4, the research methodology and developing hypothesis were explained. Chapter 5 analyzes the data and empirically demonstrates the research findings. Chapter 6 concludes the study by summarizing research findings from chapter 5 based on research objectives. Likewise, it discusses the contributions of the research, limitations of the research, and suggestions for future research areas.

CHAPTER 2

EFFICIENCY OF THE BANKING INDUSTRY: LITERATURE REVIEW

2.1. Introduction

As mentioned earlier, firm efficiency describes an association between what a company produces and what it could produce, provided that the available resources are fully used. Efficiency therefore generally examines “inputs and outputs for explaining how productive inputs are transformed into outputs” (Wahab & Rahman, 2011). “The current research concentrates on technical efficiency (TE), which is divided into pure technical efficiency (PTE) and scale efficiency (SE). Technical efficiency is the company's ability to transform its inputs into maximum outputs at minimal cost” (Falkena et al., 2004). “In other words, TE is defined as the ability of a bank to convert its multiple resources into multiple financial services” (Kumar & Gulati, 2008). “The PTE measure aims to estimate the efficient frontier assuming Variable Returns-to-Scale” (VRS). “VRS is a measuring approach of technical efficiency free from scale efficiency and simply inspires management's performance to control inputs during the process of production. Therefore, the PTE metric was used as an index to highlight management performance, while SE allows managers to choose the optimal scale of resources” (Kumar & Gulati, 2008).

This chapter provides an in-depth review of the literature on previous research using “Nonparametric methods from the DEA and stochastic parametric analysis of the SFA frontier to measure the efficiency of banks in general and CBs in Africa in particular”. Besides, this chapter reviews the literature on specific and macro-economic factors affecting banks that may affect efficiency measures. The chapter also deals with theories on measuring “the efficiency of commercial banks”. Likewise, the efficiency theoretical framework was then revealed before the chapter ended.

2.2. Efficiency Measurement

The efficiency of CBs is measured using various approaches and samples. Researchers are focusing on approaches that use multiple bank input-outputs, identified as

“frontier efficiency measures (FEM) (Berger, Hunter, & Timme, 1993). The FEM indicates the management's ability to control costs and use fixed resources to achieve the desired result”. Also, the FEM summarizes the performance of companies in the form of a single statistic (efficiency sector), which controls the differences between companies in a complex and multidimensional framework that originated from economic theory. (Cummins and Weiss, 2000). “The FEM is a more common in use nowadays to measure efficiency levels due to its ability to use multiple inputs and outputs of the companies in the sample, improve an efficiency capacity, and the efficiency of a Unit of Decision Making Unit (DMU) contrast with other DMUs in the sample. Thus, the FEM could be a more suitable means of measuring the efficiency of companies, in particular when assessing the efficiency of financial institutions (Y. Dong, 2010); and a survey done by Berger and Humphrey (1997) established this when using frontier efficiency analysis at financial institutions in 12 countries”.

Nevertheless, Wheelock & Wilson (1999) argue that “no single approach has been selected as the best way to measure the efficiency of commercial banks. Although the FEM can still be seen as a more appropriate approach for measuring efficiency levels than traditional accounting measures” (Berger & Humphrey, 1997). In addition, according to the efficiency frontier technique, “two economic approaches are called parametric and non-parametric approaches” (Bauer & Hancock, 1993). “The economic theory follows directly from the microeconomic theory of the company on which it is based on the view of (Debreu, 1951)” and (M.J. Farrell, 1957) who introduced the standard framework of productive efficiency (production frontier). According to Omar et al, (2006), “measuring the efficiency of a bank mainly focuses on two different approaches, namely parametric and non-parametric methods”. In the following section, we will briefly explain each of these approaches.

2.2.1. Parametric Approaches

Parametric approaches intend to develop least squares (OLS) estimates by “adding an asymmetrical structure for the residuals to take into account the distance between the empirical observations and the theoretically efficient frontier” (Y. Dong, 2010). Besides, parametric technology consists of three major techniques (Siyaka, 2008), namely: The stochastic frontier approach (SFA), distribution-free Approach (DFA), and the Thick Frontier Approach (TFA). The SFA is described as a composite fault model, in which the

part that represents the statistical noise that follows an asymmetrical distribution and the other part that represents the inefficiency follows a certain one-sided distribution (Y. Dong, 2010). Therefore, the "SFA suggests that observed bank costs could differ from the cost frontier due to inefficiency or random fluctuations" (Maudos, Pastor, Perez, & Quesada, 2002).

Also, the DFA is one of the frontier techniques that deal with the panel evaluation method and at the same time avoid imposing the error component on distribution hypotheses. Therefore, "the DFA is similar to SFA in providing a functional form for the efficiency frontier, although DFA uses another means to separate the inefficiencies from the rest and untangles inefficiencies from random errors, provided the inefficiencies are relatively stable and are likely to continue over time" (Y. Dong, 2010). According to Y. Dong (2010) "The Thick Frontier Approach (TFA) was developed by Berger and Humphrey (1991, 1992). It specifies a functional form for the frontier cost function as do the other parametric frontier approaches. But this approach estimates a thick frontier rather than a frontier edge for measuring efficiencies and also avoids distributional assumptions for cross-sectional data". Therefore, this method offers a solid basis for determining the achievable efficiency of a sector "(Siyaka, 2008)".

2.2.2. Non- Parametric Approaches

Non-parametric approaches are linear programming techniques for measuring firms with multiple inputs/outputs (Y. Dong, 2010). There are two main approaches among non-parametric techniques that are consistent with the techniques of linear mathematical programming utilized to assess the efficiency of firms. "These two approaches are Data Envelope Analysis (DEA) and Free Disposable Hull Analysis (FDH). DEA is a non-parametric technique for evaluating the relative efficiency of some similar units, commonly called decision-making units (DMU)" (Kumar & Gulati, 2008). Further explanations of DEA can be found in Chapter 4 as a method for this research. The FDH approach could be described as a special case of the DEA model. The FDH approach relaxes the convexity hypothesis and assumes that no linear substitution between the observed input and output combinations is possible at a piece-wise linear frontier. The defined FDH production options consist only of the DEA key points and the free disposal hull points in these key points (Berger and Humphrey, 1997), and this guarantees that efficiency developments are only

influenced by the performance observed (Y. Dong, 2010). These two approaches use different techniques to include a data set with different assumptions for random noise and the structure of the production technology. (Maghyereh, 2004). These models have been used in the measurement of business performance, but the methods most commonly used in current literature to measure the efficiency of CB are SFA as a parametric method and DEA as a non-parametric approach. This study uses the DEA method to examine the overall technical efficiency of commercial banks in The Gambia instead of SFA. This is because SFA has some limitations that can influence its results. As stated by Forsund, Lovell, & Schmidt (1980) and quoted by (Kumbhakar & Lovell, 2000)"The main weakness of SFA is not possible to decompose individual residuals into their two components, and so it is not possible to estimate technical inefficiency by observation, the best that one can do is to obtain an estimate of mean inefficiency over the sample."

On the other hand, the SFA makes static noise to distinguish it from random errors when the problem of decomposition in the real inefficiency component is measured by other purely random fractions, which affects the behavior of the producer. (Dalla Pellegrina, 2006). Also, the SFA might experience strong assumptions, in particular when econometrics must deal with the assumption necessary for the distribution of the inefficiency element and its independence from other factors that determine the behavior of producers. (Dalla Pellegrina, 2006) The next section will focus on a literature review that used DEA to measure the efficiency of commercial banks globally and Africa in particular.

2.3. The Efficiency of Commercial Banks in General

The theoretical development of the non-parametric efficiency approach of DEA was initiated by Farrell (1957), however, the model was suggested by Charnes, Cooper, and Rhodes (1978). Nonetheless, Farrell's (1957) the empirical work was restricted to the single variable with a single output and did not concern applications with large amounts of data with multiple inputs and outputs. Therefore, this concept of mathematical programming had not been studied in depth for about two decades before it was published by (Charnes, Cooper, & Rhodes, 1978) (Y. Dong, 2010). Charnes, Cooper & Rhodes in this classic paper proposed a mathematical programming algorithm is known as Data Envelopment Analysis (DEA) employed to assess the performance of a series of homogeneous units known as Decision Making Units (DMU) and multiple inputs during the conversion of multiple outputs. This

technique forms an empirical production frontier or envelopes and calculates and measures the efficiency with the constructed frontier. Since the original work by Charnes et al. (1978), numerous articles have expanded and applied the DEA method (Y. Dong, 2010). Seiford (1997) has written lists of over 400 articles in the bibliography and Cooper et al. (2007) provide more than 2000 DEA references. This rapid growth and the wide acceptance of DEA are proof of its strengths and its applicability (Y. Dong, 2010).

In addition, the DEA is diversified with a parametric approach SFA; DEA does not need to specify a particular functional form for expenditure or the production function. Therefore, the derived efficacy estimates do not depend on the functional form (Y. Dong, 2010). On the other hand, the precision of the efficiency measures in the parametric approach depends on the precision of the selected functional forms which approximate the costs or production functions to be allowed. Furthermore, DEA differs from the aforementioned parametric stochastic frontier approach, DEA generally does not accept the existence of a random error term (L. Drake & M. J. B. Hall, 2003). Therefore, the DEA features any efficient frontier deviation as purely inefficient, and for this reason, the DEA can overestimate the actual relative inefficiency levels for some units (Berger & Mester, 1997).

Many studies use the DEA method to evaluate the efficiency of banks generally and CBs in particular. Some of these studies have focused on the cost and profit efficiency of commercial banks, e.g. Maudos & Pastor (2003) utilize DEA to measure the cost-efficiency of the banking industry in Spain over the period 1985-1996. The average level of cost efficiency in savings banks and commercial banks achieves values (80.2% and 90.9%) respectively, which are far above the level of profit efficiency. The standard profit efficiency of commercial banks (66.5%) is higher than that of the savings banks (47.2%) and has converged in recent years to the point where the minimum difference occurs in the sample last year. However, commercial banks are also more efficient in terms of alternative profitability, which gives market power when setting production prices (52.9% versus 34.7% of savings banks), with levels from the late 1980s. Higher levels of standard profit-efficiency than alternative profit-efficiency imply the presence of market power in pricing and / or the existence of differences in the quality of banking performance, which reflected in the price differences.

Roberta et al. (2010) used the DEA to assess the cost, technical efficiency, and allocation efficiency of the Brazilian banking industry from 2000 to 2007. The results

demonstrate that Brazilian banks experienced a high level of inefficiency compared to other countries. The main factors influencing the Brazilian banking system were non-performing loans and market shares. Also, the results indicate that public banks are more efficient than foreign banks since the number of public banks has been reduced and, according to Roberta et al. (2010), only efficient banks have remained operational). This indicates that banks had many public sector salary accounts over the period, making them more efficient than foreign banks.

Dong (2010) uses SFA and DEA to analyze and assess the cost-efficiency of Chinese banks between 1994 and 2007. Under the SFA, the result shows that the cost-efficiency of Chinese banks averaged 91%. While the DEA results showed that around 89% and 87%, respectively, were the average cost-efficiency of Chinese banks in the reporting period. Furthermore, Dong, (2010) fund after which the efficiency of the Chinese banking sector deteriorated after China joined the WTO. In addition, a large number of Chinese banks have scale inefficiencies and with increasing asset size, and he found that banks tend to experience increasing-to-scale switch as well as decreasing- to-scale. In addition, the results display that state and foreign banks are more efficient than domestic private banks and that large banks appear to be relatively more efficient than their smaller counterparts.

Hassan & Bader (2009) use the DEA to study and compare the costs, revenues and profitability of 43 Islamic banks and 37 conventional banks for the period 1990-2005 in 21 countries. The study considered the efficiency and average overtime of these banks based on their size and region using static and dynamic panels. They found that there was no significant difference between the overall efficiency of the traditional banks and their Islamic counterparts during the reporting period. A number of these studies focus on cost, allocative, and overall efficiency, for an instant, Havrylchyk (2006) measures the efficiency of the Polish banking industry between 1998 and 2000 using DEA. The study reveals costs, allocation, technical efficiency, purely technical and size. The study also uses parametric and non-parametric data to calculate the efficiency of foreign and domestic banks and to determine whether foreign and domestic banks belong to the same environment. He indicated that the average efficiency was 44.62% for Polish banks and 69.70% for domestic and foreign banks. As a result, foreign banks are more productive of their inputs (technical efficiency) and prefer the right combination of inputs at certain prices (allocation efficiency).

In addition, the results show that the overall efficiency of the Polish banking system did not improve between 1998 and 2000.

Kyj and Isik (2008) utilize the DEA technique, to examine the X-efficiency and scale of commercial banks in Ukraine from 1998 to 2003. The analysis explores both standard efficiency frontier for all banks and separate efficiency frontiers for each category of bank size (small, medium, and large). Kyj and Isik (2008) Note that the efficiency values in the sample correlate significantly between the results at the common and separate frontier. Their results also indicate that the average technical efficiency is only 47% and that the main cause of inefficiency is motivated by unprofessional management decisions (pure technical efficiency) rather than inefficient scaling. They further examine the impact of size and location of ownership factors on the efficiency of the banking sector in Ukraine. Also they evaluate the influence of size and location factors on the efficiency of the banking sector in Ukraine. They found that big banks appear to be technically more efficient but less efficient than small banks. Moreover, the results show that banks with majority foreign ownership are generally the most efficient and that a bank's location is also an important determinant of its relative efficiency. For the year ending March 1997, Drake and Hall (2003) used the DEA to examine the technical efficiency and scale of 149 banks in Japan. The study also evaluates the influence of type and group of banks on Japanese bank efficiency. The results show that the average technical efficiency was 72 percent and that Japan's large banks are more efficient than their smaller counterparts.

Tochkov and Nenovsky (2009) analysis of the efficiency of Bulgarian banks and their determinants between 1999 and 2007 utilizing the DEA to determine, on the one hand, the level of technical, allocative and economic efficiency and, on the other hand, the regression of certain bank-specific institutional factors connected to the EU. The findings demonstrate that foreign banks were more efficient than local private banks, but the gap was very small over time. Besides, state-owned banks have recently been positioned on average, but their privatization has led to efficiency gains. Nevertheless, capitalization, liquidity, and corporate restructuring have improved the efficiency of banks, while banking reforms have had a negative impact. They also found that EU membership enhances Bulgarian banks. Canhoto and Dermine (2000) conduct an assessment of the technical efficiency of Portuguese banks between 1990 and 1995 using DEA. They also compare the efficiency performance of the old established banks with the performance of the new banks. Empirical

results indicate that the technical efficiency values of Portuguese banks have gradually gone from 0.73 in 1990 to 0.93 in 1995 and that de novo banks as a whole tend to be technically more efficient (0, 86) than the old ones. established banks that were only taken into account 0.73 percent.

Yudistira (2004) examines the technical, purely technical, and scalar efficiency of 18 Islamic banks worldwide from 1998 to 1999 using non-parametric technology (DEA). Overall efficiency results show that the overall inefficiency of 18 Islamic banks is low at just over 10%, which is quite low compared to many traditional counterparts. Yudistira (2004) found that Islamic banks were very successful in the sample after been affected by the 1998-1999 world financial crisis. Onour & Abdalla (2011) measured the technical efficiency of 36 commercial banks in the GCC countries for the period 2006-2008 by using the DEA through the inter-mediation approach that normally applies to bank services. As noted, the entire banking sector in the GCC countries has been pure technically efficient in the past three years. Onour & Abdalla (2011) found that banks were more efficient at 33% in 2007 compared to 25% in 2008. A look at these results shows that banks in the GCC countries experienced a certain inefficiency in 2008 due to the global financial crisis, which drives up prices. Crude oil dropped from $ 100 to less than that before per barrel.

Sufian (2007b) measured the efficiency of Malaysian Islamic banks between 2001 and 2004. He used the DEA to examine three types of efficiency: technical efficiency, pure technical efficiency, and scale efficiency. Sufian (2007) also tested parametric and non-parametric data to determine whether domestic and foreign Islamic banks in Malaysia were motivated by a similar paradigm. He also compared the efficiency values of the DEA with the accounting rates. The findings indicate that the technical efficiency of domestic and foreign Islamic banks in Malaysia was generally 86.1% and 85.1%, respectively, indicating that domestic Islamic banks were slightly more efficient than foreign Islamic banks. Furthermore, the efficiency of the scale was higher than the purely technical efficiency during the selected period, and the results of parametric and non-parametric tests showed that the domestic and foreign Islamic banks operated in the same population as that indicated in the null hypothesis. In the meantime, DEA results and accounting indicators have confirmed that there is generally a positive and meaningful relationship between them as a tool to measure the efficiency of the banking sector.

Ataullah et al. (2004) provide a comparative analysis of the growth of the efficiency of commercial banks in India and Pakistan for the period from 1988 to 1998. They use two alternative approaches to DEA (loan-based and income-based models)) to examine technical efficiency. They note that the overall technical efficiency of Indian and Pakistani banks gradually improved during the sampling period. For Indian banks, the improvement is due both to the increase in pure techniques and to economies of scale. For Pakistani banks, however, the increase in overall technical efficiency is mainly due to an improvement in the efficiency of scale. Comparing the results of the loan and income models, they also found that banks are relatively more efficient at generating earning assets than at income. Chen et al. (2005) examine the costs, technical efficiency, and the allocation efficiency of 43 Chinese banks in the period 1993-2000 using the DEA. The results show that large public banks and small banks in China are more efficient than medium-sized banks. Besides, technical efficiency continues to dominate the allocation efficiency of Chinese banks. The deregulation of financial markets in 1995 was found to improve the level of profitability, including technical efficiency and allocative efficiency.

Aly et al. (1990) used a non-parametric frontier technique to examine the technical efficiency of a sample of American banks. The results show that these banks could have produced the same level of production output with only 70% of the inputs used. Also, the main inefficiency was due to purely technical inefficiency (waste of inputs) rather than inefficient scaling (operation with non-constant returns of scale). Finally, the regression analysis shows that the technical efficiency of banks is positively associated with size negatively to product variety and not at all to the extent of the authorization of bank branches.

Tandon et al. (2014) examined the technical, purely technical, and scale economies of scale of Indian banks, taking into account the ownership structure for the period 2009-2012 using the DEA. The study revealed that of the 44 banks in the sample, only 7 were at the frontier of efficiency. The study also found no significant difference between public, private, and foreign banks. In addition, the technical efficiency of private and public banks was almost the same. This indicates that the economies of scale of foreign banks have increased. The main drivers of efficiency were non-interest income**.**

Balcerzak et al. (2017) examined the efficiency of various banking sectors in EU countries for 2015 compared to 2014 using the DEA and Malmquist index. They also assessed whether decisions by bank management, regulators, or other uncontrollable

exogenous factors had a positive, negative, or normal impact on the EU banking sector during the investigation period. They found that the banking sector in the EU countries was categorized by relatively low levels of efficiency in 2015. Moreover, the findings show that there are differences between the efficiency of the banking sector in the US in the old fifteen and the new EU member states. They also certified that there is a noticeable difference between the efficiency of the banking sector within the members of the European Monetary Union and that which does not belong to the euro area during the investigation period. The study confirms that the latest global financial crisis is still having a significant negative impact and that certain other exogenous factors are likely to have a negative impact.

Yadav (2015) measured the efficiency of Russian commercial banks from 2008 to 2014 using data envelopment analysis (DEA). The research concentrates on technical efficiency, which has been broken down into pure efficiency and scale efficiency to determine whether the inefficiency in banks is due to management efficiency or an inappropriate bank size. In addition, the study uses an intermediate approach to select bank inputs and outputs, namely total deposits and total expenses as inputs and loans, financing and advances, and net investment as outputs. Empirical results show that the technical efficiency values are between 31% and 51%, which means that banks must reduce their inputs from 49% to 69% to be at the limit of efficiency. The result also shows that the commercial banks in the sample operate gradually with decreasing returns of scale. In general, the results suggest that commercial banks in Russia are performing below average when they use their inputs to achieve optimal outputs.

L. Drake & M. J. Hall (2003) examined the technical and scale efficiency of banks in Japan using the non-parametric DEA border approach. The study uses an intermediary approach to select general and administrative expenses, capital, retail and wholesale deposits as inputs, and total discounted loans and bills, cash and cash equivalents, and other investments in securities and other income as outputs. The analysis concentrated on individual banks, bank types, and size groups of banks with efficiency measures. The empirical results show that large (urban) banks generally operate above the minimum efficiency scale and have only a limited ability to remedy x-inefficiencies, while small banks prove different. In addition, the results show that controlling the exogenous effects of problem loans is an important factor in the Japanese banking sector, especially for small regional banks.

Wahidudin (2013) measures the technical efficiency of Malaysian domestic commercial banks between 1995 and 2009 employing Window Analysis for Data Envelope Analysis (DEA). The main idea of the study is to record the time effects on the technical efficiency of the bank and to divide it into pure technical efficiency (X-efficiency or management efficiency) and scale efficiency. The results show that domestic commercial banks have a certain inefficiency on average, which is mainly due to purely technical rather than economies of scale. The study, therefore, concludes that Malaysian commercial banks should benefit more from the reduction in the number of inputs used or the increase in production. Also, commercial banks should not be overly concerned that the right scale of production has not been chosen. However, one study shows that banks have not fully exploited economies of scale on average.

Sufian & Abdul Majid (2007) analysis of the efficiency of the Malaysian Islamic banking sector between 2001 and 2005 using the DEA and Tobit models. They used two different approaches to determine how efficiency values change when bank inputs and outputs change. The study also examines several variables such as bank size, ownership capital, bad debt, and quality of management to link the differences in calculating the efficiency of Islamic banks. Empirical results indicate that inefficiency of scale dominates pure technical inefficiency in the Malaysian Islamic banking sector. Besides, the study shows that foreign banks are more technically efficient than their domestic counterparts. However, the results of the second stage, which are based on the multivariate Tobit model, suggest that large banks are technically more efficient than small banks, have higher credit intensity, and have fewer non-performing loans on average.

Onour & Abdalla (2011) used the DEA to investigate the efficiency and type of returns to scale of twelve Islamic banks in Sudan in 2007 and 2008. The results show that of the twelve banks included in the sample, only two (the largest bank in the government group) and the medium-sized private bank) note the level of technical efficiency (i.e. scope and pure technical efficiency). Although the smallest bank in the group (private), its technical efficiency is pure (i.e its management efficiency), yet its scale is inefficient. These results imply that ownership does not limit the efficiency and scope of management, but the size of the bank is an important factor.

Abdul-Aziz (2017) examines the effectiveness of the participating banks (Islamic banks) compared to conventional banks in Turkey between 2010 to 2015 using a non-

parametric technique (DEA). The study also used an input-based DEA based on the intermediation approach. The results indicate that participating banks and conventional banks have achieved a relatively high level of efficiency, although conventional banks tend to be more efficient in terms of technical efficiency.

2.4. The Efficiency of the Banking Sector in Africa in Particular

Some studies on the efficiency of the banking sector have been carried out in Africa. These studies have used various methods to measure the level of efficiency of commercial banks. However, the literature review in this section also focuses on studies related to DEA as the method used in this study.

Aikaeli (2008) used the DEA and multi-product translog cost functions to evaluate the efficiency of commercial banks in Tanzania over the period 1998-2004. Tanzanian commercial banks. Aikaeli (2008) has shown that banks are generally not fully efficient. However, the banks developed relatively well between 1998 and 2004. However, the findings indicate that commercial banks in Tanzania still need to develop their efficiency performance. In addition, the results show increasing average cost curves, especially in 2004. Foreign banks were the top technically efficient, then small and large domestic banks followed. In terms of scale efficiency, small banks come first, then international banks and large national banks followed. The results show that x-inefficiency in banks is the result of insufficient investment capital, low wages, lower management capacity in bank development, and accumulation is overwhelming extra liquid assets.

Olaosebikan (2009) examined the efficiency of the banking system in Nigeria from 1999 to 2005 utilizing the DEA and Tobit models. With DEA, he analyzed the efficiency of the bank and with the Tobit model to measure the most important determinants for Nigerian banks. Olaosebikan found that cost inefficiency is mainly indicated by fluctuations in allocative efficiency in the five years after 1999. The study also pointed out that large banks can improve their level of efficiency and that banks are competing in their position to perform better. These results show how important it is to cover risk provisioning costs to improve the efficiency of banks. The study found no statistical relationship between executive compensation and bank efficiency.

Hauner & Peiris (2005) used the DEA, among other things, to assess the efficiency of the banking sector in Uganda, between 1999 and 2004 and to empirically examine the growth of competition and the efficiency of the banking system in the period under review. The findings indicate that the level of competition has increased significantly following the privatization of Ugandan banks, which is directly linked to an improvement in the efficiency of banks in Uganda. Nonetheless, small banks appear to be less efficient than large banks. The results show on average than large banks and banks invested abroad are more efficient than others. Kiyota (2009) examined bank efficiency of 29 countries in sub-Saharan Africa over the period 2000-2007 using the stochastic frontier approach to estimate cost efficiency and bank size. The study found that foreign banks tended to outperform domestic banks in terms of profit-efficiency. Non-SSA foreign banks were more cost efficient than SSA foreign banks and domestic banks 2000-2003 during the reporting period. Also, foreign banks in sub-Saharan Africa were the most profit-efficient in 2005-2006. The smaller the bank, the higher the profit-efficiency of the three types of banks.

Mostafa (2008) examined the relative efficiency of the 100 largest African banks employing cross-sectional data for 2005. He found that the performance of various banks was not optimal, indicating the potential for significant improvement at eight banks (8) South African Commercial banks. The sample is divided between large and small banks. The inputs were labor, capital, and resources, the outputs were advances and deposits using the SFA. The findings of the study demonstrate that South African banks significantly improved their cost efficiency between 2000 and 2005. Nevertheless, efficiency gains in profitability over the same period were insignificant. No bank was appeared to be superior to any other in terms of efficiency gains and terms of cost reduction and profitability.

Frimpong (2010) used DEA to investigate the relative efficiency of Ghanaian banks in 2007. He also examines the link between the efficiency and profitability of banks in Ghana. The study uses the input-oriented and mediation approach. The results of the study underline the average efficiency of Ghanaian banks in 2007 in general and by group, determined by the owner and the size. Only 4 banks (out of 22) were efficient. The effectiveness of the 18 inefficient banks ranged from 33% to 89% on average. The average technical efficiency of the banking sector was 74%. Frimpong (2010) found that domestic private banks with an average efficiency of 87% were the most efficient group of banks in

Ghana. Then come foreign banks (72% on average) and finally state banks with an average score of only 51%.

Alemu (2016) assessed the technical efficiency of commercial banks in Ethiopia using the DEA for the period 2011 to 2014 with three input variables (interest expense, operating costs, and deposits) and three output variables (interest income, income) not related to interest and loans). The results show that Oromia Cooperative Bank (CBO), International Bank Berhan (BrIB), and Dashen-Bank (DB) were the most efficient commercial banks under constant returns scale (CRS). The Commercial Bank of Ethiopia (CBE), United Bank (UB), Lion Bank (LIB), and Buna International Bank (BuIB) have emerged as the least efficient commercial banks. According to the VRS approach, BrIB, CBO and Nib International Bank (NIB) proved to be the most efficient banks, while CBE, UB, and BuIB were considered the least efficient banks. However, if the efficiency/inefficiency rating of the scale is taken into account; CBO and DB were characterized as the most efficient commercial banks on a large scale, while the rest of the commercial banks in Ethiopia that operated during the investigation period showed both pure technical inefficiency and scale inefficiency.

Tesfay (2016) studied the determinants of Ethiopian commercial banks' efficiency, using DEA from 2003 to 2012 in efficiency analysis. Also, the study employed the Tobit regression model to examine factors that determine the efficiency of commercial banks in Ethiopia. The results indicate that the main variables increasing banks’ efficiency are deposit and liquidity while loan quality, expenses, profitability, bank size, and diversification were statistically insignificant. Thus, According to this research finding, these variables were not determinant factors of commercial banks' efficiency in the Ethiopian banking sector. Abel & Bara (2017) measure the technical efficiency of the commercial banks in Zimbabwe during the period 2009 -2015 using the non-parametric approach of DEA. Also, the study decomposed the technical efficiency of commercial banks into pure technical efficiency and scale efficiency. The study shows that the commercial banks in Zimbabwe are technically inefficient, with the average efficient score of 82.9 percent during the period 2009-2015. This result implies that the average commercial bank suffered a 17.1 percent level of technical inefficiency. Pure technical efficiency on an average score of 96.6 percent during the study period. Meanwhile, the average scale efficiency of the commercial banks in Zimbabwe was 0.8564 for the period 2009-2015.

Raphael (2013) evaluates the relative efficiency of 58 commercial banks operating within the East African countries (Tanzania, Kenya, Uganda, Rwanda, and Burundi) by using Data Envelopment analysis from 2008 to 2011. The results show a sharp decline in Technical efficiency from 0.81 in (2008) to 0.56 (2009), thereafter showing an increasing trend of technical efficiency of 0.73 (2011). Under the BCC and CCR model, the number of efficient commercial banks in four years score 1. Also, the findings show that most commercial banks in east Africa are operating under a decreasing return to scale.

Akeem & Moses (2014) conducted an empirical analysis of the allocative efficiency of Nigerian commercial Banks for the period between the years 2002 to 2011. The study included ten Nigerian Banks that were randomly selected among 15 banks operating in Nigeria, using the DEA model. Also, the study employs three input variables (deposits, operating expenses, and assets) and four output variables (loan and advances, investment, Interest income, and non-interest income). The results indicate that the mean allocative efficiency during the study period stood at 0.896 or (89.6%). Generally, the results show that the banking sector in Nigeria needs managerial attention beyond the emphasis on continual banking reforms of recapitalization, merger, and acquisition and to be ranked with a global perspective.

Garamu (2016) evaluate the relative technical efficiency and productivity change of commercial bank in Ethiopia over the period 2007 to 2011, by using DEA with intermediation approach. Also, the study employs the Malmquist productivity index (MPI) to measure the productivity gains of Ethiopian commercial banks during the study period. The results indicate that on average, commercial banks in Ethiopia were relatively technically inefficient. The main source of inefficiency was led by Scale inefficiency rather than pure technical efficiency. The study also shows that the average total-factor productivity (TFP) change is 0.965 percent during the period of the study. Therefore, technical efficiency regress takes the greatest contributions to the loss of TFP. Yannick, Hongzhong, & Thierry (2016) investigate technical efficiency and transformation of deposits into credits efficiency issues of the banking sector in Côte d'Ivoire during the period 2008 to 2010, by using DEA and utilizing intermediation approach of selecting inputs and outputs. The results indicate that Ivorian banks do not operate efficiently in loan allocation. Also, the study reveals that foreign ownership private banks are relatively efficient than their public ownership counterparts. Generally, the results show that the commercial banks were technically

inefficient in converting resources into loans, during the study period. That is mostly due to an incompatibility of production scale with a scale inefficiency average of 38%.

In the case of Gambia, Agu (2004) utilized equity returns to examine the impact of portfolio equity returns, and aggregated by bank size of the risk associated with bank equity returns in The Gambia (efficiency of the payment mechanism, efficiency of the resource allocation, operational efficiency of the Gambian banking system)). The study finds evidence of regression results strongly supports the suggestion that portfolio composition and bank size play a major role in the Gambian banking system. Influence on both market and non-market risks of bank stock returns. Jabbi & Fatty (2018) examined the efficiency of The Gambian commercial banking sector from 2005 to 2009. The DEA's results show that the majority of Gambian banks are fully efficient in terms of PTE based on the VRS hypothesis. While the main cause of inefficiency in The Gambia from 2005 to 2009 were technical and scale inefficiencies. The study reveal that Trust Bank Limited (TBL) had been the most efficient bank in The Gambia for the past subsequent five years, while the International Commercial Bank (ICB) had the lowest efficiency in The Gambia over the same period. The results of the Tobit regression analysis show that only the size of the bank is significantly and positively related to TE and SE, while profitability and market power tend to negatively associate with TE and SE.

2.5. The Relationship Between Efficiency and Banks' specific Determinants

Some researchers measured the association between efficiency and the specific characteristics of banks and macroeconomic factors to determine the factors that affect bank efficiency. Casu and Molyneux (2003) employ the DEA approach to analyze whether the productive efficiency of the banking systems in Europe for the period 1993-1997 has improved and has converged towards a common frontier. They also use a Tobit regression to identify the main determinants of the efficiency of European banks. Their main findings reveal that profitability ratios are positively linked to the efficiency of banks and listed banks. Similarly, they found no link between the level of capitalization and the banking efficiency

Isik & Hassan (2002) examine Turkish commercial banks to study the impact of ownership and market structure, control and governance, and other banking features on bank efficiency. Using a non-stochastic approach, they estimated five measures of the efficiency of the input economy for the Turkish banking industry between 1988 and 1996. In addition

to other amazing findings, the results show that public and foreign banks outperform private banks in cost and technical efficiency. While public banks dominate in terms of allocative efficiency. One of the possible reasons for the 'superiority' of government ownership over allocative efficiency is that public banks benefit from factor prices that are significantly lower than those of national and foreign private banks, especially in the area of labor. Concerning corporate control and governance, they found that banks whose shares are listed on the Istanbul Stock Exchange (ISE) are technically more efficient, in line with the assumption of market discipline. However, they found that larger bank sizes are strongly negatively associated with economies of scale, implying that the recent development policies of medium and large banks in Turkey are not compatible with minimization of cost.

Pasiouras & Kosmidou.(2007) analyze the cost-efficiency of Greek banks and their determinants. They utilize a DEA approach to analyze technical, allocative, and cost-efficiency. In addition, they employ a Tobit regression to indicate the internal and external factors that affect the level of banking efficiency. The main finding shows that Greek banks operate with an average efficiency of 82%. Moreover, they believe that bank size is positively associated with higher banking efficiency; though, they consider that GDP per capita and unemployment negatively affected the efficiency of banks. In the end, they establish that the level of capitalization, the number of branches, and the number of ATMs affect banking efficiency differently based on the level of efficiency utilized.

Naceur et al. (2009) assess the level of efficiency of banks in MENA countries utilizing a meta-frontier measured by DEA. They then employ a Tobit regression to study the influence of institutional, financial, and bank-specific determinants of bank efficiency. They found that MENA countries have an average efficiency score of 67%. On the other hand, they found that large-cap banks, more liquidity, and changes in the stock markets increase the efficiency of banks; while more credit to the private sector and increased market concentration reduce the efficiency of banks

Garza-García (2012)examines the developments and the main determinants of bank efficiency in the Mexican banking sector during the period 2001-2009, utilizing the Data Envelopment Analysis (DEA) method and then using the Tobit model to identify the main determinants of the banking sector. The first result indicates that the Mexican banking sector has shown average inefficiencies of 15%, 29%, and 14% for technical efficiency (TE), pure technical efficiency (PTE), and efficiency of scale (SE) respectively. He noted that the

increase in bank efficiency was observed from 2001 to 2006, while the decrease in efficiency levels was observed from 2006 to 2008, although a recovery in efficiency was observed from 2008 onwards. Also, he found that the main determinants of greater bank efficiency are loan intensity, GDP growth, and foreign ownership. Meanwhile, non-interest charges, non-performing loans, and inflation reduce the bank's efficiency

D. Singh & Fida (2015) studied the level of technical, purely technical, and scale efficiency in Oman's commercial banks employing the Data Envelopment Analysis (DEA) approach. For the period under review, it was noted that the contribution of scale inefficiency to general technical inefficiency was greater than purely technical inefficiency. The results on scale efficiency emphasize that reducing scale efficiency is the main form of scale inefficiency. The survey shows that Bank Dhofar and Ahli Bank performed consistently as they were the two best performing banks of the period. Bank Muscat, Oman's largest bank, is suffering from declining returns to scale. The estimated efficiency scores are then regressed (utilizing the Tobit model) on a series of explanatory variables, namely bank size, profitability, capital adequacy, and liquidity. The study shows that the size of the bank is not significant; profitability and liquidity are an important explanatory positive variable

Řepková (2015) evaluates the determinants of the efficiency of the Czech banking industry between 2001 and 2012 using a data envelope analysis and a panel data analysis. The study reveals that the level of capitalization, liquidity risk, and portfolio risk had a positive impact on bank efficiency. However, ROA, interest rate, and GDP have a negative impact on the efficiency of the CCR model. While in the BCC model, the liquidity risk and the risk appetite of the portfolio had a positive impact on efficiency, and GDP had a negative impact on efficiency. The other determinants were not statistically significant.

Horvatova, (2018) examined the factors influencing the technical efficiency of banks in Central and Eastern European countries during the financial crisis. The study first analyzes the technical efficiency of banks in selected countries in Central and Eastern Europe in the period 2006-2013 using the DEA, whereby the technical efficiency of banks in Central Europe is determined and Eastern becomes concerning the size of the banks (large or small) and examined their affiliation to a certain group of countries. Empirical results show that there is a strong correlation between the number of efficient banks and the membership of banks in the V4 group of countries (the Visegrad countries are the Czech Republic, Hungary, Poland, and Slovakia). The results also show that banks in the Balkans have a negative

impact on the number of efficient banks in the group. Banks in this group of countries have the highest average efficiency. However, there is a weak correlation between the number of efficient banks and their membership in the group of Baltic countries. The efficiency of banks and the size of bank assets are also weakly linked. The results of the panel regression models for the specific country groups (V4, Baltic Sea and Balkan countries) as well as for the group of Central and Eastern European countries as a whole show that customer deposits were present had a positive effect on the technical efficiency of the banks during the financial crisis.

Zenebe Lema (2017)studies the determinants of the technical efficiency of commercial banks in Ethiopia in the period from 2011 to 2014, employing the DEA method in the first stage and the Tobit regression model in the second stage. According to the CRS hypothesis, the results indicate that the technical efficiency of commercial banks in Ethiopia during fiscal 2011-2012 led to an increase in technical efficiency scores, ranging from 91.6 to 94%. However, the Ethiopian banking sector experienced an average decline in overall technical efficiency, pure technical efficiency, and scale efficiency scores during the GTP period, especially after 2012. On the other hand, the result of the Tobit regression indicates that the level of capitalization, liquidity risk, return on assets and market shares appear to have a positive and significant effect on the technical efficiency score.

Banna, Ahmad, & Koh (2017) study the effect of the global financial crisis and other factors on the efficiency of commercial banks in Bangladesh. Using the Data Envelope Analysis (DEA) method, they calculated the technical efficiency of individual banks active in the banking sector in Bangladesh during the period 2000-2013 and the determining factors. Empirical results indicate that the banking sector in Bangladesh posted the highest level of efficiency in 2001, while efficiency recorded to be at the lowest level in 2010. The study shows that both the crisis and size of banking, capital adequacy, the average return on equity, and real interest rates have a significant impact on the efficiency of banks in Bangladesh. To maintain sound financial development in Bangladesh, it is recommended that banks operating in the Bangladeshi banking sector consider all potential technologies that can improve their profit efficiency, as the main motive of banks is to maximize shareholder value or wealth, through maximization of profit.

Onen & Tunik (2017) examine internal Total Loans over Total Assets (TL-TA), ROE, ROA, Equity over Total Assets (EQASS), non-performing loan over total loans

(NPL_TL) and (interest income over total assets (II_TA) and external GDP and inflation (INFL) factors that influence the efficiency of the commercial banks in Turkey, by using DEA and Tobit regression models. They found that internal factors are more effective than external ones on banks' efficiency.

2.6 Theories on Efficiency of Commercial Banks

Efficiency concepts are generally based on the microeconomics theory of the firm. This means that a firm will be fully efficient when it reaches production levels that maximize profits and minimize potential costs (Y. Dong, 2010). Dong (2010), suggested that four basic theories have been employed for measuring bank efficiency, these are 1-conventional neoclassical theory, 2-management theories, 3-behavioral theories, and 4-efficiency X-theory.

2.6.1. The Conventional Neoclassical Theory

The neoclassical theory of the company stems from the framework of static symmetry proposed by Cournot in 1883 (Richard M Cyert & DeGroot, 1975). He views conventional neoclassical theory under a black box that converts resources into profitable goods (inputs to outputs). This conversion of inputs into outputs is described by a production function or defined production options. In other words, conventional neoclassical business theory predicts that the business (the bank) operates in a perfectly competitive market. Therefore, all companies in this market are looking for ways to maximize their profits while maximizing revenues and minimizing expenses. Consequently, the general competitive equilibrium is achieved by mapping the marginal substitution rates for all businesses between any two economic variables (inputs or outputs). Therefore, the conventional neoclassical firm theory has argued that a company that can efficiently convert resources to achieve the maximum level of production for a given input will survive and that any company that works inefficient scope will be pushed away from the market. Demsetz (1997) found that the company reflected the requirements of the pricing system in neoclassical theory. When the pricing system works well, resources are well allocated. Nonetheless, the firm's neoclassical theory did not address the company's internal factors and was therefore replaced by alternative theories like “Managerial theories (Baumol, 1959; Marris, 1964;

Williamson, 1964). Behavioral Theories (Simon, 1959; Cyert and March 1963) and X-Efficiency Theory (Leibenstein, 1966; 1979)" see (Y. Dong, 2010).

2.6.2. The Managerial Theories

The conventional theory of profit maximization has been criticized for being too impractical and less effective in the modern economy, where ownership and control are divided into big organizations. In this context, theories of business management have been developed. Each of the management theories argues that the management team will pursue its interests and benefits instead of maximizing the profit of the business, although it is always subject to some form of profit restriction (Yizhe Dong, 2010). Baumol (1959) develops the sales maximization model, which argues that management objectives (income, power, prestige, etc.) are closely linked to sales. Thus, Baumol (1959) suggests that management's primary goal is to maximize sales after achieving the minimum profit required to shareholders' satisfaction. Marris (1964) introduces a dynamic firm model by assuming that the management's goal is to maximize firm development over a while. Williamson (1964) generated a more universal model for maximizing management benefits, in which managers seek to maximize their value rather than maximize the bottom line. Then he proposes that the manager's obvious "cost preferences" mean that managers achieve their goals by spending part of the company's potential profits for unnecessary reasons, thereby increasing their preferences or benefits for management. Jensen and Mackling (1976) introduced The Agency Theory, in which it was assumed that agents can pursue their interests, ie better working conditions, high wages, and job security. Employment, etc., but managers cannot fully perceive their actions due to the separation between management and ownership.

2.6.3. Behavioral Theories of the firm

According to Dong (2010), The behavioral theory of the firm leads to the argument that, in practice, the capacity of the firm to optimize (maximize) its objectives, is required, or even wishes to optimize it, can be questioned. The challenges for businesses in the business world are categorized by uncertainty and a lack of comprehensive information. In these conditions, Simon (1959) developed a firm theory that highlights satisfaction and limited rationality in the decision-making process rather than attaining an objective of

maximization. Cyert & March (1992) pointed out that the firm as an organization, based on the work of Simon (1959), is not a structure that is combined, but an alliance of several participants such as owners, managers, workers, customers, etc. Both of these groups or individuals have different interests and goals

In addition, the company has five goals in particular: production, inventory, sales, market share, and profit. Some of the goals may be the opposite. As a result, corporate decision making is an ongoing negotiation process and an ambitious process in which parallel payments are made to ensure compliance or to attract individuals to specific subgroups. However, there may be a gap between the company's resources also, the payments needed to keep the factors in place. The difference between total resources and total payments is called a loose organization. For example, higher wages than those required to maintain the workforce can be paid. This organizational loss increases unnecessary costs and reduces the overall efficiency of the business. In a stable environment, payments can reach the desired level, resulting in an organizational loss close to zero. In real life, however, it is obvious that the environment in which the company operates still not stationary. There are not only business cycles, but also the flow of technological growth that ensures that companies must continue to strive to reach a limit of best practices. To implement this change, inefficient companies are likely to remain on the market (if they are not very inefficient) (Dobbs, 2000).

2.6.4. The Theory of X-efficiency

The X-efficiency theory, which is related to both behavioral and management utility theory, comes from a series of works done by Leibenstein (1966, 1975, 1977 and 1978). Y. Dong (2010) explained that X efficiency theory generally defines the efficiency of a company (taking into account the resources used and the best available technology) when converting minimal inputs into maximal outputs. Thus, Leibenstein (1966) criticizes the idea of the neoclassical theory that companies maximize their profits. He explained that not only can companies not maximize their profits but that many of them alternatively maximize management benefits. It also shows that the ineffectiveness due to the X inefficiency is significant in contrast to the inefficiencies due to the allocative ineffectiveness. In the theory of X-inefficiency, he branded non-maximizing behavior as the key pattern of X-efficiency. The degree of X-inefficiency is mainly determined by the efforts of individuals within the

company. The principal-agent relationship problem is a major cause of X-inefficiency, because of incomplete conditional contract, there is also an agreement between the principal and the agent. For instance, agents can escape the penalties of cost invades while they are not having any motivation to retain costs down. In general, X-Efficiency is a theory that relates to the actual world of real people and organizations and focuses on understanding how they can be improved. It is a theory of option and action in certain organizational environments and not a general theory of markets or the economic order. On this basis, however, a better awareness of how the market organization works is made possible. The X-efficiency, in summary, is the theory that assumes that the same inputs are not always clearly assigned to the same technically efficient output (Potts, 2006). Therefore, this study intends to combine these theories with the overall efficiency (TE, PTE, and SE) of the Gambian banking sector while measuring their efficiency degrees between 2009 and 2017. Figure (2.1) describes the theories about the efficiency of the firm.

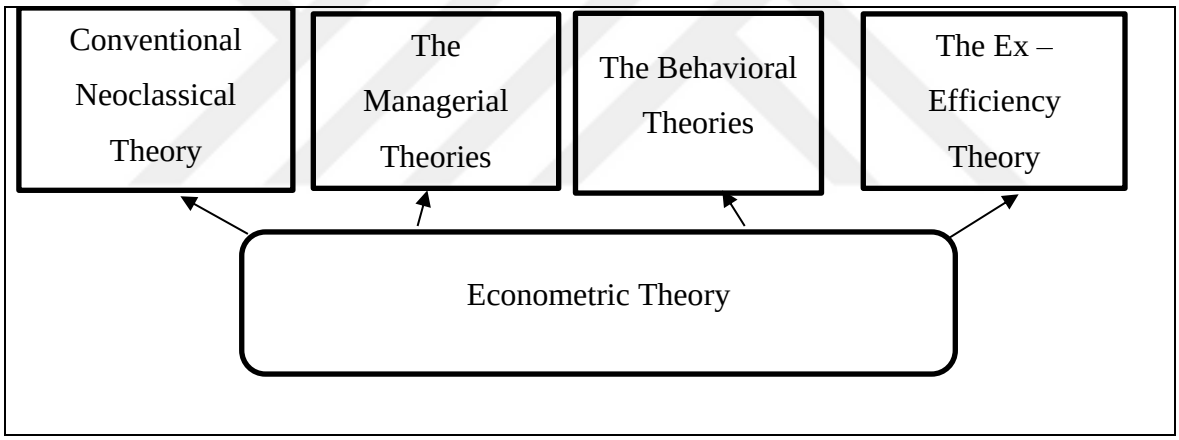


Figure 2.1. Efficiency theories of the firm.

2.7. The Efficiency Theoretical Framework

The existing theories utilized for the efficiency of CBs were originated from the economic theories (the term economy denotes to the use of resources to maximize the production of goods and services), which is derived from microeconomic firm theory and it relays on the Debreu (1951) and Farrell (1957) concepts, who created the standard productivity of efficiency (or production frontier) framework, explained that efficiency could generally be broken down to scale efficiency, scope efficiency, purely technical efficiency, and allocation efficiency. Ahmed (2008), revealed that Farrell (1957) introduced

this view of productive or economic efficiency by taking into account all inputs and ignoring all problems with the index number. He further separated the productive or economic efficiency of a corporation into technical efficiency (TE) and allocation efficiency (AE). TE measures a company's ability to achieve maximum returns with a given set of inputs. This is supported by the microeconomic theory that a company produces the level of efficient production and mixtures that maximize profit and minimize possible costs efficiently frontier (Y. Dong, 2010).

PTE collaborates with the isoquant unit use, which anticipates constant returns to scale (CRS), yet this hypothesis does not always seem valid. A corporation that uses more than two inputs than the combination represented by the resources may have VRS (Variable Returns to Scale). Hence, technical efficiency can generally be separated into measures of pure technical efficiency (PTE) and efficiency of scale (SE), and the principle of SE determines whether the corporation works with an optimal size or not. Measuring the efficiency of the scale, the VRS hypothesis switches that of CRS. The allocation efficiency (EA) indicates the company's capacity to use the proportions of the optimal input (M.J. Farrell, 1957). Thus, AE appears when there is an optimum distribution of goods and services. Figure 2.2 displays the efficiency framework.

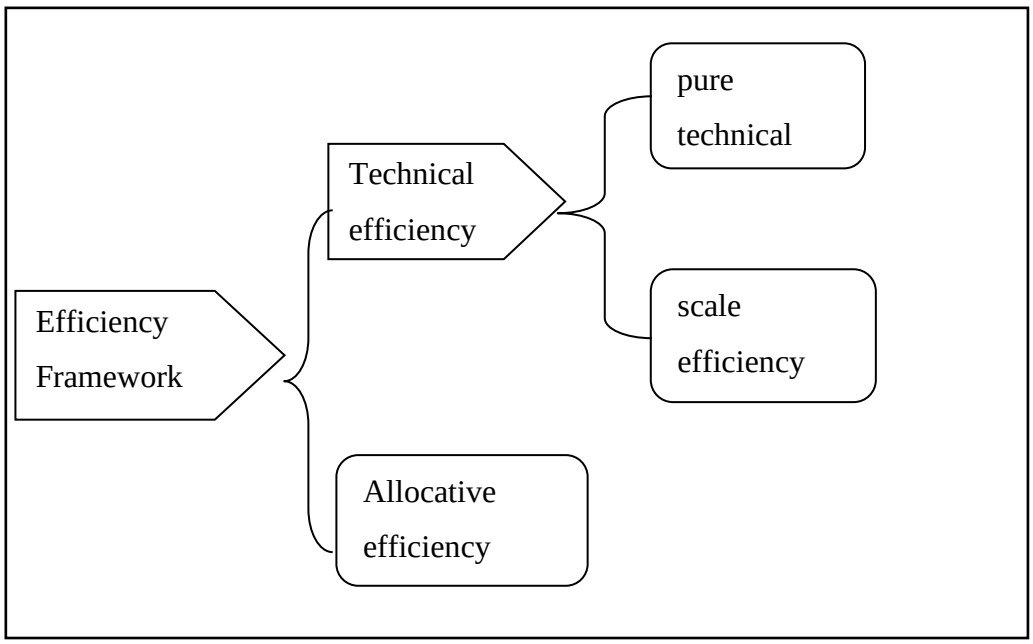


Figure 2.2. Framework of efficiency.

This study emphases only technical efficiency, which is then broken down into pure technical efficiency and scale efficiency, and excludes AE because no data is available to measure the AE of commercial banks in The Gambia. Indeed, the AE measures require data on prices like the price paid on physical capital and the labor price (Y. Dong, 2010), while the commercial banks in the Gambia do not disclose prices paid for purchasing inputs in their annual reports, rather, they only disclose the total costs on every input group.

Figure 2.3 shows two effective limit values: one is based on CRS (represented by the line OR) and the other on VRS (represented by the line segment PABCD). By projecting the inefficient DMU E to the efficient VRS frontier (point F) by minimizing the input X while keeping the output Y constant (i.e. the input orientation), PTE for DMU E is defined as XF / XE. If we change the optimization model to that of production maximization, the PTE for company E is now defined as YE / YH. DMU E focuses on the efficient CRS frontier and projects on point G, where the input-oriented OTE dimension is defined by XG / XE. The output-oriented OTE dimension is defined similarly to YE / YI. However, if the slope of the effective CRS frontier is 1, XG / XE = YE / YI, which means that the alignment does not change the OTE values. To extend the figure above to the efficiency of the scale, the efficiency measures of the scale oriented towards input and output are defined as XG / XF = YH / YI. The increase in scale effects means that the DMU can increase efficiency by increasing the production of Y (which generally occurs during production on the PAB of the VRS efficacy frontier), while the reduction in scale effects means down-scaling, efficiency (what happens) BCD increases the VRS efficiency frontier). If we produce optimally, there is no gain in efficiency by changing the scope of production. This appears when a company operates at point B where the two frontiers are tangent, i.e. OTE = PTE (D. Singh & Fida, 2015).

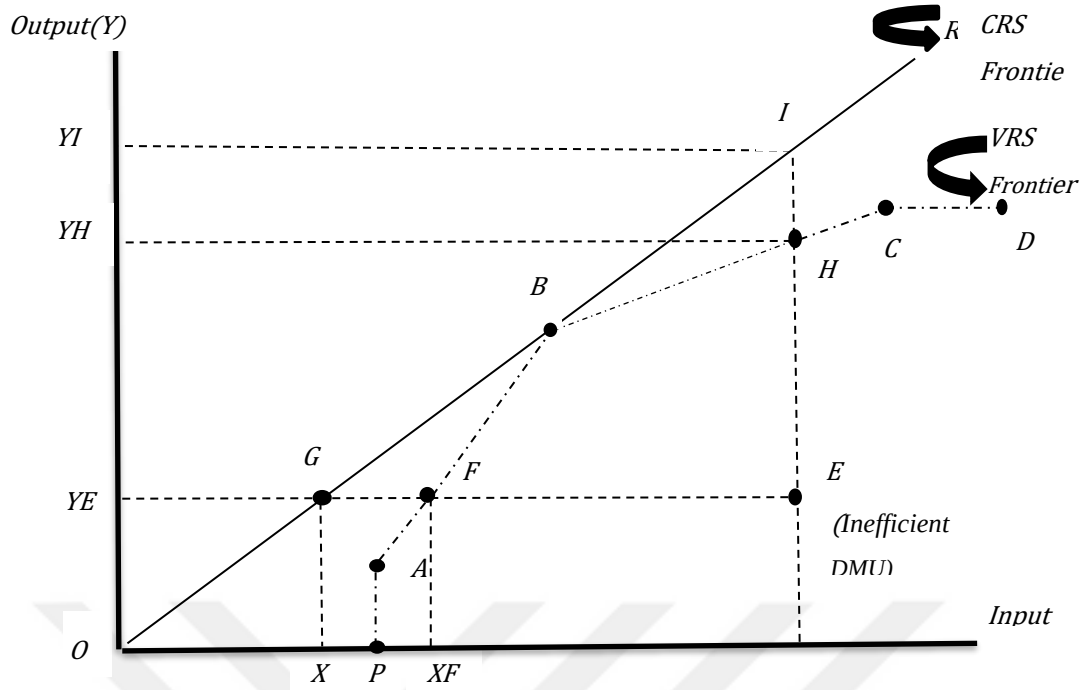


Figure 2.3. Efficient frontiers for CRS and VRS.

2.8. Conclusion

Chapter 2 generally reviews the literature on bank efficiency using firm efficiency measurement methods, with two main methods in focus: parametric SFA and nonparametric DEA approaches. The efficiency of banks in Africa is then examined. Chapter 2 also examines the theories that explain bank efficiency and finally defines the theoretical framework of the study. This chapter highlighted, in particular, the review of the literature on the efficiency of banks using selected methods, and in particular the efficiency of banks in Africa.

This chapter also examined the methods used in previous studies in measuring the efficiency of the banking sector, such as SFA and DEA. The review of literature in previous studies has concentrated on several goals, for example, some of these studies have focused on cost efficiency, cost, and efficiency, and some of them have concentrated only on technical efficiency. Meanwhile, some studies have focused on the impact of banks on certain characteristics and macroeconomic factors that affect overall technical efficiency, like; Profitability, market power, size of the bank, bank ownership and bank organization, etc. Some researchers have also compared the efficiency of Islamic banks with their traditional counterparts. On the other hand, Chapter 2 discusses theories of commercial bank

efficiency that focused on four main firm theories, taken from (Y. Dong, 2010), namely: Conventional Neoclassical Theory, Management Theories, Behavioral Theories, and the Theory of X-Efficiency. Lastly, the chapter presents the theoretical framework of efficiency, which consists of two components: allocative efficiency and technical efficiency, which is divided into pure technical efficiency and scale efficiency. The chapter is then concluded

CHAPTER 3

COMMERCIAL BANKING IN THE GAMBIA: AN OVERVIEW

3.1. Introduction

Chapter three presents an overview of the banking sector in The Gambia. The study divided this section is into four groups: banking history in Gambia, the central bank, commercial bank, and Islamic bank. The study also reveals in detail the concept of Islamic banking, the history of Islamic banking in general, and The Gambia in particular. The roles of the Islamic Bank in The Gambia have also been identified. Lastly, the challenges facing Islamic banking in The Gambia are revealed. Then the chapter is ended.

3.2. Background of the Gambia

The Gambia is officially the Republic of the Gambia and is located in West Africa. except for the west coast along the Atlantic Ocean, it is almost surrounded by Senegal. It has an area of 10,689 square kilometers (4,127 square miles) with a population of 2,101 million (World Bank Census, 2017), Muslims accounted for 90% and 8% Christian and 2% others. The country gained political independence from Great Britain on February 18, 1965. In terms of the economic situation, real gross domestic product (GDP) rose by 0.9% in 2014 after being forecast at 7%. Growth should return to 4.7% in 2015 thanks to a recovery in tourism and agriculture, and 5.5% in 2016. (African Economic Outlook, 2016). World Bank data (2019) show that real GDP growth in the country was 5.7 in 2008, then fell to 6.4 and 6.5 in 2009 and 2010, and then fell to -4.3. After that, it quickly dropped to 5.6 in 2012, but less than the 2009 growth rate, then fell slightly to 4.8 in 2013 and quickly dropped to -0.9 in 2014.

Also, real GDP rose rapidly to 5.9% in 2015 and fell speedily to 0.4% in 2016. In 2017 it roses to around 4.6%. Therefore, we can see that the Gambian economy grew by 5-6% of GDP per year (Wikipedia, 2019). Figure 3.1 shows real GDP growth in The Gambia from 2008 to 2017. Gross National Income per capita was USD 430 in 2016 based on (Atlas method), and $ 1,330 (purchasing power parity). The economy of the Gambia consists of three key segments; These are the agricultural sector, the industrial sector, and the service

sector. The contribution visibly belongs to GDP has been achieved over time. Agriculture was the dominant industry, while the service sector is now taking the dominants (Fadera, 2009). For natural resources: seismic studies reveal the possible existence of oil and offshore gas.

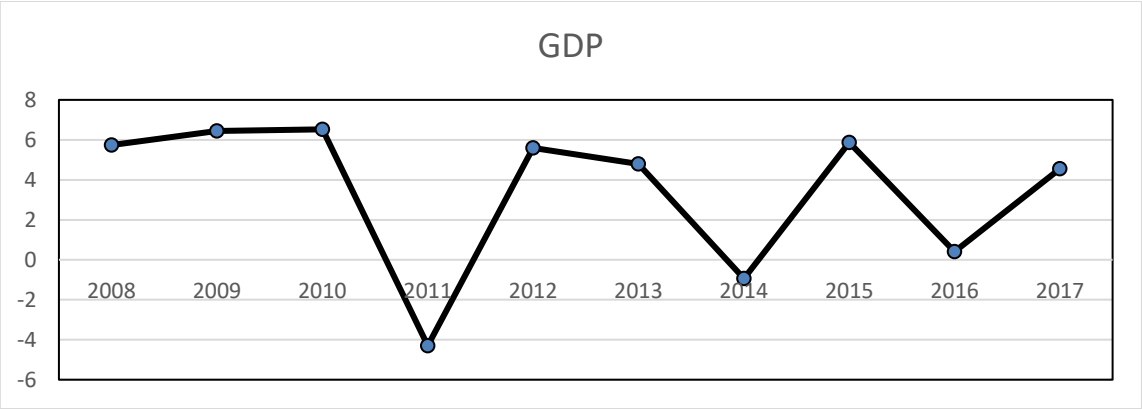


Figure 3.1. Real GDP growth 2008-2017.

The next section explains the history of banking in The Gambia, the Central Bank, the Commercial Bank, and the Islamic Bank.

3.3. Gambian Banking Sector' History

The bank that was first established in The Gambia was the Government Saving Bank (GSB). it was founded on January 1st, 1886, (Sillah, 2005). Moreover, Fadera (2009), reveals that Gambia's banking history goes back over a century. The GSB is subordinated to the Government's Finance Department and is primarily responsible for accepting limited public deposits. However, GSB was not doing business during the period and there was indeed a lack of funds for entrepreneurs. In addition, GSB's liabilities were held in the state balance sheet of the government until 1964. In 1964, GSB began dealing with foreign capital goods, mainly owned by British colonialists, and all proceeds based on the same assets. were used to pay interest on deposits while funds were being credited to the government account (Sillah, 2005). Furthermore, The Gambia Central Bank CGB was established after this long period. As a result, the importance of the GSB has diminished. In this case, believing that CBG could perform well than GSB in regards to cash management, GSB has disappeared from the business environment (Sillah, 2005).

Also, the Bank of British West Africa (BBWA) (currently known as Standard Chartered Bank) was founded in The Gambia on September 8, 1909. (Sillah, 2005). BBWA was among the West Africa Currency Board, which acted as the monetary authority for the four British colonies in West Africa, namely "The Gambia, Ghana, Nigeria, and Sierra Leone". Sillah (2005) further stated that BBWA's banking activities were exclusively commercial banking for many years, different from universal, financial or investment banks, this non-commercial activity was developed and imported to the banks in The Gambia. In addition to marketing peanuts, BBWA developed commercial behavior that formed the basis of the economy. Marketing of peanuts overcome the bank and its banking monopoly, because it was the only provider of all financing services, like the discount and discount of bills of exchange, the import and export of cash, and the establishment of government-guaranteed loans for the marketing of peanuts. The bank also facilitated the export of profits from colonial traders. Given the bank's extensive network in other British colonies, it has always been appropriate for traders to consider the bank activities like import and export financial services.

The public and decision-makers unilaterally concentrated on marketing peanuts, and the sales business was profitable. The bank accordingly has developed and designed its activities. Therefore, there is no industrial financing in the Gambia, which was an essential feature of the banks in the industrialized world at the beginning of industrialization. It was easy for the bank to concentrate on the retail business as it mastered this in other British colonies before operating in The Gambia. thus, it imported some of its business to the Gambia as stated by (Sillah, 2005).

Colonial Bank (CB) joined the banking sector in the Gambian year 1917 and closed after World War II because the CB was funding the war, but BBWA remained to operate in The Gambia only, and rendering central and commercial banking at the same time (Sanyang, 2009). However, CB's commercial activities have not helped the Gambia government's targeted development efforts in agriculture and infrastructure. The effort of financing agricultural and infrastructural works had always been a dilemma. In the hope of giving financial impetus to the agricultural sector, the peanut marketing companies called "cooperatives" founded a central bank and a cooperative marketing bank which dealt with the marketing and banking activities of the public. Nonetheless, this relayed highly on loans and loans guaranteed by the BBWA government. It remained a pyramid block of credits by

the BBWA at the maximum of the pyramid for many years. Later on, the bank was abolished and did not have a conditional license until the early 1980s.

There was then no financial development. The government and its Cooperative union and the Gambian Producing Marketing Board founded and the Gambia Commercial and Development Bank (GCDB) in the year 1972, which remained for twenty years. This period was also one of the booming seasons for peanuts and pansies from 1972 to 1987. During this time, The Gambia Produce Marketing Board, one of the founders of the bank, had the highest unequal relationships in all periods. The selling price is two to four times the producer price than the quotas. This means that the bank is collecting large deposits for peanut cooperatives, the Gambia Produce Marketing Board, and the government.

Nevertheless, GCDB established its assets on the marketing of peanuts while ignoring production, which generated more than 70% of the money in exchange. When peanut production collapsed, the bank found hardly to recover its assets from peanut traders. GCDB was the biggest bank accounted for 44% of total bank liabilities before it was finally closed in 1992. The assets of the bank after that were barely found in development work but were found in the marketing business. Then Meridian International Bank (MIB) took it over, but could not stay longer. After that, the International Bank for West Africa (IBWA) was founded. IBWA opened in the Gambia in 1983 and eventually withdrew from the market shortly before the end of the year 1992. With the above review, it seems to be is hard for banks to operate outside of commerce and to engage in other areas such as industrial and infrastructural development. Thus, according to Sillah (2005)

> "It seems that banks in the Gambia are followers of the economic activities; they hardly seek out entrepreneurs much more develop them. Entrepreneurs cannot expect the banks to lead; in fact, they have to wait long before they can see any bank following; that is, banks are lazy lagers. There could be reasons for this; one is the low rate of savings in the Gambia and the other is the inefficiency of the banking industry"

Furthermore, Continental Bank and Meridian Bank (known as Meridian International Bank Ltd.) merged again in 1992, more than just leftovers. Therefore, it can be stated that the real development of the Gambian banking industry imaged from 1996 to 2009. Currently, the number of commercial banks reached to 14 (CBG, 2011), but eventually decreased to 12 banks in 2014 to date as at now.

3.4. The Central Banking system in the Gambia

A central bank, reserve bank, or monetary authority is a public body that generally spends money, regulations for the money supply, and controls interest rates in a country. Central banks often also monitor the commercial banking system in their respective countries. Unlike a commercial bank, a central bank has the local currency printing monopoly, which generally obliges as the country's legal tender. The main function of a central bank is to provide the country's money supply. However, the most active functions include controlling interest rates (i.e. fixing prices) and lending as a last resort for the banking sector in times of the financial crisis (i.e. saying bailout packages). Also, It may have supervisory powers to prevent banks and other financial institutions from acting ruthlessly or fraudulently. The central banks of most industrialized countries are independent (i.e. private) in that they operate according to rules that are intended to exempt them from political or democratic interventions.

The Central Bank of The Gambia (CBG) (formerly known as The Gambia Currency Board) was officially founded in March 1971 (Fadera, 2009; Sillah, 2005). The main goal of creating CBG is the pursuit of price stability, high employment, and growth. It would also act as a government economic advisor and acting as a national bank that would pursue a monetary policy to guide the government's economic development and stabilization goals (Sillah, 2005).

Sillah (2005) examined the CBG balance sheet to demonstrate the CBG's goals and examines its performance from 1971 to 2002. The findings show that the CBG is made up of reserves, government deposits, external liabilities, capital and other elements, including valuation adjustments and also found that the state of SBG was stable, while each of these components accounted for its share of total funding from 1964 to 1981 and was closely maintained in 1982. Fadera (2009) clarifies that the CBG is also responsible for monetary policy and financial institutions, monitoring, exchange rate policy, and controlling the payment system. Various legislative changes have been made to modernize the Gambian banking system and regulatory tool. Therefore, the CBG enacts laws for regulatory purposes. The first CBG law dates from 1971 and was replaced by the Central Bank Law of 1992, which is now replaced by the Central Bank Law of 2005. The 2005 CBG law gives the CBG more autonomy. "The 2005 CBG Act contains provisions of modern central bank laws that

allow the CBG to conduct monetary policy without undue government intervention to maintain price stability".

3.5. The Commercial Banking System in the Gambia

Machiraju, (2008) reveals that the functions of a commercial bank are: engaging in change cash for bank deposits and bank deposits for cash, transfer of bank deposits between individuals and / or companies, exchange of deposits for bills of exchange, government bonds, guaranteed and unsecured commitments of commercial and industrial assets, subscribe to capital issues, they can also invest your additional deposit liabilities in stocks and bonds on the primary and secondary markets. Commercial banks have established subsidiaries that offer advice on portfolio management or investment advice. They also offer their clients payment services for insurance, advice on tax matters, and services for managers and trustees. Besides, in the same way as conventional banks, Islamic commercial banks do not work on interest (RIBA) or transactions forbidden by Islamic sharia. Furthermore, Islamic banks offer other products such as *Mudarabah, Musarakah, Murabaha, Ijarah,* etc. which are not available in the traditional commercial banking system.

The central bank of the Gambia Financial Institutions Act for 2003 stated that "banking activity means the activity of receiving current account deposits, savings or otherwise, paying or collecting checks drawn or paid by customers. Providing financial advisory services and advice on investment issues, making or managing investments on behalf of a person, and providing insurance marketing services and activities on the capital market or other services that the ministry of finance may ordinarily refer to as banking"

The financial system in the Gambia is relatively small. There are currently 12 banks; 11 traditional banks and 1 Islamic bank in The Gambia (CBG, 2019). These are "the Standard Chartered Bank, the Trust Bank, PHB bank (formerly IBC, now Mega Bank), Agib Bank, the First International Bank, Guarantee Trust Bank, the International Commercial Bank, Access Bank. , Eco Bank, BSIC Bank, Oceanic Bank, Prime Bank, Skye Bank (Gambia) Ltd, and Zenith Bank (Gambia) Ltd". The biggest commercial bank is the Standard Chartered Bank, 25% owned by the Gambian government (until the end of September 2008). Based on the Gambia financial soundness indicators, the banking sector images fundamentally healthy. Total assets in the industry increased by 15.3% to reach RSD 43.6 billion at the end of December 2018. The quality of assets has improved significantly with a

non-performing credit ratio of 3.3%. Less than 7.2% a year ago (CBG Monetary Policy Committee, 2019). The industry is also well-capitalized and very liquid. At 31.7%, the risk-weighted capital ratio was significantly higher than the legal requirement of 10%. The liquidity ratio is also 94.8% with a legal obligation of 30%. The total liquidity/balance sheet was 57.4% in December 2018 and was therefore above 52.9% in December 2017 (CBG Monetary Policy Committee, 2019).

Also, the main functions of the commercial banks in the Gambia depend on some services, most of which are current accounts, savings accounts, fixed deposits, electronic funds, treasury bills, and services to private and other businesses, including trading and credit financing, foreign currency transactions and equity. Instead, there are new services offered by the commercial banks to people now living in the Gambia, such as Internet banking, ATM services, SMS banking services and, more recently, VISA card services (Sanyang, 2009).

However, the Gambian banking environment faces certain challenges that can affect the efficiency of banks. These challenges include a lack of information about the state of the Earth's systems. As noted by many observers, The Gambia has a small market thus, the existence of new banks could have a negative impact on banks' efficiency. Also, few people are familiar with banking products and services in The Gambia, indicating that the banking sector in The Gambia is weak and needs to be improved. Lastly, the lack of capital markets can also minimize the efficiency of the Gambian banking sector.

3.6. Islamic Banking in the Gambia

Islamic banking refers to banking activities that comply with the principles of Islamic law (sharia) and are managed by the Islamic economy (Aburime & Alio, 2009). Hassan et al. (2009) revealed that Islamic banking has the same intermediary function as conventional banking, but does not receive fixed interest from borrowers and does not pay fixed interest to depositors; The amount of the profit is based on profit-sharing agreements with depositors and also with borrowers. Ariff (1988) views the key variance between Islamic banks and today's conventional banks is that the latter is based on the conventional principle based on interest, while the former act as intermediaries in the management of their interest-free and profit-sharing financing activities. (PLS).

The history of modern Islamic banking can be taken up in 1967 when the first experience of modern Islamic banking in Egypt was hidden without projecting an Islamic image. This was the first effort led by Ahmad El Najjar. It is a bank based on the distribution of profits in the Egyptian city of Mit-Ghamr in 1963. The bank is well known and fully developed. This experiment lasted until 1967 when there were similar nine banks in Egypt. These banks do not charge or pay interest, they usually invest directly or cooperate with others in trade and industry and share profits with their depositors. (Siddiqi & Foundation, 1983). During the 1970s and 1980s, several Islamic banks were established in North Africa and the Middle East. Dubai Islamic Bank was established in 1975. Faisal Islamic Bank of Sudan was established in 1977. Faisal Islamic Bank of Egypt was established in 1977 and Bahrain Islamic Bank in 1979. Pakistan, 1979, Malaysia 1983, followed by other Muslim and non-Muslim countries (Aburime & Alio, 2009). Financial institutions around the world have grown rapidly lately. The fastest-growing sectors are the Islamic banking sector, which is considered to be extraordinarily conquered and arouses the interest of modern and Islamic economists. (Sufian, 2007b). In addition, the latest survey shows that there are more than 160 Islamic institutions worldwide (Sufian, 2007).

Arab Gambian Islamic Bank (Ltd) AGIB was the first and only Islamic bank in the Gambia is a Gambian bank established under the Companies Act 1955. The bank has been authorized by the Gambia Central Bank to act under Islamic Principles. Parliament adopted a law allowing Islamic banking in the Gambia in 1994. AGIB was established on November 11, 1994, as a public limited company, and on September 12, 1996, it obtained a banking license from the Central Bank of Gambia. The bank began full operation in January 1997 and continue to operate in all its departments and branches following Islamic Shariah principles and practices, generate profits for its shareholders and depositors, and contribute to Gambia's socio-economic development.

AGIB is the first and only Islamic bank in the Gambia and is legally authorized to hold shares in other companies and act on its behalf in the commodity and real estate markets. In September 2008, AGIB formed a strategic alliance with First Inland Bank (FINBANK) in Nigeria. In May 2014, all FINBANK shares were purchased by Gambia businessman (Mr. Muhammed Jah), which made him a major shareholder with a share rate of 80.74%. Islamic Development Bank Jeddah also holds a 13.46% stake and the remaining 0.24% belongs to Mr. Mamour Malick Jagne. The bank has 103 employees and has 6

branches located in Banjul, New Jeshwang, Tranquil, Bakoteh, Brikama, and Basse as well as 6 ATMs in Banjul, Churchill's Town, Brikama and Basse and 2 sites outside the QCell social center to Kairaba avenue. and surround the Brusubi (AGIB 2016 annual report). Moreover, AGIB acts as a commercial bank but not as an interest-based bank (RIBA), and it doesn't engage in a business prohibited by Islamic sharia law. Also, AGIB offers various products such as *Mudarabah, Musarakah, Murabaha, Ijarah, Istisna, Qard al Hasan,* and others that are not available in traditional commercial banks.

3.7. Conclusion

In the current chapter, the overview of Gambia's banking system is discussed. In this section, the study asserted The Gambia's background and economic record. the chapter then reviewed the history of the banking system in The Gambia. The central banking system of the Gambia, commercial banking system, and the Islamic banking system are also disclosed in this study. Under Islamic banks; This study elaborates on the perception, history, and function of Islamic banking especially in The Gambia, and then the chapter ended.

CHAPTER 4

THE RESEARCH METHODOLOGY

4.1. Introduction

The previous three chapters discuss the introduction of research and the contribution of previous research on efficiency in the banking sector. It also reveals an overview of the banking sector in the Gambia, including the conventional banking system and Islam banking system. This chapter discusses research methodologies. Objectives and research questions, research populations, and sample selection procedures are elaborated, likewise the size of the sample. The sources of data and methods used in this study are also described. This chapter elaborates on the variables used in the empirical analysis. Also, The study explains the overall technical efficiency of commercial banks in the Gambia following (Sufian, 2007; Zamil, 2007; Onen; Sathye, 2003 and Tunik, 2017) while the necessary changes were observed. This study develops 8 hypotheses based on available data to study bank characteristics and macroeconomic factors that influence bank efficiency.

4.2. Research Objectives and Research Questions

This study evaluated the overall technical efficiency of commercial banks in the Gambia using the DEA in 2009-2017. This study also shows the effect of bank-specific factors that influence efficiency measures.

In addition, efficiency measures; In other words, “TE, PTE and SE” are utilized as dependent variables and then assigned to the specific characteristics and macroeconomic factors of banks by adopting the study of (Milind Sathye, 2003; D. Singh & Fida, 2015; Sufian, 2007b).

Therefore, the research objectives are:

1. To examine the overall technical efficiency[2] of commercial banks in the Gambia from 2009-2017.

[2]Overall technical efficiency, is a composition of technical, pure and scale efficiency

2. To examine the banks' specific characteristics and macroeconomics factors determine the overall technical efficiency of commercial banks in the Gambia from 2009-2017

To achieve these goals, the study asked the following questions:

1. What is the overall technical efficiency of commercial banks in The Gambia from 2009 to 2017?
2. What are the banks' specific characteristics and macroeconomic factors that determine the overall technical efficiency measures of commercial banks in the Gambia from 2009-2017?

4.3. The Population of the Research

The research population consists of commercial banks that were registered with Central Bank of The Gambia (CBG) between 2009 and 2017. According to CBG (2018), "Banking in The Gambia began over 100 years. Currently, there are fourteen banks within the industry of which one is an Islamic Bank and thirteen conventional commercial banks"[3]. Nearly all commercial banks operating in The Gambia mainly with foreign ownership. Of the 14 commercial banks, eight belong to the Nigerians, two to the African regions, one to the British, and one to the Lebanese and only two obtained a majority stake in The Gambia as shares.[4] Table 4.1 exhibits the list of commercial banks in the Gambia.

[3] http://www.cbg.gm/finance_systems/banking.html
[4]2010 The investment climate statement Bureau of Economic, Energy and Business Affairs, March 2010

Table 4.1. A list of commercial banks in the Gambia.

No	Bank name	Established	Ownership
1	Standard Chartered Bank (Gambia) Ltd	1894	British
2	Arab Gambia Islamic Bank	1996	Gambian
3	Trust Bank Ltd	1997	Gambian
4	First International Bank	1999	Regional
5	Guaranty Trust Bank (Gambia) Ltd	2002	Nigerian
6	International Commercial Bank (Gambia) Ltd	2005	Nigerian
7	Platinum Habib Bank (IBC KBL, MBL,)	1997	Nigerian
8	Access Bank (Gambia) Ltd	2007	Nigerian
9	Ecobank (Gambia) Ltd	2007	Nigerian
10	Banque Sahelo-Saherienne Pour L'investissement Et Commerce (BSIC)	2008	Regional
11	Oceanic Bank (Gambia) Ltd	2008	Nigerian
12	Skye Bank (Gambia) Ltd	2008	Nigerian
13	Zenith Bank	2008	Nigerian
14	Prime Bank (Gambia) Ltd	2009	Lebanese

4.4. Selection of the Sample and Data Sources

The sample contains 12 out of 14 banks in the Gambia due to the consistency of the data and the selected period 2009-2017. It's because; Two of the banks "Oceanic Bank Gambia Ltd and Prime Bank Gambia Ltd" were withdrawn from the sector in 2011 and 2013 because they failed to meet the capital requirements of 150 million and 200 million Dalasi respectively. This led the Gambian central bank to cease its operations in the country (The Point, January 6, 2011; The Daily Observer, January 22, 2013). Also, the Central Bank of The Gambia published a new banking law in 2005 that allows the CBG to operate its monetary policy without the government intervening excessively to maintain the stability of prices. As a result, CBG enables new banks to enter the banking sector. Thus, the real growth of the banking sector in The Gambia started in 2005 and this study was capable to collect data from 2009 to 2017 to illustrate the changes that could affect the overall technical

efficiency of CBs in The Gambia under this finance law. Also to determine the factors that influence the efficiency of the banks.

The targeted sample here will be therefore 11 conventional commercial banks and one Islamic bank. The sample contains 108 observations. The data are time series and secondary panel data, namely the annual report of the banks (profit and loss account and balance sheets of the individual banks) obtained from the CBG and the websites of the individual banks. Macroeconomic factors were extracted from the World Bank database. Table 4.2 exhibits the commercial banks contained in this research.

Table 4.2. A Group of commercial banks in the research.

No.	Name of the Bank	Established	Acronym
1	Standard Chartered Bank (Gambia) Ltd	1894	SCB
2	Arab Gambia Islamic Bank	1997	AGIB
3	Trust Bank Ltd	1997	TBL
4	First International Bank	1999	FIB
5	Guaranty Trust Bank (Gambia) Ltd	2002	GTB
6	International Commercial Bank (Gambia) Ltd	2005	ICB
7	Platinum Habib Bank(IBC before, MBL now)	1997/2008/2015	PHB/MBL
8	Access Bank (Gambia) Ltd	2007	ABL
9	Ecobank (Gambia) Ltd	2007	EBL
10	Banque Sahelo-Saherienne Pour L'investissement Et Commerce (BSIC)	2008	BSIC
11	Skye Bank (Gambia) Ltd	2008	SKBL
12	Zenith Bank (Gambia) Ltd	2008	ZBL

The sample was selected based on the 2009-2017 investigation period and the two other banks “Oceanic Bank (Gambia) Ltd and Prime Bank (Gambia) Ltd” were omitted because they did not operate consistently during the research period.

4.5. Methods of the Research

4.5.1. The First Stage on DEA

This study utilizes the DEA to study the technical efficiency of all commercial banks in the Gambia. The DEA methodology mentioned above is a non-parametric technique known as a data-based approach. The DEA technology was initially introduced by Farrell (1957) then developed by Charnes, Cooper, and Rhodes (1978) in their seminal paper, using an input-oriented approach and Constant Return to Scale (CRS) assumption for evaluating the efficiency of the public sector. Later on, Banker, Charnes, and Cooper (1984) extended the technique to include Variable return to scale (VRS) assumption, where they decomposed Technical Efficiency to Pure Technical Efficiency (PTE) and Scale Efficiency (SE). The DEA demonstrates computational efficiency by comparing each firm's input/output ratio with a subset, which is a complete set of data determined by linear programming. DEA can be calculated using input-based methods focused on minimizing inputs to produce the same level of output and output-based methods aimed at maximizing output from the same set of inputs (Coelli, 1996). A major weakness of the DEA is the assumption that the data do not contain random errors. Therefore, the DEA does not formulate functions or consider the inefficient distribution of components (Coelli, 1996).

DEA also provides useful management information from peers who are inefficient companies with the similar input-output establishment and fully efficient companies. Because of DEA's useful management information and its increasing acceptance in banking studies, DEA is the method chosen in this study because settings can be processed with multiple outputs and inputs. Also, the DEA method is comparatively healthy (Seiford & Thrall, 1990). The main objective of the DEA is to evaluate the relative productivity of the DMU clutter compared to the DMU clutter used in the model. Weight is associated with input and output DMU, and the researcher chose the output/input weights that have a high level of efficiency. Efficiency is the quantity of output weighed with the quantity of input weighed (Charnes et al., 1978; Coelli, 1996; M.J. Farrell, 1957).

$$\frac{outputs}{inputs} = Efficiency$$

Furthermore, Banker Charnes Cooper (1984) revised the DEA model and introduction of the BCC model, which later divides technical efficiency into pure technical efficiency and scale efficiency. The current research uses the input-oriented BCC model (Yizhe Dong, 2010; Onen & Tunik, 2017; Milind Sathye, 2003; Sok-Gee, 2011). The BCC model is used to evaluate the efficiency of the DMUs, which are characterized by a variable return to scale (VRS). The VRS hypothesis provides the measure of pure technical efficiency (PTE), i.e. The measure of technical efficiency without the effects of scale efficiency (Sufian, 2007a).

DEAs that are technically efficient assuming a CRS and VRS scale, while the DMUs that are technically efficient under VRS may be inefficient under CRS (Guarda & Rouabah, 2005). The introduction of CRS enables the comparison among small and big banks in a setup in which the frequency distribution is inclined due to the existence of small and big banks in the Sample. (Akhtar, 2004). However, the published CRS hypothesis only applies if all banks operate at a maximum scale (Coelli, 1996). To operate at an optimum scale does not always occur, factors such as imperfect competition, leverage concerns, and certain cautionary requirements are described as factors that may deprive banks of operating at an optimum scale. (Grigorian & Manole, 2002).

Due to factors that prevent banks from operating at a maximum scale, the assumption VRS summarizes the data more accurately than the CRS assumption, since companies of similar size tend to be compared (Coelli, 1998). As a result, VRS TE scores are higher than or equal to CRS TE scores (Grigorian & Manole, 2002). Therefore, different DEA assumptions can result in different efficiency values being generated when applied to the same data set (Guarda & Rouabah, 2005). In other words, more efficient DMUs would be described under the VRS hypothesis than efficient DMUs would have been described under the CRS hypothesis (Guarda & Rouabah, 2005). Besides, the VRS hypothesis opens up the possibility that large banks in the sample look efficient with the simple reason that no bank is truly efficient. (Berg, Førsund, Hjalmarsson, & Suominen, 1993).

Moreover, using nonparametric tests makes it easier to compare the efficiency values created from different DEA models (Brockett et al., 1991, as reported by Guarda and Rouabah, 2005). This study will analyze its data on the two hypotheses (ie CRS and VRS) and compare the efficiency values generated from the different hypotheses. The CCR model evaluates the technical efficiency of each DMU, which is between 0 and 1, and determines

whether a DMU has the constant returns scale (CRS), increasing return scale (IRS), or decreasing returns to scale (DRS). During BCC or VRS The model is used to determine pure technical efficiency and variable scale return (VRS). in addition to the CRS and VRS hypotheses, studies in this domain will depend on two orientations, whether internal or external. Input-oriented models aim at minimizing inputs when at least a certain level of output is achieved, and output-oriented models seek to maximize output without using more visible input values (Cooper et al., 2000). This study will measure the efficiency of the banks using an input-based model to measure CB efficiency in The Gambia by utilizing the DEA.

The input-orientation approach is a choice for most studies. Because banks generally have no direct control over the number of services their customers need (Schaffnit et al., 1997). Also, input and output measures will identify the same frontier, and therefore a similar group of banks will be identified as the most efficient or "best practice" banks. However, if the evaluation is based on the assumptions of VRS, the efficiency measures for banks that are less efficient than the input and output levels may be slightly different. (Neal, 2004). DEA is a non-parametric task between outputs and inputs (Charnes et al., 1984). The model aims to measure the relative efficiency of a particular homogeneous unit in the conversion of inputs to outputs. With DEA, target values can be determined for each inefficient unit based on DMU best practices. DMU best practices can serve as a guide or reference for inefficient DMUs to improve their performance. This research uses DEAP software version 2.1 developed by Coelli (1996) to evaluate TE, PTE, and SE. General discussion of mathematical models and hypotheses can be found in Coelli's (1996). DEAP guide or (Coelli, 2005) guide. In addition, TE scores, which fall under the CRS hypothesis, are called (global) because TE does not take into account economies of scale (Cooper et al., 2000). Instead, TEs express local (TE) (i.e., PTE) using VRS (Cooper et al., 2000), see,Figure,4.1



Figure 4.1. Decomposition of technical efficiency.

The above describes the causes of inefficiency, i. e. It is caused by inefficient operation (PTE) or by adverse conditions, characterized by scaling efficiency (SE). or both (Cooper et al. 2000). When DMUs are fully efficient (100%) for CRS and VRS hypotheses,

they operate at the most productive scale (MPSS) (Cooper et al., 2000). If the DMU is as good as the VRS models, but not efficient as the CRS hypothesis, then it is efficient in local level but not global level because of the DMU scale constraint (Cooper et al., 2000)

In other terms, a measure of technical efficiency at a constant returns-to-scale (CRS) is identified as a measure of global technical efficiency. The OTE measurement makes it possible to determine the inefficiency depending on the input/output configuration and the size of the processes. In the DEA, TE measurements are divided into two components that are mutually exclusive and complementary: pure technical efficiency (PTE) and scaling efficiency (SE). This breakdown illustrates the causes of inefficiency. The PTE measure is derived by estimating the efficient frontier predicting the variable returns to scale. This is a measure of technical efficiency without improving scale efficiency and it only images the performance of the management in an organization involved in input during the production process. Therefore, TEP values are used as an index to record administrative performance. The TE / PTE ratio gives the size of SE. Management can use SE measurement to select the optimum source scale (Kumar & Gulati, 2008).

DEA Model

To put the DEA model into practice, we first consider the *N* bank or banks, which are called decision-making units (DMU) and generate *S* diverse outputs with *t* different inputs. Then the efficiency of BANKS will be measured as follows:

$$ef_r = \sum_{i=1}^{s} u_i y_{ir} \,/\, \sum_{j=1}^{t} v_j \, x_{jr} \qquad (i)$$

Where y_{ir} placed for the sum of the i^{th}output created by the r^{th}BANK, $x_{jr}$is the sum of the j^{th} the input utilized by the r^{th}BANK, u_i is the output weight,$v_j$is the input weight,i runs from 1 to *s*, and *j* runs from 1 to *t*. then this efficiency ratio (ef_r) is then maximized subject to the following equation:

$$\sum_{i=1}^{s} u_i \, y_{ir} / \sum_{j=1}^{t} v_i \, x_{jr} \leq 1, for \; r = 1 \, , \ldots , N \; and \; u_i \; and \; v_j \geq 0, \qquad (ii)$$

The first equation guarantees that the ratio of efficiency of the other BANK to the individual is not exceeded one, while the second equation requires positive weight. The weight of each output is determined so that each BANK maximizes its efficiency and each BANK obtains at least one positive input with the output value. Linear CRS programs interrupted by constant returns-to- scale could be transformed into regular linear programs as follows:

$$Maximize\ \ ef_r = \sum_{i=1}^{s} u_i\, y_{ir} \qquad (iii)$$

$$Subject\ to \sum_{i=1}^{s} u_i y_{ir} - \sum_{j=1}^{t} v_j\, x_{jr} \le O, \qquad r\ =\ 1, \dots, N; \qquad (iv)$$

$$\sum_{j=1}^{t} v_j\, x_{jr} = 1\ and\ u_i and v_j \ge O$$

Where

ui = the weight assumed for *ith* output (*Yi*) of the *rth* bank.

vj = the weight assumed for *jth* input (*Xj*) of the *rth* bank.

yir = the *ith* output parameter (*Y*) of *rth* bank.

xjr = the *jth* input parameter (*X*) of *rth* bank.

On the other hand, the input-oriented of VRS multiplier or BCC-I (Banker–Charnes–Cooper– Input) model can be written following the following equation:

$$Max\ efr = \sum_{i=1}^{s} ui\,.\,yir + \mu \qquad (1)$$

Subject to

$$\sum_{i=1}^{s} u_i y_{ir} + \mu \le \sum_{j=1}^{t} v_j\,.\,x_{jr} \qquad r\ =\ 1, \dots, N; \qquad (2)$$

$$\sum_{j=1}^{t} v_j \, x_{jr} = 1 \qquad (3)$$

$$ui \geq 0, i = 1,2 \ldots \ldots . . t \qquad (4)$$

$$vj \geq 0, i = 1,2 \ldots \ldots . . s \qquad (5)$$

Parameter μ reflects the conditions of the convexity of the BCC-I model.

Or the dual problem measured as follows:

Minimize β_p

$$Subject\ to \qquad \sum_{i=1}^{s} \emptyset_r \, y_{ir,} \geq y_{irp,} \; i = 1 \, , \ldots , N; \qquad (v)$$

$$\beta_p x_{jrp} - \sum_{j=1}^{t} \emptyset_r \, x_{jrp} \geq O, j = 1, \ldots , N; \; \emptyset_r \geq O; \;\; and \; \beta_p \; finite \, . \qquad (vi)$$

The variable β_P is placed for overall technical efficiency and must be between zero and one. The linear programming problems described in (v) and (vi) assume constant returns-to-scale (CRS). Figure 4.2 shows a graph of the approach utilizing input and output, the solution for the CRS problem in (v) and (vi) is the 0CRS frontier. The bank at the frontier is efficient, meanwhile, the bank at the frontier at point P is inefficient, in this case, the overall technical efficiency (β_p) measured by an AB / AP ratio of less than 1. Thus, (1- β_p) provides details on which inputs must be reduced to produce the same output as efficient banks at point B.

Also, based on the assumptions of the VRS or BCC model, the overall technical efficiency can be divided into PTE and SE. To achieve this result, linear programming problems in (v) and (vi) must be solved after limiting the sum of the $\emptyset_r p$ from 1 to N equals one, showing in Figure 4.2, the VRS model means the ZDZ 'frontier. based on the VRS model, the PTE bank at point P provided by AC / AP, proves that bank p 'is insufficient at the efficient VRS frontier (point C) by minimizing input X while remaining at output Y (i.e. input-orientation) higher than overall efficiency $\beta_{p,}$, therefore, the difference between the two, AB / AC, is due to the scale inefficiency. SE is if and only if the technology shows CRS (i.e. point D in figure 4.2) or AC / AD.

Similarly, if there is an inefficiency in the scale, this is due to an increase in the return to scale IRS (i.e. ZCD point) or a decrease in returns to scale (DRS) (i.e. DZ'). To determine between these two possible outcomes, linear programming problems in (v) and (vi) must be resolved with a number of the $\emptyset_r p$ constraints from 1 to N are fewer than or equivalent to one. This directs to the non-increasing returns to scaling (NIRS) technology illustrated by the 0DZ frontier in Figure (4.2). The efficiency measure of this technology for bank p at point P is = AB / AP. Thus for this bank to equals β_p.

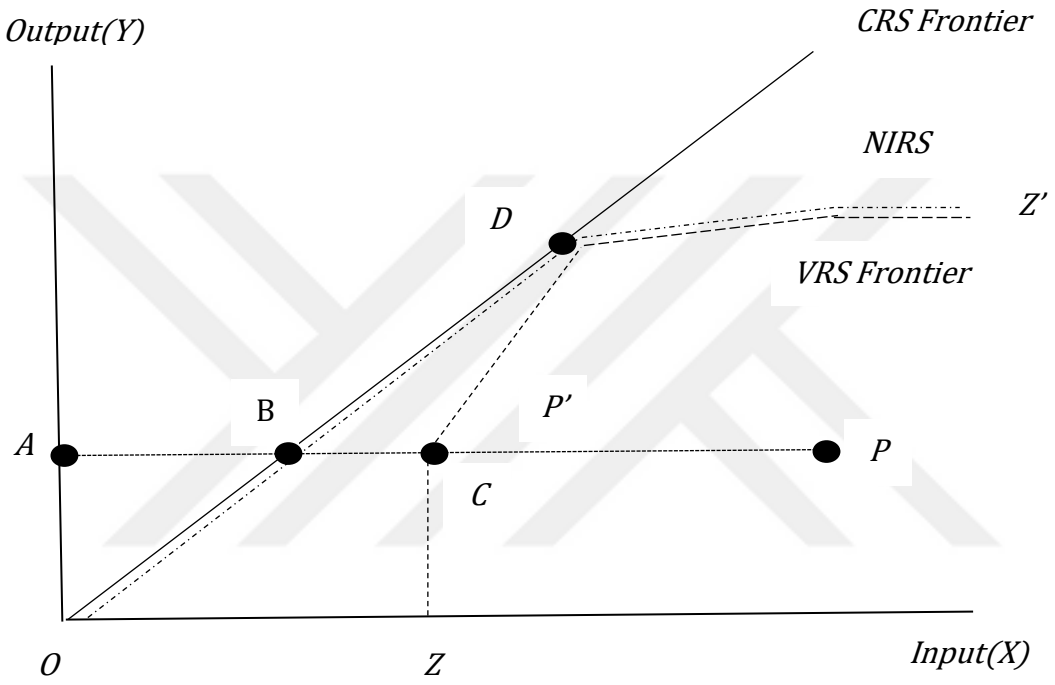


Figure 4.2. Measurement of the inefficiency of scales (Neal, 2004 and Coelli, 2005).

We can also interpret all of these in efficiency measures:

TEI, CRS = AB/AP

TEI, VRS= AP'/AP

SEI, = AB/AP'

Where all of these steps will be limited to zero and one. We have noticed that:

TEI, CRS = TEI, VRS x SEI

Empirical Approaches: Production and Intermediation

There are diverse approaches to modeling the banking process. Each is used to obtain various features of efficiency measurement. The two common approaches are intermediary

approaches (e.g., Isik and Hassan, 2002; Tahir, 2009; Taci, 2005; Wozniewska, 2008; Nenovsky and Tochkov, 2009; Zamil, 2007; Sufian, 2007 and Onen and Tunik, 2017), and production approach. (e.g. Quarterly and Vesala, 1995; Grigorian and Manole, 2002; Fries and Taci, 2004; and Yang, 2009; Onen and Tunik, 2017).

In financial intermediation, banks are seen as financial intermediaries to collect deposits and other deposits from depositors and lend them in the form of loans or other assets for other profitable purposes (Sealey and Lindley, 1977). In other words, the intermediary approach assumes that financial institutions primarily exchange funds between savers and investors. Therefore, the flow is estimated to be proportional to the holding of financial assets in the account, such as loans and deposits in US dollars, as data on service flow is not available periodically (Berger & Humphrey, 1997).

However, under the production approach, banks are viewed as institutions that use different sources of labor and capital to offer a wide range of products and services to a wide range of customers. Indeed, resources utilized such as labor and operating costs are considered inputs, while products and services such as loans and savings are considered as outputs of banking (Yang & Pollitt, 2009). According to Berger and Humphrey (1997), the Production Approach has seen that financial institutions (banks) primarily provide services to account holders. During the transaction and processing of documents for the customer, e.g. Credit applications, credit reports, checks, or other payment instruments. It is also a good idea to measure outputs by the amount and type of transactions or documents processed within a specific period.

The fundamental difference between the two approaches is that, if financial income is considered as output and liability, labor and physical capital are considered inputs in the intermediate approach. Financial assets and liabilities (deposits) are considered as outputs in the production approach. However, there is no consensus on the approach to be used when analyzing bank efficiency (Drake et al., 2009; as reported by Yang and Pollitt, 2009). While No Approach Is Perfect, Each Has Its Different Benefits From Others (Arslan & Ergec, 2010).

The production approach is more appropriate to assess branch efficiency, as branches process customer documents especially for all institutions, and branch managers generally have little control over bank financing and decisions. Nonetheless, the intermediary

approach is more appropriate for evaluation of all financial institutions, including commercial banks. The intermediation approach can also be superior to assessing the importance of marginal efficiency for financial institutions' profitability, to minimize profit, total cost and not only minimize production costs (Berger & Humphrey, 1997). This research may be similar to some other studies, which are similar to (Isik and Hassan, 2002; Havrylchyk, 2006; Onen and Tunik, 2017). The inputs and outputs variables utilized in this study are selected based on production and mediation approaches.

Input and Output Identification

The key difficulty in assessing the efficiency of a commercial bank is choosing the inputs and outputs of the bank, as it is not known exactly what the bank is producing (Berger & Humphrey, 1992). Therefore, researchers must take into consideration that the sum of DMUs (n) exceeds the sum of inputs and output combinations (m + s). (Cooper et al. 2000). More specifically, if, for instance, n is fewer than m + s, this implies that most DMUs are explained since differences and efficiency between DMUs are considered missing (Cooper et al., 2000).

There are also three other methods of selecting bank outputs: assets, user costs, and value-added approaches (Berger and Humphrey, 1992). However, the most commonly used in the literature is the Asset-based approach, also known as intermediation, to measure the efficiency of commercial banks. The above-mentioned intermediation approach views the bank as a financial intermediary, collecting deposits and other trust deposits from depositors and lending them in the form of loans or other assets to make other profits (Yang & Pollitt, 2009). Moreover, most observers will find that bank liabilities have certain input features as they are the raw material for investable funds and bank assets have a specific output as they are eventually utilized for funds that generate their size for direct income generated by banks.

Under the asset-based approach, banks are only evaluated as financial intermediaries between passive holders and those receiving bank funds. Therefore, loans and other assets are considered banking services. Deposits and other liabilities are inputs to the mediation process (Sealey and Lindley, 1977). For some big banks, which mainly buy their money from other banks and big depositors and convert this money into loans, this is a good explanation for bank outputs. However, almost all banks buy more than their money. They

also offer many deposit services. Yet, this service was not included as output with the asset-based approach.

In addition, the use of the asset-based approach to measuring the performance of banks often leads to contradictions in the applicable institutional rules. For example, imagine a bank that produces deposits and sells almost all of its funds to a second bank that uses these funds for business loans. If the two banks merge, nothing will change in overall banking performance. However, if commercial and interbank loans are treated as production using the asset-based approach, the subsequent measured output would decrease as a result of the merger, since inter-bank loans would no longer be granted. If only commercial loans are considered output, the bank selling the funds has no measured production despite the provision of deposit services and the fact that the second bank assesses the funds purchased (Berger and Humphrey, 1992). Some studies follow, for example, the asset or intermediary approach (Isik and Hassan, 2002; Fadzlan and Suraya, 2005; Sok-Gee, 2011; Zamil, 2007; Onen and Tunik, 2017).

The Intermediation Approach and the Production Approach are suitable for this research. The mediation approach adopts the framework of traditional banking, where the bank was expected to convert funds that use labor with physical capital into interest on balance sheet items such as various types of credit (Isik & Hassan, 2003). If the Intermediation Approach is followed, the inputs to this study are capital as a proxy for borrowed funds (X1); Total deposits (X2), and equity (X3). While the outputs are loans and advances (Y1) and securities (Y2). Securities include investments by banks. The research outputs assume that the main goal of the bank is revenue maximization (Grigorian & Manole, 2002). The inputs and outputs of this study are selected according to the study by (Sathye 2001; Grigorian and Manole, 2005; Fadzlan & Suraya, 2005; Zamil, 2007; and Sok-Gee, 2011; Onen & Tunik, 2017) with some changes necessary merger with Gambian banking situation. For the production approach, the inputs are interest expenses (X1), personnel expenses (X2), and non-interest expenses (X3). While the outputs based on the study by (Sufian, 2007; Onen and Tunik, 2017) are interest income (Y1) and non-interest income (Y2), the study focuses only on the valuation of "TE, PTE and SE" according to the DEA method. Study inputs and outputs for intermediation and production approaches are calculated by thousands of Gambian Dalasi (GMD). The two approaches were used for comparison. Tables 4.3 and 4.4 identify the inputs and outputs of the research.

Table 4.3. Intermediation approach: Inputs and outputs of the research.

Variable	Variable name	Explanation
Inputs		
X1	Capital	Capital, placed as a proxy for Funds borrowed (in thousands of GMD) (Onen & Tunik, 2017)
X2	Total Deposits	Deposits and Customer Deposits. (in thousands of GMD).(Sok-Gee,2011, Onen &Tunik, 2017 Zamil, 2007))
X3	Equity	Common and Preferred shares (Onen & Tunik, 2017)
Outputs		
Y1	Loans & Advances	Banks loans & advances. (Account Receivable for AGIB bank) (are measured In thousands of GMD) (Sok-Gee,2011, Onen &Tunik, 2017 Zamil, 2007)
Y2	Securities	Investment (Securities) (Onen & Tunik, 2017)

Table 4.4 Production approach: Research inputs and outputs.

Variable	Variable name	Explanation
Inputs		
X1	Interest Expenses	Total interest expenses (in thousands of GMD) (Onen & Tunik, 2017)
X2	Personnel Expenses	Full-time Employees Salaries (in thousands of GMD) (Onen & Tunik, 2017)
X3	Non-Interest Expenses	Total non-Interest Expenses (in thousands of GMD) (Onen & Tunik, 2017)
Outputs		
Y1	Interest Income	Total Interest Income (in thousands of GMD) (Onen & Tunik, 2017)
Y2	Non –Interest Income	Non –Interest Income (in thousands of GMD) (Onen & Tunik, 2017)

4.5.2. Second Stage: Regression

The DEA itself is not sufficient to provide the final result. Therefore, the study aims to include a second step regression approach to evaluate the internal (specific) and external

(macroeconomic) banks factors that influence the level of banking efficiency in the Gambia. In other words, regression was conducted to examine the effect of some environmental variables on the overall technical efficiency of commercial banks in the Gambia. The impact of these variables is generally examined in the DEA literature utilizing Tobit or logistic regression models, as the distribution of efficiency score is limited over time (0, 1).

The selected internal and external factors that influence bank efficiency are profitability, market power, bank size, liquidity, capital adequacy, and earnings as internal factors. Whereas gross domestic product and inflation are used as external factors. Therefore, this study will evaluate the relationship between these factors and the efficiency of banks in the Gambia, based on available data obtained from non-parametric DEA methods using Tobit's regression model, as the study of (Jackson & Fethi, 2000; Onen & Tunik, 2017; Milind Sathye, 2003; Zamil, 2007).

Several studies have been carried out to determine the association between bank characteristics and macroeconomic factors with efficiency measures. like, (Aly et al., 1990; Berger & DeYoung, 1997; Isik & Hassan, 2003; Miller & Noulas, 1996; M. Sathye, 2001). This empirical research also evaluates the features of banking to identify possible determinants of banking efficiency in the Gambia and to assess its technical efficiency. The following sections show the dependent and independent variables.

Measurement of the Variables

The Dependent Variables

The dependent variables that this study depends on are technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE). TE is a technical efficiency assuming constant returns to scale (CRS) introduce by CCR[5].

In the DEA, OTE measurements are divided into two components that are mutually exclusive and complementary: pure technical efficiency (PTE) and scaling efficiency (SE). This breakdown illustrates the cause of this inefficiency. The PTE measurement results from the estimation of the efficient frontier based on the assumption of variable returns to scale

[5]CCR model is named after its developers Charnes, Cooper and Rhodes (1978)

(VRS), which was developed by BCC[6]. VRS calculates technical efficiency free from scaling efficiency and only reflects management performance in order to organize the inputs during the process of production.

PTE was therefore utilized as a guide to record administrative performance. The TE / PTE ratio is provided by SE. With the SE measurement, management can select the optimum scale of the resources (Kumar & Gulati, 2008). In the DEA literature, banks that receive TE and PTE values of 1 are referred to as "globally efficient" and "locally efficient" banks. (Kumar & Gulati, 2008). Due to the different aspects of TE and PTE, the research develops a hypothesis for both, while the study concentrated on TE as OTE. Table 4.5 demonstrates the dependent variables of the research adapted from (M. K. Hassan & Sanchez, 2007; Isik & Hassan, 2002; Milind Sathye, 2003; Sufian & Habibullah, 2010)

Table 4.5. The dependent variables and their explanation.

Dependent Variables	Explanation of the Dependent Variables
TE	Technical efficiency, PTE, and SE, utilizing the same input or less to produce a certain output compared to the bank at the efficiency frontier (with an input-oriented approach)).
PTE	Pure technical efficiency; TE / SE, TE with variable returns to scale (VRS), i.e. TE without Scale Efficiency effects.
SE	Scale efficiency; TE / PTE if the bank is the right size, which is to determine where the long-term average curve (LRAC) is, or the minimum or where the return to scale (CRS) is realized.

[6]BCC model is named after its developers Banker, Charnes and Cooper (1984),

The Independent Variables

Table 4.6 exhibits the independent variables of the study adapted from (M. K. Hassan & Sanchez, 2007; Isik & Hassan, 2002; Onen & Tunik, 2017; Milind Sathye, 2003; Sufian & Habibullah, 2010).

Table 4.6. The Independent variables of the study and the explanations.

Independent Variables	**Explanation of the Independent Variables**
Internal Factors	
Profitability	Net Operating Income to total equity (Miller & Noulas,1996; Darrat et al., 2002; Zamil, 2007; Onen & Tunik, 2017)
Market Power	Bank deposits over total deposits in the banking sector where banks operate (Miller and Noulas, 1996; Darrat et al., 2002; Isik and Hassan, 2003; Zamil, 2007).
Bank Size	Log of total Assets as a proxy of bank size "Miller & Noulas, 1996; Sathye, 2001; Darrat et al., 2002; Zamil, 2007"
TL_TA	Total loan and advances over total assets as a proxy of Liquidity ratio (Onen & Tunik, 2017; Sufian & Habibullah, 2010)
EQ_TA	Equity over total assets as a proxy of Capital Adequacy (Onen & Tunik, 2017; Sufian & Habibullah, 2010).
II_TA	Interest income to total assets as a proxy of Earnings (Onen & Tunik, 2017).
External Factors	
GDP	Gross domestic product (Onen & Tunik, 2017; Sufian & Habibullah, 2010)
INF	Inflation (Onen & Tunik, 2017; Sufian & Habibullah, 2010)

4.6. Development of Hypotheses

This study develops two main hypotheses categories, namely bank-specific characteristics (Profitability, Market Power, Bank Size, Liquidity, Capital Adequacy, and

Earnings) and macroeconomic factors (GDP and Inflation) based on the nature of banking sector in the Gambia and accessible data. The relationship between these assumptions and economic theory or theory of X-efficiency is related to the fact that the costs for banks with efficient management and or technology are lower, which translates into superior performance. The more efficient the bank, the better its performance. The larger the banks' market share, the higher their concentration (Zouari, 2010).

Furthermore, according to the x-efficiency theory, the variance in performance between two companies is not due to variances in quality of management, but to variances in the efficiency of the scale (size). These banks can thus receive long market shares that increase market share (Berger, 1995). Hypotheses have been developed to regress the specific characteristics and macroeconomic factors of banks with technical efficiency measures. These hypotheses are discussed in the next section

4.6.1. Bank Profitability and Efficiency

The bank's profitability generally has a positive impact on technical efficiency (Miller & Noulas, 1996). In this study, profitability is measured using the return on equity. The ROE is selected instead of other profitability measures because the ROE shows the efficiency with which the direction of a company uses the money of the investors by measuring the profit a company with equity can achieve. The ROE offers a cost-effective measure of efficiency. Theoretically, the relationship between bank profitability and efficiency is at least two different features. The first feature shows that efficiency is the driving force for determining profitability. As a result, the higher the efficiency of the corporation, the higher its profitability. In this case, there is a positive association between efficiency and profitability.

On the other hand, a second condition suggests that banks will create monopoly rents in a focused industry where companies have market power. This reduces customer well-being as banks raise prices and reduce the number of financial services provided (Turati, 2003). Yet, Berger & Hannan (1998), suggested that a different type of well-being loss may be more important in this case, their article would have shown that banks 'efficiency will deteriorate in the more concentrated markets, as the lack of competitive pressure limits managers' efforts to minimize inputs. Managers can simply live a "quiet life" and convert

higher inefficiencies into higher prices. In this second case, the association between profitability and efficiency is much less clear (Yizhe Dong, 2010).

On the one hand, profitability leads to an increase in market concentration when efficiency is the driving force and banks compete for market shareThis argument is similar to that presented by Yanelle (1997) when she found in her work that competition for deposits can generate market attention. When banks exercise their market power, it is a market share that creates profits. When measuring cartels, it is important to study how efficiency affects profitability to obtain vital information about the competition level in the banking market. (Turati, 2003); Singh and Fida ((2015). It has been shown that capital adequacy, liquidity, and profitability have a positive and significant impact on technical efficiency, while bank size has a positive but not significant effect. Figure 4.3 exhibits the association between profitability and measures of efficiency.

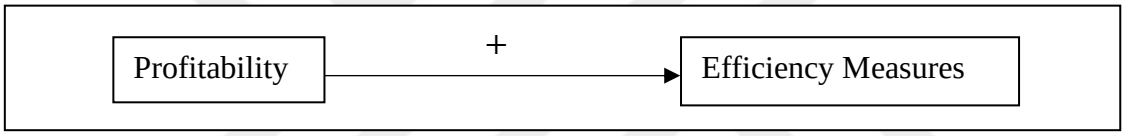


Figure 4. 3. The relationship between profitability and efficiency measures

Therefore, the assumptions were made:

H1: There is a positive significant relationship between bank profitability and overall technical Efficiency.

4.6.2. The Market Power and Efficiency

In the past, efficiency ratings were used to determine the sum of economic assumptions and to indicate control over a company, and categorically inform decision-makers about company efficiency and to improve management performance (Y. Dong, 2010). An important topic that has ended is the study of the effects of the market structure or market power of firms on the level of efficiency (Banker et al.). The market power hypothesis combines the market share of banks with the efficiency of banks. The theory of relative market power (RMP) states that only companies with large market shares and good product differentiation can use market power in pricing these products and achieve above-average profits (Berger, 1995). In addition, previous researchers focused on topics related to

the Structure-Conduct-Performance (SCP), which linked behavior (corporate behavior) and corporate performance to market structure characteristics such as number and distribution. Sizes of banks and banks. (Y. Dong, 2010).

Furthermore, Dong (2010) accordingly "SCP theory suggests that the concentration of companies and other competitive barriers create market power over prices and lead to less profitable business for consumers." These elements also affect the bank's performance and efficiency. Indeed, the prospect of high concentration is a strong signal for a market that may not be competitive and therefore inefficient. However, the main criticism of the SCP model is that market structure measures seem to assume that all companies react equally to changes in market concentration.

The study, therefore, went beyond the SCP paradigm and tested various hypotheses that are directly related to the efficiency of banks and the structure or power of the market. The "quiet life" hypothesis is used to clarify the association between efficiency and concentration of market power. The assumption of a "quiet life" is based on well-known banks with more market power, which charges higher prices if the competition is exceeded, and managers can then benefit from a "quiet life". This results in the advantages of these superior banks. Due to the high level of profitability caused by inadequate competition or other market distortions, management may not control the costs of their business as much as possible. Based on management theory, the governing body exerts its advantage by maximizing corporate profits, despite frequent profit constraints.

Market power can also allow managers to pursue profit maximization goals, such as Behavior in cost preferences (i.e. luxury offices, first-class travel instead of economy class travel, etc.). Such behaviors increase costs and decrease measured cost-efficiency. Banks with extra market power or in more concentrated markets can, therefore, achieve lower cost efficiency than other banks (Y. Dong, 2010; Isik & Hassan, 2003). In summary, management theory and the "quiet life" hypothesis show that market power or market concentrations are negatively associated with efficiency measures (Dong, 2009; Isik and Hassan, 2003). The above view has been noted in the literature. Sathye (2001) and Maghyereh (2004), found that market power has a negative and significant effect on overall technical efficiency. Seelanatha (2012) shows that market shares have a negative and significant impact on technical efficiency. however, Zenebe Lema (2017), revealed that the capitalization level, liquidity risk, return on investment, and market share has a significant impact on the

technical efficiency of commercial banks in Ethiopia. In this study, market power is measured using bank deposits over total deposits in the banking sector in The Gambia. Figure 4.4 shows the association between the market power and measures of efficiency.

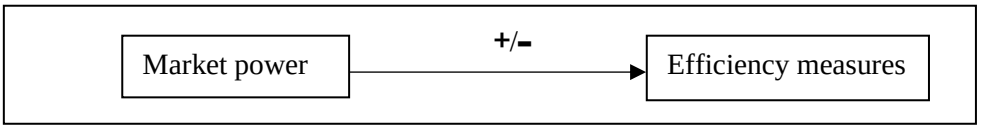


Figure 4.4. The Relationship between the market power and efficiency measures

Therefore, the hypotheses anticipated that:

H2: There is a significant positive/negative relationship between market power and overall technical Efficiency.

4.6.3. Size of the Bank and Efficiency

In addition to measuring the efficiency of banks, it is common practice to examine the impact of bank size on the estimated efficiency of banks. By analyzing the relationship between the size and efficiency of banks, regulators, and bank managers get useful information to assess the optimal scope of their activities. The microeconomics theory of companies says that one of the main goals of companies is to work as productively as possible, under constant returns to scale (CRS) to minimize costs and maximize revenue. (Yizhe Dong, 2010). It has often been observed in banking literature that size is an important factor that leads to fluctuations in efficiency between banks. It is often argued that large banks are more flexible in the financial markets and can differ their credit risk better (Cole and Gunther, 1995). The bigger the bank, the higher the efficiency.

Also, large banks may have panels of professional management that control costs more effectively, resulting in higher profits. (Evanoff & Israilevich, 1991). Casu & Girardone (2006) also show that large banks were able to achieve economies of scale due to growing and joint production options (Y. Dong, 2010). All of these factors enable large banks to leverage their economies of scale and achieve more efficient operating results. However, the big banks are more critical and therefore more complex to control. Thus, large banks may encounter technical problems that may result in less efficient operating results for the banks concerned (Delis and Papanikolaou, 2009). This means that small banks can

be more efficient than large banks. This indicates a negative relationship between size and efficiency. Sufian (2009) found in the literature that the size of total bank assets has a positive and significant impact on bank efficiency. Smirlock (1985) also found a positive and significant relationship between the size and profitability of banks. Alrafadi, Kamaruddin, and Yusuf (2014) found that bank size, mergers, and ownership structure had a negative and significant impact on overall technical efficiency. Berger et al. (1987) have shown that banks have size differences of 49 that negatively impact performance. In this research, size is evaluated according to a study by (Zamil, 2007; Dong, 2010; Sufian and Habibullah, 2010 and Zenebe Lema, 2017) using the natural log of total wealth. Figure 4.5 shows the relationship between the size of the bank and the efficiency measures.

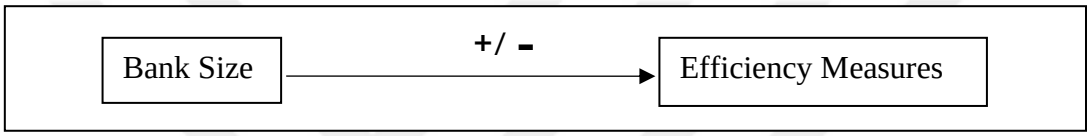


Figure 4.5. The Relationship between Size of Bank and Efficiency Measures

Therefore, the hypotheses assumed that:

H3: There is a significant positive/negative relationship between bank size and overall technical Efficiency.

4.6.4. Total Loan to A Total Asset (TL_TA) and Efficiency

The total loan on total assets (TL_TA) is a measure of the bank's liquidity and can be identified as a liquidity risk as credit risk (Onen, 2017). Liquidity risk due to the inability of the bank to post a reduction in liabilities or to finance an increase in assets on the balance sheet. Liquidity is seen as an important determinant of bank profitability and efficiency (Sufian & Habibullah, 2010). The loan market, especially credit to households and firms is risky and has a larger expected return than other bank assets, such as government securities. High ratios of liquidity may be indicative of better bank performance because of possible increases in interest income. Therefore, one would assume a positive relationship between liquidity (TL_TA) and Efficiency (Bourke, 1989). The credit market, particularly loans to households and businesses, is risky and has a higher expected return than other bank assets such as government bonds. High liquidity ratios can indicate better bank performance as

interest income can rise. Therefore, one would assume a positive association between liquidity (TL_TA) and efficiency (Bourke, 1989). Nevertheless, it could be the opposite, because the fewer funds are frozen in the liquid investment pool, the greater the likelihood that banks will become profitable (Eichengreen and Gibson, 2001). In the literature, Řepková (2015) found that the level of capitalization, liquidity risk, and portfolio risk has a positive and significant impact on the efficiency of the bank. While Seelanatha (2012) found that market share and liquidity have a negative and significant impact on technical efficiency. Figure 4.6 shows the association between the liquidity ratio of the banks and measures of efficiency.

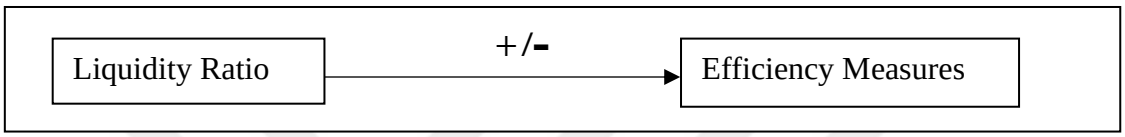


Figure 4.6. The relationship between equity ratio and efficiency measures.

Therefore, the hypotheses assumed that:

H.4: There is a significant positive/negative relationship between the Liquidity Ratio and overall technical efficiency

4.6.5. Equity to Total Assets (EQ_TA) and Efficiency

EQ_TA is a measure of Capital Adequacy. It measures the strength of the bank's capital in a given year and is calculated as equity over total assets EQ_TA. The high investment rate is an indicator of low debt and thus a lower risk (Sufian & Habibullah, 2010). According to Dang (2011), capital adequacy is assessed using the capital adequacy ratio (CAR). The capital ratio indicates the internal strength of the bank to survive losses during the crisis. Capital ratios are directly proportional to banks' resistance to crises. Banks with higher capital ratios generally require less external financing, and thus higher profitability can be achieved, leading to better efficiency. Capital ratios are considered safer in the event of loss or liquidation. Stock market standards ensure that there is sufficient capital to absorb unexpected risks. High capital ratios are considered low-risk indicators (Bhatia & Mahendru, 2015).

However, Berger (1995) has shown that a well-capitalized bank with asymmetric information can send a signal to the market that average performance is better than expected. As a result, well-capitalized banks are less risky in this regard, and profits should be lower because they are considered safer. In this regard, we expect a negative relationship between capital adequacy and bank efficiency. In the literature, Singh and Fida (2015) have shown that capital adequacy, liquidity, and profitability have a positive and significant impact on technical efficiency. lrafadi, Kamaruddin, and Yusuf (2014) found that capital adequacy and the state connection have a positive and significant impact on overall technical efficiency. Munyambonera (2012) noted that capital adequacy (equity over total assets) is positive and significant and that signs of 1%, 5%, and 10% in profitability are expected. while, Fethi & Jackson,(2000), indicating that the variable of capital adequacy had a significant negative impact on technical efficiency. Figure 4.7 displays the association between the capital adequacy ratio and efficiency.

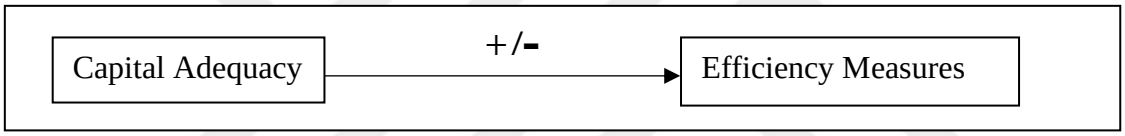


Figure 4.7. The relationship between capital adequacy ratio and efficiency.

The hypotheses therefore assumed that:

H5: There is a significant positive/negative relationship between Capital Adequacy Ratio and overall technical Efficiency.

4.6.6. Interest Income over Total Asset (II_TA) and Efficiency

II_TA is a measure of income diversification. The result is measured by the interest income over the total asset (II_TA) and indicates the strength of the bank to lower the interest expense for deposits and to keep the interest on loans and advances higher. Therefore, II_TA is an important factor that measures a bank's basic income. The larger this ratio, the better the bank's result in terms of total assets (Bhatia & Mahendru, 2015). In the literature, Niazi (2003) found that the management performance, earnings, and profitability of the bank, as well as liquidity and sensitivity to market risks, have a positive and significant relationship with the efficiency of banks. Burki and Niazi (2006) also suggested that the profit-to-wealth

ratio, credit-to-wealth ratio, and asset size are positively associated with all efficiency measures. This implies that the expected impact of bank profits on banks' efficiency measures could be positive. Figure 4.8 shows the relationship between bank returns and efficiency measures.

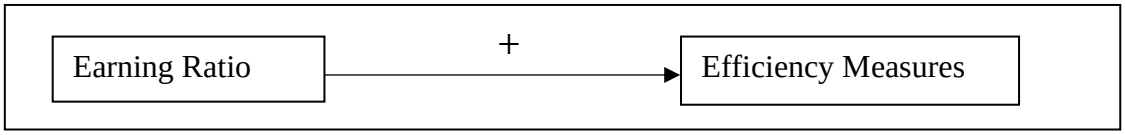


Figure 4.8. The relationship between capital adequacy ratio and efficiency.

Therefore, the hypotheses assumed that:

H6: There is a significantly positive relationship between the Earning Ratio and the overall technical efficiency.

4.6.7. Gross Domestic Product (GDP) and Efficiency

Gross domestic product (GDP) represents the monetary value of all finished goods and services that were produced in a country within a certain period and is usually measured annually. GDP, in general, is the measurement of a nation's overall economic activity.[7] The profitability or efficiency of banks is so sensitive to the macroeconomic situation of a particular country, regardless of the tendency of the sector for greater geographic diversification and the greatest tendency to use financial techniques for risk control in connection with the forecasting of the business cycle. In general, higher economic growth motivates a bank to lend more, which allows it to charge higher margins and improve the quality of its assets. Neely and Wheelock (1997) use per capita income and suggest that this variable has a strong positive impact on bank performance. Bikker and Hu (2002) found a positive relationship between bank profitability and the business cycle. Therefore, GDP growth is expected to have a positive impact on bank efficiency. Depending on how economic growth develops, it can be positive and sometimes negative. If GDP growth slows, especially during recessions, credit quality deteriorates, and defaults increase, which results (Munyambonera, 2012). Nonetheless, Sufian (2009) found that the GDP had a negative impact on the efficiency of Malaysian banks. This study uses GDP as an external or

[7] https://www.investopedia.com/terms/g/gdp.asp

macroeconomics factor affecting the efficiency of commercial banks in The Gambia and data is collected from the World Bank database. Figure 4.9 displays the association between GDP and technical efficiency.

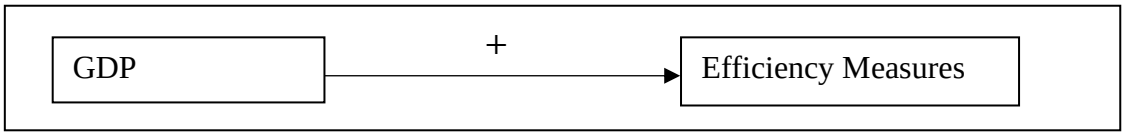


Figure 4.9. The relationship between capital adequacy ratio and efficiency.

Therefore, the hypotheses are assumed as:

H7: There is a significant positive relationship between GDP and overall technical Efficiency.

4.6.8. Inflation and Efficiency

Inflation is a quantitative measure of the rate at which the average price level of a particular set of goods and services in the economy increases over time. Often expressed as a percentage, inflation shows a decline in the purchasing power of the national currency[8]. The extent to which inflation affects the bank's profitability and efficiency depends on its ability to predict future inflationary movements. This in turn depends on the banks' ability to correctly predict their future movements. A fully expected inflation rate increases profits because banks can adjust interest rates appropriately to increase income, while an unexpected change can increase costs due to incomplete interest rate adjustments (Perry, 1992). This leads to negative effects on the efficiency of the banks. Prior studies by Bourke (1989), Molyneux and Thornton (1992), Demirguc-Kunt and Huizinga (1999) found a positive correlation between inflation and bank performance. If this is not planned, costs will rise faster than prices, and the impact on performance will be negative. (Nassreddine, Fatma, & Anis, 2013). Figure 4.10 shows the correlation between GDP and technical efficiency.

[8] https://www.investopedia.com/terms/i/inflation.asp

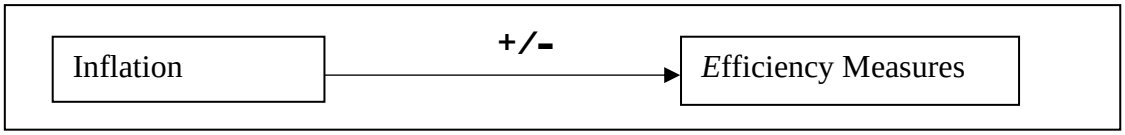


Figure 4.10. The relationship between GDP and overall technical efficiency.

Therefore, the hypotheses assumed that:

H8: There is a significant positive/negative relationship between Inflation and overall technical Efficiency.

4.7. Model Development

The second level of efficiency measure is to determine the impact of the independent variables on efficiency measures (see Tables 4.5 and 4.6). The model used in this second phase of the study is the Tobit regression model developed by (Zamil, 2007; and Sufian, 2010) & (Noor, 2009; Munyambonera, 2012); and referred to as:

$$Ef = \alpha + \beta 1Pit + \beta 2MPit + \beta 3BSit + \beta 4TL_TAit + \beta 5EQ_TAit + \beta 6II_TAit + \beta 7GDPit + \beta 8INFit + \varepsilon it$$

Where:

Ef = Overall Technical Efficiency.
a = Intercept
P = Profitability (ROE).
MP = Market Power
BS = Bank Size.
TL_TA = Total Loan over Total Assets
EQ_TA = Equity over Total Assets
II_TA = Interest Income to Total Asset
GDP = Gross Domestic Product
INF = Inflation
Ɛi = Error term

Where "i" denotes the bank for the reporting period. β is the set of parameters to be measured.

4.8. Data Analysis

This study used different techniques to analyze data. The study utilized the DEA method to measure overall technical efficiency in the first stage and uses descriptive analysis to test multicollinearity. In the second phase, the study uses the Tobit regression method to assess the relationship between overall technical efficiency and bank-specific characteristics and macroeconomic factors in The Gambia. The dependent variables of this study are the DEA scores of the first phase of the DEAP version 2.1 software developed by Coelli (1996). While the second stage of efficiency measurement (independent variables) is calculated by the Tobit regression model from Eviews 8, the Tobit regression model is introduced by James Tobin (1958) to define the relationship between a censored dependent variable and independent variables. Tobit regression is used here due to the censorship of the dependent variables (the technical efficiency is in the range from 0 to 1) and the extreme values of the independent variables, which deviate from a normal distribution and are inherently strongly distorted (Niazi, 2003). Numerous studies have utilized censored Tobit regression instead of OLS regression to examine main factors for bank efficiency (i.e. Maudos et al., 2002, Casu and Molyneux, 2003 and Weill, 2003); because the Tobit regression takes into account the censored properties of the dependent variables. Unlike OLS, Tobit's regression method now offers strong estimates for all parameters. Therefore, we also use Tobit's regression method with the left zero censored and the right-censored limit to reduce the technical efficiency of a set of environmental factors. The Tobit model for the i-th bank can be described mathematically as follows:

$$y_i^* = 0 \; if \; y_i^* \leq 0; y_i = y_i^* \; if \; 0 < y_i^* \leq 1; y_i = 1 \; if \; 1 < y_i^*$$

The dependent variable y_i^* denotes relative efficiency scores which lie between 0 and 1, it has been censored from the left as well as from the right of the equation.

Descriptive analysis is also used to the properties of the data in terms of mean, maximum, minimum, and standard deviation using SPSS. In addition, the correlations between the variables were examined using the parametric technique, the bivariate Pearson correlations, which indicate the relationship between the independent variables. Also, variance inflation factor tests and tolerance tests are conducted to show how independent variables are explained by other independent variables. Finally, linear regression for dependent variables and independent variables was used to study the possible influence of

independent variables on dependent variables by grouping them in Eview software utilizing the Tobit regression model. The association between the independent and dependent variables is illustrated in Figure 4.11.

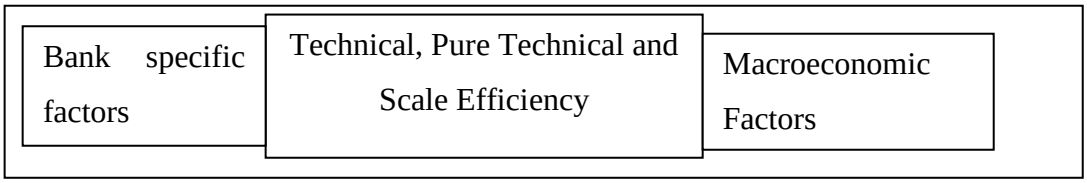


Figure 4.11. The relationship between independent variables and dependent variables**.**

4.9. Conclusion

Chapter Four focuses on research methodologies. This chapter once again focuses on the objectives and questions of the study, then on population, sample selection, and data sources. In this section, 12 out of 14 CBs were selected based on the 2009–2017 study period. This chapter also highlights the models utilized in this research, namely: DEA in the first stage of efficiency measures. This section describes the DEA and its use for measuring the efficiency of CB. Moreover, this chapter highlights the application of the DEA model to technical efficiency measures.

Approaches to measuring the efficiency of CBs were revealed, and the chapter describes the inputs and outputs of the study. This chapter also explains the Tobit regression model for the second step. In this section, the study examines the determinants of efficiency measures in the form of banking and macroeconomic factors. Finally, the study discussed both dependent and independent variables and the models utilized to analyze them. The chapter is then concluded.

CHAPTER 5

DATA ANALYSIS AND RESEARCH FINDINGS

5.1. Introduction

Chapter 4 revealed more about the data, sample selection, and methods utilized in this research. Chapter 5 examines the analytical side of the study by presenting the empirical findings on the overall technical efficiency measures of twelve commercial banks in The Gambia that were active in the Gambian banking sector from 2009 to 2017. Then the internal factors (bank-specific characteristics) and external (macroeconomic) factors that determine the technical efficiency of banks are tested.

5.2. Empirical Findings

5.2.1. First Stage on DEA: Efficiency of Commercial Banks in the Gambia

5.2.1.1. Intermediation Approach

Characteristics of the Sample

Table 5.1 exhibits descriptive statistics for some of the inputs and outputs of 12 commercial banks that were continuously active in The Gambia, including purely Islamic banks in the nine years from 2009 to 2017. The variables were chosen based on a mediation approach that stated that banks were considered Intermediary who collects deposits and other credible assets from depositors and lends them to others for profitable purposes in the form of loans or other assets (Sealey and Lindley, 1977). The study data are secondary data from the annual reports of the various banks (profit and loss account and balance sheets), which were collected on the websites of the various banks and from the Central Bank of the Gambia. All amounts are given in thousands of Gambian Dalasi (GMD'000).

Table 5.1. Inputs and outputs of commercial banks: Descriptive statistics, 2009-2017.

	N	Minimum	Maximum	Mean	Std. Deviation
Inputs					
Capital	108	48,563	868,736	250,026	1541,75.826
Total Deposits	108	15,888	5,350,663	1,219,580	1,204,482.720
Equity	108	91,700	612,538	263,739	134,333.999
Outputs					
Loans & Advances	108	1,911	1,303,960	407,731	320,803.544
Securities	108	11,836	3,427,842	780,000	923,710.158

On average, deposits and securities are the most important inputs and outputs of the Gambian banking sector. This indicates that the banks are focusing more on collecting deposits and converting them to securities, namely treasury bills for conventional commercial banks and Sukuk Salam for an Islamic bank. Of 12 commercial banks, TBL obtained the highest numbers of inputs while EBL obtains the highest number of outputs. Conversely, SKBL accounted for the lowest level of outputs and inputs among the banks. This is because SKBL is a new bank, established in 2008, just one year old before the selected period of the study. Furthermore, table 5.2 discloses the descriptive statistics of the technical efficiency measures for the 108 observations of Commercial Banks in the Gambia, using IBM SPSS Statistics 21 software. As observed from the Table, the minimum TE and SE are scored by Banque Sahelo-Saherienne Pour L'investissement Et Commerce (BSIC) that started operating in the Gambia in 2008, whereas minimum PTE is scored by Standard Chartered Bank (Gambia) Ltd (SCB) in the year 2011.

The results in Table 5.2 also show that commercial banks in The Gambia were technically inefficient with an average efficiency rate of 76% in the period 2009-2017, which means that the average commercial bank had technical inefficiency in 24%. This indicates that commercial banks had more opportunities to increase production if they worked at the same level of efficiency as the most efficient bank in the sample. In contrast, the standard deviation of 0.2837 shows that commercial banks were more diversified in terms of technical

efficiency during the research period. The results also show that commercial banks in The Gambia perform relatively better in terms of purely technical efficiency (88.16%) than in terms of efficiency of scale (84.17%).

Table 5.2. The efficiency measures: Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
TE	108	.0800	1.0000	.760454	.2837358
PTE	108	.2380	1.0000	.881593	.1984343
SE	108	.0970	1.0000	.841704	.2152538

5.3. Efficiency Measures: Input Orientation Under Intermediation Approach

The Technical Efficiency of Commercial Banks in The Gambia was measured using a data envelopment analysis (DEA) and finally divided into pure technical efficiency and scale efficiency. The summary DEA statistics are shown in Table 5.3. The findings in Table 5.3 show the mean values of TE assuming a constant return to scale CRS and of PTE and SE assuming a variable return to scale VRS. The time-series data span nine years from 2009 to 2017, with the average TE assuming that the CRS was between 71.80% and 68.80%. Using the example of the average TE in 2009, it can be concluded that the banks could have reached the same production level on average if they had mainly used only 76% of the input mix. In other words, in 2017 it was found that banks were still 31% (100-69) technically inefficient on average. Since the banks operated under CRS, much of their technical inefficiency was attributed to the waste of inputs. The TE score in the CRS is also referred to as TE (global) because economies of scale are not taken into account (Cooper et al., 2000).

In the VRS hypothesis, the PTE was between 90% and 87% between 2009 and 2017. In the same hypothesis, the SE was between 78.80% and 74.90% from 2009 to 2017. The VRS classification was acquired by controlling the DMU scale. This is the only difference in maintaining the two efficiency measures. A large number of measurements thus captures the influence of the size of the scale on the productivity of the concerned DMU

(Thanassoulis, 2001). The TE assumes that the VRS will introduce the (local) PTE (Cooper et al., 2000).

According to table 5.3, the result shows that the average TE in the Gambian commercial banking sector rose to 87.3% in 2010 above the average TE level in 2009 but suddenly fell by 11.6% in 2011. The average TE rose slightly by around 78.9% in 2012, 3.2 percentage points, which is above the average TE in 2009. In addition, the average TE fell quickly to stabilize in 2013.The average TE rose to 84.2% in 2014, but fell further to 68.8% in 2017. Therefore, the conclusion could drown that the banking sector's best performance in terms of TE was 2010 while the weakest performance was in 2017. Conversely, the average efficiency of the PTE in 2009 was 90%, before rising to 97.4% in 2010, an increase of around 7.4 percentage points compared to 2009. However, later it gradually decreased from 2011 to 2013 until it reached the level of 86 8.2% in 2017.

The average SE was 89.4% in 2010, but then decreased slightly to 87.4% in 2011, followed by a slight increase of 2% in 2012 and a slight decrease in average SE in 2013 from 79.6.1 % for almost 8%, compared to the average of the SE in 2012, the average of the SE gradually increased to 91.7% in 2015, but later fell to 74.9% in 2017. In fact, we observe that the highest average SE has recorded in 2015. While the lowest average SE was in 2017.

In general, DMU inefficiencies may be due to inefficient or unfavorable functions, as indicated by the scale at which the DMU operates (Cooper et al., 2000). If the DMU is efficient (100%) for the CRS and VRS hypotheses, it works on the most productive scale (MPSS). If the DMU has full VRS efficiency but the CRS value is low, it is local, but not global, because of the DMU scale (Cooper et al., 2000). The entire banking sector in The Gambia has been considered ineffective in “TE, PTE and SE” over the past nine years, as shown in Table 5.3. Figure 5.3 exhibits the OTE of commercial banks in The Gambia from 2009 to 2017.

Table 5.3. Technical efficiency of Gambian banking sector, 2009-2017.

Year	Sample size	Means for the Technical Efficiency of the CRS sample	Means for Pure Technical Efficiency of VRS sample	Means for Efficiency of the Scale sample
2009	12	0.718	0.900	0.788
2010	12	0.873	0.974	0.894
2011	12	0.757	0.843	0.874
2012	12	0.789	0.874	0.876
2013	12	0.675	0.836	0.796
2014	12	0.842	0.905	0.896
2015	12	0.767	0.823	0.917
2016	12	0.737	0.912	0.794
2017	12	0.688	0.868	0.749
Mean		0.760	0.882	0.843

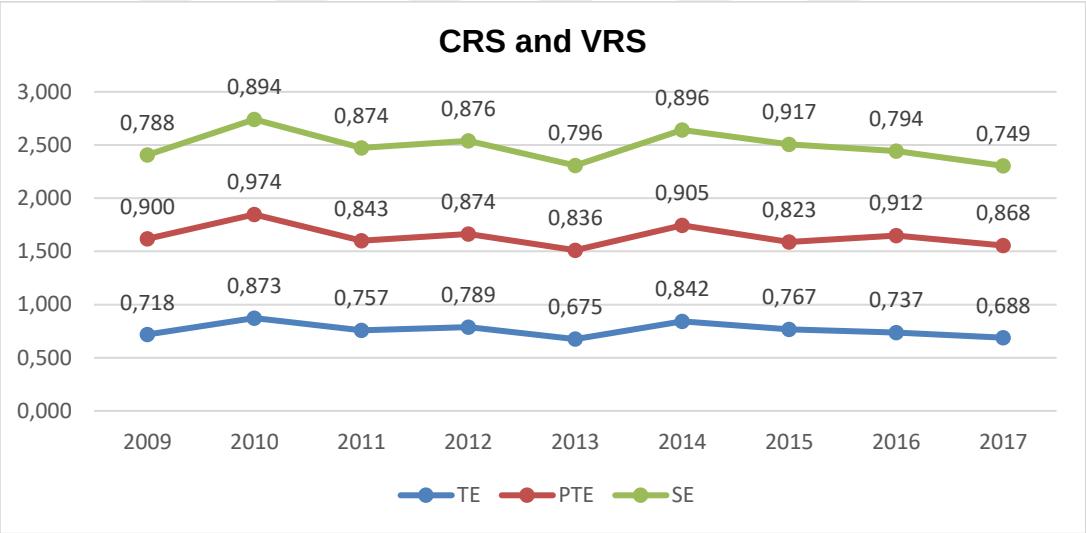


Figure 5.1. Technical efficiency of Gambian banking sector, 2009-2017.

5.3.1. Technical Efficiency (Based on CRS)

Table 5.4 shows the TE measurements utilizing the DEA technique, assuming the CRS. As the result of the table shows, GTB was consistently efficient in the selected period with the exception of 2009. Compared to the other banks in the sample, we find that GTB has an annual highest average of TE 99.5%. In addition, TBL became the second largest bank with an average of 92.2%, followed by SKBL with an average of 91.8%. Next up are the FIB and the only Islamic bank AGIB with an annual average of 87% and 86.6% respectively. Assuming CRS, ZBL is next to AGIB bank with an annual average of 83.2%,

while SCB and BSIC produced a lesser TE with only an annual average of 49.7% and 48%. We can therefore conclude that GTB had the highest TE level while BSIC had the lowest TE level among banks during the research period.

In general, all banks achieved a TE of 76% from 2009 to 2017. Empirical results have shown that commercial banks could easily have reached a similar production potential outputs during the observation period by only using 76.5% of their input mix, for reaching the optimal TE level under CRS assumption, because TE is a company's capacity to achieve optimum performance with a certain set of inputs. Overall, the banking sector recorded the highest TE in 2010 with an average of 87.3%, contrarily the lowest level was recorded in 2013 with an average of 67.5% in 2010. Figure 5.2 exhibits the technical efficiency of all banks that operate under CRS from 2009 to 2017.

Table 5.4. Technical efficiency of commercial banks, 2009-2017.

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean
SCB	0.606	0.618	0.181	1.000	0.455	0.272	0.218	1.000	0.122	0.497
TBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.687	0.615	0.922
PHB	0.335	0.765	0.568	0.592	0.477	1.000	0.636	0.694	0.745	0.646
GTB	0.956	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995
FIB	0.865	1.000	0.933	0.821	0.904	1.000	0.586	0.986	0.737	0.870
AGIB	0.634	0.784	1.000	0.957	1.000	0.979	1.000	0.460	1.000	0.868
ICB	0.511	1.000	0.716	1.000	0.441	0.832	0.700	0.974	0.867	0.782
ABL	1.000	1.000	0.219	0.278	0.351	0.763	0.877	1.000	0.600	0.676
EBL	0.623	1.000	0.461	0.499	0.319	1.000	0.600	0.842	0.391	0.637
BSIC	0.080	0.754	1.000	0.321	0.154	0.252	0.589	0.169	1.000	0.480
SKBL	1.000	0.553	1.000	1.000	1.000	1.000	1.000	0.713	1.000	0.918
ZBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.316	0.176	0.832
Mean	**0.718**	**0.873**	**0.757**	**0.789**	**0.675**	**0.842**	**0.767**	**0.737**	**0.688**	**0.760**

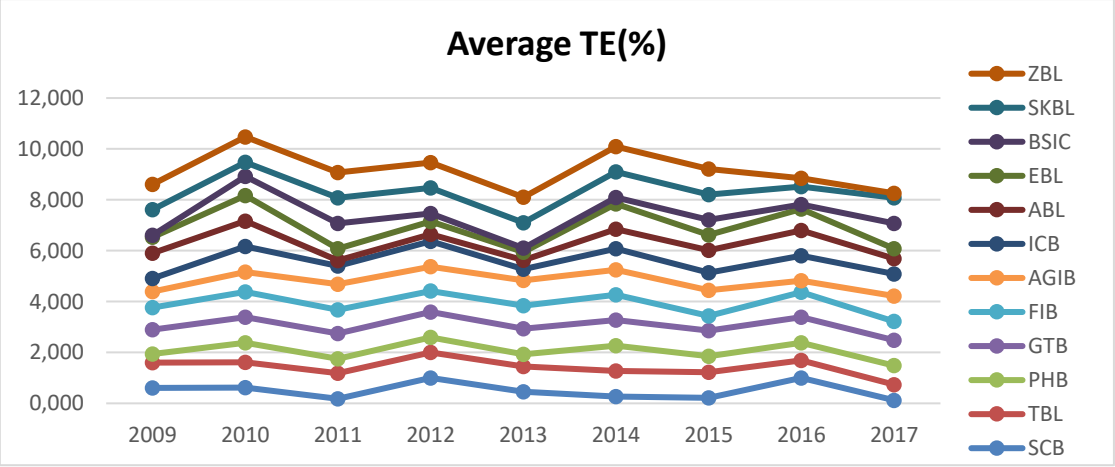


Figure 5.2. Technical efficiency of the commercial banks, 2009-2017 (CRS).

5.3.2. Pure Technical Efficiency (Based on VRS)

Table 5.5 shows the PTE of commercial banks in The Gambia using DEA assuming VRS. The management of DMU resources reflects pure technical efficiency. As observed in the table GTB and SKBL were consistently efficient over the nine years ever since each of them had an annual average of 1, which is the highest PTE score. We can therefore suggest that these banks perform best in accordance with PTE. The ICB followed with an annual average of 98.4%, followed by the FIB scoring an annual average of 96.8%. ZBL, TBL and AGIB received 95.3%, 93.8% and 93.2%, respectively. Finally, BSIC Bank only reached 75.1% of the annual average. In fact, Table 5.5 shows that BSIC Bank is the least among banks during the period 2009-2017.

In general, all banks efficiently achieved a PTE of 88.2% or almost 11.8% inefficient during the selected period. Which implies that on average all banks could easily reach the same level of production with 88.3% of their input mix. Banks had the highest PTE in 2010 at 97.4% on average, while the lowest in 2015 was 82.3% on average. This implies that based on VRS, PTE assumption, they concerned with the use of the isoquant unit, which requires a constant returns- to- scale. Figure 5.3 shows the PTE of commercial banks in The Gambia assuming VRS.

Table 5.5. Pure technical efficiency of the commercial banks, 2009-2017 (V RS).

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean
SCB	0.806	0.859	0.238	1.000	0.539	0.520	0.325	1.000	0.294	0.620
TBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.707	0.739	0.938
PHB	0.810	1.000	1.000	0.909	0.889	1.000	0.641	1.000	1.000	0.917
GTB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
FIB	1.000	1.000	1.000	0.997	0.985	1.000	0.731	1.000	1.000	0.968
AGIB	0.805	1.000	1.000	1.000	1.000	0.979	1.000	0.608	1.000	0.932
ICB	0.857	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.984
ABL	1.000	1.000	0.402	0.478	0.466	0.838	0.881	1.000	1.000	0.785
EBL	0.698	1.000	0.477	0.540	0.370	1.000	0.685	1.000	0.803	0.730
BSIC	0.827	0.834	1.000	0.560	0.783	0.520	0.607	0.631	1.000	0.751
SKBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
ZBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.574	0.953
Mean	**0.900**	**0.974**	**0.843**	**0.874**	**0.836**	**0.905**	**0.823**	**0.912**	**0.868**	**0.882**

Source: Own Computation

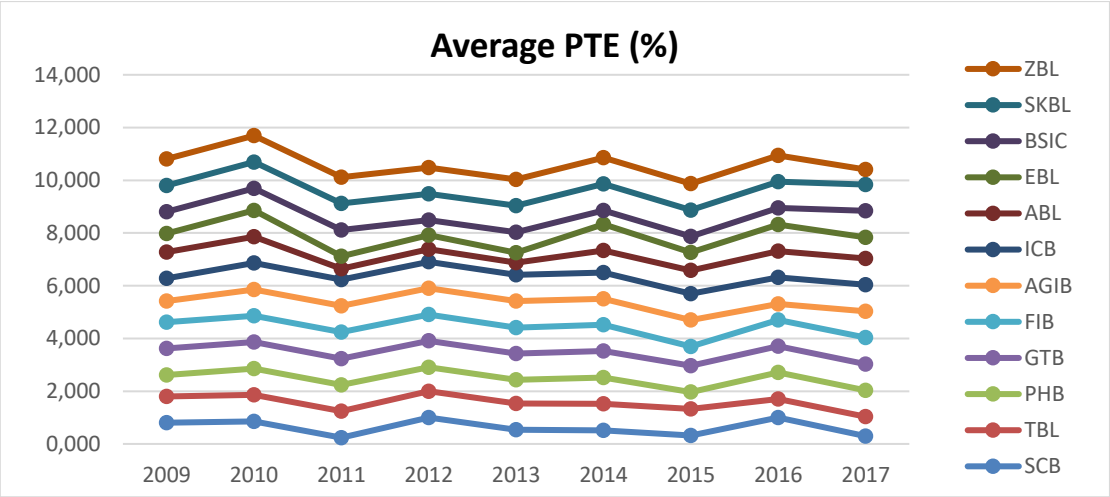


Figure 5.3. Pure technical efficiency of commercial banks, 2009-2017 (VRS)

5.3.3. Scale Efficiency

Table 5.6 shows the SE level of commercial banks in The Gambia from 2009 to 2017. The efficiency of the scale was based on the relationship between outputs level and average costs and therefore relates to the size of the company. The table shows that the GTB is still efficient in terms of SE with the exception of 2009, where 95.6% was achieved. This shows that GTB is the most efficient bank during the observation period. Then to TBL was GTB with an annual average of 97.8%, then AGIB with an annual average of 92.1%. Then, next to AGIB was SKBL with an annual average of 91.8%. FIB, EBL and ZBL achieved an annual average of 89.6%, 87.2% and 84.7%, respectively. The lowest performing bank in the banking sector is the BSIC Bank with an annual average of only 62.2%. In general, all banks achieved an average SE value of 84.3% in the 2009-2017 investigation period. The results in Table 5.6 show that banks suffer largely from the problem of operating in the poor volume of activity. In other words, we can conclude that in the banking sector, where most banks have been tightly controlled by limited capital and liquidity constraints, there is still room for improvement to achieve optimal levels of scale efficiency. As a result, TE is affected by inefficient scaling rather than purely technical efficiency, which means that banks face the challenge of determining the optimal size of the business. Figure 5.4 shows the SE of the commercial banks in The Gambia in the study period.

Table 5.6. Scale efficiency of the commercial banks, 2009-2017 (SE).

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean
SCB	0.752	0.719	0.761	1.000	0.844	0.523	0.672	1.000	0.417	0.743
TBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.972	0.832	0.978
PHB	0.413	0.765	0.568	0.651	0.537	1.000	0.992	0.694	0.745	0.707
GTB	0.956	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995
FIB	0.865	1.000	0.933	0.823	0.918	1.000	0.802	0.986	0.737	0.896
AGIB	0.788	0.784	1.000	0.957	1.000	0.999	1.000	0.757	1.000	0.921
ICB	0.596	1.000	0.716	1.000	0.441	0.832	0.700	0.974	0.867	0.792
ABL	1.000	1.000	0.543	0.581	0.753	0.910	0.995	1.000	0.600	0.820
EBL	0.891	1.000	0.968	0.925	0.861	1.000	0.876	0.842	0.487	0.872
BSIC	0.197	0.905	1.000	0.573	0.197	0.485	0.971	0.268	1.000	0.622
SKBL	1.000	0.553	1.000	1.000	1.000	1.000	1.000	0.713	1.000	0.918
ZBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.316	0.306	0.847
Mean	**0.788**	**0.894**	**0.874**	**0.876**	**0.796**	**0.896**	**0.917**	**0.794**	**0.749**	**0.843**

Source: Own Computation

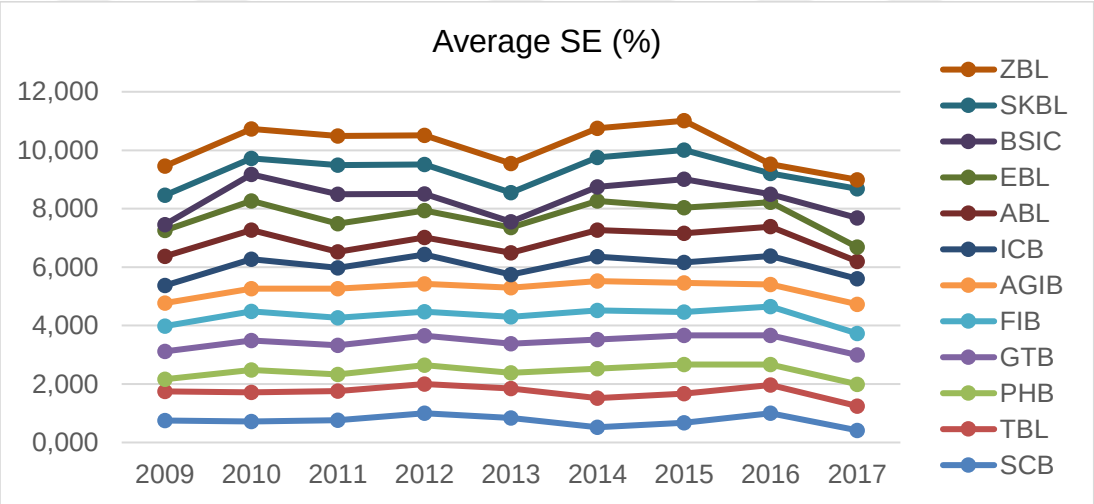


Figure 5.4. Scale efficiency of the commercial banks, 2005-2009 (SE).

5.4. Production Approach

5.4.1. First Stage on DEA

The production approach and the intermediary approach are employed more often in the literature to measure the efficiency of the banking sector. According to the production approach, the task of banks is to provide services to their customers. The output of the bank is the volume of services for savers (managed accounts) and borrowers (loans granted). In order to maintain these services banks use physical capital and labor, thus tangible capital assets and wages can be treated as inputs (KAMGNA & Dimou, 2008). In other words, the production approach considered banks as institutions that use a lot of labor and capital

resources to generate different products and services for customers. Therefore, resources used such as labor and operating costs are considered inputs, while products and services such as loans and deposits are considered output for banks (Yang & Pollitt, 2009).

According to Berger and Humphrey (1997), the production approach views that financial institutions (banks) mainly provide services for account holders. Three inputs and two outputs are used in this study. Study inputs are interest expenses, personnel costs and non-interest-related costs, while outputs are interest income and non-interest-related income, following the study of (Onen & Tunik, 2017; Sufian & Habibullah, 2010; Zenebe Lema, 2017). Table 5.7 contains the summary statistics of the input and output variables of the study based on the production approach. On average, non-interest expenses and interest income are the most important inputs and outputs in the Gambian banking sector. The study uses the DEA method to analyze the technical efficiency of commercial banks in The Gambia. The TE was divided into pure technical efficiency and scale efficiency. Table 5.8 provides the summary statistics of DEA scores for minimum, maximum, mean, and standard deviations based on the production approach. The results in the table show that commercial banks in The Gambia were technically inefficient between 2009 and 2017 with an average efficiency of 86.46%. This shows that commercial banks had an average inefficiency of 13.5% in the period under review. In other words, the results show that banks wasted an average of 13.54% of the inputs used in production. The standard deviation of 0.1853 shows that the Technical Efficiency of Commercial Banks in The Gambia was slightly diversified during the analysis period.

Table 5.7. Inputs and outputs of commercial banks: Descriptive statistics 2009-2017.

	N	Minimum	Maximum	Mean	Std. Deviation
Inputs					
Interest Expense	108	180	292,614	58,269.565	56,012.696
Personnel Expenses	108	2,064	153,355	31,719.361	32,896.597
Non-interest Expenses	108	16,209	496,969	140,511.907	112,243.299
Outputs					
Interest Income	108	6,359	565,186	170,913.045	158,937.188
Non-interest Income	108	248	285,551	93,729.685	79,378.348

Table 5. 8. The efficiency measures: descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
TE	108	.2190	1.0000	.864685	.1853322
PTE	108	.3010	1.0000	.931296	.1478349
SE	108	.4590	1.0000	.925148	.1182104

5.5. Efficiency Measures: Input Orientation Under Production Approach

Table 5.9 indicates the technical efficiency values of commercial banks in The Gambia from 2009 to 2017 utilizing the DEA as part of the production approach. The results in Table 5.9 display the mean values of TE with constant returns to scale (CRS), PTE, and SE with variable returns to scale (VRS). Assuming that the CRS fluctuates, the average TE fluctuated between 91.20% and 80.40%, and the average TE for the selected period is 86.50%. This indicates that the sample banks could have used 13.50% fewer inputs to reach the existing output level. In other words, in 2017 it was found that banks with an average of 13.50% (100-86.50) are still technically inefficient on average. Because banks operated under CRS, much of their technical inefficiency was attributed to the waste of inputs.

Assuming the VRS, the average PTE between 2009 and 2017 was between 93.70% and 94.40%. In the same hypothesis, the average value of the SE score fluctuated between 97.20% and 85% from 2009 to 2017. The VRS classification is attained by controlling the scale of the DMU. Table 5.9 illustrates that the average TE of commercial banks in The Gambia fell to 85.20% in 2010, below the average TE level in 2009, but rose rapidly to 91%. After that, the banking sector maintained a similar performance until it reached its lowest median of 79.40% in 2015 and rose to 93.60% in 2016 before falling to 80.40%. For example, the highest performance of the banking sector in the Gambia was in 2016, while the lowest performance TE was in 2015

On the other hand, the PTE average efficiency was 93.70% in 2009 before falling to 92.10% in 2010, a decrease of almost 1.5 percentage points from 2009. Later, however, it

rose slightly to 94.90% in 2011 and continued to fluctuate in the same range until 2015, when it fell to 85.80%, but rose again to 94.40% in 2017. However, the average SE fell by around 5.9% in 2010, but then rose to 96% in 2011, followed by a rapid decrease to 88.20% in 2012. The average of The SE rose again to 97.30% in 2013, which corresponds to an increase of 9.1% compared to the average value of the SE in 2012. The average value of the SE gradually increased to 97.20. We can, therefore, conclude by saying that the highest value of the average SE was recorded in the context of the production approach in 2013, and the lowest average of SE was in 2017. Figure 5.5 shows the OTE of commercial banks in The Gambia from 2009 to 2017.

Table 5.9. Technical efficiency in Gambian banking sector: 2009-2017.

Year	Sample size	Technical efficiency mean of sample CRS	Pure technical efficiency mean of sample VRS	Scale efficiency mean of the sample
2009	12	0.912	0.937	0.972
2010	12	0.852	0.921	0.913
2011	12	0.910	0.949	0.960
2012	12	0.839	0.946	0.882
2013	12	0.935	0.962	0.973
2014	12	0.801	0.902	0.881
2015	12	0.794	0.858	0.924
2016	12	0.936	0.963	0.972
2017	12	0.804	0.944	0.850
Mean		0.865	0.931	0.925

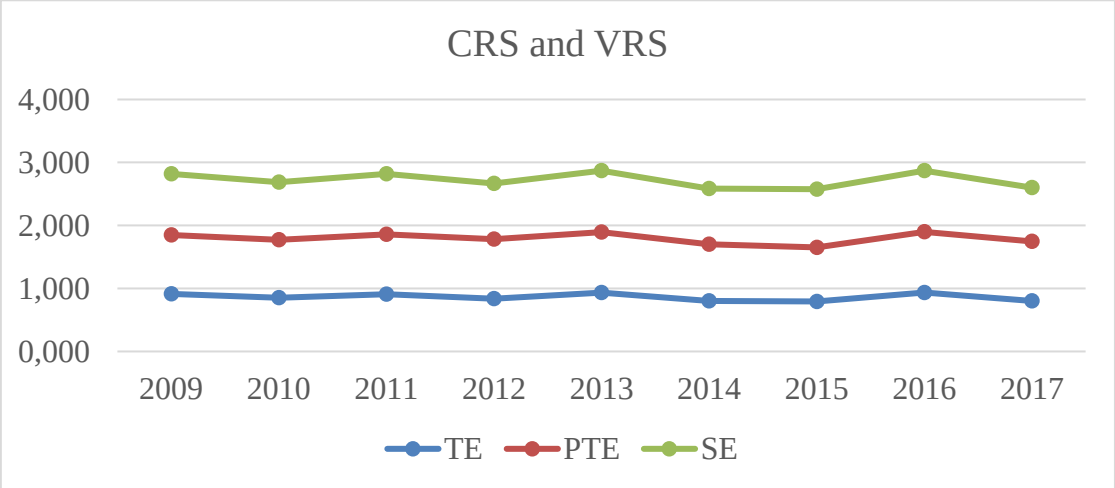


Figure 5.5. Technical efficiency in Gambian banking sector: 2009-2017.

5.5.1. Technical Efficiency (Under CRS): Production Approach

Table 5.10 exhibits the TE measures of commercial banks in the Gambia from 2009 to 2017, utilizing the DEA method based on the CRS assumption. As the empirical result shown in the table, the SCB has an average annual TE of 99.10%. Unlike the other banks in the sample, it was found that SCB had the highest average TE during the analysis period. In addition, SKBL is the second most efficient bank of the period under review with an average value of 98.20%, followed by ZBL with a TE value of 94.30%. ABL and GTB are next to ZBL with an average TE of 91% and 89.10% respectively.

Under the same assumption, TBL found to be the sixth most efficient bank in the sample achieving an annual average of 87.10%, followed by BSIC Bank with an average TE of 85.50%. The FIB and ICB were the eighth and ninth most efficient banks in the sample, with an annual average of 84.80% and 84% respectively. We can, therefore, conclude that SCB is the most efficient bank in the sample, while EBL achieved the lowest TE score of 68.90% in the period under review.

Overall, all banks achieved an average TE of 86.50% from 2009 to 2017. Empirical results have shown that commercial banks could have achieved similar production potential on average over the observation period, if they had only used 86.50% of their input mix to reach the optimum TE level based on CRS assumption, TE registers the ability of the company to achieve the maximum output with a certain set of inputs. In other words, the average CRS efficiency score is 86.50%, indicating that banks have an average inefficiency of 13.50%. For banks to work at marginal efficiency, they have to reduce all input quantities in a similar ratio without affecting the existing level of outputs. Figure 5.6 presents the technical efficiency of all banks based on the CRS assumption from 2009 to 2017.

Table 5.10. Technical efficiency of commercial banks, 2009-2017.

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean
SCB	1.000	1.000	0.957	0.961	1.000	1.000	1.000	1.000	1.000	0.991
TBL	1.000	1.000	0.895	0.645	1.000	0.734	1.000	0.854	0.712	0.871
PHB	0.973	1.000	1.000	1.000	0.816	0.219	0.383	1.000	0.739	0.792
GTB	1.000	0.817	0.827	1.000	1.000	0.734	1.000	1.000	0.637	0.891
FIB	1.000	0.856	1.000	0.716	0.937	0.935	0.484	1.000	0.707	0.848
AGIB	0.988	0.375	1.000	0.378	0.991	0.834	0.784	1.000	0.527	0.764
ICB	0.894	0.620	0.621	0.710	1.000	1.000	0.712	1.000	1.000	0.840
ABL	0.686	1.000	0.875	1.000	1.000	0.632	1.000	1.000	1.000	0.910
EBL	0.489	0.838	0.748	0.964	0.690	0.519	0.380	1.000	0.571	0.689
BSIC	0.911	0.718	1.000	0.691	0.788	1.000	1.000	0.829	0.754	0.855
SKBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.842	1.000	0.982
ZBL	1.000	1.000	1.000	1.000	1.000	1.000	0.786	0.703	1.000	0.943
Mean	0.912	0.852	0.910	0.839	0.935	0.801	0.794	0.936	0.804	0.865

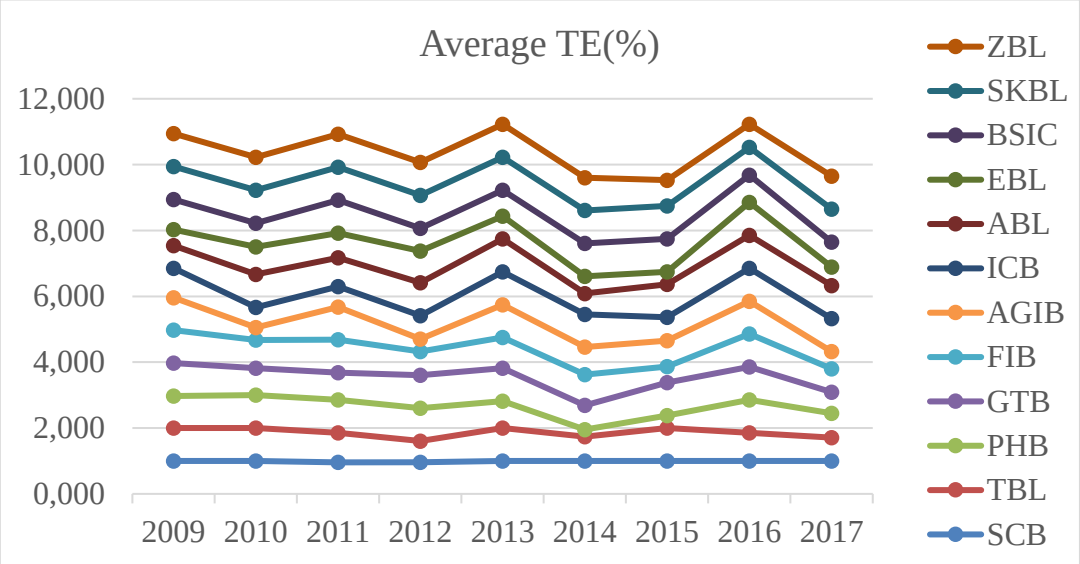


Figure 5.6. Technical efficiency for all banks (TE), 2009-2017.

5.5.2. Pure Technical Efficiency (Under VRS): Production Approach

Table 5.11 exhibits the PTE of commercial banks in The Gambia utilizing the DEA based on the VRS assumption. DMU resource management reflects pure technical efficiency. As the table shows, SCB and GTB Bank were consistently efficient in nine years, each scores an annual average of 1, which is the highest PTE score. We can, therefore, emphasize that these banks do better in terms of PTE. TBL and SKBL followed with an annual average of 99.30% and 98.80%, respectively. As a result, ZBL became the fifth most efficient bank scores an annual average of 96.90%. BSIC, ABL and FIB achieved 95.60%,

94.10% and 93.50%, respectively. While ICB, AGIB, and PHB recorded an average PTE of 89.00, 88.80, and 83.50 percent. Finally, the EBL only reached 78.1% of the annual average. Table 5.11 shows that the most efficient banks are SCB and GTB, while the least efficient bank among the banks in the sample from 2009 to 2017 is EBL.

Generally, all banks achieved an average PTE of 93.10% or around 6.9%, which was inefficient during the research period. This means that on average all banks that hold 93.10% of their input mix can easily reach the same level of output. Banks had the highest PTE value in 2016 with an average of 96.3%, while the lowest value was recorded in 2015 with an average of 85.8%. This is based on the VRS assumption. PTE is concerned about the use of the isoquant unit, which requires a constant return to scaling. See Figure 5.7.

Table 5.11. Pure technical efficiency of commercial banks, 2009-2017.

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean
SCB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
TBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.938	1.000	0.993
PHB	0.985	1.000	1.000	1.000	0.817	0.301	0.415	1.000	1.000	0.835
GTB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
FIB	1.000	0.901	1.000	1.000	1.000	0.973	0.541	1.000	1.000	0.935
AGIB	1.000	0.615	1.000	0.824	1.000	0.905	1.000	1.000	0.649	0.888
ICB	0.936	0.778	0.641	0.720	1.000	1.000	0.938	1.000	1.000	0.890
ABL	0.825	1.000	1.000	1.000	1.000	0.648	1.000	1.000	1.000	0.941
EBL	0.492	1.000	0.750	0.965	0.723	1.000	0.406	1.000	0.680	0.780
BSIC	1.000	0.754	1.000	0.847	1.000	1.000	1.000	1.000	1.000	0.956
SKBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.895	1.000	0.988
ZBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.718	1.000	0.969
Mean	0.937	0.921	0.949	0.946	0.962	0.902	0.858	0.963	0.944	0.931

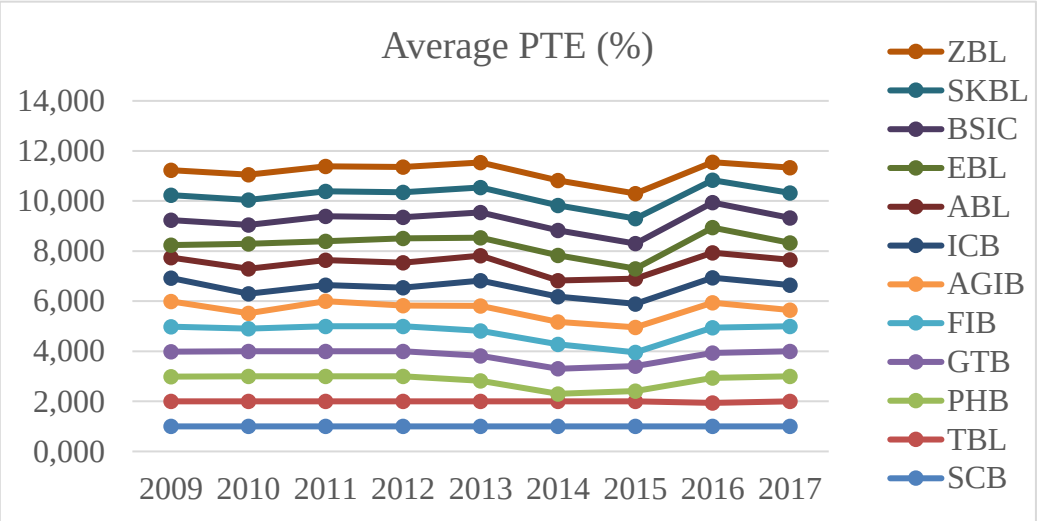


Figure 5.7. Pure Technical efficiency for all banks (TE), 2009-2017.

5.5.3. Scale Efficiency Under Production Approach

Table 5.12 shows the SE of commercial banks in The Gambia between 2009 and 2017 that use DEA as part of the production approach. The findings indicate that SKBL achieved the highest SE value with 99.30%, followed by SCB, ZBL, and ABL with an annual average of 99.10%, 97.40%, and 96.50%. ICB, PHB, and FIB were the second most efficient banks with 94%, 93.10%, and 90.70% respectively. Empirical results show that AGIB had the lowest SE score of 84%. Therefore, the conclusion can be drowned out that SKBL is the most efficient bank and AGIB became the least efficient bank during the investigation period. As the table shows, Gambia had the best performance in the banking sector with an average SE of 97.30% in 2013, while the weakest performance compared to SE was recorded with an average SE in 2017.

In summary, the overall inefficiency of the banking sector in The Gambia is 7.9%. This suggests that banks have not developed efficiently during the period because they are mainly suffering from the problem of operating in poor business volume. Figure 5.8 exhibits the scale efficiency of commercial banks in The Gambia from 2009 to 2017.

Table 5.12. Scale efficiency of commercial banks, 2009-2017.

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean
SCB	1.000	1.000	0.957	0.961	1.000	1.000	1.000	1.000	1.000	0.991
TBL	1.000	1.000	0.895	0.645	1.000	0.734	1.000	0.911	0.712	0.877
PHB	0.988	1.000	1.000	1.000	0.999	0.728	0.922	1.000	0.739	0.931
GTB	1.000	0.817	0.827	1.000	1.000	0.734	1.000	1.000	0.637	0.891
FIB	1.000	0.949	1.000	0.716	0.937	0.961	0.896	1.000	0.707	0.907
AGIB	0.988	0.610	1.000	0.459	0.991	0.921	0.784	1.000	0.813	0.841
ICB	0.955	0.796	0.968	0.986	1.000	1.000	0.759	1.000	1.000	0.940
ABL	0.831	1.000	0.875	1.000	1.000	0.976	1.000	1.000	1.000	0.965
EBL	0.993	0.838	0.997	0.999	0.955	0.519	0.936	1.000	0.840	0.897
BSIC	0.911	0.951	1.000	0.816	0.788	1.000	1.000	0.829	0.754	0.894
SKBL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.941	1.000	0.993
ZBL	1.000	1.000	1.000	1.000	1.000	1.000	0.786	0.979	1.000	0.974
Mean	0.972	0.913	0.960	0.882	0.973	0.881	0.924	0.972	0.850	0.925

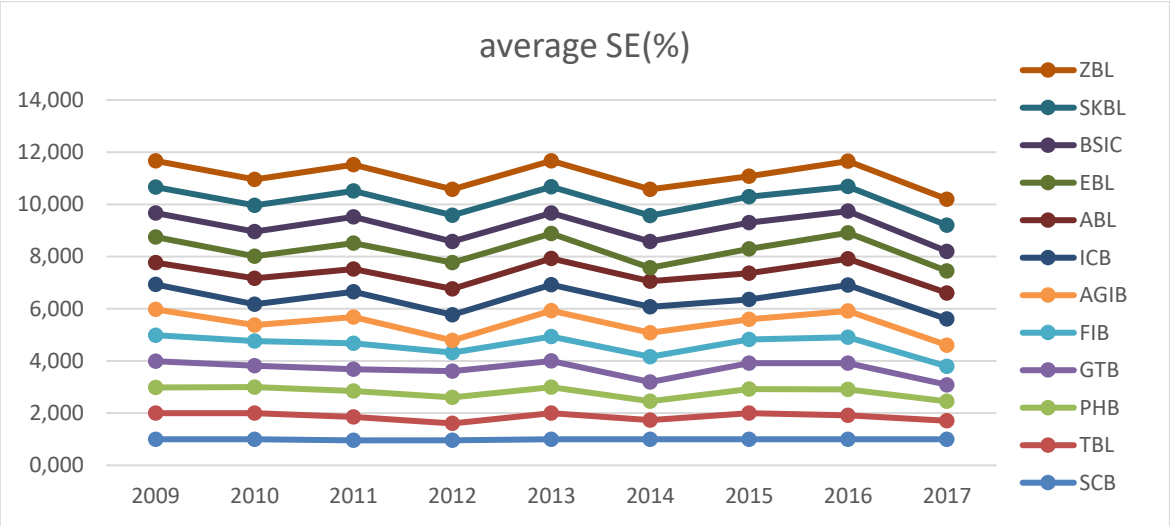


Figure 5.8. Scale efficiency of commercial banks from 2009 to 2017.

5.6. Intermediation Approach vs., Production Approach

Table 5.13 shows a comparison between the mediation approach and the production approach. The table shows that the production approach gave the most efficient banks and higher overall efficiency than the results of the intermediation approach. According to the production approach, CRS (TE) scored 86.50%, while the placement resulted in an annual average of only 76%. In contrast, the VRS (PTE) was 93.10% in the production approach, while only 88.20% was recorded in the intermediation approach. For the efficiency of the scale, the table shows that the evaluations of the production approach are approximately 8.20% higher than the intermediation approach. This is in line with the fact that Gambian banks do not grant their customers as much credit as is necessary. Nonetheless, a common feature of the results of the two approaches is that the number of efficient banks is less than 50% of the number of banks in the sample. This suggests that the main cause of the technical inefficiency of commercial banks in The Gambia is the inefficiency of the scale magnitude rather than pure technical inefficiency.

Also, this implies that commercial banks in the Gambia are performing well in terms of managing their resources since they achieved a high level of PTE for both intermediation and production approach compared to scale efficiency during the study period, therefore, the bank managers need to increase the scale of their banks in order to reach to optimal level of efficiency.

Table 5.13. Intermediation approach vs. production approach.

Approaches	**Intermediation Approach**			**Production Approach**		
Year	TE	PTE	SE	TE	PTE	SE
2009	0.718	0.900	0.788	0.912	0.937	0.972
2010	0.873	0.974	0.894	0.852	0.921	0.913
2011	0.757	0.843	0.874	0.910	0.949	0.960
2012	0.789	0.874	0.876	0.839	0.946	0.882
2013	0.675	0.836	0.796	0.935	0.962	0.973
2014	0.842	0.905	0.896	0.801	0.902	0.881
2015	0.767	0.823	0.917	0.794	0.858	0.924
2016	0.737	0.912	0.794	0.936	0.963	0.972
2017	0.688	0.868	0.749	0.804	0.944	0.850
Mean	**0.760**	**0.882**	**0.843**	**0.865**	**0.931**	**0.925**

5.7. Constant Return to Scale (CRS) of Commercial Banks: Intermediation and Production Approach

Tables 5.14 and 5.15 indicate the CRS value (Constant Return to Scale) of commercial banks in The Gambia between 2009 and 2017. Both tables show reasons to offset the inefficiency in the scale of commercial banks in the Gambia. One of the fundamental features of the DEA is the capability to decide whether the DMU operates in the area of constant returns to scale (CRS), increase the return to scale (IRS) or decrease returns-to-scale (DRS). DMUs that display CRS at the optimum or most productive scale size (MPSS) and work with complementary parts of the long-term average input curve. On the contrary, the DMU shows DRS when the percentage of input increases in input less than expected improvement in output. DMUs where DRS operates beyond the optimum operating scale and improve efficiency by reducing their operating scale (e.g., by dividing it into two or more production units working under the CRS).

In addition, a DMU has an IRS if a percentage increase in inputs leads to a disproportionate increase in expenditure. The DMUs that know the IRS are below the optimal operating range and would improve their efficiency by expanding their operating scale. Thus, the existence of increasing or decreasing returns to scale can be identified by the equality or inequality of the efficiency values according to the “CRS, VRS and NIRS” hypotheses (Gulati, 2011).

Tables 5.14 and 5.15 show the banks that are at the frontier of efficiency for intermediary and production approaches. Table 5.14 shows, within the framework of the

mediation approach, the composition of the efficiency frontier at which no bank has achieved the upper efficiency of 100%, during the study period. The results showed that GTB reached the highest CRS or occurred eight times at the efficiency frontier throughout the period. This followed by TBL, SKBL, and ZBL with similar CRS levels of 7. Although it appears that the least at CRS level was PHB (now known as Megabank), where it only appears once at the efficiency frontier. AGIB and ABL appeared four and three times respectively, while other banks appeared twice on the frontier. Based on the production approach, Table 5.15 shows that SKBL appears 8 times on the frontier, followed by SCB and ZBL with a 7-time score at the CRS level. Then ABL, GTB, TBL, and PHB appear 6, 5, and 4 times respectively. EBL appeared twice and the other banks three times. The table, therefore, shows that the most efficient bank at the CRS efficiency frontier was SKBL and the lowest bank values during the period were EBL.

Overall, the tables show that small banks tend to work at the CRS or IRS frontier, while large banks tend to work at CRS or DRS frontier. In summary, McAllister and McManus (1993) indicate that while small banks have generally shown IRS, large banks tend to operate at DRS and at best CRS frontier. It appears that the small commercial banks in the sample experienced an IRS activity during the period under review. One implication is that for small CBs, an impartial increase in inputs would result in more than a comparative increase in outputs. As a result, the small CBs working on the IRS have been able to achieve significant efficiency scores by increasing their size. In a highly competitive and competitive market, efficient banks should absorb inefficient banks to use resources (Sufian & Noor, 2009). Therefore, banks with the IRS should eliminate their inefficiencies or be the primary target of banks that can benefit low-income banks by reforming their business and eliminating their stagnation and inefficiency (Evanoff and Israelvich 1991).

However, the results seem to indicate that a further increase in scale would only result in a smaller increase in outputs for each proportional increase in the inputs of large banks because large banks are overburdened with decreasing returns to scale. (DRS) during the period. As a result, policymakers need to be more vigilant about promoting mergers between large banks to make their banking sector more efficient.

Table 5.14. Constant return-to-scale (CRS), intermediation approach. 2009-2017.

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Count bank
SCB	DRS	IRS	IRS	CRS	IRS	IRS	IRS	CRS	IRS	**2**
TBL	CRS	CRS	CRS	CRS	CRS	CRS	CRS	IRS	DRS	**7**
PHB	IRS	IRS	IRS	IRS	IRS	CRS	IRS	DRS	DRS	**1**
GTB	IRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	**8**
FIB	IRS	CRS	IRS	IRS	IRS	CRS	IRS	IRS	IRS	**2**
AGIB	IRS	IRS	CRS	DRS	CRS	DRS	CRS	IRS	CRS	**4**
ICB	IRS	CRS	IRS	CRS	IRS	IRS	IRS	IRS	IRS	**2**
ABL	CRS	CRS	IRS	IRS	IRS	DRS	IRS	CRS	IRS	**3**
EBL	IRS	CRS	IRS	DRS	DRS	CRS	DRS	IRS	DRS	**2**
BSIC	IRS	IRS	CRS	IRS	IRS	IRS	IRS	IRS	CRS	**2**
SKBL	CRS	IRS	CRS	CRS	CRS	CRS	CRS	IRS	CRS	**7**
ZBL	CRS	CRS	CRS	CRS	CRS	CRS	CRS	IRS	IRS	**7**
Count year	**4**	**7**	**6**	**6**	**5**	**7**	**5**	**3**	**4**	**47**

Table 5.15. Constant return-to-scale (CRS), production approach, 2009- 2019.

Bank	2009	2010	2011	2012	2013	2014	2015	2016	2017	Count bank
SCB	CRS	CRS	IRS	IRS	CRS	CRS	CRS	CRS	CRS	**7**
TBL	CRS	CRS	DRS	DRS	CRS	IRS	CRS	DRS	DRS	**4**
PHB	DRS	CRS	CRS	CRS	IRS	DRS	IRS	CRS	IRS	**4**
GTB	CRS	DRS	DRS	CRS	CRS	IRS	CRS	CRS	DRS	**5**
FIB	CRS	DRS	CRS	DRS	IRS	IRS	IRS	CRS	IRS	**3**
AGIB	DRS	IRS	CRS	IRS	IRS	CRS	DRS	CRS	IRS	**3**
ICB	IRS	IRS	DRS	IRS	CRS	DRS	IRS	CRS	CRS	**3**
ABL	IRS	CRS	DRS	CRS	CRS	DRS	CRS	CRS	CRS	**6**
EBL	IRS	DRS	DRS	IRS	IRS	CRS	IRS	CRS	DRS	**2**
BSIC	IRS	IRS	CRS	IRS	IRS	CRS	CRS	IRS	IRS	**3**
SKBL	CRS	CRS	CRS	CRS	CRS	CRS	CRS	IRS	CRS	**8**
ZBL	CRS	CRS	CRS	CRS	CRS	CRS	DRS	DRS	CRS	**7**
Count year	**6**	**6**	**6**	**5**	**7**	**6**	**6**	**8**	**5**	**55**

5.8. Discussion on DEA Results

The DEA or CCR and BCC models as a search method allow each bank to use its weight, maximizing efficiency as much as possible against other banks. In this case, banking efficiency is defined as the maximum ratio between weighted outputs and inputs. The DEA results under the assumption of CRS and VRS indicate that GTB is the greatest efficient bank in the Gambia under the intermediation approach. On the contrarily, the result established that BSIC bank is the smallest efficient bank during the research period under the Intermediation approach. This result reflects the operational performance of GTB during the period. On the 5th of March, 2002 GTB was offered a license by CBG to operate full commercial banking activities. Since then, the bank has offered a large scale of commercial

banking services and providing products to individuals, businesses, international institutions, and public sector establishments.[9] GTB in 2009 opens 5 branches nationwide to expand its operational capacity in the country. Also, in the same year, the bank ranked as the second most profitable bank in the Gambia. GTB appeared to be the first bank to deploy Visa card services in the Gambia which attract a lot of customers.

In 2010 GTB become the first bank to offer loan syndication in the Gambian financial market. In the same year, the bank opens 2 more branches in Basse and Bakau to expand its scale of operation in the country. In 2011 the bank received a bank of the year award from the Gambia Chamber of Commerce and Industry (GCCI). In the year 2012 the bank able to open the 3rd branch in Banjul. This increases the bank branches to 16 braches countrywide, in the same year the bank engages in Money Gram transfer to enlarging its serviceability in the country.

Moreover, GTB in 2013 launched the first-ever electronic branch in the Gambia and as a result, it is awarded as the service provider of the year by GCCI. In 2014, the bank became the first bank to introduce master card services, which can use in all its ATM and point of sale terminals. Also, the bank in 2015 successfully launched a mobile banking service, which is the first of its kind in the Gambia. In the same vein, the bank received an award as best internet bank and best commercial bank from UK based Global Banker and financial review (world investment News, 2019)[10]. Due to the above achievement of the bank in a short period, it is obvious to conclude that GTB is deserving of becoming the highest efficient bank in the Gambia. Moreover, figure 5.9 shows that GTB enjoys an increase in total assets, deposits, and loans and advances throughout the study period except the year 2017 due to post political impasse which started in September 2016. Figure 5.9 exhibits the growth of the bank from 2009 to 2017.

[9] http://www.accessgambia.com/information/guaranty-trust.html
[10] http://www.winne.com/gm/company-profiles/guaranty-trust-bank-gambia-ltd

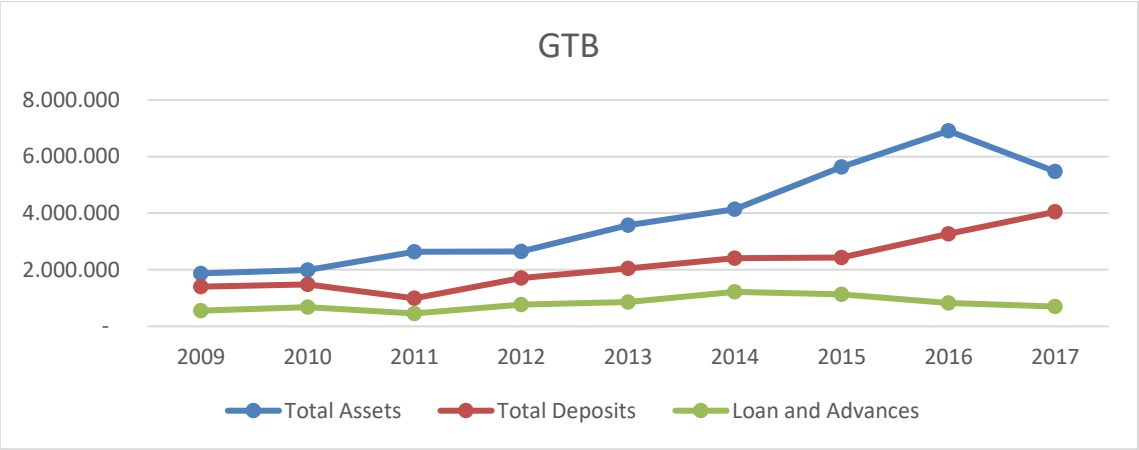


Figure 5.9. GTB Assets, deposit and loan and advances growth from 2009 to 2017.

On the other hand, the results of the DEA have shown that the BSIC bank has achieved a lower technical efficiency based on the intermediary approach. BSIC has its main headquarters in Tripoli, Libya, and stands for the Bank for Investment and Commerce or in French Banque Sahelo-Saherienne Pour L'Investment et Le Commerce[11]. BSIC became the latest commercial bank to operate in the growing banking sector in The Gambia, it started its operation in the Gambia on the 8th of January, 2008. Because the bank is new it could not perform well in the Gambian banking sector which is very competitive during the study period. Therefore, the bank suffers from losses from 2009 to 2012, then realized a notable profit from 2013 to 2017 (Financial Statements). Also, it's observed from the balance sheet of the bank that the total assets, deposits, and loans and advances did not grow much during the period. Thus, for all that is stated above, we can safely conclude that the findings of this research are consistent with the performance of the bank during the period. Figure 5.10 represents the growth of the bank from 2009 to 2017.

[11] http://www.accessgambia.com/information/sahelo-saharienne.html

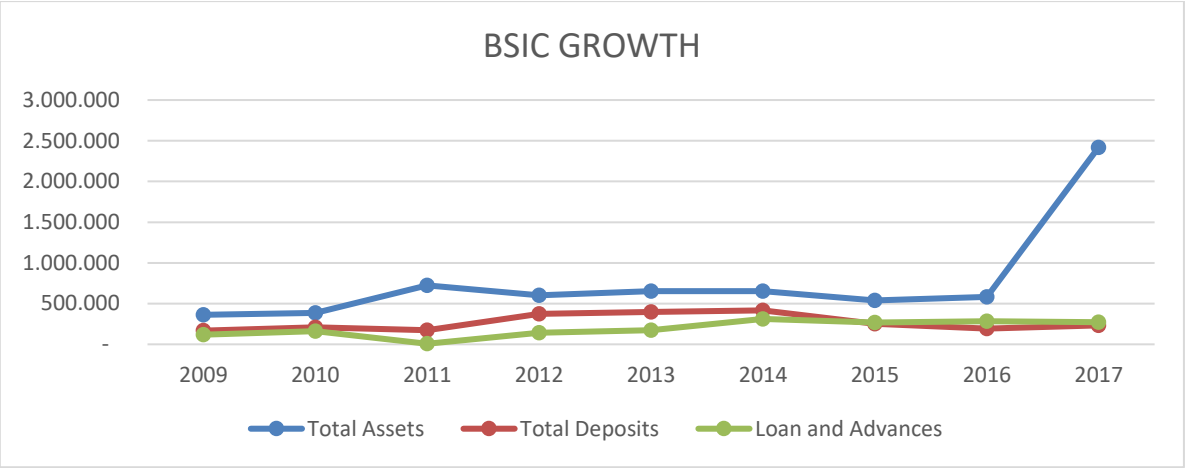


Figure 5.10. BSIC Bank assets, deposits and loan and advances from 2009 -2017.

However, TBL and SCB are the biggest banks with total assets, but they could not reach the highest level of average efficiency. This might depend on their main focuses of business during the study period. Although, TBL was fully efficient from 2009 to 2015 and realized a drop in 2016 and 2017, which might be referred to as the impact of the political impasse in 2016 and post-political impasse in 2017. This is not surprising because TBL is a local ownership bank which is rendering more services to the government and its institutions. Gambian real GDP growth was 4.4 in 2015 and decreased to 2.2 in 2016, then raise to 3.5 in 2017. Thus, TBL may be affected by economic growth fluctuation.

The Standard Chartered Bank (SCB) in The Gambia now has a market share of 55%, of which more than 80% consists of the middle and upper market segments. SCB generated scores greater than 70% of its operating profit and foreign exchange earnings and was honored by the banker in 2007, 2008 and 2009 with the award for the best foreign exchange bank in the Global Finance and three bank awards of the year from the Banker for the past six years. This reveals that the SCB is not focusing heavily on the intermediary approach, which uses deposits to generate loans and advances. Therefore, the bank did not appear to become an efficient bank during the period.

However, SCB became the most efficient bank based on the production approach, which explains that banks are known as institutions that use different resources of labor and capital to offer their customers various products and services. Under the same approach, the result indicates that EBL appeared to be the least efficient bank in the sector over nine years period. This is because EBL started operating in The Gambia in the year 2007 and it could be facing competition challenges to have more share in the market. Although, the bank Profit

before Tax in Gambian Dalasi (GMD) reached GMD 219 million from GMD211 million in 2015, 4% growth over the prior year. Meanwhile, Profit after Tax grew by 3% to GMD151 million from GMD146 million in 2015. Total revenue raised by about 8% to GMD521 million, however, the cost/income ratio deteriorated to 58% from 56% in 2015. The customers' deposits raised from GMD2.3 billion to GMD2.5 billion in 2016, with a 23% increase in the savings portfolio. While, Loans and Advances declined to GMD435 million in 2016 from GMD489 million the previous year on account of their selective lending strategy (ECOBNAK AR, 2016).

5.9. The Influence of Factors that Determine the Efficiency of Commercial Banks in the Gambia

5.9.1. Second Stage DEA

5.9.1.1. Intermediation and Production Approach

Descriptive Analysis

Table 5.16 and Table 5.17 exhibit the descriptive statistics of the dependent and independent variables of the study for both the intermediation and production approach. As noted from the tables, the dependent variables of the research are TE, PTE, and SE scores, which were obtained from the first stage DEA analysis under intermediation and production approach. However, the independent variables are internal and external factors that affect the efficiency level of commercial banks. The internal factors are Profitability, measured by Return on Equity (ROE) or Net operating income to Equity, market power (MP), measured by banks deposit over total industry deposits, Size of the bank, measured by Logarithm of total assets of the bank, Liquidity, measured by Total loans over total assets (TL_TA), Capital adequacy, measured by Equity over total assets (EQ_TA), earning, measured by interest income over total assets (II_TA). While the external factors are Gross Domestic Products (GDP) and inflation obtained from the World Bank database. The explanation of dependent and independent variables was discussed in chapter four table 4.16 and 4.17.

Table 5.16. Descriptive statistics: Dependent variables (DV) and independent variables (IV). Intermediation approach.

	N	Minimum	Maximum	Mean	Std. Deviation
TE	108	.0800	1.0000	.760454	.2837358
PTE	108	.2380	1.0000	.881593	.1984343
SE	108	.0970	1.0000	.841704	.2152538
ROE	108	-.5417	1.2575	.127766	.2839046
MP	108	.0010	.2810	.076980	.0732630
SIZE	108	209,943.3	6,908,404.0	1,963,691.910	1,746,365.3837
TL_TA	108	.0091	1.0257	.254558	.1754658
EQ_TA	108	.0307	.8206	.247458	.1885384
II_TA	108	.0154	.3709	.089800	.0506314
GDP	108	-4.2951	6.5263	3.580059	3.3266496
INF	108	4.2545	6.8083	5.214418	.7840180
Valid N (listwise)	108				

Table 5.17. Descriptive statistics: Dependent variables (DV) and independent variables (IV), production approach.

	N	Minimum	Maximum	Mean	Std. Deviation
TE	108	.2190	1.0000	.864685	.1853322
PTE	108	.3010	1.0000	.931296	.1478349
SE	108	.4590	1.0000	.925148	.1182104
ROE	108	-.5417	1.2575	.133771	.2831225
MP	108	.0010	.2810	.076980	.0732630
SIZE	108	209,943.3	6,908,404.0	1,963,691.910	1,746,365.3837
TL_TA	108	.0091	1.0257	.254558	.1754658
EQ_TA	108	.0307	.8206	.247458	.1885384
II_TA	108	.0154	.3709	.089800	.0506314
GDP	108	-4.2951	6.5263	3.580059	3.3266496
INF	108	4.2545	6.8083	5.214418	.7840180
Valid N (listwise)	108				

To define the influence of internal and external bank factors on the technical efficiency measures of CBs in The Gambia, further important tests ha*ve to be c*arried out, e.g. the multicollinearity test for independent variables to identify the results of a valid and reliable linear regression, which eventually will relate the dependent variable with the independent variables.

5.9.2. Test of Multicollinearity

Multicollinearity tests describe whether or not the model variables utilized are strongly related (Pallant, 2001). also, as stated by (Afifi, Clark, & May, 2004) If the variables seem to be largely associated, the regression coefficient estimates are considered to be unsteady and inaccurate due to high standard errors. Table 5.18 exhibits the correlation form for the independent variables employing Pearson's bivariate correlation. Table 5.18 displays that market power and bank size seem to be strongly correlated to 0.815. According to (De Vaus, 2002) A high association leads to multicollinearity problems. In general, multicollinearity occurs if the independent variables are highly correlated, which can lead to an unstable correlation model. In other words: "Multicollinearity" happens when the independent variables are strongly correlated (r = 0.9 and more). Singularity happens when an independent variable is a mixture of other independent variables, i.e. if the partial ratings of the scale and the overall rating of a scale are comprised (Pallant, 2007) (Pallant, 2007). However, the problems resulting from multicollinearity must be solved to obtain a reliable and steady regression estimate, significant levels, and a level of confidence (De Vaus, 2000). In this research, the matrix shows that the correlation between bank-specific variables is generally not strong, which means that the problems of multicollinearity are not serious or nonexistent. According to Kennedy (2008) and (De Vaus, 2002) multicollinearity is a problem if the correlation is exceeded 0.90, which is not the case here. Table 5.18 exhibits the Multicollinearity test for independent variables of the study.

Table 5.18. Multicollinearity test- bivariate person correlation.

	ROE	MP	LSIZE	TL_TA	EQ_TA	II_TA	GDP	INF
ROE	1.000							
MP	0.735**	1.000						
LSIZE	0.618	0.815**	1.000					
TL_TA	-0.028	-0.073	-0.230**	1.000				
EQ_TA	-0.662**	-0.682**	-0.783**	0.062	1.000			
II_TA	0.458**	0.143	0.001	0.283**	-0.103	1.000		
GDP	0.032	-0.069	-0.116	-0.003	0.000	-0.030	1.000	
INF	-0.035	0.023	0.207*	-0.201*	-0.114	-0.002	-0.320**	1.000

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

In addition, multicollinearity problems can be described using collinearity diagnostic tests as part of the multiple regression process. This test can solve unknown multicollinearity problems in the correlation matrix (Pallant, 2007). These are the two values given in this

case, namely the tolerance and variance inflation factor (VIF). As stated by Pallant (2007), "tolerance is an indication of the number of independent variables determined by the other independent variables in the model and calculated using the quadratic formula l-R for each variable. When this value is very small (less than 0.10), this indicates that many correlations with other variables are high, which indicates multicollinearity. Another value is the VIF (variance inflation factor), which is opposite to the tolerance value (1 divided by tolerance)."In other words, high multiculturality is known when the VIF is less than 10.0.of 0.10 and the VIF value does not exceed 10.0.This research used VIF values greater than 10 to indicate multicollinearity". The results in Table 5.19 illustrates that neither tolerance nor VIF violates the multicollinearity rule since the tolerance value for all variables is greater than 0.10 and the VIF value does not exceed 10.0. So we can conclude that the multicollinearity hypothesis has not been violated. According to (Yizhe Dong, 2010) there can be multicollinearity between the independent variables, which can lead to inconsistent parameter estimates. However, multicollinearity may not be a serious problem if the efficiency values are used for estimation purposes only.

Table 5.19. Multicollinearity test – tolerance and variance inflation factor (VIF)

Variables	Collinearity Statistics	
	Tolerance	VIF
ROE	.203	4.922
MP	.184	5.444
SIZE	.188	5.326
TL_TA	.713	1.402
EQ_TA	.406	2.465
II_TA	.515	1.943
GDP	.858	1.165
INF	.729	1.372

Dependent Variable: OTE

The study conducts the Linear Regression estimate in the next section using E-Views 8.0 with the Tobit regression model. In this second step, the efficiency values obtained from the analysis of the first step are then traced back to some bank characteristics and macroeconomic factors. Tobit regression is used because the efficiency values are limited between 0 and 1. The study should, therefore, use the Tobit regression model. The normal Tobit model adopted from (Sufian & Noor, 2009) can be defined for the bank as follows$i$:

$$y_i^* = \beta' \chi_i + \varepsilon_{i,} \, y_i^* = y_i \; if \; y_i^* \geq 0 \; and \; y_i = 0, otherwise \; 1 \qquad (1)$$

Where $\varepsilon_{i\sim}N(0,\sigma^2), x_i$ and β are courses of explanatory variables and indefinite parameters, respectively, while y_i^* is an underlying variable and y_i is the efficiency score, obtained from ith bank from DEA model.

Using the efficiency values as a dependent variable, we estimate the following regression model with the statistical software "Eviews 8":

$$BANKEF_{jt} = \alpha + \beta_1 \sum Bank_CHaracteristics \quad (2)$$

Where, $BANKEFF_{jt}$ is the technical efficiency of j^{th} bank in t period gained from the DEA model, Bank _Characteristics is a display of bank-specific aspects of variables.

5.9.3 Linear Regression

When interpreting the regression output, special elements must be considered, namely the trend of the cause of the independent variable and not the size change that the independent variable would cause in the direction of the dependent variable (G. S. P. Singh, 2009). Saxonhouse (1976) noted heteroscedasticity can appear when utilizing parameters estimated as dependent variables in the second-level analysis. However, in this study, Tobit's regression method was employed to measure the relationship between banking efficiency and explanatory variables illustrated in the results table. Tobit regression is useful when the dependent variables are constrained by a specific constraint that is consistent with this study. The DEA efficiency measures obtained in the first step are then executed as dependent variables with the restricted range (0, 1). The study chose Tobit regression rather than the Ordinary Lease Square (OLS) because the OLS estimate would lead to distorted results for the efficiency parameter since normality and a homoscedastic distribution of the error term are assumed (Jackson and Fethi, 2000), while Tobit Regression does not follow these conditions.

Furthermore, a positive and significant coefficient of the independent variable shows an increase in efficiency as these variables increase, while a negative coefficient demonstrates an association with a decrease in efficiency. The regression results are significant at 95% or more. The sample included 108 observations for 12 commercial banks in The Gambia for nine years from 2009 to 2017. The independent variables in this study are profitability (measured as return on equity) and market power (measured as the ratio of bank

deposits to total deposits in the banking sector), the size of the bank (as a natural logarithm of total assets). The other independent variables are TL_TA (total loan to total assets), EQ_TA (equity on total assets), II_TA (interest income on total assets), GDP (gross domestic product), and INF (inflation). (See table 4.5). The following section explains the relationship between the dependent variable and the independent variables in the study.

Dependent Variable: Technical Efficiency Under the Intermediation Approach

Table 5.20 reveals the Tobit Regression results, where the dependent variable is TE scores obtained from the first stage of the study. Under the intermediation approach, the results in table 5.20 indicate that ROE is positive and significantly related to TE, while MP is positive but insignificant. This indicates that ROE will increase the TE in a positive direction. On the other hand, the findings reveal that Size, EQ_TA, and II_TA have a negative and significant coefficient relationship with TE measures. This means Bank Size, EQ_TA, and II_TA will increase TE in the negative curve dimension. Also, TL_TA, GDP, and INF are negative but insignificant related to TE measures. This suggests that the ROE only has a greater influence on the technical efficiency of the commercial banks in The Gambia.

Table 5.20. Dependent variable of technical efficiency: Intermediation approach

Dependent Variable: TE
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Included observations: 108

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	4.513176	0.931829	4.843350	0.0000
ROE	**0.327822**	**0.134395**	**2.439248**	**0.0147****
MP	0.253513	0.672858	0.376771	0.7063
LSIZE	**-0.228535**	**0.065503**	**-3.488910**	**0.0005*****
TL_TA	-0.161492	0.160514	-1.006095	0.3144
EQ_TA	**-0.736222**	**0.218400**	**-3.370978**	**0.0007*****
II_TA	**-1.046682**	**0.543064**	**-1.927365**	**0.0539****
GDP	-0.009690	0.007941	-1.220248	0.2224
INF	-0.045165	0.035316	-1.278883	0.2009
	Error Distribution			
SCALE:C(10)	0.254412	0.017311	14.69694	0.0000
Mean dependent var	0.760454	S.D. dependent var		0.283736
S.E. of regression	0.267121	Akaike info criterion		0.285461

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

Dependent Variable: Pure Technical Efficiency Under Intermediation Approach

Table 5.21 shows the results of the Tobit regression on the effect of the independent variables on the PTE. In the context of the intermediation approach, the results show that ROE is significantly and positively associated with PTE, while INF is positive but not significant. The results also show that SIZE and EQ_TA are significantly and negatively associated with PTE, while MP, TL_TA, and GDP are not significantly and negatively associated with PTE.

Table 5.21. Dependent variable: Pure technical efficiency; Intermediation approach.

Dependent Variable: PTE
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Included observations: 108

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	3.886236	0.631447	6.154492	0.0000
ROE	**0.260076**	**0.091072**	**2.855733**	**0.0043*** **
MP	-0.154069	0.455957	-0.337902	0.7354
LSIZE	**-0.200064**	**0.044388**	**-4.507173**	**0.0000*** **
TL_TA	-0.123467	0.108771	-1.135108	0.2563
EQ_TA	**-0.599664**	**0.147997**	**-4.051862**	**0.0001*** **
II_TA	-0.328664	0.368003	-0.893100	0.3718
GDP	-0.001565	0.005381	-0.290797	0.7712
INF	0.002604	0.023932	0.108808	0.9134
Error Distribution				
SCALE:C(10)	0.172400	0.011730	14.69694	0.0000
Mean dependent var	0.881593	S.D. dependent var		0.198434
S.E. of regression	0.180983	Akaike info criterion		-0.492810

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

Dependent Variable: Scale Efficiency

Table 5.22 exhibits the Tobit regression results of the independent variable on SE, under the intermediation approach. The results demonstrate that ROE and MP are positive and insignificantly related to SE, while TL_TA and GDP are insignificant and negatively associated with SE. Meanwhile, SIZE EQ_TA, II_TA, and INF are negative and significantly related to SE.

Table 5.22. Dependent variable: Scale efficiency intermediation approach.

Dependent Variable: SE
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Included observations: 108

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.499556	0.724774	3.448739	0.0006
ROE	0.156782	0.104532	1.499848	0.1337
MP	0.273524	0.523347	0.522644	0.6012
LSIZE	**-0.083621**	**0.050948**	**-1.641295**	**0.1007***
TL_TA	-0.067300	0.124847	-0.539059	0.5898
EQ_TA	**-0.349780**	**0.169871**	**-2.059091**	**0.0395****
II_TA	**-0.926788**	**0.422393**	**-2.194136**	**0.0282****
GDP	-0.009411	0.006177	-1.523579	0.1276
INF	**-0.057093**	**0.027469**	**-2.078490**	**0.0377****
	Error Distribution			
SCALE:C(10)	0.197881	0.013464	14.69694	0.0000
Mean dependent var	0.841704	S.D. dependent var		0.215254
S.E. of regression	0.207732	Akaike info criterion		-0.217118

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

Dependent Variable: Technical Efficiency Under Production Approach

Table 5, 23 displays Tobit regression results on the relationship between independent variables and technical efficiency scores, under the production approach. The results reveal a positive and significant coefficient of MP and II_TA with TE scores, while GDP and INF are positive and insignificant related to TE, implying that the banks with more market share and high earning have higher technical efficiency scores. On the contrary, the results show that SIZE and TL_TA are significant and negatively associated with TE scores, while ROE and EQ_TA are negative insignificantly related to TE.

Table 5.23. Dependent variable: Technical efficiency; Production approach.

Dependent Variable: TE
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Included observations: 108

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.865596	0.627894	2.971195	0.0030
ROE	-0.014719	0.091490	-0.160876	0.8722
MP	**0.826325**	**0.453954**	**1.820285**	**0.0687***
LSIZE	**-0.083197**	**0.044159**	**-1.884020**	**0.0596****
TL_TA	**-0.189142**	**0.108062**	**-1.750317**	**0.0801***
EQ_TA	-0.005519	0.147033	-0.037538	0.9701
II_TA	**0.925087**	**0.363439**	**2.545375**	**0.0109****
GDP	0.007841	0.005349	1.466044	0.1426
INF	0.009676	0.023784	0.406824	0.6841
	Error Distribution			
SCALE:C(10)	0.171292	0.011655	14.69694	0.0000
Mean dependent var	0.864685	S.D. dependent var		0.185332
S.E. of regression	0.179819	Akaike info criterion		-0.505707

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

Dependent Variable: Pure Technical Efficiency Under Production Approach

Table 5.24 shows the Tobit regression statistics for the independent variables for PET. In the production approach, the results show that MP and II_TA have a significant and positive relationship with PTE, while ROE, EQ_TA, GDP, and INF have an insignificant positive association with PTE. On the other hand, the result shows that SIZE has a negative and significant relationship with the PTE values, while TL_TA is negative and insignificant concerning PTE.

Table 5.24. Dependent variable: Pure technical efficiency; Production approach.

Dependent Variable: PTE
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Included observations: 108

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.877704	0.490866	3.825289	0.0001
ROE	0.043685	0.072255	0.604597	0.5454
MP	**0.759546**	**0.364490**	**2.083856**	**0.0372****
LSIZE	**-0.064348**	**0.035056**	**-1.835586**	**0.0664***
TL_TA	-0.091473	0.084248	-1.085755	0.2776
EQ_TA	0.018310	0.117574	0.155730	0.8762
II_TA	**0.064386**	**0.028321**	**2.273429**	**0.0230****
GDP	0.001667	0.004289	0.388624	0.6976
INF	0.014094	0.019044	0.740086	0.4592
	Error Distribution			
SCALE:C(10)	0.137374	0.009347	14.69694	0.0000
Mean dependent var	0.931296	S.D. dependent var		0.147835
S.E. of regression	0.144213	Akaike info criterion		-0.947031

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

Dependent Variable: Scale Efficiency Under Production Approach

Table 5.25 shows the regression results of the independent variable on SE under the production approach. The results demonstrate that II_TA and GDP are positive and significantly associated with SE, while MP is positive and insignificant related to SE. Contrarily, the findings in the table highlighted that TL_TA is negative and significantly related to SE, while ROE, SIZE, EQ_TA, and INF show a negative and insignificant association with SE scores.

Table 5.25. Dependent variable: Scale efficiency; Production approach.

Dependent Variable: SE
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)
Included observations: 108

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.639370	0.515090	3.182685	0.0015
ROE	-0.060961	0.051673	-1.179748	0.2381
MP	0.017951	0.030036	0.597649	0.5501
LSIZE	-0.035781	0.034244	-1.044871	0.2961
TL_TA	**-0.041127**	**0.016200**	**-2.538688**	**0.0111****
EQ_TA	-0.038303	0.094818	-0.403966	0.6862
II_TA	**0.079241**	**0.022670**	**3.495459**	**0.0005*****
GDP	**0.005689**	**0.003384**	**1.681008**	**0.0928***
INF	-0.004654	0.015337	-0.303451	0.7615
	Error Distribution			
SCALE:C(10)	0.106266	0.007230	14.69694	0.0000
Mean dependent var	0.925148	S.D. dependent var		0.118210
S.E. of regression	0.111556	Akaike info criterion		-1.460556

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

5.10. Hypotheses Test: Under Intermediation Approach

Table 5.26 contains the expected results and the summary of the results of the linear regression. The hypotheses tested here are internal (bank-specific) and external (macro-economic) factors. Internal factors are: Profitability, measured as return on equity ROE, Market Power, measured as banks Profitability (ROE), Market Power, measured as bank's total deposit to total deposits of banking industry, Bank Size, measured as natural logarithm of total assets, Total Loan over Total Assets (TL_TA) as a proxy for Liquidity ratio, Equity over Total Assets (EQ_TA) as proxy for Capital adequacy, and Interest Income to Total Asset (II_TA) as proxy for Earnings. While external factors are: GDP placed for Gross Domestic Product, and INF placed for Inflation.

Table 5.26. Directional signs and results of linear regression: Intermediation approach.

Hypotheses	Expected Sign	Study Results and the Efficiency Levels			Hypotheses Test
		TE	PTE	SE	
H1: There is a significant positive relationship between bank profitability (ROE) and OTE.	+	+**	+**	+	FAILED TO REJECT
H2: There is a significant positive/negative relationship between Market Power and OTE.	+/_	+	-	+	REJECTED
H3: There is a significant positive/negative relationship between bank SIZE and OTE.	+/_	-***	-***	-*	FAILED TO REJECT
H4: There is a significant positive/negative relationship between liquidity (TL_TA) ratio and OTE.	+/_	-	-	-	REJECTED
H5: There is a significant positive/negative relationship between Capital adequacy ratio (EQ_TA) and OTE.	+/_	-***	-***	-***	FAILED TO REJECT
H6: There is a significant positive relationship between Earning ratio(II_TA) and OTE	+	-**	-	-**	REJECTED
H7: There is a significant positive relationship between GDP and OTE	+	-	-	-	REJECTED
H8: There is a significant positive/negative relationship between inflation and OTE	+/_	-	+	-**	REJECTED

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

5.10.1. Discussion on Hypothesis Results: Intermediation Approach

Hypothesis 1 in this study indicates that there is a significant positive relationship between bank profitability and overall technical efficiency OTE. The profitability was measured by return on equity ROE. Under the intermediation approach, the regression results show that ROE has a significant and positive relationship with OTE, yet has a positive insignificant relationship with SE. In general, the study can conclude that the regression results are relatively supported by hypothesis 1. This implied that bank profitability (ROE) is an important factor that drives the variation in efficiency scores and that the profitable banks seem to be more efficient than non-profitable banks. Therefore, we can fairly state

that profitability is among the leading internal factors that influence the efficiency of commercial banks in the Gambia.

In the literature, bank profitability had a positive and significant connection with measures of efficiency. Traditional Neoclassical trading theory also assumes that companies operate in a highly competitive market. In this market, all companies strive to maximize profits, maximize sales, and minimize costs. According to the theory, the relationship between profitability and efficiency must be positive. Therefore, this study also predicted a positive relationship between profits and OTE. Darrat et al. (2002) establish that the profits were significantly positive for OTE. Ahmad and Noor (2011) indicate a positive relationship between bank profitability and TE level. Miller and Noulas (1996) show that bank profitability is significant and positively related to the PTE level.

Hypothesis 2 indicates that there is a significant positive/negative relationship between Market Power and OTE. This assumption is based on Ex-efficiency theory which stated that the better the market power of the bank or market concentration (shares) of the bank the better its efficiency level (Zouari, 2010). On the other hand, the "quiet life" hypothesis assumes that market power or concentration has a negative impact on efficiency measures (Y. Dong, 2010). However, the regression results of this study reveal an insignificant positive correlation between MP ratios in terms of TE and SE, yet there is an insignificant negative relationship between MP and PTE. Therefore, the results rejected hypothesis 2 of this study which indicated that there is a significant positive relationship between MP and OTE. This implies that MP does not seem to have an influence on OTE measures of the commercial banks in the Gambia. The intuition of these results could refer to the fact that the prices charged by banks for their services and other activities are largely managed by the government. Banks have limited opportunities to exercise market power by paying lower deposit rates and / or even using higher interest rates. Thus, they do not appear to have many opportunities to use a concerted structure of the market (Fu & Heffernan, 2009).

Meanwhile, this finding is not consistent with other studies. For instance, Sathye (2001) and Maghyereh (2004) revealed that market power has a significant negative impact on overall technical efficiency. Zamil (2007) also found a significant and negative correlation between market power and efficiency measures.

Hypothesis 3 indicates that there is a significant positive/negative relationship between bank SIZE and OTE. This assumption is supported by the X-efficiency theory, which has shown that the variance in performance between two companies is not due to variances in management quality, but to variances in the efficiency of scale (Size). Similarly, The shakeout theory shows that small banks may not be able to raise enough capital and management to operate in complex environments that require frequent technological updates, which show a positive relationship between size and efficiency (Isik, 2006). However, the empirical results of this study indicate that bank size is significant and negatively affects OTE. This suggests that as banks become smaller, banks become more efficient. Therefore, the case of Gambia's commercial banks does not support the size of the bank, and the argument is that the bigger the bank, the more efficient it becomes. This finding is inconsistent with some studies of efficacy in developed and non-developed countries i.e (Darrat et al., 2002; Isik & Hassan, 2002; Isik & Hassan, 2003; Katib, 1999 and Guan & Randhawa, 2005) found a positive relationship between size and efficiency measures. While, Alrafadi, Kamaruddin, and Yusuf (2014), found that bank size, mergers, and ownership structure had a negative and significant impact on overall technical efficiency. Berger et al. (1987) have shown that banks have size differences that had a negative influence on performance. This indicates that the size of the banks is an important internal factor causing the variation in efficiency values and that the big banks do not seem to be more efficient based on intermediary approach than the small banks in the Gambian banking sector.

Hypothesis 4 indicates that there is a significant positive/negative relationship between liquidity (TL_TA) ratio and OTE. The regression findings highlight that the TL_TA is negative and insignificantly associated with OTE in all aspects, which is not consistent with the expected hypothesis of the study. This indicated that bank liquidity is not an important internal factor that drives the variation in efficiency scores of the banking sector in the Gambia. Meaning that increasing or decreasing the ratio of liquid assets to that of deposits of the banks doesn’t improve the efficiency scores, which is consistent with the finding of (Xiaofeng & Sun, 2013). This finding is not consistent with some literature reviews. For an instant, Niazi (2003) established that earning, management soundness and profitability, and liquidity & sensitivity to market risk had a positive and significant influence on efficiency scores. Sufian (2010) found that TL_TA is positively related to efficiency scores. Onen & Tunik (2017) found that banks with higher TL_TA ratios tend to be more efficient in the Turkish banking sector under the intermediation approach. Alemu

& Aweke (2017) showed that asset quality, management efficiency, earning ability, and liquidity were the key drivers of efficiency for private commercial banks in Ethiopia.

Hypothesis 5 exhibits that there is a significant positive/negative relationship between capital adequacy ratios (EQ_TA) and OTE. EQ_TA is a measure of capitalization, calculated as equity to total assets. The concept of a positive relationship between EQ_TA and efficiency measures is driven from the fact that well-capitalized banks are more technically efficient, and the higher the equity to total asset ratio, the lower the need to external funding and therefore the higher the efficiency of the bank, thus the expected sign of EQ_TA with bank efficiency is positive (Isik and Hassan 2003). This idea is supported by previous studies. Tecles and Tabak (2010) found a positive relationship between the degree of capitalization and bank efficiency. Naceur et al. (2009) found that highly capitalized banks, greater liquidity, and stock market developments increase bank efficiency. Banna (2017) established that crises related to bank size, capital adequacy ratio, the average return on equity, and real interest rates had a significant impact on bank efficiency in Bangladesh.

However, the regression results of this study demonstrate that there is a significant negative relationship between capital adequacy EQ_TA and OTE. The results show that both TE and PTE are significant at 1% while SE is significant at a 5% level. Therefore, this study supported the theory that stated that there is a negative relationship between capital adequacy and overall technical efficiency. This indicates that banks with lower EQ_TA capital adequacy ratios are less efficient because they avoid risk and prefer safer, lower-income portfolios and banks with higher capital adequacy ratios are less efficient than other banks with lower capital adequacy ratio of the Gambia banking industry. This finding is consistent with some prior studies that find similar results; for instant, Fethi & Jackson,(2000) found that the capital adequacy ratio has a statistically significant negative effect on the performance of Turkish banks. Yayar and Karaca (2014) found that the capital adequacy ratio and some branches have a negative effect on the efficiency of the Turkish banking sector.

Hypothesis 6. Suggests that there is a significant positive relationship between earnings ratio and OTE. The earning is measured by interest income to total assets II_TA shows the ability of the bank to lower interest on deposits and maintain interest on loans and advances higher. Therefore, II_TA is an important factor to measure a bank's core income.

The higher this ratio the better the bank earnings from total assets (Bhatia & Mahendru, 2015) under the intermediation approach. The Tobit regression results reveal that there is a significant negative relationship between II_TA and OTE. This indicates that interest income to total assets does not seem to be an important factor that influences the efficiency level of commercial banks in the Gambia. This result is totally against the null hypothesis of this study and previous literature. Niazi (2003)shows that profitability, profitability, and liquidity and sensitivity to market risk have significant positive and effects on efficiency. Burki and Niazi (2010) show that the ratio of productive assets to total assets linked, loan/asset ratio, and asset size are positively related to all measures of efficiency. Nonetheless, this study is consistent with several studies, namely Sharma et al. (2012)who reveal that banking diversification practices have a negative and significant impact on bank efficiency.

Hypothesis 7 revealed that there is a significant positive relationship between GDP and OTE under the intermediation approach. The results from the Tobit regression analysis highlighted that there is an insignificant negative relationship between GDP and OTE, indicating that GDP is not a significant external factor that determines the efficiency level of the commercial banks in the Gambia. This result is consistent with some previous studies indicated a negative relationship between GDP and OTE. For instance; Pasiouras, et al. (2007) found the size of the bank had a positive impact while GDP per capita had negatively and substantially affected all measures of efficiency. Adjei-Frimpong, et al. (2014) GDP found that the growth rate negatively affected bank cost efficiency. Hassan and Sanchez (2007) assumed the difficulty of predicting efficiency direction as the economy grows. They added that the response capacity was slow. Karimu Tossa, (2016) shows that Inflation and GPDPC have a significant negative impact on CRS TE in Model 1 and VRS TE in Model 3 and Model 4.

Hypothesis 8 indicates that there is a significant positive/negative relationship between inflation and OTE. The regression results demonstrate that there is an insignificant negative relationship between inflation and OTE yet significant with SE at level 05. Therefore, we can conclude that this result inconsistent with hypothesis 8, implying that inflation is not an important factor that affects the efficiency level of commercial banks in the Gambia. This finding is similar to some of the literature review, for instant Karimu Tossa, (2016) shows that Inflation and GPDPC have a significant negative impact on CRS TE in Model 1 and VRS TE in Model 3 and Model 4. Khan, et al. (2001) found that inflation

is negative and significantly delays the growth and efficiency of the financial sector. Kosmidou,(2008) shows that inflation has a significant negative impact on the performance of Greek banks during the period of EU financial integration (1990-2002). Perry (1992) shows that the effect of inflation on bank performance depends on whether or not inflation is expected. In the previous case, interest rates were adjusted to generate income, which increased faster than costs, with a positive effect on efficiency. In the latter case, banks may be slow to adjust their interest rates, resulting in higher bank costs than bank revenues, which in turn negatively impact bank efficiency.

5.11. Hypotheses Test: Under Production Approach

Table 5.27 exhibits the predicted scores and a summary of the Linear Regression findings. The study in this section tested the hypotheses, which are internal (banks specific characteristics) and external (macroeconomic) factors.

Table 5.27. Directional signs and results of linear regression: production approach.

Hypotheses	**Expected Sign**	**Study Results and the Efficiency Levels**			**Hypotheses Test**
		TE	**PTE**	**SE**	
H1: There is a significant positive relationship between bank Profitability (ROE) and OTE.	+	-	+	-	REJECTED
H2: There is a significant positive/negative relationship between Market Power and OTE.	+/_	+*	+**	+	FAILED TO REJECT
H3: There is a significant positive/negative relationship between bank SIZE and OTE.	+/_	-**	-*	-	FAILED TO REJECT
H4: There is a significant positive/negative relationship between the Liquidity (TL_TA) ratio and OTE.	+/_	-*	-	-**	FAILED TO REJECT
H5: There is a significant positive/negative relationship between Capital Adequacy ratio (EQ_TA) and OTE	+/_	-	+	-	REJECTED
H6: There is a significant positive relationship between Earning ratio(II_TA) and OTE	+	+*	+**	+***	FAILED TO REJECT
H7: There is a significant positive relationship between GDP and OTE	+	+	+	+*	FAILED TO REJECT
H8: There is a significant positive/negative relationship between Inflation and OTE	+/_	+	+	-	REJECTED

Notes: ***, **, * indicates significance at 0.01, 0.05, and 0.10 levels respectively

5.11.1. Discussion on Hypothesis Results: Production Approach

Hypothesis 1 of this study shows that there is a positive significant correlation between bank profitability and OTE. Profit is measured by ROE. Under the production approach, the regression results demonstrate that ROE has an insignificant negative relationship with OTE, nonetheless, ROE has a positive relationship with PTE. In general, the study can be concluded that the regression results are not relatively supported by hypothesis 1, this implies that ROE is not an important factor that drives the variation in efficiency scores under the production approach.

Bank profitability in the literature has a positive and significant correlation with measures of efficiency. Based on the conventional neoclassical theory, the correlation between profitability and efficiency measures is considered positive. Therefore, these results are not consistent with some prior studies, until recently, Darrat et al (2002) found that profits were very positive to OTE. Ahmad and Noor (2011) found a positive correlation between bank profitability and level of TE. Miller and Noulas (1996) illustrated that bank profitability is strongly related to the level of PET.

Hypothesis 2 indicates that there is a significant positive relationship between market power and OTE. This assumption is based on Ex-efficiency theory which stated that the better the market power of the bank or market concentration (shares) of the bank the better its efficiency level (Zouari, 2010). On the other hand, the “quiet life” hypothesis proposes that the power of the market or market concentration is negatively linked to efficiency measures (Y. Dong, 2010). Under the production approach, the Tobit regression results of this study established that there is a positive and significant correlation between MP ratios and OTE. Therefore, the results supported the hypothesis 2 of this study. This shows that under the production approach MP seems to have an influence on OTE measures of commercial banks in the Gambia. This study is consistent with other studies. For example, Darrat et al. (2002) show that strong markets in the Kuwaiti banking sector led to significant profit growth. Grigorion and Manole (2002) show that banks with larger market shares in some countries tend to be more efficient. Katib (1999) found that market strength in Malaysia is significantly and positively linked to TE. Miller and Noulas (1996) performed a regression analysis to determine the effect of bank size, profitability, market strength, and location on efficiency. They demonstrate a significant positive relationship between bank efficiency and size, profitability, and market strength of the localization dummy.

Hypothesis 3 shows that there is a significant positive/negative relationship between the size of the bank and the OTE. This expectation is supported by X-efficiency theory that shows that the performance differences between the two companies were not due to differences in management quality, but rather to differences in scale efficiency (size). Likewise, the shakeout theory, which suggests that small banks may not be able to raise enough capital and management to operate successfully in a complex environment that requires frequent technological updates, suggesting a positive association between size and efficiency (Isik, 2006). Nonetheless, the empirical findings of the regression analysis in this research show that the size of the bank is significantly and negatively related to OTE, although it is not significantly correlated with SE, which implies that when the size increases there will be a decrease in the efficiency curve. This indicates that the size of the bank is an important internal factor that determines the variation in efficiency values. The smaller the bank, the more efficient the bank will be in the Gambian banking sector based on the production approach. On the other hand, small banks compete with big banks mainly in the metropolitan markets and not in the rural markets. Strong competition could have given small banks more market discipline and better profitability (Isik & Hassan, 2002). These findings confirm the fact that the Gambia is a small country, thus increasing the number of banks will lead to a reduction in their efficiency level. The negative relationship between bank size and efficiency scores found in some prior literature reviews, such as (Darrat et al., 2002; Isik & Hassan, 2002; Isik & Hassan, 2003; Katib, 1999 and Guan & Randhawa, 2005). Jackson & Fethi, (2000) found that the number of branches and the second proxy for bank size yields a negative and insignificant coefficient.

Hypothesis 4 reveals that there is a significant positive/negative relationship between liquidity (TL_TA) ratio and OTE. Bank liquidity is measured by total loan over total assets, and it indicates a bank's loans strength. Higher figures denote lower liquidity. If the bank fails to meet its obligations, the bank will eventually fail. Therefore, to avoid bankruptcy, banks often keep liquid assets, which can be easily converted into cash. However, liquid assets are generally associated with lower rates of return. Therefore, the expected increase in liquidity will be associated with lower profitability (Kosmidou, 2008). The regression results indicate that the TL_TA is negative and significantly associated with both TE and SE but insignificant with PTE, which is consistent with the expected hypothesis of the study. This indicated that bank liquidity (TL_TA) is moving in an inverse direction with OTE, shows that TL_TA is a key factor behind the variation in the banking sector's efficiency

score in the Gambia. This finding is consistent with some literature reviews. For instant, Fernandes et al. (2018) indicate that liquidity and credit risk were found be to negatively affect bank productivity while capital and profit risk had a positive effect on their performance. Elsiefy,(2013) established that bank liquidity had a negative effect on Islamic banks' profitability Banks. Said & Tumin,(2011) show no association between liquidity levels and the performance of banks in the case of both China and Malaysia.

Hypothesis 5 exhibits that there is a significant positive/negative relationship between capital adequacy ratios (EQ_TA) and OTE. EQ_TA is a measure of capitalization, calculated as equity to total assets. The idea of a positive relationship between EQ_TA capital adequacy and efficiency measures is driven by the fact that banks are financially efficient, leading to EQ_TA bank efficiency (Isik and Hassan 2003). The regression results show that there is a negative relationship between EQ_TA and OTE, This indicates that capital adequacy is not an important factor that drives efficiency measures in the Gambian banking sector under the production approach. This finding is inconsistent with some previous studies. Tecles and Tabak (2010) found a positive association between bank capitalization level and efficiency. Naceur et al. (2009) found that large capital, high liquidity, and a growing equity market bank improved bank efficiency. Banna, (2017) found that the crisis of bank size, capital adequacy ratio, the average return on equity, and real interest rate have a significant impact on the efficiency of banks in Bangladesh. Nonetheless, some studies have found a negative correlation between capital adequacy EQ_TA and OTE. For example, Jackson and Fethi (2000) found that the capital adequacy ratio has a statistically significant negative effect on the performance of Turkish banks. Yayar and Karaca (2014) found that the capital adequacy ratio and the number of branches have a negative effect on the efficiency of the Turkish banking sector.

Hypothesis 6. Indicates that there is a significant positive relationship between Earning ratio (II_TA) and OTE. The earning is measured by interest income to total assets. II_TA displays the capability of the bank to lesser interest on deposits and maintain interest on loans and advances higher. Therefore, II_TA is a vital factor to examine a bank’s core income. The higher this ratio the better the bank earnings from total assets (Bhatia & Mahendru, 2015). Under the production approach, the Tobit regression findings disclose that there is a significant positive connection between II_TA and OTE. This indicates that interest income to total assets seems to be an important factor that influences the level of efficiency

of the Gambian commercial banking sector, under the production approach. This result is totally in line with the null hypothesis of this study and previous literature. Niazi (2003) indicates that earning and Profitability, and liquidity & sensitivity to market risk had significant positive and influence on efficiency. Burki and Niazi (2010) imply that the ratio of earning assets to total assets is related, loans to asset ratio and asset size were found to be positively associated with all the efficiency measures. Although Sharma et al. (2012) reveal that bank diversification practices were negatively and significantly influencing the bank's efficiency.

Hypothesis 7 established that there is a significant positive relationship between GDP and OTE under the production approach. The positive influence of GDP growth is in line with the well-known argument that economic growth is related to the positive performance of the financial sector (Pasiouras & Kosmidou, 2007). The results from regression analysis in this study highlighted that there is a significant positive relationship between GDP and SE, indicating that GDP is an important macroeconomic factor that determines the efficiency level of the commercial banks in the Gambia. This result is consistent with some previous studies. For instant; Kosmidou, (2008) indicates that the growth of GDP has a significant and positive impact on bank performance, while inflation has a significant negative impact. Anayiotos et al. (2010) illustrate that there is an effect of GDP and bank ownership on efficiency.

Hypothesis 8 indicates that there is a significant positive/negative relationship between inflation and OTE. The regression results demonstrate that there is an insignificant positive relationship between inflation and OTE. Yet SE shows a negative relationship with inflation. Therefore, we can conclude that this result is not consistent with hypothesis 8, indicating that inflation is not an important factor that affects the efficiency level of commercial banks in the Gambia. This finding is inconsistent with some of the literature review, for instant Karimu Tossa, (2016) shows that Inflation and GPDPC have a significant negative impact on CRS TE in Model 1 and VRS TE in Model 3 and Model 4. Khan, et al. (2001) inflation is negative and significantly delays the growth and efficiency of the financial sector. Kosmidou,(2008) shows that inflation has a significant negative impact on the performance of Greek banks during the period of EU financial integration (1990-2002). Perry (1992) shows that the influence of inflation on the performance of a bank relies on whether or not inflation is forecast. In the previous case, interest rates were adjusted to

generate rising revenue faster than costs, with a positive impact on profitability. In the latter case, banks may be slow to adjust their interest rates, resulting in bank payments faster than bank profitability, which negatively affects bank profitability and efficiency as well.

5.12. Conclusion

Chapter 5 concentrates more on data analysis and presentation of the results. The descriptive statistics of the inputs and outputs were covered in this chapter. This chapter then shows efficiency measures based on research goals. In this context, the study shows the annual average of overall technical efficiency scores "TE, PTE and SE" of the various commercial banks as part of the intermediary and production approach with the DEA method[12].

The study also shows the constant returns to scale level for individual banks. The results showed that only the GTB appears to be completely efficient in intermediation approach out of 12 commercial banks in The Gambia during the study period, while only 2 banks are entirely efficient in terms of PTE with a VRS variable return to scale, it is assumed that a similar bank must be efficient in 2010. In that regard, it could be stated that the main source for the efficiency of the intermediation approach was the introduction of the VRS or PTE. The study on the other hand discussed the results and associated them with the factors of commercial banks in The Gambia to determine the impact of political and post-political standstills on the Gambian banking sector in general from 2016 to 2017.

In contrast, this chapter examines in more detail the factors that affect the commercial banks' efficiency in The Gambia. The study used a Tobit regression model to assess the variables after examining the data transformation and multicollinearity tests. The dependent and independent variables are gathered in Eviews 8 software. Moreover, the dependent variables were technical efficiency measures and the independent variables were profitability (ROE), market power, bank size, capital adequacy, liquidity, GDP, and inflation. Then the study examined hypotheses. In general, the results of the regression show that the profitability (ROE) under the intermediation approach is significantly and positively linked to OTE. This implies that the more the profitable the bank is, the more efficient it is, while size, EQ_TA, and II_TA were significantly negatively correlated with OTE, which

[12]The research utilized DEAP version 2.1 by Coelli 1996.

indicates that increasing these variables reduces OTE costs. During the production approach, the results showed that MP, II_TA, and GDP are significantly and positively associated with OTE, while the size and TL_TA are negatively and significantly associated with OTE. This shows that only the profitability of the bank had a more positive impact on the efficiency measures under the intermediary approach, while market power, profits, and GDP during the investigation of the period had a more positive impact on efficiency measures based on the production approach in The Gambian Banking Industry

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

The first chapter focuses on the concept of the study, in which the study focuses on problematic statements, research objectives, research questions, and the importance of research. Moreover, Chapter Two presents a comprehensive review of the literature on efficiency in the banking sector. In the same chapter, the theory of efficiency in the commercial banking sector is also discussed. Also, Chapter Three focuses more on the functions of the commercial banks in the Gambia for the conventional and Islamic banking sectors. In chapter four, the research methodology and hypothesis development are presented. Chapter Five empirically reviews the data and presents the findings of the research. Chapter Six ends the study by concentrating on the findings of Chapter Five based on the objectives of the study. In addition, we elaborate on contributions for research, study limitations, and suggestions for other areas of research.

6.2. The Summary of Findings: Efficiency of Commercial Banks in the Gambia

To examine the efficiency of Gambian commercial banks, specific objectives were explained in this study. The key research objective of this research was to measure the overall technical efficiency of commercial banks in The Gambia from 2009 to 2017. In these studies, TE was examined, PTE, and SE for individual banks using intermediary and production approaches. As part of the intermediary approach, the study uses capital, total deposits, and equity as inputs, as well as loans and advances and securities as outputs of the study. Following the production approach, the study uses interest expense, personnel expenses, and non-interest costs as input, while interest and non-interest income are used as the outputs of the study. The Study adapted the study by (Sathye 2001; Grigorian and Manole, 2005; Fadzlan & Suraya, 2005; Zamil, 2007; and Sok-Gee, 2011; Onen and Tunik, 2017) with the required modifications. Therefore, the study uses the input-oriented method to measure the efficiency of banks using the DEA method.

Table 6.1 exhibits a comparison between the intermediation approach and the production approach. It is clear from the table that the production approach produced the highest number of efficient banks and a greater overall efficiency score than the results produced by the intermediation approach. Under the production approach, the CRS (TE) recoded 86.50%, while the intermediation approach produced an annual average of 76% only. On the other hand, VRS (PTE) found to be 93.10% under the production approach, while only 88.20% is recorded under the intermediary approach. For scale efficiency, it is noted from the table that the scores of the production approach are higher than the intermediation approach for about 8.20%. This is consistent with the fact that the Gambian banks are not active in providing loans to their customers as much as needed. Nevertheless, a common feature of the findings of the two approaches is that the number of efficient banks is less than 50% of the number of banks in the sample., yet the study found 7 banks out of 12 banks are above average technical efficiency (CRS) level of 76 percent under intermediation approach and 6 banks appeared above average technical efficiency level of 86.50 percent under production approach. This implies that the root cause of the technical inefficiency of commercial banks in the Gambia is in the form of scale inefficiency rather than pure technical efficiency. Table 6.1 compared the intermediation approach and production approach scores.

Table 6.1. Intermediation approach vs. production approach.

Approaches	**Intermediation Approach**			**Production Approach**		
Year	TE	PTE	SE	TE	PTE	SE
2009	0.718	0.900	0.788	0.912	0.937	0.972
2010	0.873	0.974	0.894	0.852	0.921	0.913
2011	0.757	0.843	0.874	0.910	0.949	0.960
2012	0.789	0.874	0.876	0.839	0.946	0.882
2013	0.675	0.836	0.796	0.935	0.962	0.973
2014	0.842	0.905	0.896	0.801	0.902	0.881
2015	0.767	0.823	0.917	0.794	0.858	0.924
2016	0.737	0.912	0.794	0.936	0.963	0.972
2017	0.688	0.868	0.749	0.804	0.944	0.850
Mean	**0.760**	**0.882**	**0.843**	**0.865**	**0.931**	**0.925**

However, PTE under the VRS measurement hypothesis provides an assessment using a local measurement (Zamil, 2007). The findings indicate that only 4 out of 12 banks work for PTE based on the intermediation approach and the production approach below the annual

average. Also, GTB and SKBL are fully efficient in intermediation approaches assuming VRS, but only GTB is efficient under the CRS assumption with an annual average of 99.50% for TE. However, SCB and TBL are the largest banks in terms of total assets and deposits and continue to operate with optimal efficiency of 1 due to their minimum commitment to provide loans and advances to businesses. Also, the 2016-2017 political impasses had a negative effect on TBL to be the most efficient bank. From a Production perspective, SCB and GTB appeared to be the most efficient banks, with an average of 1 based on the VRS assumption.

However, assuming VRS, the bank can take full effect at PTE if it uses the largest number of the outputs, namely loans and advances and investments like GTB, as the third-largest bank in the sector, which lends to economic sectors that are the engines of the economy of the Gambia such as trade, telecommunications, tourism, and agriculture. However, the less efficient bank in terms of TE and SE can be fully efficient in terms of PTE if it provides a small number of inputs (capital, deposits, and equity) like BSIC. BSIC has proven to be the least bank to become inefficient in terms of TE and SE, yet it is more efficient than SCB in terms of PTE based on the intermediation approach. The efficiency in terms of PTE, therefore, does not depend on the size of the bank. (Zamil, 2007). Generally, the cause of technical inefficiency in the Gambian banking sector can be scale inefficiency. In contrast to PTE, this was found in the lower SE zone. The SE average score of the CBs in The Gambia was 84.30% in the intermediary approach and 92.50% in the production approach. The results, therefore, show that the average efficiency of CBs in The Gambia over the analysis period could be associated with the adverse situations achieved by SE and not to the inefficiency of operations or PTE in both approaches.

This result can be compared to fewer results in The Gambia due to the absence of empirical research in this area. Agu (2004) The key reasons for inefficiency are the high regulatory framework, the oligopolistic structure of the market, and the small banking market, which have made the banking sector a bank-centered system, as opposed to a market-based system of different sizes attached to the market. Jaabi, S, & Fatty, B. M (2018) found that Trust Bank Limited (TBL) was the most efficient bank in the Gambia for the five years from 2005 to 2009, while International Commercial Bank (ICB) was the least efficient over the same period. The results of the linear regression analysis show that only the size of the bank is significantly and positively associated with TE and SE, while profitability and market

power were negatively associated with TE and SE. The finding may be consistent with other global results, for example: Miller and Noulas (1996); Sturm & William (2004) and Maghyereh (2004) noted that the root cause of technical inefficiency in the United States, Australia and Jordan is not a purely technical efficiency measure but a scale issue. Moreover, Katib (1999) reveals that the scale of inefficiency in Malaysia was relatively greater between 1989 and 1995. Besides that (Krishnasamy, Ridzwa, & Perumal, 2004) noted that Malaysian banks proved to be scale inefficient between 2000 and 2001. Nevertheless, some studies have found various results such as Aly et al. (1990) and Darrat (2002)find that technical inefficiencies in the American and Kuwait banking sectors are a major consequence of waste disposal operations; Sufian & Ibrahim (2005) also found that purely technical inefficiencies were associated with TE after the merger of Malaysian banks from 2001 to 2003

6.3. Factors That Affect the Efficiency of Commercial Banks in The Gambia

The second objective of this research is to assess the factors that affect the efficiency of CBs in The Gambia. To measure these factors, the study used the Tobit regression model to explain the relationship between efficiency measures and the specific and macroeconomic factors of banks in The Gambia. This type of analysis determines the factors that affect commercial banks. The macroeconomic characteristics and factors of banks (i.e. profitability, market power, bank size, capital adequacy, liquidity, GDP, and inflation) are utilized as independent variables. While DEA efficiency measures (TE, PTE, and SE) are used as dependent variables in intermediary and production approaches.

6.3.1. Influence of Characteristics of the Banks on Technical Efficiency

Under the intermediation approach, the results show that the ROE and MP are positively related to TE, while SIZE, TL_TA, EQ_TA, II_TA, GDP, and Inflation are negatively associated with TE. On the other hand, the regression results under the production approach indicate that MP, II_TA, GDP, and inflation are positively related to TE. While, ROE, SIZE, TL_TA, and EQ_TA were negatively correlated to TE.

6.3.2. Influence of Characteristics of the Banks on the Pure Technical Efficiency

Under the intermediation approach, the results reveal that ROE and inflation are positively correlated to PTE. While SIZE, EQ_TA, II_TA, GDP, and Inflation are negatively related to PTE. Moreover, the results from regression analysis under the production approach show that ROE, MP, EQ_TA, II_TA, GDP, and inflation are positively related to PTE. While SIZE and TL_TA found to have a negative relationship with PTE.

6.2.3. Influence of Characteristics of the Banks on Scale Efficiency

The research measures the association between SE and the bank's specific characteristics and macroeconomic factors to determine how these independent variables can affect SE. SE generally indicates the key cause of inefficiency due to economies of scale which have a negative impact on scale efficiency. The results under the intermediation approach illustrate that SE had a positive coefficient for ROE and MP. While other independent variables indicated a negative relationship with SE. Moreover, the results under the production approach established that MP, II_TA, and GDP are positively associated with SE, while other independent variables illustrate a negative association with SE. In general, the results reveal that only ROE has a significant and positive relationship with OTE under intermediation approaches while MP and II_TA demonstrated a positive and significant relation with OTE under the production approach. This indicated that bank profitability (ROE), Market Power and Earnings (II_TA) are the most important factors that positively drive banks efficiency level of commercial banks in the Gambia, indicating that the most profitable, earnings and having more market share banks are the most efficient banks in the Gambia.

However, under the intermediation approach, the results established that bank size, EQ_TA, II_TA, and inflation are the most important factors negatively influencing the OTE of commercial banks in the Gambia. Indicating that any increase in bank size, liquidity, and earning will cause a decline in cost of efficacy level and thus, the banks will achieve a high level of efficiency in the long run. Further, the results under the production approach demonstrated that bank size and capital adequacy are the driving and important factors that negatively effect on OTE of commercial banks in the Gambia. Indicating that the higher these variables the lower the cost of efficiency, the bank market share, and bank earnings supporting by economic growth will increase the level of efficiency of commercial banks in

the Gambia. In general, these results finally reaffirm and highlight that the more the bank can obtain enough liquidity, market share, earnings, profitability, and enough size will appear as successful and efficient bank in the Gambia.

6.4. Research Limitations

As every research has its limits, this research also has limits to note here. The first limitation of this research is that the sample size is very small. During the nine-year study period, only 12 banks are regularly active in the industry. It would, therefore, be preferable if the data covered more than nine years only with a broader observation. Secondly, this research limits to only 3 inputs (i.e. capital as a proxy for borrowed funds, deposits, and equity) and 2 main outputs (i.e. Loans and advances and securities) for the intermediary approach, while interest expenses, Personnel costs, and non-interest-related costs are used as input and due to the nature of the data available, interest income and non-interest income are used as outputs based on the production approach. The third limitation of this study lies in the fact that it only focuses on technical efficiency, breaks down into PTE and SE due to the data constraint, instead of including allocation efficiency measures (AE), since the AE depends on prices that are not available from the received data. Another limitation is the fact that the study used the DEA methodology to assess the overall technical efficiency, rather than using SFA and other efficiency measures that may be better for this study than for DEA because there is no appropriate data available. After all, the study uses only a few internal and external factors instead of other environmental factors.

6.5. Research Contributions

This research is important in various ways. The research seems to be the first study of the efficiency of commercial banks in the Gambia using the non-parametric DEA method from 2009 to 2017 and covers all CBs operations in The Gambia. This study also extends the literature on efficiency measures in general and in the Gambia. This would also be the first research to measure the efficiency of Gambian commercial banks intensively before and after the political status quo of the Gambia in 2016. This research will be useful for policymakers: CBG and the Ministry of Finance to understand the technical efficiency of all the commercial banks in the Gambia and to take steps that will improve the efficiency of the banking sector in the Gambia. Also from the results of this study; you can see the causes of

CBs inefficiency in the Gambia. "Best banks" can also be measured according to their technical efficiency rather than relying on CAMELS standards only. Ultimately, this will help bank managers improving their bank's overall technical efficiency and learn from best banking practices.

6.6. Suggestion for Further Research

This study is intended to reveal the Technical Efficiency of Commercial banks in The Gambia and the factors that influence the efficiency of CBs in The Gambia. However, the study left open other important questions that needed to be addressed. Therefore, future research can focus on:

1. This research employs 12 banks as a total sample of the research. Therefore, the sample size can be extended to more CBs and more than nine years to cover more observations and to get a clear picture of the efficiency level of CBs in The Gambia, since this study only limits to 108 observations.
2. This study used only 3 inputs and 2 outputs for the intermediary and production approaches. Other researchers may use different inputs and outputs. Other factors such as bad credit and ownership could also be tested as this study looked only at bank profitability, market power, size and liquidity (TL_TA) and capital adequacy (EQ_TA), earnings (II_TA), GDP and inflation as internal and external factors affecting the OTE level of CB in The Gambia.
3. This study uses only the non-parametric DEA method. Other studies may utilize other methods to examine efficiency (i.e., Parametric Method: SFA) or comparisons between parametric and non-parametric methods.
4. Other empirical studies could explore cross-border studies by relating the efficiency of CBs in The Gambia with CBs in other African countries with a parallel economic condition.
5. Further research could employ more approaches, such as a profit approach, than the only intermediary and production approach used in this study for comparison.

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APPENDIX

Ek-1. Resume

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