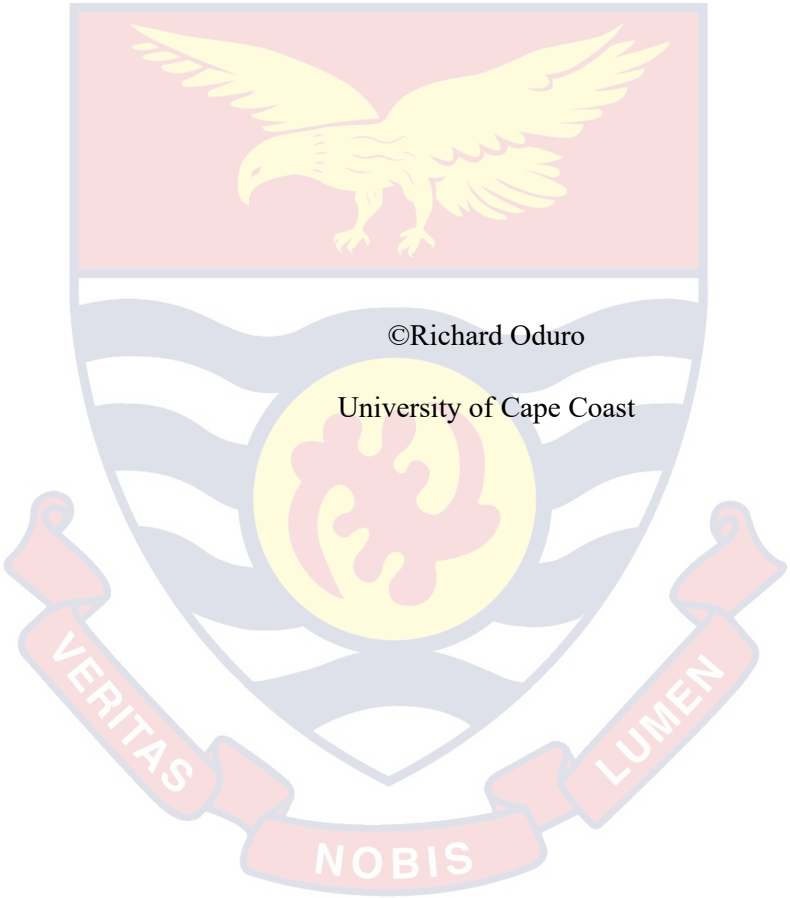
UNIVERSITY OF CAPE COAST

# COST EFFICIENCY, COMPETITION AND BANK PROFITABILITY IN GHANA: THE ROLE OF ECONOMIC AND FINANCIAL FREEDOM

RICHARD ODURO

2020



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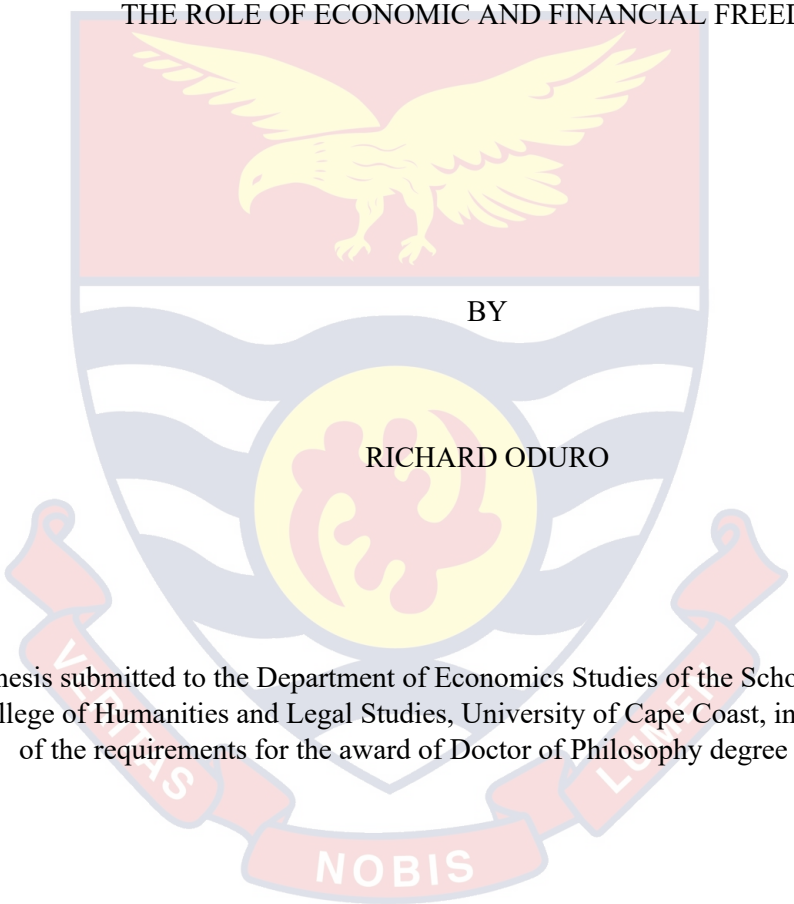

BY

RICHARD ODURO

Thesis submitted to the Department of Economics Studies of the School of Economics, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfillment of the requirements for the award of Doctor of Philosophy degree in Economics

OCTOBER 2020

# DECLARATION

## Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature ..... Date.....

Name: .....

## Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature..... Date.....

Name: .....

Co- Supervisor's Signature..... Date.....

Name: .....

## ABSTRACT

The Ghanaian banking industry has experienced significant reforms in the quest to ensure efficiency and full openness to competition. This is eventually expected to stimulate profits of banks and increased economic and financial freedom is expected to play a significant role in such relationship. To this end, the study explored the linkage between bank cost efficiency, competition level of the market, and the profitability of banks in Ghana in the presences of economic and financial freedom. Using a panel data from 22 banks in Ghana over the period 2009 to 2018, it was observed that the cost efficiency of banks in Ghana is between 60% to 70% implying that banks have capability of reducing their costs up to 40% to 30%. Shadow return on equity was found to be positive except after 2016 when it became negative reflecting evidence of increased capital ratio. Also, the loan market was seen to be most competitive. Finally, it was observed that concentrated market has a detrimental effect on bank profit but efficient market has positive impact. In addition, both financial freedom and economic freedom show a positive impact on bank profits. In the presence of increased economic and financial freedom, competition tends to positively impact profits. It was recommended that domestic banks could mimic the cost efficiency practices of their foreign counterpart. Also, policymakers and regulators should be cautious in implementing recapitalisation programme by comparing the benefit gained from increased capital adequacy ratio with the associated impacts on the banks. Again, government should enhance freedom in the financial sector in terms of banking transactions and businesses banks can undertake.

**KEYWORDS**

Efficiency

Competition

Profitability

Economic freedom

Financial freedom

**ACKNOWLEDGEMENT**

I sincerely express my deepest appreciation to my supervisors, Professor James Atta Peprah and Professor Emmanuel Ekow Asmah, who despite their heavy schedules, rendered immeasurable supports by guiding and reviewing this thesis. I am also grateful to my wife, who supported and encouraged me in coming out with this piece.

## DEDICATION

This work is dedicated to my wife and children.

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## LIST OF ACRONYMS

| | | |
|---|---|---|
| ACH | - | Automated Clearing House |
| ATM | - | Automated Teller Machine |
| BC 92 | - | Battese and Coelli (1992) |
| BC 95 | - | Battese and Coelli (1995) |
| BoG | - | Bank of Ghana |
| BSD | - | Banking Supervision Department |
| CCC | - | Cheque Code-line Clearing |
| CE | - | Cost Efficiency |
| CMCV | - | Conditional Mean Conditional Variance |
| CUs | - | Corporative Unions |
| DEA | - | Data Envelopment Analysis |
| ES | - | Efficient Structure |
| ESS | - | Scale Efficiency |
| ESX | - | X-Efficiency |
| EVA | - | Economic Value Added |
| FDH | - | Free Disposal Hull |
| FGLS | - | Feasible Generalized Least Square |
| FINSAP | - | Financial Sector Adjustment Programme |

| | | |
|---|---|---|
| GDP | - | Gross Domestic Product |
| GIPSS | - | Ghana Interbank Payment and Settlement System |
| HHI | - | Herfindahl-Hirschman index |
| IAS | - | International Accounting Standards |
| IFAD | - | International Fund for Agriculture |
| IFRS | - | International Financial Reporting Standards |
| IMF | - | International Monetary Fund |
| ISSER | - | Institute of Statistical, Social and Economic Research |
| LSDV | - | Least Squared Dummy Variable |
| MENA | - | Middle East and Northern Africa |
| MFI | - | Micro-Finance Institutions |
| ML | - | Maximum Likelihood |
| MP | - | Market Power |
| NBFI | - | Non-Bank Financial Institutions |
| NEIO | - | New Empirical Industrial Organisation |
| NPART | - | Non-Performing Asset Recovery Trust |
| OLS | - | Ordinary Least Square |
| PWHC | - | PricewaterhouseCoopers |
| QR | - | Quantile Regression |

| | | |
|---|---|---|
| RCB | - | Rural and Community Banks |
| RFSP | - | Rural Financial Service Project |
| RMP | - | Relative Market Power |
| ROE | - | Return on Equity |
| ROSCAS | - | Rotatory Savings Companies |
| RTGS | - | Real Time Gross Settlement |
| SCP | - | Structure, Conduct, Performance |
| SROE | - | Shadow Return on Equity |
| TFA | - | Thick Frontier Approach |
| WTO | - | World Trade Organisation |

# CHAPTER ONE

# INTRODUCTION

## Background to the Study

The banking sector of Ghana has undergone through a series of reforms over the past four decades. These reforms include deregulation of interest rate, privatization of state banks, listing of banks on Ghana Stock Exchange, liberalisation of entry into the banking market, introduction of universal banking concept and amendments of banking regulations. The aim of these reforms is to resuscitate the industry from financial repressive regime (which characterized the banking system in the 1980's) to a much more transformed market characterised by increased competition, enhanced efficiency and improved profitability.

Recently, the regulator (Bank of Ghana) undertook a significant initiative to strengthen the industry in a bid to enhance operational efficiency, improve market structure characteristics and to restore confidence in the sector. Key among them are recapitalisation of licensed commercial banks to GHS400 million by end of 2018, voluntary winding up of banks and specialised deposit taking institutions, sound corporate governance directives, revocation of license of insolvent banks and microfinance institutions, among others. All these were implemented as a preparatory step to introduce the Basel III accord necessary to improve the efficiency and competitiveness of the sector. Consequently, stakeholders of the industry expect the sector to be more vibrant, efficient, responsive and competitive than before. Throwback to the past ten years, the profitability of the sector has been fairly good, even though it is characterized by undulating trendas shown by some

selected indicators as depicted in Table 1. For instance, the primary indicators of industry profitability; profit margin, net interest margin, return on equity and return on asset, show some level of improvement over the period.

Table 1: Trend of selected performance indicators of the Ghanaian banking industry

| Performance indicator | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| Profit margin (%) | 19.7 | 27.2 | 30.5 | 37.3 | 45.2 | 42.6 | 30.7 | 29.5 | 36.4 | 38.1 |
| Net interest margin (%) | 7.7 | 9.3 | 8.0 | 15.4 | 16.7 | 9.7 | 9.8 | 9.2 | 9.4 | 8.0 |
| Cost income ratio (:1) | 0.6 | 0.60 | 0.60 | 0.50 | 0.50 | 0.51 | 0.53 | 0.54 | 0.54 | 0.53 |
| Return on asset (%) | 1.6 | 2.3 | 2.4 | 3.5 | 4.2 | 4.1 | 2.9 | 2.3 | 2.8 | 2.9 |
| Return on equity (%) | 12.1 | 16.6 | 17.8 | 23.8 | 27.5 | 28.0 | 20.0 | 17.3 | 19.7 | 17.9 |

Source: Ghana Banking Survey (2018, 2014)

Despite these positive outlooks, the banking sector is still "confronted with problems such as wide interest spread, increasing ratio of non-performing loans, high level of concentration and cost inefficiencies (Alhassan & Ohene-Asare, 2016). For instance, cost-to-income ratio (a measure of cost efficiency applied in the industry) has consistently be maintained above the acceptable ratio of 50% over the last decade with the current trend showing an increment, suggesting a deterioration in cost efficiency (see Table 1)." These problems have raised concerns as to how competitive and how efficient the banking industry is. This has led to some industry players advocating for further reforms to curb these glitches as, in their view, the banks operating in the market are not efficient enough and also, the market is not competitive enough to foster the improved returns all stakeholders expect to realize from the market. This leads us to the debate on bank efficiency, competitiveness and bank profitability nexus on which the current study is founded.

Bank efficiency, competitiveness and profitability nexus has been in the center of debate among economic and finance researchers over several decades. In one breath, being cost efficient and operating in a well competitive market guarantee cost reduction, lower prices, improve quality, promote innovations, and above all increase profitability (Liu *et al.*, 2014); in another breath, operating in a highly competitive market may hamper financial stability through excessive risk taking by banks to keep up to the competition pace which may eventually cause financial crisis. The potential impact of efficiency and structure on performance always make regulators and other key stakeholders face a dilemma in a trade-off between competition and instability.

Despite the copious studies on efficiency-competition-profitability nexus, literature on the role economic and financial freedom of the banking sector plays in the efficiency-structure-profitability relationship barely exist. Considering the role banking sector plays in the economic development and the fact that government coercion beyond a minimal level may be detrimental to development in the financial industry, the limited studies in this area seems startling. Economic freedom is the absence of government coercion or constraint on the production, distribution, consumption of goods and services beyond the extent necessary for citizens to protect liberty whiles financial freedom measures security of the banking system and its independency from government control (Heritage Foundation, 2020). It has been argued in one breadth that, when banks operate in a less restricted environment, they are more likely to engage in competitive policies which is likely to result in higher levels of efficiencies, hence improved profitability. In another

breadth, excessive freedom in the sector opens up the sector for excessive risk and to compensate for such risk, banks tend to increase their spread and reluctant in venturing in businesses they consider as risky. Studies in this area are not conclusive.

Considering the elaborated background, the study seeks to extend the frontiers of this debate by first, exploring the cost efficiency and cost sensitivity of banks operating in the Ghanaian banking market, secondly, investigating the nature of competition of the Ghanaian banking industry and finally examine the linkage between cost efficiency, competition and profitability of banks in Ghana bringing out the moderating role played by economic and financial freedom in this relationship.

**Motivation of the Study**

The current study primarily aimed at analysing "the effect of cost efficiency and competition level on bank profitability and the role financial and economic freedom plays in such relationship, drawing evidence from the Ghanaian banking industry." Evidence of linkage or lack thereof between efficiency, competition and profitability will enable banks to make appropriate changes in their strategies to improve efficiency and also adjust accordingly to market trends in order to improve bank profitability, thereby, creating value for their shareholders and at the same time contributing to economic development. On this basis, the motivations of the study are discussed as follows;

The first motivation is drawn from the primary objectives of banking sector reforms embarked by the regulator over the last four decades. With the several reforms in the banking sector embarked upon by the regulator since 1980,one would have expected an efficient financial sector in Ghana. However, the rising level of inefficiencies here in the Ghanaian banking system has contributed significantly to recent bank failures and distresses, high non-performing assets and the likes, hence, alerted the regulators and other stakeholders to the danger involved in banks not being sensitive to efficient banking practices. Lack of efficient banking practices is viewed as the lead cause of recent deterioration in bank profitability which is adversely affecting shareholders and other stakeholders. All of these have reinforced interest in the enforcement of efficient banking practices in the Ghanaian banking industry, hence it is essential to objectively assess of the current efficiency level of the banking units in the industry and how their operating cost respond to changes in input and output variables.

Another source of motivation for the study is taking from the fact that, there is the need assess whether the numerous financial sector reforms have altered the efficiency of banks, competition level of the market and its implication on profitability of banks in Ghana as well as the role economic and financial freedom plays in this. There is a large body of empirical literature that had investigated the linkage of efficiency and performance dynamics among state and private banks, domestic and foreign banks (Hafer, 2013; Chortarea*set al.,* 2011;Sufifian&Habibullah, 2010), universal banks and focus banks (Chortarea*set al*., 2013), and listed banks and non-listed banks (Kasman&Kasman, 2015; Ray &

Das, 2010). These studies seem to have mixed result as some have reported positive linkage between efficiency, competition and profitability (Duyguna, *et al.,* 2015; Schaeck&Cihák, 2014), others have reported no linkage between them (Aliyu & Yusof 2016; Alam, 2012) whiles few have reported an inverse relationship(Van Leuvensteijn, *et al.,* 2011)." The current study seeks to fill the gap by investigating how bank efficiency and competition impact banks profitability mediated by economic and financial freedom after the industry had undergone several reforms.

**Statement of the Problem**

Studies on bank efficiency, competition and profitability nexus have sort to test the structure-conduct-performance (SCP) hypothesis (Mason, 1939; Bain, 1951), market power (MP) hypothesis (Demsetz, 1973), relative market power (RMP) hypothesis (Peltzamn, 1977) and efficiency structure (ES) hypotheses (Brozen, 1983) in different economies, and have reported a mixed results (Tan &Floros, 2018; Tan, 2018; Ding *et al*., 2017; Tan, 2016, Nguyen & Stewart 2013; Trujillo-Ponce 2013; Garza-Garcia 2012; Chortarea*set al*., 2011)." The "SCP hypothesis postulates that, the market competition influence firms' pricing conduct and ultimately impact their profitability. The MP hypothesis argues that, collusion among firms with high market power results in higher pricing which intend result in improvement in profitability. Applying these hypotheses to banking studies, banks with market power collude to charge high fees on their services and provide lower rates on customer deposits thereby increasing their spread. A variant of MP hypothesis is the RMP hypothesis which "argues that, the transmission mechanism

from competition to profitability occurs through product differentiation and improved service quality which are normally associated with dominant firms rather than collusive behaviour. In contrast to both the MP and RMP hypotheses, the ES hypothesis argues that, bank performance is influenced by increased efficiency rather than collusion. It further argues that, efficient firms enjoy lower production cost which is translated into lower pricing. This as a result increases sale volume and improves market shares, hence improvement in profitability.

In testing these hypotheses, some studies have provided empirical support for the SCP hypothesis (Tan &Floros, 2018; Tan, 2018; Tan, 2016) whiles others found no evidence of competition or market power having effect on bank's profitability (Ding *et al.,* 2017; Qin & Shaffer, 2014). Even those studies that found competition or market power to be a determinant of bank profitability, there are variations in the outcome of their studies in terms of the direction of effect and also the extent to which structure affect profitability. Some studies have reported a positive relationship between market structure and banks' profitability (Kathuria, 2013; Singh, 2012; Chortareas*et al*., 2011) providing support for the MP hypothesis whiles other have reported a negative relationship (Erkens*et al.,* 2012; Aebi *et al.,* 2011; Seelanatha, 2010) refuting the MP hypothesis, instead, found that, banks' profitability is explained by operational efficiency, supporting the ES hypothesis. The inconsistencies in the observed relationship between efficiency, competition and profitability in the literature has been attributed to differences in coercion or constraints levels exerted by the government or the regulator on the activities of the banks in the economies where these hypotheses are tested. Nevertheless, studies on

efficiency, competition and profitability nexus either treat coercion as one of the control variables or ignore it altogether. In light of this, the present study attempts to fill the demanding gap in the literature by analysing the moderating role of coercion within the general economy (measured by economic freedom) and coercion within the financial sector (measured by financial freedom) on the efficiency, competition and profitability relationship. The findings of the study would enhance the understanding of the unclear relationship between efficiency, competition and bank profitability, and the potential effect of economic and financial freedom on this relationship.

Again, studies that seeks to test these hypotheses proxy efficiency with market share in the case of testing the ES hypothesis. However, as indicated by the extant literature, efficiency enhance banks' core competency in transforming inputs (in the form of deposits, capital and labour) to output (in the form of financial products and services) at the minimum cost and risk especially in an environment where there is ever changing financial market conditions in the quest to improve profitability. Thus, testing these hypotheses would require a robust measurement and assessment of efficiency level of the banking industry for which the current study seeks to explore. Thus, the study aims at filling the identified gap by analyzing the cost efficiency level of banks in Ghana using a more robust method in estimating bank's cost efficiency necessary to test these hypotheses.

Also, market structure is proxied by competition or concentration indexes in testing SCP and RMP hypotheses. It is undeniably fact that, competition in the banking industry cannot be measured directly, hence, studies on banking

competition tends to adopt different measures such as concentration indexes (following the traditional industrial organizational theory). However, these indexes present an over simplification view of competition and besides does not always measure competition. Boone, *et al.,* (2007) indicated that, these approaches are potentially poor measure of competition and misleading as they do not take into account the distribution of firms, as a high market concentration may be consistent with fully contestable markets, hence these indexes are ambiguous measure of competition. Few studies have attempted to apply a more robust methods such as Lerner index developed by Lerner (1934) and Panzar-Rosse H-statistic developed by Rosse and Panzar (1977), inmeasuring competition especially. Nevertheless, the Panzar-Rosse H-statistic have been criticized as requiring a restrictive assumption about the market being in a long-run equilibrium and does not differentiate between competition different markets (Schaeck&Cihak, 2010). Similarly, the Lerner index is subject to two major concerns. First, it does not recognize that, some of the deviation of price level from marginal cost may be due to reasons other than monopoly (for example, efficient use of scale or the need to cover fixed costs). Second, it is does not provide any information on the ES hypothesis, it assumed that competition enables more efficient banks to achieve superior performance in terms of higher profits at the expense of their less efficient rivals and also attract greater market share (Bikker, *et al*., 2012). Based on these limitations, the current study seeks to explore the competition level of the Ghanaian banking industry using a much more robust techniques known as the Boone indicator (Boone, 2004; 2008) which seeks to capitalized on the limitations identified. The indicator exploits the

difference in bank's performance that results from difference in efficiency (proxied by marginal cost) to measure competition. The use of the Boone indicator offers five main advantages in competition estimation over the existing measure; Firstly, it approaches to degree of competition measurement is in terms of the ability of banks to transform efficiency in term of higher market shares, hence rewards only efficient banks. Secondly, it measures the evolution of competition over time rather than focusing on static analysis. Thirdly, it can be applied to a given market at a sectorial level (advantage over Panzar- Rosse H statistic). Fourthly, it has a robust theoretical foundation as a measure of competition, meaning that it correctly depicts the level of competition both when competition becomes more intense through more aggressive interactions between firms and when entry barriers are reduced (advantage over both Panzar-Rosse H statistic and Lerner index). Finally, it has the same data requirements as that required by H-statistics and the Lerner index. On this basis, the current study presents estimation of competition in the loan market, other earning asset market and fee-based services market of the Ghanaian banking industry using the Boone indicator and explore the factors that influence the Boone indicator in Ghana.

**Objectives of the study**

The main objective of the study is to examine the effect of cost efficiency and competition on profitability of banks in Ghana and the role played by economic and financial freedom in the observed relationship. To achieve this objective, three empirical objectives are set to be achieved, that is;

(a) to explore the cost efficiency and cost sensitivity of the banking industry of Ghana from 2009 to 2018.

(b) to investigate the degree of competition in the Ghanaian banking industry and examine the factors that influence the level of competition.

(c) to examine the effect of cost efficiency and competition level on bank profitability and analyse the role played by economic and financial freedom on the efficiency-competition-profitability nexus.

**Research Questions**

The main objective of the study is achieved by addressing the principal question on which the study is premised, that is, To what extent does cost efficiency and competition influence profitability among banks in Ghana and what is the role played by economic and financial freedom?. Answer to the principal question of the study is essential for policy makers in the banking industry, in terms of developing strategies to improve financial performance of universal banks. In order to answer the principal question, the study is guided by the eight specific questions as follows;

(a) What is the level of cost efficiency of banks in Ghana?

(b) What factors underlie the behaviour of cost efficiency of banks in Ghana?

(c) Which method best explain cost efficiency level of banks in Ghana; the industry-based cost efficiency measurement approach or frontier-based cost efficiency measurement approach?

(d) How sensitive is bank cost to changes in bank outputs, input prices, time and regulatory capital?

(e) What is the degree of competition in the Ghanaian banking market?

(f) What factors influence competition levels in the Ghanaian banking market?

(g) How does cost efficiency and competition in the banking industry influence bank profitability?

(h) Does economic and financial freedom play a moderating role in the relationship between cost efficiency, market structure and bank profitability?

**Significance of the Study**

The study possesses importance significance to both the industry players and the academic arena. First, to the industry players, the findings of the study provides essential information which would help industry players to enhance their understanding of a more robust measure of competition, efficiency and their linkage to bank's profitability. These measures are intended to provide a basis for implementation of vibrant policies. Secondly, Ghana is a developing economy, the findings of this study would be seen to benefit many economies with similar political, cultural, environmental and economic conditions, particularly, economies in the Sub-Saharan Africa. Thirdly, the study promotes efficiency awareness among banking institutions as stakeholders of the banking institutions will be enlightened on the need for banks to be efficient and its implications on profitability, thereby demanding high level of efficiency from the banking institutions.

**Contribution of the Study**

By addressing research questions, the study seeks to make several contributions, as well as extending the existing bank efficiency and competition literature. First, current study contributes immensely to the finance literature by examining the effects of cost efficiency and competition on bank profitability and the role played by economic and financial freedom in such relationship. The findings of the study would enhance the understanding of the unclear relationship between efficiency, competition and bank profitability, and the potential effect of economic and financial freedom on this relationship.

Secondly, a distinctive contribution of this study is the estimation of shadow return on equity of Ghanaian banks from their cost function. Shadow return on equity represents the capacity of banks to pay returns on investment of shareholders and the extent to which these banks make use of the capital they have accumulated to generate returns. It is also a robust measure of profitability even though, is rarely applied in the literature.

Finally, this study represents one of the first attempts to moderate economic and financial freedom on the efficiency-competition-profitability relationship. In fact, over the past two decades, several studies have used the economic and financial freedom index (sometimes called banking freedom) either as control variable or instrumental variable, but hardly is there any focus on its effect on bank performance. To the best of my knowledge, there have been no known study that moderate freedom on the efficiency-competition-profitability relationship

especially within the context of the Ghanaian banking market. In light of the knowledge gap, the present study attempts to fill a demanding gap in the literature.

**Organisation of the Study**

The remaining part of the thesis is organised as follows. The next chapter discusses the Ghanaian banking environment. Chapter three provides a comprehensive review of literature in relation to cost efficiency, competition in the banking industry, economic and financial freedom and their relationship with bank profitability. Chapter four provides a description of the data and models applied in the study. Chapter five presents analysis of results of the bank cost efficiency and cost sensitivity study. This is followed by estimation of competition in the banking industry of Ghana in chapter six. Chapter seven provides the result of the estimation of the linkage between bank cost efficiency, competition, economic and financial freedom and then bank profitability. Chapter eight present summary of the findings of the study and makes policy recommendation.

# CHAPTER TWO

# REVIEW OF THE BANKING INDUSTRY OF GHANA

## Introduction

The Ghanaian banking industry has witnessed significant reforms since 1988. The implementation of these reforms has been gradual and steady with the aim of enhancing competition, efficiency and stability which in turn, is expected to foster economic growth and development of the country. This chapter, therefore, aims at providing overview of the Ghanaian banking system within which the study is premised.

The chapter is divided into five sections. The first section presents the historical development of the banking sector of Ghana with much emphasis on the pre-deregulation era. The second section of the chapter discusses the structure of banking industry in Ghana. The chapter then traced the banking reforms that have taken place since 1988 to 2018. This is followed by a review of the market structure of the banking industry in terms of market share and finally it then provides a review the financial performance of the Ghana's banking sector. The chapter then ends with a summary of the review.

## Historical Background of Ghana's Banking Industry

Banking in Ghana can be traced to the pre-independence period where only three banks, namely, Standard bank, Barclays bank and Bank of Credit and Commerce were the only banks operating in Ghana under the colonial rule, to provide commercial banking services. The primary business of these banks was to

offer trade finance and mainly served the expatriate community. In 1953, the first indigenous bank, Ghana Commercial Bank, was opened to offer credit services to the indigenous Ghanaians as well. After independence in 1957, the Bank of Ghana was set-up to replace the West African Currency Board established in 1912 by the colonial British rule to oversee the banks in Ghana, Gambia, Nigeria and Sierra Leone. The Bank of Ghana became the central bank of Ghana, hence, replicated the functions of the West African Currency Board. "Between the period 1957 and 1988, additional three state-owned development banks were set-up, namely, National Investment Bank, Agricultural Development Bank and Bank for Housing and Construction to offer long-term credit facilities; Merchant Bank for merchant banking services; Cooperative Bank to consolidate cooperative banking and the Social Security Bank to offer banking services to workers (World Bank, 1994). The ultimate aim of establishing Cooperative Bank and Social Security Bank was to help encourage savings.

In addition, the government of Ghana acquired minority shares in both Standard Bank and Barclay Bank. The entry into Ghana's banking market during those periods was restricted. Before the financial reforms, Standard Bank, Barclay Bank and Bank for Credit and Commerce were the only foreign banks, in addition to the seven state banks that were operating in Ghana. The state-owned banks dominated the banking industry and financial sector as well. In 1981, government decision to freeze bank deposits accounts of GHS50,000 or more undermined the confidence of the public in the Ghanaian banking system (World Bank, 1988). As with many developing countries at that time, the banking system was characterised

by financial repression, negative interest rate and massive public sector borrowing which are often unproductive (Brownbridge & Gockel, 1996). A landmark reform to address these market imperfections known as Financial Sector Adjustment Programme (FINSAP) was implemented in the 1989 with the assistance of the World Bank and International Monetary Fund. The aim of the FINSAP was to resuscitate the financial sector to make it more responsive. Most of the obstacles especially the interest rate ceiling was removed to allow the market to determine the equilibrium interest rate (Brownbridge & Gockel, 1996).

**Structure of Banking Sector in Ghana**

The banking sector of Ghana has experienced significant transformations in its structure, from a highly state-owned market to its current laissez-faire structure, with the influx of more domestic and foreign private ownerships. These transformations were driven by technological innovation, government regulation, economic and financial deregulation, information and communication technology and opening-up to international competition; corporate behavior, such as growing disintermediation and increased emphasis on shareholder value that are changing incessantly (Amidu& Hinson, 2006; Nabieu, 2013). The change has been key to sustaining economic growth and capital investments in the economy of Ghana. It is estimated that, overall, the banking sector currently carries up to about 50% of the services sector contribution of the Gross Domestic Product (ISSER, 2011). The structure of the banking system of Ghana is shown in Figure 1.

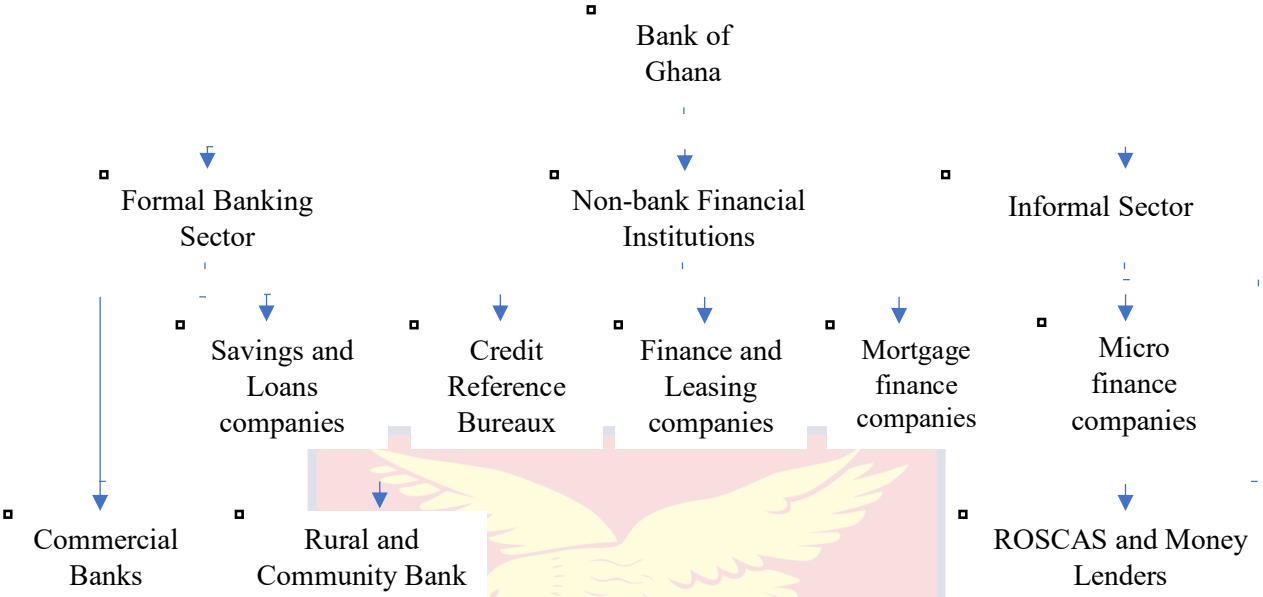


Figure 1: Structure of the banking system of Ghana
Source: Author's construct (2020)

At the apex of the banking structure is Bank of Ghana (BoG). It is obligated to provide sound and efficient financial system necessary for wealth creation, economic growth and development. Authorized by Act 612 and Act 673, BoG is concerned with activities such as monetary management, regulation of the financial system and direct involvement in the development of the economy in order to serve the interest of financial institutions and their clients as well as other users of financial services and the economy at large. The financial sector of Ghana is made up of three tier institutional framework: the formal banking sector, the non-banking sector and the informal sector.

The formal banking and the non-banking sector make up the formal financial institutions. The formal financial institutions are those incorporated under the Companies Code 1963 and licensed by the BoG under either the Banking Law

1989 or the Financial Institutions (Non-Banking) Law 1993 (NBFI Law) to provide financial services under the Bank of Ghana regulation (Steel &Andah, 2003). The formal banking sector comprises the universal banks and the rural and community banks (RCBs). These institutions operate as licensed and statutory financial institutions engaged in the business of banking under the banking laws of Ghana and are required to have a large capital base with good liquidity reserve. It must be stated, however that, until 2003, banks were not allowed to operate as universal banks. Until the adoption of the universal banking policy in 2003, banks were constrained separately to the traditional activities of commercial (retail) banking, investment banking, development banking, and merchant banking. According to "Bank of Ghana (2019), as at June 2019, there were 23 Class-1 licensed universal banks operating in Ghana. These comprised 15 foreign owned and 8 Ghanaian-owned. The top five universal banks with largest market share in terms of total asset as at 2018 are Ghana Commercial Bank (14.2%); Ecobank Ghana (13.3%); Barclays Bank Ghana Limited (now Absa Bank – 8.4%); Standard Bank Ghana (7.7%) and Fidelity Bank Limited (7.4%).

The RCBs, on the other hand, operate under the apex body of ARB Apex Bank, which has its delegated authority from BoG to supervise and streamline rural banking services in Ghana. ARB Apex Bank was granted a banking license in 2001 and commenced commercial operations in 2002 with significant financial support from the Rural Financial Services Project (RFSP), which was funded by the World Bank, the International Fund for Agricultural Development (IFAD), and the African Development Bank (AfDB) (Nair &Fissha, 2010). Current statistics show

that 144 RCBs exist in Ghana, with much concentration in Ashanti region. Also, the Financial Institutions (Non-Banking) Law in 1993, which saw the proliferation of Non-Bank Financial Institutions (NBFIs) in Ghana, including Savings and Loans Companies (SandLs), Cooperative Unions (CUs), finance houses, mortgage companies, among others, consequently opened up the financial sector for enhanced financial intermediation. Currently, it is estimated that 145 NBFIs, including 90 microfinance companies, 28 finance houses, and 21 savings and loans companies operate in Ghana.

The informal sector, on the other hand, is basically made up of the Rotatory Savings Companies (ROSCAS), which are locally referred to as the *susu* companies and moneylenders.The informal sector is a potent subsector with an estimated value of more than £75 million untapped savings. Estimates also show that, the average ROSCA has the potential of engaging over 10,000 depositors (Microfinance Insider, 2008; Steel &Andah, 2003).

The most significant changes in the structure of Ghana's banking sector are the increase in the foreign banks operating in Ghana, the adoption of the universal banking and to some extent the introduction of rural banks (unit banks) which has only 3.8% of the total assets of Ghana's financial system in 2018. The major banks (excluding the rural banks), on the other hand, have 78.3% of the total assets of Ghana's financial system in 2018 (International Monetary Fund, 2018). This undoubtedly demonstrates the dominance of the banks in Ghana's financial system with a remarkable 42.3% of the assets of Ghana's financial system are owned by the foreign banks (International Monetary Fund, 2018). In term of Ghana's banking

system, foreign-owned banks domination account for 51% percent of the total assets. The state banks, however, dominate the domestic part of the banking system (28.9%), one of the highest in the Sub-Saharan Africa region (International Monetary Fund, 2018). In addition, total bank branches have increased from 315 in 1998 to 1,062 in 2018.Furthermore, concentration has declined in the banking industry mainly as a result of the entry of many new banks. The market share of the five largest banks fell from 65.6% in 2000 to 51% in 2018 reflecting the intense competitive environment under which the banks are operating in Ghana (Bank of Ghana, 2018; International Monetary Fund, 2018).

**Banking Sector Reforms in Ghana**

This section traces the reforms that has taken place in the Ghanaian banking sector from the post-independence era. The section is organised as follows; first we discuss the historical background of the reform. This is followed by the discussion of the objectives set for implementation of the reform programs. The next section outlines the development of the reform program since 1988. The section concludes with a discussion of regulatory and supervision reforms done so far as well as payment and settlement reforms.

**Background to banking sector reforms**

The origin of the financial crisis in Ghana can be traced to the macroeconomic and financial sector policies that were implemented in the post-independence period.The crisis in the sector and its timing can be attributed to the

sharp decline in economic performance in the late 1970s.The history of the development of the financial sector during the early years of independence was closely linked to extensive government intervention. In an attempt to ensure rapid industrialisation, the government intervened in every sphere of the economy. Financial policies were set within an overall import-substituting industrialisation strategy.By the 1970s, interest rate controls and credit ceilings ensured that cheap credit was available to government-imposed priority sectors such as manufacturing. Also, heavy taxation of the banking sector had become a major source of revenue to the government. High reserve requirements were placed on the banks. These, together with other restrictive policies created major distortions in the financial sector. In the presence of high inflation, real interest rates became negative.

The financial sector's reform cannot be analysed without setting it in the context of the general macroeconomic environment. The Ghanaian economy, which at independence in 1957 had considerable foreign reserves, suffered a persistent decline until it hit it nadir in 1983. By then, all structures were under severe stress and the economy was in deep crisis. The economy was experiencing rapid deterioration characterised by per capita GDP growth of not more than -3% per annum during 1970-1983, inflation peaked at 123% in 1983, low levels of saving and investment, and a low volume of international trade, which led to crisis in the financial sector. By 1982 Ghana provided a classic case of financial repression. High inflation had eroded the capital base of most banks and demand deposits accounted for more than 76% of total private sector deposits, constraining long-term lending. Negative real rates of interest on deposits and lack of confidence

in the banks had resulted in high levels of currency outside the banks system, with the currency-deposit ratio at 70% at the end of 1983. In the same vein, the currency/Ml ratio rose from about 49% in 1970 to 58% in 1980. Ghana began to experience some financial disintermediation as the M2/GDP ratio declined from about 19% in 1970 to reach about 13% in 1983. During those period, Ghanaians preferred currency holdings to making deposits at banks. In the late 1970s and early 1980s, there was a significant growth in informal financial arrangements which became a significant feature of the Ghanaian financial system (Aryeetey &Gockel, 1991). By the mid-1980s, most banks in Ghana were showing signs of distress. The severe inflation during the 1970s and early 1980s had led to severe undercapitalisation of the banks. Moreover, widespread defaulting on bank loans by both public and the private corporate sector burdened the banks with huge non-performing assets.

In 1987, the banks in Ghana were in distress, especially the state-owned banks. The World Bank study of the Ghanaian banking sector in 1988 concluded that the banking sector was characterised by high operating costs due to inefficiencies, huge non-performing loan portfolios, insufficient provisions for loan losses, insolvency of the banking system, capital inadequacy, and reported inflated profits. As a result, economic and financial reforms were imminent as the Ghanaian economic situation was in profound crisis in 1987, precisely on the verge of collapse. This led to the financial sector reform which gave birth to the Financial Sector Adjustment Programme (FINSAP).

**Objectives and implementation of the banking sector reforms**

The financial sector reform programme, referred to as the Financial Sector Adjustment Programme (FINSAP) was initiated in the last quarter of 1987. The financial reforms had the following objectives:

(a) to establish a sound prudential and regulatory framework for banking operations;

(b) to ensure uniform accounting and auditing standards for all banks;

(c) to put in place a more effective Banking Supervision Department (BSD);"

(d) endowed with the requisite personnel and skills to enforce the prudential rules and regulations and a code of conduct for the banking sector;

(e) to create a framework for restructuring distressed banks with the intention of transferring their non-performing assets, which had choked their balance sheets and stunted initiative in credit operations, to a new government agency, the Non-Performing Assets Recovery Trust (NPART);

(f) to engage efficient top management for distressed banks;

(g) to develop fully liberalised money and capital markets in Ghana. The reforms were expected to bring about benefits, such as the effective mobilisation of domestic savings and a more efficient allocation of loanable funds.

**Implementation of the banking reform program**

The stages of implementation of the banking sector reform can be categorised into two: the regulatory and supervisory reforms and then payments

and settlements system reforms. Nevertheless, the chronological sequencing of events in the banking sector from 1988 to 2019 is shown in Table 2.

Table 2: Ghana's banking industry reforms implementation from 1988-2018

| Year | Reform |
|---|---|
| 1988 | (a) Private banks are authorised to operate.<br>(b) Decontrolled the minimum banks savings rate.<br>(c) Removed of sectoral credit controls except for agriculture.<br>(d) Established foreign exchange bureaus. |
| 1989 | Enacted new banking law, Banking Law 1989 to strengthen the regulatory environment and supervisory authority of the Bank of Ghana in the following areas: minimum capital requirement, disclosure, and prudential lending guidelines. |
| 1990 | (a) Liberalisation of commercial banks interest rates and bank charges.<br>(b) Abolition of credit controls including credit allocation by sector.<br>(c) Non-performing loans of state enterprises in three financially distressed state - owned banks are replaced by Bank of Ghana bonds.<br>(d) Restructuring of six financially distressed banks. |
| 1991 | Non-performing loans of private sector in four sound banks are replaced by Bank of Ghana bonds. |
| 1992 | New law, Bank of Ghana Law 1992 (P.N.D.C.L 291) is enacted to offer stronger supervisory and regulatory powers to the Bank of Ghana. |
| 1993 | Enacted new law, Financial Institutions (Non-Banking) Law 1993 (NBFI Law), to regulate the non-bank financial institutions |

Table 2: Ghana's Banking Industry Reforms from 1988-2018 (Continued)

| | |
|---|---|
| 1995 | (a) Sale of 30 percent of government shares in Social Security Bank after merging with National Savings and Credit Bank: only 21% was subscribed.<br>(b) Placement of 60% of the capital of the Social Security Bank through the Ghana Stock Exchange. |
| 1996 | Sale of 30% of government shares in Ghana Commercial Bank through the Ghana Stock Exchange; after oversubscription the public offer was raised to 42%." |
| 1998 | Government sold three quarters of the remaining 40% shares it held in Barclays Bank. |
| 2000 | Closure of three insolvent banks: Bank for Housing and Construction, Cooperative Bank and Bank of Credit and Commerce and transfer of guaranteed deposits. |
| 2002 | (a) Bank of Ghana Act (2002) was passed to give independence to the central bank,<br>(b) Bank of Ghana, making price and financial stability as its primary function.<br>(c) Introduction of Real Time Gross Settlement (RTGS) System also known as the Ghana Interbank Settlement System. |
| 2003 | (a) The universal banking license was introduced and as a result Bank of Ghana issued a directive requiring all banks to increase their minimum stated capital requirements to GHS7million by the end of 2006 from GHS20,000.<br>(b) Maintenance, transaction, and transfer fees charges by commercial banks were<br>(c) abolished.<br>(d) The Payment System Act (2003) gave explicit powers to the Bank of Ghana to oversee payments system. |
| 2004 | (a) Banking Act 2004 replaced the Banking Law 1989. Bank of Ghana began to strengthen its risk based prudential supervision policies. In addition, the minimum capital adequacy ratio was increased from 6% to 10%.<br>(b) Bank of Ghana introduced a paper-based credit clearing system. |
| 2006 | (a) Foreign Exchange Act 2006 was passed to liberalise inflows of foreign exchange into Ghana for foreign direct investment purposes.<br>(b) Abolition of secondary deposits reserves requirement (15%) by banks. |

Table 2: Ghana's Banking Industry Reforms from 1988-2018, (Continued)

| | |
|---|---|
| 2007 | (a) Banking Amendment Act, 2007 was passed to allow Offshore banking; to enable establishment of international financial services in Ghana.<br>(b) "The Credit Reporting Act, 2007 (Act 726) was enacted to establish credit reference bureaux to offer a legal and regulatory framework for credit reporting in Ghana."<br>(c) All banks were to report their financial position and performance in accordance with the International Financial Reporting Standards (IFRS).<br>(d) Implementation of risk-based supervision of banks. |
| 2008 | (a) The Anti-Money Laundering Act, 2007 (Act 749) enacted to provide structure for criminalising money laundering.<br>(b) The Borrowers and Lenders Act (2008) was enacted to provide a framework for full disclosure in creditor and borrower relations and in particular the role of collateral in the delivery of credit.<br>(c) Operation of a common electronic platform, the National Switch (e-zwich) and a biometric smartcard. |
| 2009 | (a) The Cheque Code-line Clearing (CCC) was introduced which reduced the cheque clearing period from 5–8 days to 2 days throughout the country.<br>(b) Minimum capital requirement was increased from GHS7 million to GHS60 million in order to strengthen the capital base of the banks to enable them assume greater levels of risk.<br>(c) Mobile payment services were authorised and launched. |
| 2010 | Commencement of electronic direct credit transfer system a component of the Automated Clearing House project. |
| 2011 | The guideline for licensing and operations of Credit bureaux under the Credit Reporting Act 2007 (Act 726) was published by Bank of Ghana. |
| 2014 | New commercial banks were required to have a minimum stated capital of GHS120 million. |
| 2016 | The enactment of the Banks and Specialised Deposit-Taking Institutions Act, 2016 (Act 930) and the Deposit Protection Act, 2016. |

Table 2: Ghana's Banking Industry Reforms from 1988-2018, (Continued)

| | |
|---|---|
| 2017 | Freeze on licensing of new banks and other financial institutions in a bid to strengthen supervision of the existing financial institutions and ensure efficiency in the banking system. |
| 2018 | (a) Recapitalisation of licensed commercial banks to GHS400 million by end of 2018.<br>(b) Directive for Voluntary Winding up of Banks and Specialised Deposit taking Institutions.<br>(c) Cyber and Information Security Directive.<br>(d) Corporate Governance Directive 2018.<br>(e) Revocation of license of insolvent microfinance, microcredit and savings and loans companies. |

Sources: Bank of Ghana Annual Reports (2018, 2014, 2009), PricewaterhouseCoopers(2018, 2014) and International Monetary Fund Country Reports (2018, 2010).

**Regulatory and Supervisory Reforms**

As part of the reform program, regulatory and supervisory framework of the banking system was strengthened with the passage of the following regulatory and supervisory polices:

Following the passage of the new banking law in 1989, the regulatory structure of the banking system was strengthened in areas such as the minimum capital requirements, capital adequacy ratios, prudential lending ratios, exposure limits, accounting and auditing regulations (World Bank, 1989; International Monetary Fund, 1999). For instance, in terms of minimum capital requirements,

commercial banks with at least 60% of Ghanaian ownership were required to obtain a minimum paid-up capital of GHS20,000, while minimum paid-up capital for foreign banks was GHS50,000.In addition, development banks were asked to obtain a minimum paid-up capital of GHS100,000. The Banking Act also prescribed a minimum capital adequacy ratio of 6% which is lower than the Basel prescription. These regulations were implemented due to the financial liberalisation which placed strong demand on prudential regulation and supervision as in the previous year. New private banks, including foreign banks were granted permission to enter into the Ghanaian banking sector in addition to the three foreign banks: Barclays Bank, Standard Bank and Bank of Credit and Commerce.

During 1990, bank interest rates and charges were also liberalised and credit controls were abolished (International Monetary Fund, 2003). However, the banking sector reforms were implemented at a cost. For instance, during the years 1990 and 1991, most non-performing loans of banks were swapped for government guaranteed interest-bearing bonds totaling GHS4.75 million and set to mature in two to five years and earning 7% to 9% in interest (World Bank, 1994). In total, GHS6.2 million non-performing loans were removed from banks' portfolios at an estimated cost of 6% of GDP (International Monetary Fund, 1999). The difference was offset against liabilities to the government or Bank of Ghana. These policies were pursued in order to assist the banks to revive the Ghanaian economy. This move became necessary due to the role played by banks in the provision of credit, payment system and the transmission of monetary policy and as result are vital to

Ghana's financial stability and economic development. Also, this was done to preserve confidence and avoid a flight from deposit (World Bank, 1989).

A new Bank of Ghana law was passed in 1992 to offer stronger supervisory and regulatory powers to the Bank of Ghana, while in 1995, 21% of government shares in Social Security Bank and National Savings and Credit Bank were sold after merging through a public offer (International Monetary Fund, 1999). In 1996, 42% shares of Ghana Commercial Bank were sold. Initially, the government intended to issue 30% shares but the initial offer was oversubscribed so the government increased it to 42% (International Monetary Fund, 1999). Similarly, government sold 75% of its 40% shares in Barclays Bank in 1998. Two state-owned banks: Bank for Housing and Construction and Cooperative Bank were liquidated in 2000 without disrupting banking activities in Ghana. The cost relating to the closure was about GHS6 million and the government issued treasury bills to cover the liabilities to depositors and guaranteed deposits were transferred to solvent banks. In the same year, a private bank, Bank of Credit and Commerce was also closed. This occurred when its parent bank was liquidated. As a result of these liquidations, paid-up capital of the banking industry declined by GHS0.246 million (Bank of Ghana, 2000).

In 2002, a banking law was passed to give independence to the Central Bank (Bank of Ghana) in formulating monetary and financial policies and supervising the financial system and making it more transparent and accountable. The law also empowered Bank of Ghana to strengthen supervision and modernise regulatory

practices. These were aimed at ensuring price and financial stability and providing favourable economic environment for sustainable economic growth.

To enhance competition in the banking industry, the Bank of Ghana introduced universal banking in 2003 to permit banks to enter into commercial, development, investment or merchant banking with no requirement for separate licence (Bank of Ghana, 2007). Universal banking was intended to give banks the ability to take on higher level of intermediation needed to support growth in an expanding economy. Bank of Ghana issued a directive requiring all banks to increase their minimum stated capital requirements from GHS20,000 to GHS7million by the end of 2006. The Foreign Exchange Act 2006 (Act 723) announced in 2006 offered a new statutory structure for foreign exchange payments and transactions. Bank of Ghana, instead of controlling as occurred during the repressive era, monitored foreign exchange transactions for balance of payments and other purposes in uniform with international best practice (Bank of Ghana, 2006). The banks, in turn, were required to submit reports on all transactions in foreign exchange to the Bank of Ghana.

In furtherance to the implementation of the financial reforms, in 2007 Credit Reporting Act, 2007 (Act 726) was enacted." "Companies such as XDS Data limited, Hudson Price Data Solutions and Dun and Bradstreet were some of the earlier credit reference bureau in Ghana to offer credible information on prospective borrowers (PricewaterhouseCoopers, 2012). All banks were required to provide credit details to the bureau. This was an effort to reduce the information asymmetry that had characterised the lending function in Ghana which puts the financial

system at greater risks. In addition, this law protects and enforces creditor rights and help to establish confidence in the banking system (International Monetary Fund, 2007). In addition, Bank of Ghana has established a collateral registry to prevent a borrower from using the same collateral to secure more than one loan.

To prevent money laundering, the Anti-Money Laundering Act, 2007 (Act 749) was set up to offer the structure for criminalising money laundering. This led to the establishment of the Financial Intelligence Centre to identify and monitor money-laundering activities and report to the investigating authorities any information obtained (Bank of Ghana, 2007). Under the Anti-money Laundering Act, a person commits the offence of money laundering if they knowingly convert, conceal, disguise, transfer, take possession of, or use property forming part of the proceeds of unlawful activity (PricewaterhouseCoopers, 2009).

In an attempt to improve the overall efficiency and effectiveness of the supervision process, Bank of Ghana started the risk-based supervision (RBS) of banks in 2007.The banks complied by setting up risk management departments with well trained personnel. The Bank of Ghana obtained technical assistance from the Office of the Superintendent of Financial Institutions of Canada in the form of advice and review of the RBS process. The RBS process involves critical identification, measurement, continuous monitoring, management of risks associated with the operations of banks such as new technologies, branch expansion, product innovation, size, linkages and interdependence of banks (Bank of Ghana, 2007).

In line with the international regulatory standards and to improve transparency as well as facilitating comparison of reported financial results, Bank of Ghana requested all banks in Ghana to report their financial position and performance in line with International Financial Reporting Standards (IFRS) by end December 2008 in which most of the banks complied with the Bank's directive by December 2007 (Bank of Ghana, 2008).

In 2008, the Borrowers and Lenders Act,2007 (Act 738) came into force to ensure full disclosure of information by borrowers and lenders and disallow certain credit practices. It also indicated the role of collateral in granting credit. It set up a collateral registry for charges and collateral credited by borrowers. It gave lenders the authority to take ownership of collateral security after a borrower was given 30-day notice of default without appealing to the court (International Monetary Fund, 2011). Thus, the Borrowers and Lenders Act provides the lending conditions, rights and obligations of lenders and borrowers (PricewaterhouseCoopers, 2009).

In 2009, Bank of Ghana set the minimum capital requirement at GHS60 million from GHS7 million.The foreign-owned banks were required to meet the new minimum capitalization of GHS60 million by 2010.Domestic (local) banks were to attain a capitalization of at least GHS25 million by 2010 and GHS60 million by 2012 (Bank of Ghana, 2008, 2009). The aim is to strengthen the capital base of the banks to enable them assume greater levels of risk, particularly, at a time when banks are allowed to engage in universal banking.

In 2016, the Bank and Specialised Deposit-Taking Institutions Act 2016, Act 930 was enacted to be the primary law governing the banking industry of

Ghana. The coming into force, this law, repealed the Banking Act 2004, Act 673. The Act provided a wider scope to banking compared to the previous law and also increases the supervisory power of Bank of Ghana.

In 2017, the Bank of Ghana revised upward the minimum paid-up capital for existing banks and new entrants from GHS120 million to GHS400 million with a deadline of December 31, 2018. The aim of the recapitalization was to further develop, strengthen and modernize the banking sector to support the economic development of Ghana, restore confidence in the sector and help banks to become more resilient to withstand shocks and underwrite bigger ticket transactions.

**Payments and Settlements Reforms**

In an effort to reform the payment and settlement system, Bank of Ghana set up the Ghana Interbank Payments and Settlement System (GIPSS). All banks operating in Ghana are expected to be members of GIPSS either directly or access the system through member banks as transactions of the GIPSS are settled almost instantaneously.

To modernise Ghana's payments and settlement system infrastructure, the Bank of Ghana set up the Real Time Gross Settlement System (RTGS), meant for high-value payments in 2002." "The RTGS provided good environment for safe, sound, secure, and timely payments (Bank of Ghana, 2007). To complement the RTGS, the Bank of Ghana also introduced a paper-based credit clearing system to ensure the settlement of low-value payments in 2004 (Bank of Ghana, 2007).

In 2008, a common electronic platform, the National Switch (also known as e-zwich) was introduced for all payment's transactions." "This common platform

links all banking institutions at significantly reduced costs. Further, it connects all ATMs and the settlement of payments transactions by customers of different banks at Points of Sale (POS). The National Switch enables transactions to be undertaken on online and offline. To include all segments of the population, Bank of Ghana also introduced a biometric smartcard (e-zwich smartcard). The e-zwich smartcard is mainly used for cash deposits and withdrawals, transfer of e-money, point of sale purchases, card to bank, loading and withdrawal of wages and salaries. (Bank of Ghana, 2007).

In 2009, the Cheque Codeline Clearing (CCC) with cheque truncation system was introduced. CCC reduced the clearing cycle from 5-8 days to 2 days throughout the country (Bank of Ghana, 2010; International Monetary Fund, 2011). In the same year, the Bank of Ghana introduced a branchless banking that allowed mobile phones to be used to provide financial services. It is fast, convenient and secure method mobile phone users could use to transfer money. The services provided are deposits and withdrawals of funds, account balance enquiry, bills payments and funds transfer. (Bank of Ghana, 2009, 2010).Also, an electronic direct credits transfer system started operation. This retail payment system operates on the Automated Clearing House (ACH) platform and facilitates large electronic credit transfer of funds into the accounts of bank customers. Thus, it accelerates the clearing of funds into the accounts of bank customers. The system replaced the paper credit clearing system which ended operations after CCC system was introduced in 2009 (Bank of Ghana, 2010).

In effect, all these activities and infrastructures have been put in place with the objective of modernising and improving the payments, clearing and settlement systems in order to lower over-dependence on cash-based transactions.

**Overview of market structure of Ghanaian banking industry**

Market structure describes the state of a market with respect to competition, thus market concentration (the number and size distribution of firms), market shareholding structure, entry barriers and the extent of product differentiation are main elements that explain the competition. In this section, we provide an overview of the market shareholding structure of the Ghanaian banking industry in terms of deposit, advances and total asset

First, let consider the market share distribution of the banks in terms of total deposits. “The trend of growth in deposit over the study period has been slow with an average growth rate of deposits of 21.3% between 2009 and 2016.” “This percentage however declined to an average of 6.2% in the following years until 2018.” “The significant decline in the growth of deposits reflects the general uncertainty on the future outcome of banks.” “Competition for deposits in the Ghanaian banking industry over the study period have been intense due to the challenge posed by the attractive yields from money market instruments issued by the Government.” “The distribution of market share of the industry’s deposits has not changed significantly over the years due limited differentiation in the products offered by banks to give any bank a strong edge over the others.” “The deposit market however, appears to be concentrated as the top three banks (GCB Bank,

EcoBank, and Barclays Bank) hold an average of over 35% of the industry as at 2018, with the top five holding over 50% of the industry deposit as depicted in Table 3. Over the years, the concentration level seems to be fairly stable but skewed towards some few banks."

Table 3: Market share of total deposits (%) 2009 – 2018

| Bank | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| GCB | 13.3 | 12.5 | 12.8 | 11.3 | 10 | 8.5 | 7.8 | 8.1 | 12.3 | 14.2 |
| Ecobank | 10.5 | 9.5 | 10.7 | 13 | 14 | 11.9 | 11.5 | 11.3 | 12.6 | 13.3 |
| Barclays | 12.1 | 10.2 | 9.3 | 7.3 | 6.6 | 6.4 | 6.6 | 8.1 | 8.0 | 8.4 |
| Standard Chartered | 8.9 | 10.2 | 9.2 | 8.2 | 8.3 | 7.1 | 5.9 | 6.1 | 6.1 | 7.4 |
| Stanbic | 6.2 | 5.8 | 5.7 | 6.7 | 9.3 | 8.3 | 7.3 | 7.8 | 6.2 | 7.7 |
| Fidelity | 3.1 | 4.4 | 5.6 | 5.4 | 5.4 | 6.0 | 7.2 | 6.1 | 7.0 | 7.6 |
| Zenith | 4.9 | 4.4 | 3.6 | 3.8 | 4.0 | 5.1 | 4.7 | 5.1 | 6.2 | 5.8 |
| CAL | 2.9 | 2.3 | 3.6 | 3.8 | 3.2 | 3.8 | 3.7 | 4.5 | 4.4 | 5.4 |
| Access | 1.3 | 0.7 | 1.0 | 2.6 | 2.8 | 3.8 | 3.2 | 3.8 | 4.1 | 4.4 |
| Agriculture Dev. | 4.5 | 4.3 | 5.1 | 4.7 | 4.0 | 3.5 | 4.4 | 3.8 | 4.1 | 4.4 |
| Societe-Generale | 4.1 | 3.9 | 3.9 | 4.2 | 3.7 | 3.8 | 3.2 | 3.4 | 3.5 | 3.7 |
| HFC/Republic | 1.5 | 1.5 | 1.7 | 1.7 | 1.9 | 2.0 | 2.2 | 3.4 | 3.5 | 3.7 |
| United Bank for Africa | 2.1 | 2.5 | 2.9 | 2.7 | 5 | 5.0 | 4.8 | 5.7 | 3.7 | 3.6 |
| Guaranty Trust | 1.9 | 2.3 | 1.6 | 2.3 | 2.5 | 2.0 | 2.2 | 2.1 | 2.6 | 3.0 |
| Prudential | 2.7 | 2.7 | 2.8 | 2.7 | 2.6 | 2.4 | 2.5 | 2.5 | 2.6 | 2.8 |
| First Atlantic | 2.7 | 1.2 | 0.8 | 0.8 | 0.8 | 1.4 | 2.1 | 2.2 | 2.6 | 2.3 |
| Bank of Africa | n/a | 3.0 | 1.8 | 2.3 | 1.5 | 1.5 | 1.6 | 1.3 | 1.6 | 1.3 |
| FBNBank Ghana | n/a | n/a | n/a | n/a | n/a | 0.5 | 0.8 | 0.8 | 0.7 | 0.8 |
| First National | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 0.3 | 0.2 | 0.3 |
| National Investment | n/a | 4.0 | 4.5 | 3.4 | 3.0 | 3.7 | 4.1 | n/a | n/a | n/a |
| Universal Merchant | 5.4 | 5.2 | n/a | n/a | n/a | n/a | 2.1 | 2.7 | 3.4 | n/a |
| Omin Bank | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 0.7 | 0.8 | n/a |

Sources: Bank of Ghana Annual Reports (2019,2014), Ghana Banking Survey (2019, 2014) and Banks' financial statements (2009 to 2018). n/a - non availability of data at the time of data collection.

From Table 3, it can be observed that, the market shares of EcoBank and GCB Bank, the top banks in the industry, has shown consistent increment over the study period. "This trend which further deepens the concentration of deposits towards the top tier banks may be of concern because these banks can influence the

deposit patterns and the deposit rates which can diminish the favourable effects that can be achieved by market forces. Observations in the current year shows that, GCB Bank dominants the "deposit market as the market leader as its deposits grew by 20% from GHS6.95 billion in 2017 to GHS8.33 billion in 2018 representing 14.2% of total industry deposits. This dormancy was over last two years after overtaking the Ecobank. This may be due to the assumption of assets and liabilities of the defunct banks in 2018 which have contributed to its increase in customer base and expansion of its network. In 2018, Ecobank however showed 18% growth in customer deposits over the previous year. However, deposit from other banks suffered a 71% decline in deposits and only achieved an overall 9% growth in total deposits. In comparison with the 21.3% annual growth reported between 2009 to 2016, this is a slower pace. This reflects the general industry trend and reluctance by other banks to make placements because of uncertainty in the sector.

In the loans and advance market, generally, there have been a slowdown over the years in providing loans and advances and this has been the case due to the industry being a "more risk adverse industry as the risk profile of customers in a challenging economic condition has not considered favourable over the years. In all these, on the average, the services sector has been the largest beneficiary of credit extended to any sector of the economy. Nevertheless, the industry showed an average annual increment of 23.7% in loan and advances over the years with Ecobank being the most aggressive credit expansion bank in the industry with 55% growth in its net loan book to end the year 2018 at GHS4.12 billion in comparison with GHS2.69 billion in 2017. Ecobank holds the largest share of the industry's

lending, averaging 15.4% of the total market share and the trend is in line with the bank's commitment to business growth. This is followed by GCB Bank which controls about 11.2% of the market share. On the average, the top three banks hold about 38% of the total industry loans and advance as shown in Table 4.

Table 4: Market share of total loans and advance (%) 2009 – 2018

| Bank | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ecobank | 7.7 | 7.1 | 10.3 | 11.7 | 13.5 | 12.2 | 12.1 | 12.5 | 10.9 | 15.4 |
| GCB | 21.7 | 14.3 | 5.8 | 7.1 | 7.2 | 5.6 | 6.6 | 5.1 | 9.4 | 11.2 |
| Barclays | 8.8 | 6.2 | 7.1 | 5.9 | 5.6 | 5.3 | 6.6 | 7.5 | 10.5 | 12.0 |
| Stanbic | 4.5 | 4.9 | 6.1 | 6.7 | 7.4 | 7.5 | 6.5 | 6.0 | 7.6 | 9.6 |
| CAL Bank | 3.7 | 3.7 | 5.0 | 6.2 | 6.2 | 6.0 | 7.0 | 7.0 | 7.5 | 9.1 |
| Societe-Generale | 5.1 | 4.3 | 4.2 | 4.3 | 4.7 | 4.0 | 3.5 | 3.4 | 5.7 | 6.2 |
| Fidelity | 3.0 | 3.0 | 5.0 | 5.3 | 5.1 | 7.0 | 5.8 | 4.7 | 4.2 | 5.3 |
| Standard Chartered | 7.0 | 6.7 | 7.2 | 8.0 | 7.2 | 5.7 | 4.7 | 4.5 | 5.6 | 4.9 |
| HFC/Republic | 2.7 | 2.6 | 2.6 | 2.8 | 3.3 | 3.1 | 3.6 | 3.3 | 3.3 | 4.4 |
| Prudential | 3.2 | 3.2 | 3.5 | 3.6 | 3.3 | 3.4 | 3.3 | 3.3 | 3.8 | 4.1 |
| Agriculture Dev. | 6.4 | 4.5 | 5.8 | 5.7 | 5.8 | 5.0 | 4.2 | 3.6 | 4.6 | 4.0 |
| Access | 1.3 | 0.3 | 0.9 | 2.3 | 2.7 | 3.8 | 4.7 | 4.6 | 3.6 | 3.0 |
| Zenith | 3.2 | 3.9 | 2.4 | 2.7 | 4.3 | 4.9 | 3.8 | 3.6 | 3.3 | 2.7 |
| United Bank for Africa | 1.3 | 1.2 | 2.1 | 2.3 | 1.1 | 1.9 | 3.0 | 6.6 | 4.5 | 2.4 |
| Bank of Africa | 2.1 | 2.7 | 2.4 | 2.5 | 2.1 | 1.5 | 1.5 | 1.6 | 2.0 | 2.1 |
| Guaranty Trust | 1.8 | 2.0 | 1.4 | 2.0 | 1.9 | 2.1 | 2.5 | 2.2 | 1.6 | 1.6 |
| First Atlantic | 1.5 | 1.5 | n/a | 0.1 | 0.1 | 1.5 | 1.4 | 0.8 | 1.0 | 1.4 |
| First National | n/a | n/a | n/a | n/a | n/a | 0.0 | 0.0 | 0.0 | 0.1 | 0.3 |
| FBNBank Ghana | n/a | n/a | n/a | n/a | n/a | 0.7 | 0.5 | 0.3 | 0.3 | 0.3 |
| National Investment | n/a | 4.7 | 4.8 | 3.8 | 3.3 | 3.5 | 2.9 | 0.0 | 0.0 | 0.0 |
| Universal Merchant | 5.8 | 3.3 | n/a | n/a | n/a | 0.0 | 2.5 | 3.7 | 4.4 | 0.0 |
| Omin Bank | n/a | n/a | n/a | n/a | n/a | 0.0 | 0.0 | 0.3 | 0.7 | n/a |

Sources: Bank of Ghana Annual Reports (2019,2014), Ghana Banking Survey (2019, 2014) and Banks' financial statements (2009 to 2018). n/a - non availability of data at the time of data collection.

Interestingly, the top three companies (Ecobank, GCB and Barclays) that controls the deposit market (see Table 3) tends to be the same companies that controls the advances and loan market (see Table 4), though the order of ranking differs, it is an indication that, the market is concentrated around these companies. In the last few years, Stanbic has consistently gained market in the loan and advance

market amidst the risks relating to the unfavourable macroeconomic environment. Stanbic strategy of pursuing innovative campaign of significant customer acquisition placed the company in the fourth position of the loans market. The same cannot however be said about deposit mobilisation. The industry's loan to deposit ratio has being maintained at a fairly stable at ratio 49.3% per annum which generally portrays the willingness of banks to lend despite the high appetite for Government securities. Growing number of middle-income earners have created opportunities for retail banking and it is common to find new products targeting this group. However, there is very little by way of product differentiation targeting corporate customers. The underlying factor for choosing one bank over the other has been the competitiveness of rates offered by banks.

Finally, we explore the variations in market share based on total assets. The market share of the companies included in the study in terms of operating asset over the study period is shown in Table 5. The industry operating asset grows by 32% annually on the average. The growth may be attributable to increase in deposits and borrowings over the years. Component analysis of the asset shows that, loans and advances remained the most significant component of the industry's operating assets accounting for an average of 43% of the entire industry asset. This composition appears to be consistent over the years even though, there seems to be limited opportunities for banks to extend credit to customers due to the general industry perception that the risk profile of customers has not improved.

Nevertheless, GCB and Ecobank has been the most dominant bank holding 12.1% and "12% of the industry's operating assets respectively. The gap between

the Ecobank and GCB bank market share of operating assets continues seems to narrow year by year. In 2018 for instance, GCB bank held 12.1% of the industry operating asset with Ecobank holding 12%. Nevertheless, the top three companies in the industry holds a third of the industry asset and the top five holds about 35% of the operating asset of the industry making the industry highly concentrated in terms of asset held.

Table 5: Market share of total operating asset (%) 2009 – 2018

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| GCB | 14.3 | 12.3 | 11.8 | 11.0 | 9.4 | 8.5 | 7.9 | 8.2 | 11.4 | 12.1 |
| Ecobank | 10.1 | 8.8 | 10.2 | 12.4 | 12.9 | 11.5 | 10.9 | 10.5 | 11.3 | 12.0 |
| Barclays | 10.8 | 9.3 | 9.0 | 7.3 | 6.4 | 6.0 | 6.3 | 7.4 | 7.9 | 10.9 |
| Fidelity | 2.7 | 3.9 | 5.0 | 5.0 | 4.7 | 6.2 | 7.2 | 5.8 | 7.1 | 8.3 |
| Stanbic | 5.3 | 5.3 | 5.6 | 6.5 | 8.2 | 6.9 | 7.3 | 7.2 | 6.7 | 7.0 |
| Standard Chartered | 10.5 | 9.7 | 9.6 | 8.7 | 8.1 | 6.9 | 5.7 | 5.9 | 6.0 | 6.9 |
| Zenith | 4.1 | 3.8 | 3.4 | 3.6 | 5.5 | 6.3 | 4.4 | 4.6 | 5.9 | 6.6 |
| CAL | 3.4 | 2.8 | 3.7 | 4.3 | 4.4 | 5.5 | 5.7 | 4.6 | 5.3 | 6.0 |
| Agric. Development | 5.5 | 5.5 | 5.6 | 5.3 | 4.4 | 4.3 | 4.1 | 3.5 | 4.0 | 4.2 |
| United Bank for Africa | 2.0 | 2.3 | 2.8 | 2.7 | 4.5 | 3.6 | 4.3 | 5.3 | 4.0 | 4.3 |
| Access | 0.6 | 1.1 | 1.3 | 2.9 | 2.6 | 3.3 | 4.1 | 3.5 | 4.0 | 4.0 |
| Societe-Generale | 4.3 | 3.9 | 3.8 | 3.9 | 3.2 | 3.3 | 3.4 | 3.4 | 3.4 | 3.8 |
| HFC/Republic | 1.9 | 2.1 | 2 | 2.2 | 2.7 | 2.6 | 2.7 | 2.5 | 2.7 | 3.4 |
| Guaranty Trust | 2.1 | 2.4 | 2.1 | 2.5 | 2.6 | 2.4 | 2.4 | 2.2 | 2.5 | 2.7 |
| Prudential | 2.5 | 2.3 | 2.6 | 2.5 | 2.3 | 2.2 | 2.3 | 2.2 | 2.7 | 2.6 |
| First Atlantic | 2.2 | 1.1 | 0.8 | 0.9 | 1.2 | 1.8 | 2.0 | 1.9 | 2.1 | 2.0 |
| Bank of Africa | n/a | 2.4 | 1.8 | 2.1 | 1.7 | 1.8 | 2.0 | 1.5 | 1.6 | 1.4 |
| FBNBank | n/a | n/a | n/a | n/a | n/a | 0.7 | 0.8 | 0.8 | 0.7 | 1.2 |
| First National | n/a | n/a | n/a | n/a | n/a | 0.0 | 0.2 | 0.4 | 0.3 | 0.7 |
| National Investment | n/a | 3.8 | 3.8 | 3.2 | 3.4 | 4.0 | 3.7 | n/a | n/a | n/a |
| Universal Merchant | 5.2 | 4.8 | n/a | n/a | n/a | 0.0 | 2.2 | 3.7 | 3.8 | n/a |
| Omin | n/a | n/a | n/a | n/a | n/a | 0.0 | 0.0 | 0.6 | 3.8 | n/a |

Sources: Bank of Ghana Annual Reports (2019,2014), Ghana Banking Survey (2019, 2014) and Banks' financial statements (2009 to 2018). n/a - non availability of data at the time of data collection.

**Performance of Ghana's Banking Industry**

Ghana's banking industry have shown a steady trend in performance over the study period. Performance is assessed in terms of profitability, liquidity and quality of asset held. Profitability shows the extent to which the industry generate profit from the use of the asset held and the main indicators applied here include profit margin, net interest margin, cost to income ratio, return on asset and return on equity. The performance of the industry in terms of profitability is shown in Table 6.

Table 6: Performance indicators of Ghana banking industry from 2009 to 2018

| Performance indicator | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Profitability* | | | | | | | | | | |
| Profit margin (%) | 19.7 | 27.2 | 30.5 | 37.3 | 45.2 | 42.6 | 30.7 | 29.5 | 36.4 | 38.1 |
| Net interest margin (%) | 7.7 | 9.3 | 8.0 | 15.4 | 16.7 | 9.7 | 9.8 | 9.2 | 9.4 | 8.0 |
| Cost income ratio (:1) | 0.6 | 0.60 | 0.60 | 0.50 | 0.50 | 0.51 | 0.53 | 0.54 | 0.54 | 0.53 |
| Return on asset (%) | 1.6 | 2.3 | 2.4 | 3.5 | 4.2 | 4.1 | 2.9 | 2.3 | 2.8 | 2.9 |
| Return on equity (%) | 12.1 | 16.6 | 17.8 | 23.8 | 27.5 | 28.0 | 20.0 | 17.3 | 19.7 | 17.9 |
| *Liquidity* | | | | | | | | | | |
| Liquid fund to total deposit | 0.68 | 0.73 | 0.71 | 0.65 | 0.68 | 0.68 | 0.66 | 0.77 | 0.84 | 0.91 |
| Liquid fund to total deposit | 0.48 | 0.52 | 0.54 | 0.50 | 0.50 | 0.48 | 0.48 | 0.55 | 0.60 | 0.62 |
| Liquid fund to total deposit | 0.60 | 0.66 | 0.67 | 0.61 | 0.62 | 0.60 | 0.60 | 0.68 | 0.75 | 0.79 |
| *Asset Quality* | | | | | | | | | | |
| Impairment charge to gross loan & advance | 4.2 | 4.7 | 3.7 | 3.6 | 2.1 | 1.9 | 4.6 | 4.5 | 3.0 | 3.0 |
| Impairment allowance to gross loan & advance | 8.2 | 9.1 | 9.4 | 6.6 | 6.3 | 4.9 | 7.9 | 8.6 | 10.7 | 9.8 |

Sources: Ghana banking survey (2018, 2014)

Over the period, the profit margin of the industry showed a steady increment from 19.7% in 2009 to reach it highest ever in 2013 at 45.3% even though the new

banks entry into the banking sector. During the same period, the net interest margin of the industry showed increment from 7.7% in 2009 to its highest ever at 16.7% in 2013 except that there was a sharp decline to 8% in 2011 but quickly rose again in the following year. The fall in the industry interest margin in 2011 may be attributed to the pressure which were mounted on the banks in meeting the minimum capital requirement demanded by the regulator. As expected, cost to income ratio showed a decline from 60% in 2009 to 50% in 2013 which is an indication of efficiency improvement over time. Over the same period, return on asset and return on shareholders' funds of the industry showed significant improvement from 1.6% in 2009 to 4.2% in 2013 in the case of returns on asset and from 12.1% in 2009 to 27.5% in 2013 in the case of returns on equity. "This increase in the performance indexes was in the amidst of the global financial crisis between 2008 and 2011 and it appears that, the banking industry in Ghana was not hardly hit with the crises especially during the time when the country had discovered oil in commercial quantity.

Also, the improved profitability of the industry was mainly driven by income from foreign currency trading and translation or revaluation of asset and liabilities denominated in various foreign currencies.The increase is a result of movements in exchange rates, as the Ghana Cedi depreciated against the major trading currencies in 2013. Even though there was a downturn in the business activities in the country, the volume of foreign exchange transactions increased, mainly driven by funding of oil, energy and telecommunication industries.

During the period from 2013 to 2018, the industry performance in terms of profitability was not encouraging given an adverse movement of all the profitability indicators. Profit margin for instance fell from 45.3% in 2013 to 38.1% in 2018 with 2016 showing it lowest with this period even though during 2017 and 2018, it shows a sign of improvement in profitability. Similar story could be told for net interest margin which showed a fall from 16.7% in 2013 to 8% in 2018. Both return on asset and return on shareholders' funds also exhibited fall over the same period as indicated on Table 6. Efficiency measure, cost to income ratio, which was locked at 50% begun to show a rise after 2013 to 52.7% in 2018. This may be attributed to the industry' strategy of tightening credit to on account of history of loan defaults and the falling rates on treasury bills and other government securities.

The ability and ease with which assets can be converted to cash without significant loss in value to meet the banks' financial obligations is measured by liquidity and is a key performance indicator monitored by the BoG.Holding a high level of liquid assets widens the safety net of the banks and ensures compliance with the BoG's minimum liquidity requirements; however, these benefits are offset by the returns the banks may forfeit by not investing in longer term assets with relatively higher returns. Excess liquidity in the industry may also be an indication of limited lending opportunities for banks; a core earning activity of these banks. The main indicators are ratio of liquid fund to total deposit, ratio of liquid fund to total asset and ratio of liquid fund to interest bearing liabilities. These indexes are shown in Table 6. The liquidity of the industry has been undulating over the period. Generally, all the indicators showed improvement in liquidity between 2009 to

2011, a fall in performance from 2011 to 2015 and the improvement in performance from 2015 to 2018. The improvement in liquidity performance between 2009 and 2011 could be attributed to the fact that, during this period, there was a growing trend for banks to hold funds in less risky assets.The favourable macroeconomic condition of lower inflation and greater stability of the cedi did not stimulate an increase in lending activity. At the end of 2010 for instance, liquid funds held was 73% of the industry's deposits. Between 2009 and 2010, the rate of increase in the industry's liquidity has been relatively slower.The government reduced its borrowing in 2010 and in consequence, interest on government securities dropped.Returns from placing funds in liquid assets is gradually becoming a less attractive option because depositors are demanding competitive rates. Half of the banks in the industry remained risk averse and held funds in money market securities. Liquidity performance of the banks then showed a sign of falling from 2011 but improved during 2016.This is an indication that, the liquidity profile of Ghanaian banks has not changed significantly from the prior years. The industry is being very cautious in maintaining liquid funds to meet its contractual obligation when it arises.

Loan impairment ratios is used as asset quality indicator. Indicators of asset quality as proxied by impairment charge to gross loan and advance and impairment allowance to gross loans and advances is shown in Table 6. Between 2009 to 2011, even though profitability of the industry shows improvement, the banks are showing an increasing trend in impairment charge. During this period, the industry's annual impairment charge as a proportion of the gross loans and

advances has increase from 4.2 % in 2009 to 4.7% in 2010. In the last two years, the trend appeared to be slower but remained high. The slower deterioration in the loan book is an indication of the action taken by the industry in strengthening credit administration and recovery procedures. From 2012 to 2014, the industry begun to achieved remarkable success in ensuring an improvement in the quality of the loan book.The impairment allowance as a percentage of gross loans and advances remained fairly stable 6.3% in 2013. The industry became very aggressive in its loan underwriting practices between 2006 and 2009 and as a consequence suffered high default rates. In a turnaround, banks 'cleaned up' their books after 2010 and strengthened the credit assessment, monitoring, remedial and recovery processes. Legislative changes as part of BoG credit administration reforms led to the establishment of three credit reference bureaux, collateral registry and the Borrowers and Lenders Act for effective credit administration. These changes contributed to the improvement in quality of the loan book. From 2015, the asset quality begun to deteriorate, even though it showed some improvement towards the end of the study period.

**Chapter Summary**

Ghana's financial system is dominated by both domestic and foreign banks. Most remarkably, foreign banks hold over 51% of the total assets of Ghana's banking industry.Ghana banking system is small and banks sizes are small on average. The amount of total assets of the Ghanaian banking sector in 2018 was GHS80.6 billion (Ghana Banking Survey, 2019). The amount of total deposits in

2018 was GHS58.8 billion representing 82.1% (of total liabilities), thus being the main source of bank funding whereas the total borrowings in 2018 amounted to GHS29.7 billion (Ghana Banking Survey, 2019).

Between 1988 and 2018, the entry of foreign banks and more market-oriented policies have fostered competition and efficiency in the banking system. The repressive policies have either been removed or diminished. The removal of restrictions on foreign bank entry, interest rates and exchange rates and decreased in direct government intervention have entice foreign banks to enter Ghana's banking and financial markets. The quality of bank services to their customers has been immensely enhanced. The banks have provided innovative products such as electronic-banking, telephone banking, internet banking and ATM facilities. The Bank of Ghana has also introduced the necessary reforms regarding payments and settlements and supervision and prudential regulations. However, the strong competition and increased liquidity has caused bank management to take on higher risk ventures. Over the last five years (2014-2018), asset quality, even though improving, continue to be a major problem in Ghana's banking industry. Nevertheless, Ghana's banking industry is adequately capitalized, liquid and profitable especially following the clean-up exercise carried out by the regulator.

# CHAPTER THREE

# LITERATURE REVIEW

## Introduction

This chapter provides a review of the relevant theoretical and empirical literature on bank efficiency, market structure, economic and financial freedom and their linkage with banks' profitability. Specifically, the chapter seeks to achieve two main goals: Firstly, the chapter provides a review of existing theoretical and conceptual literature that explains efficiency and market structure and attempt to link these concepts to banks' profitability. The object here is to describe the theoretical blocks on which the study is based. Secondly, the chapter aimed at carrying out a review of empirical literature on efficiency, market structure, freedom and profitability.

The chapter is organised into three main sections; the first section provides a comprehensive review of methodological and empirical bank efficiency literature; this is followed by review of literature in relation to market structure with much emphasis on competition in the banking industry. Finally, the chapter presents a review of studies on efficiency-structure-performance relationship. The chapter then ends with a summary and conclusion.

## Literature Review on Bank Efficiency

There are profuse number of literatures on efficiency measurement methodology and application of these methods across several industries and across

countries. In this section, the study provides a review of efficiency concept, review of various methodological approaches on efficiency measurement and then explore recent empirical studies on cross country studies on bank efficiency, first, among emerging economies and then studies focusing on the banking industry of Ghana.

**Concepts of efficiency**

Efficiency refers to the optimization of resource allocation to maximize output levels, using minimum resource at minimum costs in order to achieve stated business operational goals. Studies on efficiency measurement may differ from one another in different dimensions such as the conceptualization of efficiency assumed and the measurement method applied in the study. As such, the efficiency scores may vary across studies. Thus, this section discusses efficiency concepts and the different methodologies applied in measuring efficiency, especially, in the banking environment.

In embarking on efficiency study, a primary decision to make at the onset of the study is to determine the type of efficiency to estimate, since a firm may not be efficient in all respect. For instance, a firm may be technically efficient, but may possibly be allocatively inefficient such that, maximum output may be achieved from the minimum feasible input combination (technically efficient) but may fail to allocate their inputs in a cost-minimizing manner within the price of the input (allocatively inefficient) which may in tend leads to cost inefficiency. Additionally, some firms may even be allocatively or cost efficient, but may not be profit efficient due to misallocation of outputs in a revenue-maximizing manner within the price

of the output, which may lead to profit inefficiency. This brings out three most common concepts of efficiency that have been extensively examined in the empirical literature; technical efficiency, allocative efficiency and X – efficiency (cost efficiency and profit efficiency), each of which provides valuable information and insight into the firm's efficiency paradigm.

***Technical efficiency***

Technical Efficiency is the effectiveness with which a given set of inputs is used to produce a desire output. Thus, if a firm is producing the maximum output attainable, given the input resources it employs, it is said to be technically efficient (Leibenstein, 1966). In terms of distance functions, technical efficiency is the distance, in terms of output produced, between individual firm and the 'optimal' or 'best-practice' firm, which is shorten based on the firm's ability to use the best available practices and technology in the most effective way (Olson & Vu, 2007).

More specifically, a technically efficient bank optimally transfers physical inputs, such as labor and capital, into outputs at an optimum level of performance. Hence, there is at least or no waste in using inputs to produce output (Al-Delaimi& Al-Ani, 2006). In this respect, when a firm's expected output (frontier) is equal to its actual output, then technical efficiency is attained. Rahman and Rahman (2009) posited that a firm's level of efficiency in the technical sense could be considered, given locational and environmental constraints. Greco (2008) put it in another perspective that, as a precondition for allocative efficiency, technical efficiency describes production that has the lowest possible opportunity cost. That is to say,

input resources are not wasted in the production process in a technically-efficient production system.

***Allocative efficiency***

Allocative efficiency reflects the ability of a firm to use inputs in optimal proportions, given their respective prices and the production technology, hence also known as price efficiency. From Farrell (1957), a firm is allocatively efficiency when the firm is able to equate it marginal product of factor of production to the price of those factors. This can be achieved where the firm is able to combine different input resources to produce a mix of different output at a minimum cost. At this point, the marginal cost of the firm's production is equal the marginal benefit (Manjunatha*et al*., 2013, Guerrero &Negrin, 2005).

***X - efficiency***

The X-efficiency, as initiated by Leibenstein (1966), refers to the ability of firm to select input and/or output levels and combination of them to optimize an economic goal, such as cost minimization or profit maximization. X – efficiency can be derived from a cost function or profit function.

***Cost efficiency***

The X – efficiency derived from a cost function is known as cost efficiency. Cost efficiency measures how proximate a firm's cost is to that of a best practice firm within the industry when producing the same output bundle under the same cost conditions. In the case of banking industry, it measures how close the bank's cost is to the minimum cost determined by the best practice banks in the sample.

Cost efficiency is derived from estimating a cost function for the industry, where total cost ($c$) is considered as endogenous variable and regressed as a function of a set of exogenous variable; outputs ($y$), price of inputs ($w$), environmental variables ($z$), random noise ($v$) and inefficiency ($u$), written in log terms as:

$$\ln c = \ln f(y, w, z) + v + u \tag{1}$$

From equation (1), cost efficiency score can be computed as the ratio of the minimum costs that could have been incurred to produce a given output set to the actual costs incurred. That is;

$$X - efficiency_{cost} = \frac{\hat{c}_{min}}{\hat{c}_i} = \frac{\hat{u}_{min}}{\hat{u}_i} \tag{2}$$

Where

$\hat{c}_{min}$ = the predicted minimum costs used by the best practice firm

$\hat{c}_i$ = the estimated actual costs of each specific firm

$\hat{u}_{min}$ = the minimum of the cost inefficiency across all banks in the sample

$\hat{u}_i$ = the estimated actual cost inefficiency of a specific bank

Theoretically, the cost efficiency score falls between zero and unity. It is equals to one for a best practice bank within the sample and the extent of inefficiency is measured from deviation of the score from unity. For instance, if a bank has a cost efficiency score of 0.9, it would indicate the bank is 10% less efficient in costs relative to the best practice bank operating under the same condition.

*Profit efficiency*

Considering from the angle of profit, X - efficiency can also be obtained from a profit function (known as profit efficiency in this case). Profit efficiency measures how close a firm is to produce the maximum possible profit. There are two ways of obtaining profit efficiency in the literature; the standard profit efficiency and an alternative profit efficiency.

*Standard profit efficiency*

The standard profit efficiency measures how close a firm is to achieve the maximum profit given a certain level of input prices and output prices. Profit efficiency is derived from estimating a profit function given as follows

$$\ln(\pi + \theta) = \ln f(p, w, z) + v - u \tag{3}$$

where π is the profits of the firms, θ is a constant to the profit to ensure the natural log is taken on a positive number, *p* and *w*are the vectors of output prices and input prices, respectively, while *v* and *u* are random noise and inefficiency respectively. From Equation (3), standard profit efficiency score can be computed as the ratio of actual profit of a firm to the maximum possible profit obtained by the best practice firm in the same. That is;

$$X - efficiency_{profit} = \frac{\hat{\pi}_i}{\hat{\pi}_{max}} \tag{4}$$

Where

$\hat{\pi}_{max}$ = maximum estimated profits generated by the best practice bank in the sample

$\hat{\pi}_i$ = estimated actual profits of each specific firm

Again, the score would theoretically lie between zero and unity with unity indicating the profit efficiency for the best practice bank within the sample." "Thus, if a bank has a profit efficiency score of 0.9, it would indicate that, the bank is losing 10% of its profit due to excessive cost used or insufficient revenue raised.

*Alternative profit efficiency*

Profit efficiency can also be viewed as how close a bank is to achieve maximum profit at a given output level rather than output prices. In this case, profit function in log terms is written as;

$$\ln(\pi + \theta) = \ln f(y, w, z) + v - u. \quad (5)$$

It can be observed that, equation (5) is identical to equation (3) except that $y$ replaces $p$ in the function. Using equation (5), profit efficiency is measured as ratio of actual profit to the possible maximum profit earned by the best practice. The main difference between equation (3), the standard profit model and equation (5), an alternative profit model is that the alternative profit model is applied to cases where market power is present. Also whiles standard profit model assumes perfect competition, i.e. firms are price takers, the alternative profit model assumes imperfect competition, i.e. firms can be price makers.

*Profit or cost efficiency?*

In estimating X – efficiency, it is necessary to determine whether to use cost or profit efficiency scores. Berger and Mester (1997) argued that, profit efficiency provides a better measure than cost efficiency when evaluating the overall performance of firms such as banks. They further argued that, cost efficiency accounts for errors only on input side but profit efficiency accounts for errors at both on the input and output side. Comparing the two, they stated that cost efficiency is based on economic objective of cost minimization, requiring bank managers to focus on reducing operating costs without any effort to maximize revenue, but profit efficiency is premised on a more accepted economic objective of profit maximization which requires bank managers to focus on raising marginal revenue as well as reducing marginal cost. Teclesand Tabak (2010) however observed that, whether cost efficiency or profit efficiency, they all suffer a limitation; the efficiency is a relative measure against the best practice bank within the sample and that, the best practice bank itself may not be efficient when compared to banks outside the sample.

In this study however, efficiency is examined from the perspective of cost, as the current stage of development of the banks of the Ghanaian banking industry, managers are more concerned with cost minimization rather than profit maximization. Besides, cost efficiency it is a more commonly specified and accepted efficiency concept in the literature, thus, its estimation would enable a possible comparison with other banking industry under the same concept.

*Decomposition of X - efficiency*

X-efficiency is a multifaceted concept with several meanings depending on which perspective to look at it. Farrell (1957) was the first to propose the decomposition of X-efficiency. Based on his seminal study, cost efficiency can be decomposed into technical (the ability to avoid waste by maximizing outputs for a given set of inputs or minimizing inputs for a given set of outputs) and allocative efficiency (the ability to combine inputs and outputs in optimal proportions given prevailing prices). Farrell (1957) illustrated the decomposition using a simple hypothetical example as shown in Figure 2.

Let define $y = f(x_1,x_2)$ as the function of efficient production, where $x_1$and $x_2$denote the two inputs used in obtaining output $y$. Assuming of constant returns to scale, the efficient production function is characterised by a unit isoquant $SS'$, where the unit isoquant is defined as $f\left(\frac{x_1}{y},\frac{x_2}{y}\right) = 1$. Assume, a firm uses the quantities of inputs $(x_1^*, x_2^*)$ represented by point P to obtain a unit of output $y^*$. Point Q represents an efficient firm that uses the same proportion of inputs as P. As such, the same quantity of P can be produced using only the fraction $\frac{OQ}{OP}$ of inputs. This ratio, which measures the proportion of inputs that are really necessary, is a measure of the technical efficiency of firm P. This ratio takes values between zero, if the firm is inefficient, and one, if the firm is efficient.

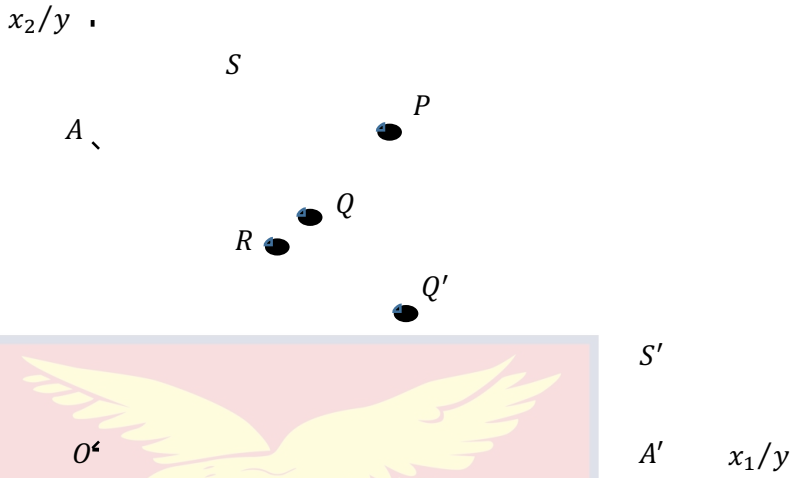


Figure 2: Technical and Allocative Efficiency
Source: Adapted from Farrell (1957)

Points Q and $Q'$represent a technically efficient firm. Taking into consideration the price of the of the production inputs, the slope of the straight iso-cost $AA'$ is equal to the ratio of the prices of the inputs. In this new situation, even though both points represent full technical efficiency, given the prices of the inputs, the cost of production is only minimized in point Q. Considering that the cost in R is the same as in Q, the allocative efficiency is defined as the ratio$\frac{OR}{OQ}$. A value of 1 of this quotient indicates allocative efficiency and values below the unit indicate the degree of allocative inefficiency achieved by the firm. Lastly, if the firm observed is efficient from the technical point of view, as well as in relation to the prices of the inputs, the cost efficiency or X – efficiency is defined as the ratio $\frac{OR}{OP}$. Mathematically, it can be shown that X – efficiency is the product of both technical efficiency and allocative efficiency. That is, X – efficiency is;

$$\frac{OR}{OP} = \frac{OQ}{OP} \times \frac{OR}{OQ} = TE \times AE \quad (6)$$

Thus, X - efficiency is a broader concept and requires firm to be technically efficient as well as allocatively efficient. It is quite possible that some firms are relatively technical efficient but cost inefficient, depending upon managers' abilities to use the production technology and their abilities to control the prices. Therefore, the use of different efficiency concepts may give significantly different efficiency scores and rankings, even under the same approach.

**Methodological review of bank efficiency measurement**

The measurement of efficiency was initially studied in the early works of Edgeworth (1881) and Pareto (1927), and empirically operationalized in the work of Shephard (1953). From this period, efficiency of banking institutions has raised much concerns and interest of research scholars especially during the time when there is a rising level of instability in the financial systems of most economies. A review of the literature suggests three main approaches for measuring bank efficiency: traditional, econometric, and frontier approach as depicted in Figure 3.

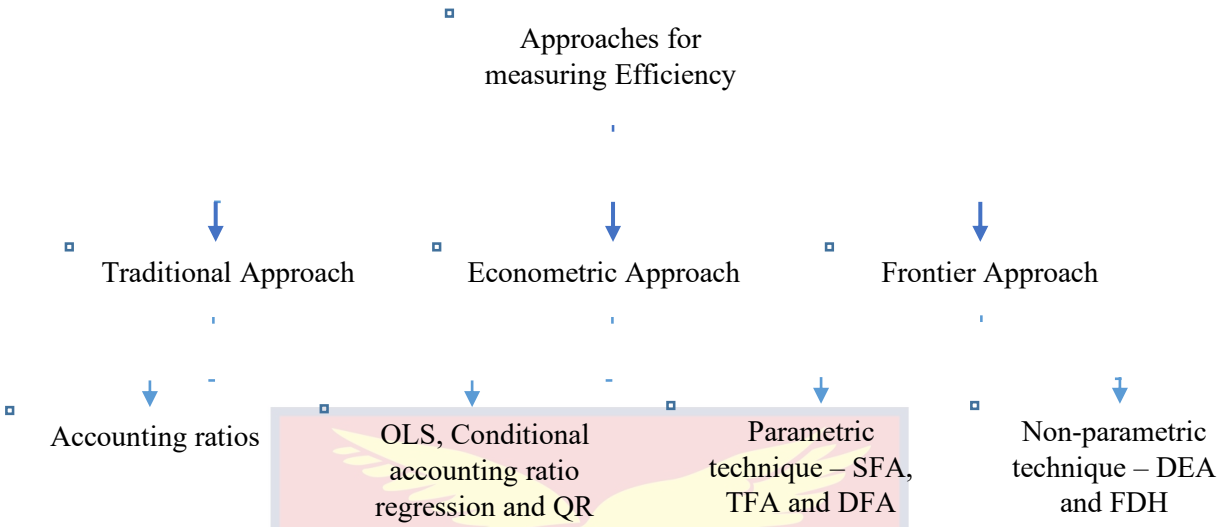


Figure 3: Approaches for measuring efficiency
Source: Adapted from Sunil and Rachita(2008).

***Traditional approach***

The traditional approach of measuring efficiency basically involves the use of accounting ratio and is considered as one of the simplest and most frequently used methods for assessing cost efficiency (Sherman, 1984; Ehreth, 1994). The approach is commonly used by regulators, managers of financial institutions, and industry consultants to evaluate bank performance. Several traditional methods can be identified in the bank efficiency literature; financial accounting ratios, productivity per employee indicator, reserve requirement such as capital adequacy, monetary indicators, and interest rate spreads (Moffat, 2008). Among these traditional techniques however, the most commonly used is the financial accounting and efficiency ratios, where efficiency is defined as the ratio of the

firm's output to the firm's input. The ratios are derived from financial statements and annual reports of these banks.

Generally, accounting ratios is used to compare the performance of a unit to other similar units (horizontal performance analysis) and the performance of a single unit over time (vertical performance analysis).The application of ratio analysis to assess banks' efficiency is embraced due to its simplicity in terms of computations and also is useful in identifying which aspects of an organization's operations that are out of line with the norm (Pham, 2011). Despite the appealing simplicity of this approach to efficiency measurement, Berger and DeYoung (1997), Colwell and Davis (1992), Moormann and Sottocornola (2009) among other authors have criticize several aspects of accounting ratios. In particular, Berger and DeYoung (1997) retreated that, ratios compare two variables at a time, one measuring an input quantity and another measuring an output quantity. Thus, ratio analysis examines only a part of the unit's activity at a time. This explains why the use of ratios in efficiency assessment is based on the calculation of several ratios simultaneously. These ratios, however, tend to present a set of numbers that give no clear indication of true efficiency. A typical instance is where a bank opens a new branch and employ additional labour and equipment to keep the branch running, the bank in this case may increase its productivity per labour, but the cost per labour may rise.

In assessing efficiency using ratios, the productivity per labour ratio may suggests an improvement in the bank's efficiency, but the cost per labour may suggest that the bank is less-efficient. Hence, there may be no comprehensive picture of how

the bank is efficiently operating, and thus, the ratio analysis becomes ineffective in efficiency evaluations. Daley and Matthews (2009) also challenged the application of accounting ratios in assessing efficiency on the basis that while accounting ratios are useful and give some indication of the level and changes in efficiency over time, they represent a final outcome and do not allow for identification of the sources of inefficiency and where improvements are necessary. Also, the classical view of bank efficiency measurement using accounting ratios is considered misleading as the cross-sectional differences in input and output mixes and their prices are not properly accounted for in this approach, and besides, the analysis requires great caution and in-depth knowledge of the indigenous conditions of the bank which may not be realistic (Berger *et al.*, 2009).

The use of accounting ratios failed to control for the influences of input price, output price and other exogenous market factors, which constrain the standard performance ratios from reaching closer estimations of the true performance. In an attempt to overcome some of the limitations of the use of accounting ratio in efficiency assessment, methods such as the frontier approach, have been developed with the limitations of the ratios approach in mind for which the current study seeks to employ. Several studies have provided a comparison of the accounting ratio approach to other approaches such as the frontier approach and the results under the frontier appears to be robust and more reliable (see Sherman, 1984; Thanassoulis*et al*., 1996; Nyhan& Martin,1999). On this basis, the current study makes use of the frontier approach.

***Econometric approach***

Applying econometric approach to efficiency measurement involves estimation of frontier production functions necessary to achieve the "maximum output attainable given a set of inputs.The estimation of the frontier production function is premised on the theoretical foundation that all observed units cannot exceed the maximum attainable output, with the given set of inputs. Basically, two techniques can be identified under this approach; ordinary least square regression, conditional accounting ratio regression and quantile regression.

*Ordinary least square regression*

Ordinary least square (OLS) regression involve the modeling of the production function and estimate the relationship between a predicted output and various inputs of individual units. The primary advantage of regression techniques over ratio analysis is that, it can handle multiple inputs measured against a single output. However, it suffers from the same major limitation as ratio analysis – the inability to incorporate multiple outputs in the model. Single-equation regression analysis assumes that there is only one output in the model, therefore, multiple outputs need to be combined into a single indicator of production. multiple equation regression models can be used, but there is no explicit way to interpret performance by the multiple set of residuals. Secondly, regression analysis measures efficiency based on estimates of average production functions. Therefore, it provides little direct information concerning the potential extent of efficiency gains for individual units in the sample.

Finally, regression analysis requires the parametric specification of a production function, which is unlikely to be known for many units. For example, it is difficult to say, on average, how banks combine and should combine their inputs to produce outputs. These limitations make the technique to provide only limited information about efficiency hence spirally applied in efficiency studies (DeLancer, 1996).

*Conditional accounting ratio regression*

Instead of directly regressing inputs on output, one mechanism suggested by efficiency researcher such as Berger and DeYoung (1997), Colwell and Davis (1992), Moormann and Sottocornola (2009) is to form peer groups in order to compare the firm-specific efficiency values, that is, grouping the banks operating at the same scale and in the same region, where all banks follow the same strategic objectives and are identically organised. All these environmental factors severely affect revenues and expenses of banks so that comparisons among multiple groups are meaningless. The natural extension of the peer group idea is the regression of accounting ratios conditional on all environmental factors of importance. After estimation of the parameters using the ordinary least square, the expected (mean) efficiency ratio for every bank can be calculated, given the firm-specific values of the respective explanatory variables. A comparison between the conditional mean value and the actual value of the efficiency ratio provides insight as to whether a bank is better or worse than the average.

This method was applied by DeYoung to 330 observations where a goodness-of-fit (the R-squared) of 19.78% was achieved." "He admits that a log-specification might lead to a higher explanatory power of the model and that further explanatory variables can be added (even squared variables), but he mentions that it is important that those variables are beyond the control of the management. As conditional accounting ratio regressions indeed offer the possibility to compare banks among each other, they certainly provide a rough guidance for practitioners. For scientific purposes, the above-mentioned shortcomings prevail.

*Quantile regression*

Quantile regression (QR) has become widely use in the economics literature as large micro data sets have become available and also in efficiency studies. Comparative to ordinary least square (OLS) regression, the later yields a conditional expected value function for the dependent variable – a function that allows for the calculation of the expected value of the dependent variable given values of the explanatory variables. In working with large micro data sets such as those from the banking industry, it is common for even well-behaved equations (ones with large t- and F-statistics) to have low R values as the data may be widely scattered around the least square line. Traditionally, in looking at the properties of the scatter of observations around their estimated conditional mean the focus has been simply to check for heteroscedasticity.

Quantile regression extends the analysis of the distribution of the observed value of the dependent variable around its expected value by fitting equations

characterizing the expected conditional quantiles of that distribution. Thus, just as OLS yields an equation characterizing the way the mean of the observations on the dependent variable is expected to change as the values of the explanatory variables change, so quantile regression produces equations that can be used to observe how the spread of the distribution around the mean changes. Basically, quantile regression is an extension of least absolute deviation (LAD) estimation, which yields an equation for the conditional median of the dependent variable. Thus, it can be applied in reducing the impact of large outliers on the estimated conditional function for a measure of central tendency.

Thus, quantile regression offers an alternative to OLS as a method of estimating the production frontier. Since inefficient firms will lie below the true frontier, the presence of a handful of highly inefficient producers might bias the OLS-estimated location of the production function downward, that is, may pull the estimated curve below the true frontier. By choosing one of the upper quantiles to estimate, the effect is to down-weight any unusually low values of the observed dependent variable, on the assumption that they are likely to represent inefficient firms and, presumably, this will yield an estimate of the production frontier that is closer to the true than would obtain using OLS.

Quantile regression is a semi-parametric approach, which requires an assumption about the functional form of the frontier but does not require the imposition of a particular form on the distribution of the inefficiency terms. The true distribution of the inefficiency term is never known in practice, so quantile regression avoids imposing strict assumptions on the inefficiency terms. Bernini *et*

*al*. (2004) applied quantile estimation in the context of frontier production function estimation, using micro data on Italian hotels, which they assume that hotels in the upper quantiles of the output distribution are the more efficient production units and investigate how the estimated coefficients of the production function change as they move to higher output quantiles. The argument here would be that less-efficient firms are probably not extracting the full marginal product from each additional unit of inputs. They find quite dramatic changes in the input elasticities in the upper quantiles, especially from the 95th percentile up. The details of the methodology and equations for running quantile regression are set out in Koenker (2005) and the details of general discussion of quantile regression is set out in Koenker and Hallock (2001).

***Frontier approach***

Frontier approach of measuring efficiency is essentially a means of 'benchmarking' the relative performance of production units which is a usual practice in the financial industry where most financial institutions with varying degrees of success, benchmark themselves with the best performing units within the industry or with the average industry performance. The history of theoretical developments in frontier analysis of producers' performance can be traced back to the pioneer work of Michael Farrell, who was the first to measure economic efficiency. Farrell (1957) also introduced a method to decompose the overall efficiency into its technical and allocative components.

A review of the extant literature showed that, at least five different types of techniques that adopt the frontier approach have been employed in evaluating bank efficiency. These techniques differ primarily in the assumptions imposed on the data in terms of first, the functional form of the best-practice frontier (whether a more restrictive parametric functional form or a less restrictive non-parametric form), secondly, whether or not account is taken of random error that may temporarily give some production units high or low outputs, inputs, costs, or profits, and finally, if there is random error, the probability distribution assumed for the inefficiencies (whether half-normal or truncated normal distribution) used to disentangle the inefficiencies from the random error. Concentrating on the first criteria, the frontier techniques can be classified as non-parametric and parametric."

*Non-parametric frontier techniques*

Non-parametric approaches, place relatively little structure on the specification of the best-practice frontier. Two methods are commonly applied in the literature; data envelopment analysis (DEA) and Free Disposal Hull (FDH) with the former being mostly applied. As Berger and Humphrey (1997) summarized, the primary advantage of the non-parametric techniques is that they do not require the specification of a particular functional form for the cost or production function for the inefficiency. So, it imposes very little structure on the shape of the efficient frontier. It also makes no prior assumption regarding the form of the distribution of inefficiencies across observations.

However, the key drawback of the nonparametric techniques is that, they usually do not incorporate idiosyncratic error and attribute all the difference to the inefficiency. This may overstate the true level of inefficiency and mislead the conclusion, if the difference is due to measurement errors, luck or exclusion of important regressors. This limitation actually restricts the application of these techniques in efficiency measurement. Nevertheless, a review of 122 frontier studies in financial institution efficiency by Berger & Humphrey (1997), 60 of the applied non-parametric method indicating how common the application of these techniques is.

*Data envelopment analysis (DEA)*

DEA is a linear programming technique where the set of best-practice or frontier observations are those for which no other decision-making unit or linear combination of units has as much or more of every output (given inputs) or as little or less of every input (given outputs). The DEA frontier is formed as the piecewise linear combinations that connect the set of these best-practice observations, yielding a convex production possibility set. As such, DEA does not require the explicit specification of the form of the underlying production relationship. DEA develops an empirical frontier function the shape of which is determined by the most efficient producers of the observed dataset. Because efficiency is measured as the distance to this frontier, without considering statistical noise, DEA is a deterministic model. The main advantage of the method is the flexibility due to its non-parametric nature, i.e. no assumption about the production function is required.

DEA was originally introduced by Charnes*et al*. (1978) to measure efficiency in public sector and non-profit entities where typical economic behavioral assumptions, like cost minimization or profit maximization may not apply, such as police force, healthcare and education. This was extended, amongst others, by Banker *et al*. (1984) to account for variable returns to scale. Sherman and Gold (1985) were the first to apply the DEA to banking industry which is reviewed in Berger and Deyoung(1997). Since then, there has been a large number of papers which have applied and extended this methodology. For example, Lovell (1993) and Seiford (1996) offered extensive reviews of this literature, and Cook and Seiford (2009) presented recent methodological development.

DEA does not distinguish between inefficiency and random error. Thus, any deviation from the frontier is attributed to inefficiencies. For instance, if there is any shock that reduces the performance of a bank, it will be considered as inefficiency. This may result in overestimation of inefficiencies. In addition, it is not possible to conduct statistical hypothesis tests due to it nonparametric methodology.

*Free Disposal Hull (FDH)*

The free disposal hull approach (FDH) is a special case of the DEA model developed by Deprins*et al.* (1984) where the points on lines connecting the DEA vertices are not included in the frontier. Instead, the FDH production possibilities set is composed only of the DEA vertices and the free disposal hull points interior to these vertices. Because the FDH frontier is either congruent with or interior to

the DEA frontier, FDH will typically generate larger estimates of average efficiency than DEA (Tulkens, 1993). Either approach permits efficiency to vary over time and makes no prior assumption regarding the form of the distribution of inefficiencies across observations except that undominated observations are 100% efficient.

*Parametric frontier techniques*

Parametric methods are based on the econometric ordinary least squares method (OLS). Parametric efficiency is derived on the assumption of a production function and specific distributions for the error terms that allows calibration through an estimation method. The main advantage is the ability to measure efficiency, while simultaneously considering the presence of statistical noise. Three main parametric frontier approaches are employed to estimate efficiency in the bank efficiency literature.

*Stochastic Frontier Approach (SFA)*

This is the most common parametric estimation technique originated by Aigner, Lovell and Schmidt (1977), and then Meeusen and van den Broeck (1977). It defines a functional form for cost, profit, or production relationship among inputs, outputs, and environmental factors and allows for error term (Berger & Humphrey, 1997). The fundamental benefit of SFA is that, it allows for idiosyncratic error (which arise from measurement error, sampling error and specification error). In the SFA, the inefficiency and idiosyncratic error term are disentangled by making

different assumptions about their distributions. The inefficiency term is assumed to follow an asymmetric distribution, such as half-normal and truncated half normal, while the idiosyncratic error term is assumed to follow a symmetric distribution, usually the standard normal distribution. The main disadvantage of the parametric methods, however, is that they have to impose particular structure on (i) the shape of the frontier by specifying a functional form for the relationship among inputs outputs and other influential factors, such as Cobb-Douglas production function and translog cost function, and (ii) the specification of the error component distributions.

*Distribution free approach (DFA)*

DFA was developed by Berger (1993) based on the assumptions of SFA, except that, DFA imposes no assumptions about the distribution of the inefficiency and the random errors, because it considers inefficiency to be constant over time while random error tends to average out over time. This assumption has been criticized due to it unrealistic application, hence, rarely applied in the literature.

*Thick frontier approach (TFA)*

"TFA developed by Berger & Humphrey (1991), also requires a functional form just like the SFA. It measures separately the highest and lowest performance quartiles of the observations. It assumes that deviations in predicted performance values between the highest and lowest quartiles represent inefficiencies while the

random error is the deviation within the lowest and highest performance quartile of observations (Berger & Humphrey, 1997).

***Which approach to apply?***

As the non-parametric and parametric methods have their own advantages and disadvantages, there is no consensus about the single best estimation methodology for efficiency measurement. Both parametric and non-parametric estimation techniques are equally good when measuring various forms of the efficiency of firms. However, the parametric techniques are often preferred as they generally correspond well with cost and profit efficiency concepts. Non-parametric techniques generally ignore prices and therefore can only account for technical inefficiency and not allocative inefficiency (Berger &Mester, 1997).Also, the DEA reports both the inefficiency scores and the random error term as one, which consequently provides inaccurate efficiency measures whereas the SFA reports the random disturbance term separately from the one-sided inefficiency scores of the individual firm. The SFA approach therefore gives a more robust estimate of the bank's efficiency scores. On this basis, this study applied the SFA to estimate the cost efficiency of the banks in the sample.

**Review of empirical literature on bank efficiency**

There is a volume of literature that have empirically studied the efficiency of banking institutions over the past decades. These studies have applied parametric and/or non-parametric approach to estimate bank efficiency most of which have

been conducted on developed economies. However, the recent resurgence of economic and financial reforms across the developing countries has also raised the awareness of the importance of bank efficiency for which the current study seeks to explore. On this basis, this section is structured into two main parts; the first part review studies on bank efficiency in mostly in developing and emerging economies both based on individual-country studies and cross-country studies and the second part review studies on bank efficiency within the study area of the current study, Ghana.

***Efficiency assessment in the banking industry of developing economies***

Ncube (2009) examined the South African banking sector efficiency with the main focus of the study being the cost and profit efficiency of banks in South Africa. Applying the SFA, the study examined cost and profit efficiency of small and large banks.The results indicated that, over the period of study 2000-2005, South African banks significantly improved their cost efficiencies but no significant gains in profitability fronts.The results also indicated that there was a weak positive correlation between the cost and profit efficiencies of South African banks. In addition, most cost-efficient banks were also most profit efficient. A regression analysis of cost efficiency in bank size suggested a negative relationship, with cost efficiency declining with the increasing bank size.

Tecles and Tabak (2010) used both Bayesian stochastic frontier and DEA approaches reported that, large banks are the most efficient banks. Their finding shows a lower level of bank cost efficiency in Brazil, with an average cost

efficiency score of 0.66. On the determinants of bank efficiency based on a static model, their results report a positive effect of bank capitalization on efficiency.. The authors also find no significant relation between non-performing loans and bank efficiency.

In China, a study by Matthew and Zhang, (2010) applying the non-parametric DEA found out that, on average efficiency was constant in the Chinese banking industry for the period 1997-2007. The findings showed that the policy of opening up the banking industry was yet to accrue any benefit at the time of the study. However, in relation to bank ownership, comparing State-owned commercial banks, Joint-stock Bank and City Commercial Banks experience efficiency progressively, indicating possible benefits of the liberalization of the banking industry.

Turk-Ariss (2010) uses 821 commercial banks in 60 developing countries from five different regions, including Africa, East and South Asia and Pacific, Eastern Europe and Central Asia, Latin America and Caribbean, and the Middle East for the years 1999–2005. The author's aim is to assess the effect of a higher degree of market power on bank efficiency and stability using SFA among other to estimate bank efficiency. The author reports evidence of significant negative relationship between bank market power and cost efficiency and documents that market power is significant and positively associated with bank profit efficiency and overall stability.

In another study, Staub *et al.* (2010) estimated cost, technical and allocative efficiencies for Brazilian banks for the period 2000 – 2007. The authors applied

the DEA approach and find that banks in Brazil are inefficient. The inefficiency in the Brazilian banks was assigned mostly to technical inefficiency rather than allocative inefficiency. The authors explain that the higher technical inefficiency is evidence that the Brazilian banks' managers selected the appropriate input mix given the prices. The authors, however, used fewer inputs which could be attributed, for some banks, to the large interest expenses or capital, personnel expenses and a low production. On the other hand, between the period 2003-2007 technical efficiency was greater than allocative efficiency. They conclude that non-performing loans have effect on allocative efficiency. However, investigating the factors of bank efficiency by applying dynamic system GMM estimator, the study indicates that non-performing loans have insignificant and negative relationship with bank technical and cost efficiency. Bank capitalization and size also have no significant effect on technical and cost efficiency. In addition, the coefficient of the lagged efficiency (the persistence effect) was positive and significant.

Kiyota (2011) examined whether foreign banks are more efficient than domestic banks using the SFA. The empirical results of the study indicated that foreign banks outperform domestic banks, which are consistent with the Agency Theory postulates, that is, banks with higher leverage or lower equity are associated with higher profit efficiency. In terms of bank size, smaller banks were more profit-efficient, whereas medium-size and larger banks are cost-efficient. On another hand, the findings of the study suggested that non-Sub Saharan African foreign banks were more cost-efficient than Sub-Saharan foreign as well as domestic banks, for the period of 2000-2003.

Kamau (2011), using the non-parametric DEA, investigated intermediation efficiency and productivity in Kenyan commercial banks during the post-liberalization period. The study showed that, though the banks were not fully efficient in all aspects, they performed fairly well during the period under study. Moreover, the commercial banks' efficiency score was not less than 40% at any point. In terms of ownership and size, foreign banks were found to be more efficient than local banks, and in the local category, local private banks were more efficient than local public banks, while large-size banks were more efficient than medium and small-size banks.

Gordo (2013) applied DEA to estimate technical efficiencies and productivity of Philippine banks for the period 1999-2009. The results showed a general decline in technical efficiency over the period of the study. The results also indicated that Philippine banks experienced decline in productivity, which was mainly due to declines technical efficiency changes with weak technological progress over the study period. The study was however not conclusive as the differences in efficiencies and changes in total factor productivity are not supported statistically.

Ghosh (2016) shows that banking globalizationmay be a precondition for improved efficiency of banking firms, suggesting that greater foreign investment in the banking system of developing economies has an increasing effect on the financial consumer welfare possibly because of a significant reduction in both profit and cost inefficiency which were estimated using the DEA.

*Efficiency assessment in the banking industry of Ghana*

Frimpong, (2010) examined the relative efficiency of banks in Ghana during the year 2007 using the input-oriented intermediation-based approach of DEA estimation technique. CCR model for both overall and by group, the study showed that, only 4 out of 22 banks were efficient, of which 3 were relatively new and 1 small domestic private bank. The study found the overall mean technical efficiency score to be 74% whilst domestic private banks were portrayed to be the most efficient group of banks with an average of 87% efficiency score followed by the 72% of foreign banks. The lowest performing banks were found to be state-owned banks which according to the author can be attributed to lower tendencies of achieving efficiency by management of state-owned banks. The study, using one-year data, make it difficult to observe the time changes mechanism in efficiency of the banks. A bank may be efficient in a particular year but may be inefficient the following year. The current study address this by using a panel data and a time varying model in estimating cost efficiencies of banks in Ghana.

Saka, Aboagye and Gemegah (2012) assessed the effects of the entry of foreign banks and changes in bank concentration on the technical efficiency of domestic banks in Ghana over the period 2000–2008. Technical efficiency scores were obtained by the DEA. Then, the Tobit regression was used to analyze the impact of hypothesized explanatory variables on bank efficiency. Foreign bank share of total industry assets was used to proxy the impact of foreign banks. The findings suggested that efficiency of domestic banks has been positively affected by the entry of foreign banks and reduction in concentration. Thus, the central

bank's policy of liberalizing the banking sector appeared to be well placed. Between 2008 and now, a lot of development have happened in the Ghanaian banking industry which are likely to impact on the efficiency of the banks in the industry. The current study therefore employs current data series from 2009 to 2018 which would reflect the current efficiency trend of the banks.

Isshaq and Bokpin (2012), applying different methodology, used a translog functional form to estimate SFA of cost and profit efficiency of Ghanaian banks under the Battese–Coelli time-varying decaying inefficiency parameterization for (unbalanced) panel data." "They regressed efficiency estimates on a distance variable controlling for bank size, total cost, and profits." They found that Ghanaian bank profit efficiency is worsening, whereas cost efficiency was improving for the period analyzed. Their results showed that Price-Earning (P/E) was not related to distance, size, or cost and profitability ratios. Distance was however positively and significantly related to cost efficiency. Cost efficiency was however not influenced by size or cost and profit ratios.

Bopkin (2013) examined the effects of ownership structure and corporate governance on bank efficiency among banks in Ghana using panel data from the period 1999-2007. Efficiency was measured using the SFA based on estimated translog cost and profit functions. The results of the study showed that foreign banks are more cost-efficient than domestic banks, but not necessarily more profit-efficient. Managerial ownership leads to the cost inefficiency of banks. Governance (characterised by larger board size) strongly improves profit efficiency but slightly worsens banks' cost efficiency. Finally, the capital adequacy ratio and bank size

were found to be both significant predictors of bank efficiency in Ghana. The data used for this study however seems to be old considering the time of the study. Besides significant reforms have occurred in the banking industry since 2007 which would have had major impact of the findings of the study. The current study address this by using the current data series from 2009 to 2018, data which reflect the dynamics and changes in the banking industry during the recent period.

A closer study to the current study is one undertaken by Alhassan and Ohene-Asare (2013) who examined the impact of competition on technical and cost efficiency of banks in Ghana. Using an unbalanced panel data of 26 banks for the period 2003-2011, a second stage analysis indicated that the nexus between efficiency and competition was dependent not only on general efficiency but the type of efficiency under consideration was critical. The study found that cost efficiency for the period had improved in a competitive environment supporting the Quite Life Hypothesis that say that increased competition forces managers to have only one objective, which is cost efficiency.

Adjei-Frimpong, Gan and Hu (2014) analyzed the efficiency of the banking industry in Ghana over the period of 2001-2010 using the DEA. The study investigated the impact of size, capitalization, loan loss provision, inflation rate and GDP growth rate on Ghana's bank efficiency using both static and dynamic panel data models. The static model was estimated by the fixed effects estimator whereas the dynamic model was estimated by the two-step system GMM estimator. The results suggested that Ghana banks are generally inefficient. This study revealed that well-capitalized banks in Ghana are less cost efficient. In addition, bank size

has no influence on bank cost efficiency suggesting that larger banks in Ghana have no cost advantages over their smaller counterparts. The findings also exhibited that loan loss provision ratio has no effect on bank efficiency in Ghana. This study found GDP growth rate negatively influences bank cost efficiency and that lagged cost efficiency tends to persist from year to year. This study result of is likely to be affected by the draw backs associated with the use of DEA which box both inefficiency and statistical noise as inefficiency, thus likely to over-state the inefficiency of the banks.

Owusu-Ansah (2015) used an unbalanced panel data from 2009 to 2012 for sixty-six financial cooperatives to examine technical and cost efficiency of cooperative financial institutions in Ghana. The study used the Cobb-Douglas SFA to capture the dual roles of financial cooperatives, and applied production and intermediation approaches in the selection of inputs and outputs.The distribution of technical efficiency scores showed an average of 53.40% and 57.96% across the sampled units for production and intermediation approaches respectively. On the other hand, the distribution of cost efficiency scores showed an average of 92.44% and 70.67% across the sampled units for production and intermediation approaches respectively.

Alhassan (2015) explored the non-linear relationship between income diversification and efficiency of Ghanaian banks within the universal banking era. The SFA was employed on annual data of 26 Ghanaian banks from 2003 to 2011 to estimate cost and profit efficiency scores. In the second stage analysis, a Tobit regression model was estimated to examine the empirical effect of diversification

into non-interest generating activities on estimated cost and profit efficiency scores while controlling for other bank specific characteristics. The findings of the study revealed high levels of efficiency in cost compared with profit to reflect high inefficiencies on the revenue side. An analysis of efficiency scores by two categories of bank size suggests that large banks have high cost and profit efficiency compared to small banks. A non-linear relationship was found between income diversification and efficiency while size was also found to be important in enabling banks exploit the potential benefits of income diversification.

Alhassan and Ohene-Asare (2016) examined the relationship between competition and efficiency in the Ghanaian banking industry. Data on 26 banks from 2004 to 2011 was used to estimate technical and cost-efficiency scores by the data envelopment analysis while the Boone indicator was employed to proxy for competition. Controlling for bank size, lending, income diversification, tangibility, leverage and profitability, ordinary least squares, instrumental variables and fixed effects estimations were used to estimate the panel regression model. The authors also applied the growth convergence theory to examine the existence of efficiency convergence. The resulted points to improvements in cost efficiency (CE) and competition within the banking industry. From the empirical estimations, the findings suggested that competition exerts a positive influence on CE. The authors also found evidence of convergence in both technical and CE. The study recommended that efforts at improving competitiveness of the banking industry will translate into lower interest rate spread through improved CE. This will

ultimately improve access to bank credit and impact positively on economic growth.

Alhassan, Tetteh and Brobbey (2016) study examined the determinants of bank profitability in Ghana within the market power, relative market power and efficient structure frameworks. Using annual data on 26 Ghanaian banks from 2003 to 2011, they employed the Herfindahl Index and concentration ratio as proxies for market power hypothesis while efficiency scores from the DEA was employed as a proxy for the efficient structure hypothesis. The system generalized method of moment was employed to estimate a panel data model with return on assets, return on equity and net interest margin as our proxies for bank profitability. The results of the empirical estimation rejected both the market power and relative market power hypotheses in the Ghanaian banking industry. While technical efficiency was found to have a positive relationship with profitability to support the efficient structure hypothesis, a negative relationship between scale efficiency and profitability was reflected by the inability of banks to operate at the optimal scale of operations. They also documented evidence on the low persistence of profit which suggests a competitive banking industry.

To sum up, there are limited research evidence on the Ghanaian banking sector's efficiency, with mixed results on the relative efficiency among different groups based on ownership and size as well as on the effects of regulatory reforms. Even though their results are inconsistent, they provide preliminary and valuable information on banks efficiency in Ghana. Although previous studies have not achieved agreement on the level of efficiency, most of findings support that huge

wastes exist in operation of Ghanaian banks and they are largely inefficient compared to banks in the advanced economies and still very low efficiency among developing countries. This study therefore extends the frontiers of the efficiency studies in Ghana by focusing on cost efficiency of Ghanaian banks and estimating the elasticity of cost to changes in output, input prices and regulatory capital of the banks.

**Review of literature on Bank Competition Measurement**

The second part of the study focused on examining the market structure of the Ghanaian banking industry, with focus on measuring the competition level in the industry. Empirical methodologies applied in the literature to measure competition in banking markets has been classified into structural model (based on the Structure-Conduct-Performance (SCP) hypothesis following the traditional Industrial Organization theory) and non-structural models (based on the New Empirical Industrial Organisation (NEIO) approach).This section reviews the various technique under each model and empirical studies that have applied these techniques.

**Structural models**

Structural approach of measuring competition is based on the Structure-Conduct-Performance (SCP) paradigm was developed by Mason (1939) and Bain (1956) with the aim of explaining the relationship existing between the conduct and performance of firms in relation to the structural characteristics of the markets they

operate. Market structural characteristics covers the number of firms in the market, their absolute and relative size, conditions for entry and exit conditions and the extent of product differentiation whereas conduct refers to pricing strategies, collusion, product quality and advertising strategies.

The SCP paradigm postulate that market structure influences the conduct of firms and conduct intends determines performance.The SCP paradigm's most important insight is that, the more concentrated an industry is, the easier it is for firms to operate in an uncompetitive manner. For instance, as the number of firms operating in an industry reduces, tacit collusion becomes more likely (Tirole, 1988) and these firms can exploit their market power in order to charge prices above marginal costs and thus become more profitable at the expense of customer social welfare.

***Concentration indexes***

According to the SCP paradigm, the competitiveness or concentration of a market is inferred from the structural characteristics of that market. In measuring the level of concentration in a market, empirical works focus on the number of firms and their relative size. However, there is a general agreement on the elements that constitute concentration measures. An index that accurately measure concentration takes both the distribution of firm size (inequality) and the number of firms into account in a given market. Thus, Hall and Tideman (1967) put forward the key criteria a good concentration index should satisfied. That is; should be a one dimensional measure; be independent of the size of the industry; should increase

with the market share of any firm that is increased at the expense of a smaller firm; should be a decreasing function of *N* when the industry is divided into N equal sized firms and finally, should have a range of zero to one (to make the measure easier to interpret).

Consequently, empirical literature measuring concentration has focused on the three main measures of concentration; number of firms, concentration ratios and Herfindahl-Hirschman index (HHI), even though there are other concentration measures such as the Hall-Tideman index, the Rosenbluth index, the Hannah-Kay index, the U-index, the Hause indices, and the Entropy measure (Bikker&Haaf, 2002). Even though these measures do not adhere to all the criteria of a good concentration measure as per Hall and Tideman, they differ according to their weighting schemes and structure. Since the first three indexes are the widely applied in the banking literature, our discussion will be limited to them.

*Number of firms*

In terms of data limitation, number of firms as a concentration measure is the simplest index to compute even though it is characterised by numerous limitations such ignoring the distribution of firms in the industry. That is, using the number of firms as concentration index, level of concentration between two industries may differ greatly if one industry is dominated by one firm, while another industry has numerous firms with same size. Consequently, very few studies employ number of firms as an index of concentration.

*Concentration ratio*

Concentration ratio is one of the most frequently used measures of concentration in the empirical literature, probably, due to its simplicity and less data requirement such as the market share of the leading firms even though it requires more information than the number of firms. The *k*-firm concentration ratio measures the market share of the top *k* firms in the industry:

$$CR_k = \sum_{i=1}^{K} s_i\,, \quad \text{with} s_1 \geq s_2 \geq \cdots \geq s_K \geq s_N \tag{7}$$

where $s_i$ is the market share of the $i^{th}$ firm, assuming firms are ranked in descending order of market share and *N* is the total number of firms. The index approaches zero for an infinite number of equally sized firms and equals 1 if the firms included in the computation makes up the entire industry. There is no rule of tomb for determining the value of K, however commonly used values in the literature are 3, 5 or 10. By focusing only on the market share of the top *k* firms, concentration ratio takes no account of the size distribution of remaining firms. A typical instance is that, mergers of small firms whose combined size do not fall with the *k* firms may not be reflected in the concentration ratio, although the market becomes more concentrated. Thus, ignores most of the criteria for evaluating a good concentration measure.

*Herfindahl-Hirschman Index*

The Herfindahl-Hirschman Index (HHI) developed by Hirschman (1964) improves on the earlier concentration measures even though is relatively more data intensive as it requires information on the entire firm size distribution (that is, the market share of each firm in the industry). It is computed by summing the squares of the market share of all firms in the industry:

$$HHI = \sum_{i=1}^{N} {s_i}^2, \quad i = 1,2, \dots, N \tag{8}$$

where $N$ is the total number of firms in the market. The HHI index ranges between $1/N$ (for equal-sized firms) and 1 for monopolies. According to United States Department of Justice, the banking industry is regarded to be a competitive market if the HHI is less than 0.10, a somewhat concentrated market if the HHI lies between 0.10 and 0.18, and a very concentrated market if the HHI is more than 0.18 (Cetorelli, 1999). One main strength of HHI over the other concentration measures is the fact that, HHI stress on importance of larger firms in the industry by assigning them a greater weight than smaller ones, thus reflecting their relative importance in the measure. Again, it avoids arbitrary cut-off in its computation by incorporating each firm in the computation of the index.

***Limitations of the SCP paradigm***

In the extant literature however, the SCPparadigm and its associated concentration measures have limited use due to their conceptual and practical limitations as well as its questionable theoretical underpinnings. As stipulated by

the SCP hypothesis, a rise in concentration is regarded as increasing collusive opportunities between firms, and hence would lead to higher prices and profitability.

Alternative theories have however questioned the linkage between structure and conduct as stipulated by the SCP hypothesis. Baumol *et al.* (1982) who propounded the theory of contestability, suggested that, a concentrated markets industry can behave competitively if hurdles for entry and exit are low. The threat of low entry hurdle can exert pressure on incumbents and keep the sector competitive. They further argue that, even in a duopoly market, price competition can be fully efficient as the Bertrand equilibrium is a possible outcome. Also, the SCP hypothesis stipulate that, structural approaches to measuring competition rely on concentration. However, empirical studies have revealed that the relationship between concentration and performance is not always positive as stipulated by SCP hypothesis (see Jackson, 1992; Anzoategui*et al.,* 2010) and thus, concentration is not a reliable measure of competition (see Fernandez de Guevara *et al.,*2005; Maudos& Fernandez de Guevara, 2011; Claessens&Laeven, 2004).

**Non-structural models**

Due to the theoretical and empirical deficiencies of the structural models, the non-structural models of measuring competition, developed in the context of the New Empirical Industrial Organization (NEIO) approach, were developed and widely popular in the banking literature since the early 1980s. The NEIO approach to measurement of banking competition challenged the usual way of measuring

banking competition based on market structure. Rather it measures the degree of competition from the conduct of firms directly, without considering the analysis of the structure of the market (Degryse*et al*., 2009). The non-structural models determine the degree of competition based on the estimation of equations using theoretical models and assumptions on price and output determination.

***Indexes under the Non-Structural model***

As indicated by Carb´o-Valverde *et al.* (2009), the first generation of non-structural measures are based on the oligopoly theory (that is, the neoclassical conception of competition) and this includes Lerner index, the conjectural variation models (Iwata, 1974; Bresnahan, 1982; Lau, 1982) and the Panzar and Rosse (1987) model. Even though these models share a common standard and theoretical framework, they produce results are often divergent (Carb´o-Valverde et al., 2009; Liu et al., 2013). With the first-generation models assuming a static nature of the market, a second generation of NEIO measures were developed with focus on the dynamics of markets and are thus in line with the *dynamic conception of competition*. These include the Persistence of Profits developed by Mueller (1977, 1986) and the recently proposed Boone indicator by Boone (2008). Among these models, the widely applied in the literature are Lerner index, the conjectural variation model, the Panzar-Rosse model and the Boone indicator.

*Lerner index*

The Lerner index (or price-cost margin) proposed by Lerner (1934) measures degree of competition in a banking industry by measuring the extent to which banks are able to keep their product price above their marginal cost. The index directly measures market power and take it inverse as a measure of competition. In this case, market power is defined to be the difference between the price banks charge for their product and services and the marginal costs they pay to offer these product and services. Hence, it measures the ability of a bank to fix prices above their marginal cost. It is stated as

$$L_{it} = \frac{p_{it} - mc_{it}}{p_{it}} \tag{9}$$

where $p_{it}$ is the price determined as total revenue divided by total assets following Fernandez de Guevara *et al.* (2005) and Carbó-Valverde*et al*. (2009) method and $mc_{it}$ denote marginal cost of production estimated from the cost function of the bank. A zero Lerner index is an indication of a perfect competition, an indication of no pricing power. An index equals to one is an indication of pure monopoly implying prices are fixed above the marginal cost. The closer the Lerner index is to one the higher the bank's market power and the closer to zero signifies increase in competitive behaviour of the banks. Finally, when the Lerner index is less than zero it implies pricing is below marginal cost. This reflects non-optimizing behaviour of the banks (Delis &Pagoulatos, 2009; Soedarmono*et al*., 2011). "This means that the banks do not function within the principles of a market economy and may be supported by government for instance (Delis &Pagoulatos, 2009).

Several studies have applied the Lerner index in estimating market power across the globe mainly due to its simplicity, straight forward interpretation, and the fact that it does not pose stringent data requirements. Also, as the index provides a firm-year specific measure of market power, it offers the possibility of studying the evolution of bank pricing behavior over time. For instance, Fernandez de Guevara et al. (2005) assessed the evolution of competition in the banking industries among five European countries by estimating the market power using the Lerner Index and examine their determinants. They employ 18,810 observations of the banking sectors of Germany, France, Italy, Spain, and the United Kingdom over period 1992-1999. Their study reported large differences in the Lerner index among the sampled countries suggesting market power (lack of competition) still exist in spite of the reforms in the European banking systems.

Again in 2007, Fernandez de Guevara &Maudos (2007) investigated the degree and determinants of market power in the Spanish banking sector in the period 1986-2002." "Their study, even though applied the fixed effects regression model to assess the explanatory factors of market power, the Lerner index was employed to measure market power. Their results showed that, the savings banks have more market power than the commercial banks.

In Ghana, Aboagye *et al.* (2008) in measuring and identifying the determinants of market power in the Ghanaian banking industry using data from 2001 to 2006, employed the Lerner index in measuring market power.Their finding supports the view that Ghanaian banks exhibited market power.

All these studies, however, failed to acknowledge the fact that, the use of Lerner index as a measure of market power pose risk of theoretical and practical limitations. In fact, it is a measure of pricing market power and not a proxy of competition." "In other words, an increase of average market power over time can be consistent with an increase in the intensity of competition. Emerging literature have shown that there are theoretically possible scenarios in which price-cost margins increase with more intense competition (see Stiglitz, 1987, 1989; Bulow & Klemperer, 2002; and Amir, 2010).

*Conjectural-variation model*

Out of the inability of Lerner index to distinguish between markets that have high margins due to inelastic demand and markets that have high margins due to lack of competition, Iwata (1974), Bresnahan (1982), and Lau (1982) introduced the conjectural variation model with the aim of controlling the changes of the Lerner index due to demand changes, and therefor isolate firms' competitive behavior. Conjectural variation refers to the beliefs that one firm has about the way its competitor may react if it varies its output or price (Bowley, 1924). As such, the model operates by estimating the conjectural variation parameter ($\lambda_i$) as the expectation of the extent to which the output initiatives of a firm trigger changes in the output of its rivals. The conjectural parameter ranges from $\lambda = -1$ (indicating perfect competition) to $\lambda = N - 1$ (indicating collusive situation) where N is the number of firms in the industry. If $\lambda = 0$, then firm $i$expects no reaction to its change in output and therefore it is a Cournot situation.

The conjectural variation model has been widely applied in banking industry (see Shaffer, 1989, 1993) primarily due to its strength of directly analyzing firms' conduct based on static industrial organisation theory. As such conjectural variation parameter can be estimated and treated as a continuous variable under unrestricted conditions and test statistic maps into oligopoly solution. However, Shaffer (2001) pointed out that, the estimated parameter under the conjectural variation model can exhibit a bias if the sample fails to span the complete market which is very likely in cross-country samples based on a limited sample of banks.

*Panzar-Rosse (PR) model*

This is a non-structural approach applied in assessing the competitive conditions of a market (whether is monopoly, monopolistic competition or perfect competition) based on the idea that banks priced differently in response to changes in input prices or any other exogenous economic shock. The model was developed by Rosse and Panzar (1977) and then Panzar and Rosse (1982, 1987) who postulate that, the pricing ability of a firm depends on the degree of market power it can control and the market structure it operates within. As changes in pricing strategy directly change revenue, variation in revenues can reflect the market structure in which a firm operate. Intuitively, the model predicts that banks market power is measured by the extent to which changes in input prices are reflected into revenues earned by bank itself, so market competition can be examined by analyzing bank's revenue responds to changes in input prices.

In examining market competition, Panzar and Rosse proposes competition test derived from revenue equation at firm level, known as the *H*-statistic, defined as the sum of the elasticities of the reduced-form revenues with respect to the input prices. The Panzar-Rosse H statistic represents the percentage variation in revenues resulting from one percent aggregate change in the price of input factors used by the bank. The H-statistic is based on strict assumptions such as long run equilibrium condition, profit maximization, homogeneous production function, single product firms (De Bandt& Davis, 2000), and higher input prices are not associated with higher quality services that generate higher revenues (Molyneux *et al*., 1996).This *H*-statistic ranges from $-\infty$ to 1. An *H*-value equal to or less than zero indicates monopoly or perfect collusion, since monopolist's revenue is expected to respond in the opposite direction to the change in input prices. Panzar and Rosse (1987) further showed that the H statistic is also negative when the structure is a perfectly collusive oligopoly or a conjectural variations short run oligopoly. H statistic equal to one is an indication of perfect competition. In this case, a proportional shift in all input prices is expected to increase marginal and average costs by the same proportion. In such markets, banks survival would depend on their ability to increase prices until they cover the increased costs. In doing so, inefficient banks might be acquired by efficient ones or be eventually driven out of the market by competition. Consequently, the reduction in the number of banks in the industry will reduce the supply of the industry, thereby leading to a rise in output price and revenue by the same amount as costs. Where H statistic lies between zero and unity there is an evidence of oligopolistic or monopolistic types of competition. However,

the market entry or exit of other banks with imperfect rival products make them cannot generate abnormal profits as monopoly. Hence, revenue will increase less than proportionally to changes in input prices.

The strength of the PR model lies in its simplicity and the fact that it does not pose stringent data requirements. The H-statistic can be derived by running only one equation requiring a few numbers of variables and relatively small number of observations which is crucial for studies on less mature banking industry. Also, the PR model is said to be robust to the extent of the market as no specific market definition appears in the revenue equation (Shaffer, 2004). Thus, only the data from firms included in the sample are required to estimate revenue equation. Again, both the magnitude and sign of the H statistic can be informative. For instance, Vesala (1995) showed that, a non-positive value of H statistic is an indication of a decreasing function of the demand elasticity and a smaller absolute value of H statistic is associated with less monopoly power. Bikker and Haaf (2002) also showed that, H statistic values between 0 and 1, indicate increasing function with the competitiveness of the market. Thus, higher value of H statistic indicates stronger competition than lower values.

On this basis, several studies have applied the PR model in banking studies across the globe. For instance, Smith and Tripe (2001) using pooled regressions for the period from 1996 to 1999 to assess New Zealand banking market competitiveness, applied Panzar&Rosse (1987). H-Statistic to measure the level of market competitiveness and finds that, New Zealand banking market operate under conditions of monopolistic competition. Through the use of the PR model, the

authors were able to indicates conditions of monopolistic competition for 1996, while the analysis suggests the existence of monopoly or conjectural variation oligopoly conditions in 1997. In another study, Coccorese (2004) addresses the competitive conditions in the Italian banking industry using the Rosse–Panzar H-statistic test for a panel of banks for the period 997–1999 both nationwide and in the standard four macro-regions within the country. The study shows that Italian banks earn revenues as if they are under conditions of monopolistic competition.

Again, Matthews *et al.* (2007) examine competitive conditions among the major British banks during the period of major structural changes. They estimate the Rosse–Panzar H-statistic for a panel of 12 banks for the period 1980–2004. The authors also estimate the Lerner index of market power and both measures confirm that UK banking system is monopolistically competitive. The study also reports that the intensity of competition in the core market for bank lending is almost the same throughout the 1980s and 1990s. On the other hand, competition in the non-core business of banking (off-balance sheet business) appears to be less intense." "The authors were, however, puzzled at the results that competitive conditions on the core business of banking (balance sheet business) are unchanged in the 1990s and 2000s as in the 1980s. This is because their empirical investigation includes a number of mergers and acquisitions by banks and newly converted banks. Their results reveal a small reduction in concentration in the 1990s, indicating that the mergers and acquisitions by the banks have been neutralized by the new bank entrants.

In emerging economies, BuchsandMathisen's (2005) study on 20 banks operating in Ghana during 1998-2003 using Panzar-Rosse (1987) approach and find evidence of a non-competitive market structure in the Ghanaian banking system. In China, Yuan (2006) investigates the degree of competition in the Chinese banking industry over the period 1996-2000 before its affiliation with the World Trade Organisation (WTO) using Panzar-Rosse (1987) H-statistic. The findings of the study show that the banking system in China is close to perfect competition in the years; 1996, 1997, 1999 and 2000, whereas monopolistic competition is evidenced in 1998. The four largest banks in China show evidence of monopolistic competition from 1996 to 2000. In contrast, the small banks operate under conditions of perfect competition under the same period of time. The author also suggests that the Chinese banking system was already showing competitive behaviour before it became a member of WTO in 2001. GunalpandCelik (2006) used the Panzar-Rosse (1987). H-statistic to assess the competitive conditions of the Turkish banking industry over the period 1990 to 2000. Their results show the existence of monopolistic competition in the Turkish banking industry. The authors conclude that their findings are in accordance with the result of Aydinli (1996) on the competitiveness of the Turkish banking industry.

In a cross-country study, BikkerandSpierdijk (2008) examine the evolution in bank competition spanning 15 years in 101 countries with 112,343 bank-year observations from 17,476 different banks. Using the Panzar-Rosse H-statistic, the authors document large changes in the 107 competitiveness of the banking industry over time. On average, they observe small changes in competition over time in all

the 101 countries under evaluation, but substantial differences for several countries and regions.

Turk-Ariss (2009) investigates 12 banking sectors in the Middle East and Northern Africa (MENA) countries over the period 2000–2006. Using Panzar&Rosse H-statistic, the author finds evidence of monopolistic competition in the banking sectors. In a similar study, Anzoategui et al. (2010) examine bank competition in the MENA region during 1994–2008, using the H-statistic and the Lerner index. These two measures suggest that the banking sectors in MENA region are less competitive compare to other developing countries around the world and have not improved in recent years.They also assess the determinants of bank competition across countries and find evidence that lower levels of bank competition in the MENA are due to the region's worse credit information environment and high barriers to entry into the banking sector (lower market contestability). The authors also find that competition is more pronounced in countries with large size of non-bank financial intermediaries. The banking sector is not contestable, because of high barriers to entry and exit.

Also, Sun (2011) analyses the effect of both the introduction of euro and before and after the recent financial crisis on bank competition in the euro area, the U.S and U.K. The results indicate that overall bank competition decline from 0.699 to 0.518 (changes in the values of H-Statistic) after the introduction of euro which is consistent with the findings of BikkerandSpierdijk (2008), who also report some decline in European banks competitive behaviour. Similarly, the bank competition

in euro area fell after the financial crisis. The decline is more pronounced in US and Spain where large credit and housing booms occurred.

Despite the wider application of the H statistics, the major limitations of PR model which emanate from the econometric identification and the interpretation of the H-statistic seems to have run through the studies reviewed. In a sample of firm level observation, a long-run competitive equilibrium would show $H = 1$ while a profit-maximizing monopoly would show $H \leq 0$. However, from theoretical studies, H-statistic can assume negative value in a competitive market and positive in a monopoly market (Shaffer, 1993; Bikker*et al.*, 2012; Shaffer &Spierdijk, 2013). Also, in using the PR model, some studies employ scaled revenue equation or estimate price function by using the ratio of revenue to total assets as dependent variable. However, the properties of the price and revenue equations are identical in the case of long-run competitive equilibrium but critically different in the case of monopoly or oligopoly. This disqualifies a large number of studies. The proper revenue equation must exclude the scale variable and use the total revenue as dependent variable.

*Boones indicator*

The Boones indicator (Boone, 2004; 2008) is a competition measure based on the notions, that more efficient firms (defined as firms with lower marginal costs) gain higher market shares or profits and this effect is stronger when there is a heavier competition in the market. Thus, in a more competitive market, firms are punished more harshly in terms of profits for being inefficient. Boone Indicator

follows the pattern of profit-efficiency relationship under the efficiency hypothesis (Demsetz, 1973), which postulate that, more efficient firms achieve superior performance in terms of higher profits at the expense of their less efficient rivals and also attract greater market share.Put differently, in a market with a tighter competition, efficient firms can exploit their cost superiority to be an effective tool to explore the market size and profit.

Thus, Boone indicator reflects the elasticity of bank's earnings to changes in bank's marginal costs. As such, it is obtained by regressing the logarithm of income (proxied by return on assets) or market share on the logarithm of marginal costs (proxied efficiency). That is;

$$\ln \pi_i = \propto + \beta \ln c_i + \varepsilon_i \quad (10)$$

Where $\pi_i$ denotes income, $c_i$ is marginal cost denoting efficiency and $\beta$ (the Boone Indicator) denote profit elasticity which represents the percentage fall in bank profit due to a percentage increase in it cost. In theory, the indicator is negative reflecting the inverse relationship between marginal costs and profit. In addition, the magnitude should be lower to ensure a more competitive market condition. Boone *et al.* (2007) conducted simulations for the PE indicator and found that changes in competition are correctly identified with this measure.

Several studies have applied the Boone indicator in competition measurement in banking industry across different countries. For instance, Maudosand Solis (2011) investigated the evolution of competition in the Mexican banking sector from 1993-2005, a period that covers the eras of deregulation,

liberalization and consolidation of the banking sector in Mexico. Using the Boone Indicator, the authors find evidence of monopolistic competition. Thus, the transformation experienced by Mexican banking sector have not led to greater competitiveness within the sector.

Delis (2012) also estimates the degree of market power at the bank-level for 84 banking sectors drawn from both developed and developing countries across the world with data sample ranging from 1987–2005 using the Boone Indicator (2008). The author finds that worldwide bank competition steadily improves in the period 1993–2002, but decreases after 2003. However, the market power of banks in the lower-middle and low-income countries are higher than that observed in high-income countries.

Kar and Swain (2014) also measured competition among micro-finance institutions using the Boone indicator. Their study sought to ascertain the effect of competition on the outreach, financial performance and quality of loan portfolios of micro-finance institutions (MFIs). The study used the generalized methods of moments estimation technique to circumvent the problems of endogeneity. It found that increased competition in the micro-finance sector led to an increase in the amount of loans and a decline in financial self-sustainability. The results also concluded that competition negatively affected the loan portfolio quality."

Schaeck and Čihák (2008) applied the Boone indicator method to two complementary data sets for Europe and the United States of America. The results showed that smaller banks responded more strongly to competition than larger banks.

**Review of literature on Efficiency-Structure-Performance nexus**

There have been several studies that have examined and tested the nature of relationship between the structure of the market (concentrated against competitive market), efficiency and firm's performance. Conversely, studies on the role financial freedom plays in such relationship is not much explored. The result of these studies appears to be mixed and inconclusive such that, there is no conclusive evidence to indicate the superiority of one explanation over another.

This section therefore provides an extensive review of the major theoretical and empirical literatures concerning the structure-performance relationship, a framework in which the current study is posited, and the conclusions these studies arrived at. This is followed by a review of literature concerning financial freedom-performance nexus and then gaps in the literature for which the current study seeks to explore.

**Market structure hypotheses**

"There have been several theories that have attempted to explain the relationship between market structure and the performance of firms operating in such markets. Prominent among these theories is the structure-conduct-performance (SCP) hypothesis and the efficient structure (ES) hypothesis. This section provides a review of these hypotheses and the trend of studies that have confirm and refute these hypotheses in different economies."

***Structure-conduct-performance (SCP) hypothesis***

The thinking surrounding the SCP hypothesis is that, certain market structures are suitable to monopolistic conduct which allow firms to augment prices beyond marginal costs thereby making unusual profits (Bain, 1951). "This conduct, as a result would lead to reduction in competition and imperfect market structure (Shepherd, 1983). In effect, SCP hypothesis basically states that, the structure of the market determines firm's conduct (proxied by pricing) which in turn determines firm performance. Thus, a firm with greater market power (price maker) can earn higher profit (monopolistic rents). This is so because, in a more concentrated market, collusion is easier and less costly, hence, firm collude to set prices more favorably (in the form of higher spread) to gain more profit. Successful collusion leads to abnormal profits but loss of social welfare." "Therefore, the resultant positive link between industry concentration and performance emanates from the anti-competitive behavior of firms with large market share (Berger & Hannan, 1998). This is so because, firms in such markets easily collude and become price leaders. In the context of banking industry, banks operating in a concentrated market would find it easier to collude and enjoy higher spreads (Shepherd, 1983; Goddard*et al.*, 2001). Thus, evidence of SCP paradigm within the industry often leads to banking reforms necessary to reduce market concentration and restricting larger banks from taking over smaller banks (Berger, 1993)."

"Several studies have tested the applicability of SCP hypothesis in different markets and have observed a positive relationship between profitability and market concentration, hence providing overwhelming support of the hypothesis. For

instance, a positive and significant linkage between bank concentration and profitability (measured by ROE) was found by Short (1979) in a study which was based on a sample of banks from Canada, Western Europe and Japan. Gilbert (1984) survey on 44 studies depicted that thirty-two of the studies were in line with the fact that market concentration significantly and positively related with bank performance." "Also, Civelek and Al-Alami (1991) find a statistically significant relationship between concentration and performance in most years with perverse signs in some years in the Jordanian banking market. In a similar study, Molyneux and Thorton (1992) find overwhelming evidence of a significant positive relationship between concentration and profitability. Again, Molyneux and Forbes (1995) tested the SCP among European banks covering the period 1986 to 1989. The findings of their study showed that profitability was mainly driven by market concentration. Goldberg and Rai (1996) also found some evidence in support of the SCP hypothesis by studying 11 top European banks over the period 1988 to 1991 and the results showed a mild positive relationship between market concentration and bank profitability. They however, conceded that the results were not robust enough."

"Similarly, Moore (2010) explored the casual link between concentration ratio and profitability using both univariate and multivariate regression tests and found that the bank concentration had positively affected performance. He has added technology variable to the model and found that the positive relationship doesn't altered even when technology variable varies."

"Tregenna (2009) also analyzed the effects of structure on bank profitability in an attempt to test the recent applicability of the SCP hypothesis in the U.S from 1994 to 2005. He found evidence that market concentration increases bank profitability. This holds even when the largest banks are excluded from the sample, suggesting that the relationship between concentration and profitability acts in a generalized structural way and that the higher profits arising from concentration are at the expense of the rest of the economy."

"Similarly, Al-Muharrami and Matthews (2009) find that the performance in banking industry is best explained by the mainstream SCP hypothesis in the Arab Gulf Cooperation Council (GCC) region. Perera*et al*. (2006), in more recent study, find that even though increasing competition (arguably driven by deregulation and liberalization of the financial services industries) exerts negative pressure on bank profitability, high levels of industry concentration still allows South Asian banks to earn higher profits."

"Some studies have however found no relationship between the performance of firms and the structure of the market. For instance, Athanasoglou*et al.* (2008) and Garza-Garcia Garcia (2012) applied the HHI as a measure of concentration and found no significant relationship between market concentration and bank performance in Greece and Mexico respectively. Shepherd (1983) in his study found that, not all market participants in the concentrated market can benefit and earn higher profits. He asserted that only firms with large market shares and well-differentiated products are able to exercise market power and make

supernormal profits, hence introduced a variant of the SCP hypothesis known as Relative-Market-Power (RMP) hypothesis."

***Relative market power (RMP) hypothesis***

"Profitability according to RMP hypothesis is driven by market share (Garza- Garcia, 2012) as against concentration in SCP hypothesis, such that, firms with comparatively larger market share are more likely to be profitable than their counterparts (Berger, 1995). Shepherd (1983) tested the RMP hypothesis during the period 1960 – 1969 and concluded that, market share was the main determinant of the profitability of 500 firms in the United State after controlling for other determinants like barrier to entry and concentration. He emphasized the importance of price discrimination, as most markets are believed to contain submarkets with a unique demand elasticity, so that only firms with a large market share can exercise market power and influence prices. Rhoades (1985) empirically confirmed the findings of Shepherd using a sample of 6,492 banks in the United States. Controlling for other variable such as concentration, economies of scale and explicit product differentiation, it was shown that, market share was a significant determinant of banks profitability. "

"Berger (1995) used dataset comprising of 1300 to 2000 observation covering ten years period in 1980 to provide empirical evidence in support of the RMP hypothesis by regressing market share on firm's profitability and found that, the coefficient for the measure of market share is positive and significant even after controlling for market concentration and efficiency. He further noted that the

inclusion of market share changes the positive coefficient of the concentration estimate confirming that profitability was influenced by greater market share and not concentration as stipulated by the SCP hypothesis."

"Nissan (2003) also confirmed that, market share is significantly correlated with profit, even after controlling for the effect of other variables in the study such as size of dominant firms, advertising power, and growth. Fu and Heffernan (2009) also investigated the relationship between market share and performance in China's banking system from 1985 to 2002, a period when this sector was subject to gradual but notable reform. Their results lend some support to the relative market-power hypothesis in the early period."

"Again, Garza-Garcia (2011) tested the RMP among the Mexican banks over the period, 2001 to 2009. The coefficient for market share was highly significant in the study confirming market share as a main determinants of bank profitability in Mexico. In a comparative study by Mirzaei *et al.*(2011), they tested the RMP hypothesis among advanced and emerging countries. Their study covered 1621 and 308 banks in advanced and emerging economies respectively. For emerging economies, there was no evidence for RMP hypothesis unlike the advanced economies where the coefficient was positive and significant. From the forgoing discussion, it could be observed that, the RMP hypothesis stresses the individual market share which provides direct market power, rather than collusion which represents indirect market power, gaining strong incentives for merger and acquisition activities. "

"Comparing both SCP and RMP paradigm, both hypotheses indicate that the market structure (or market power) is the underlying driving force behind the profitability, SCP focuses on the overall concentration of the market, while the RMP stresses the individual market share. Thus, Mirzaei *et al.* (2013) empirically investigate the effects of market structure and market concentration on profitability of 1,929 banks in 40 emerging economies (Eastern Europe and Middle East) and advanced economies (Western Europe) over 1999-2008 by incorporating the traditional SCP and RMP hypotheses. They observe that a greater market share leads to higher bank profitability being biased toward the RMP hypothesis in advanced economies, yet neither of the hypotheses is supported for profitability in emerging economies."

***Efficient-Structure (ES) Hypothesis***

"The SCP and RMP hypotheses were challenged by a thought from the efficient market theorists and mainly of Demsetz (1973) and Peltzman (1977). They argue that banks are able to maximize profits and gain market share by being efficient. Thus, market concentration increases following a rise in market share, which is a gain from the superior efficiency of the leading banks (Zouari &Mensi, 2010).Demsetz (1973) pointed out that, more efficient firms have lower costs, which enable them to gain bigger market share and higher profits and in turn leads to greater concentration in the market. To prove this proposition, Demsetz conducted a study on two groups of firms (small and large) and expected a positive relationship for both small and large firms to indicate the presence of market power.

A non-positive relationship is an indication that, profitability is driven by efficiency which is measured by either market concentration or market share (Bond and Greenberg, 1976). Berger (1995) argued that market share captures more than just efficiency. Accordingly, if one controls for efficiency, the link between profitability and market structure variables will become insignificant and thus economically meaningless. Therefore, under the efficiency hypothesis, efficiency drives both profit and market concentration. Efficient structure (ES) hypothesis can be view from two angles depending management efficiency and firm scale of operation;X-Efficiency (ESX) and Scale Efficiency (ESS)."

"X-Efficiency occurs when a bank operates at a lower cost because their management and technology expertise is superior to that of their competitors (Berger, 1995) and as a result, controls a larger market share. Scale efficiency occurs when a bank produces at a lower unit cost compared to its competitors resulting in higher unit profitability. Therefore, it's possible for two or more banks to have the same management and technological expertise but one is more efficient because, it scales of production results in lower cost and higher profitability (Berger 1995). Berger (1995) proposed that, in testing the ES hypothesis, the efficiency coefficients must be positive together with any of the market-power hypotheses (SCP and RMP) to prevent misinterpretation."

"Most empirical studies on ES hypothesis found efficiency to be more important in explaining bank profitability. Berger (1995) was the first to test the two types of efficiency explicitly and reported that, X- efficiency only supported profitability partially, whiles scale efficiency was insignificant in the model. The

condition that X-efficiency needed to be positively related with the market structure hypotheses was weak in his study. To build on the earlier study by Berger (1995), Berger and Hannan (1997) replicated approach used by Berger, but included other innovations. For instance, they controlled for differences in market size proxied by population, regulatory restrictions proxied by branching restrictions and business conditions proxied by business failure rate. They also use both profit rates and price levels as proxies for banks' performance. Contrary to the findings of Berger, they found overwhelming evidence to support the structure-conduct performance hypothesis than for the relative market-power and efficient-structure hypotheses."

"Frame and Kamerschen (1997) also employed a similar approach to that of Berger and Hannan by directly measuring bank efficiency and examining it relationship with profit. They however deviated from Berger (1995) methodology by focusing on a sample of legally protected rural banks, as they believed that, the existence of entry barrier was critical to study structure performance relationship. The aim of their study was to empirically distinguished between the X-efficiency hypothesis and relative market power hypothesis. They found support for the relative market power hypothesis but reject the X-efficiency hypothesis for their sample of data."

"Similarly, Tregenna (2009) analyzed the effects of market structure on profitability for banks in the US during the pre-crisis period from 1994 to 2005. The study empirically, rejected the efficient structure hypothesis in favour of the performance structure hypothesis as efficiency was not found to be a strong determinant of profitability but concentration does. "

"Zouari and Mensi (2010) tested for bank efficiency on profitability in the Tunisia and reported similar results to that of Berger, (1995) in the case of scale efficiency but reported a negative relationship for X-efficiency which was counterintuitive since a positive relationship was expected. Seelanatha (2010) suggest that the traditional SCP argument is not held in the banking industry in Sri Lanka, and that bank profitability does not depend on either market concentration or market power of individual firms but on the level of efficiency of the banking units. "

"Likewise, Chortarea*set al.* (2011) suggest that despite the significant rise in takeovers from foreign banks and the increase in market concentration, banks' profits do not seem to be explained by greater market power in Latin America. Instead, efficiency (particularly scale efficiency) seems to be the main driving force of increased profitability for most countries. The key implication is that policies aimed at removing the remaining barriers to competition should be expected to benefit the banking system without being detrimental to consumers. Garza- Garcia (2012) tested efficiency of Mexican banks and reported insignificant results for both scale and X-efficiency."

"Goldberg and Rai (1996) however reported a positively significant relationship was found between efficiency and bank performance on the assumption that, the banking market has low concentration." "Maudos (2008) tested for efficiency of Spanish banks over the period 1990 to 1993 and found efficiency to be positively related to profitability and market share." "Thus, according to the ES hypotheses, a positive correlation between concentration and

profitability does not necessarily indicate a causal economic relationship, but could be spurious." "Chortareas*et al.* (2011) advanced the existing literature by testing the market power and efficient structure hypotheses for nine Latin American countries over 1997-2005. The study provided evidence in support of efficient structure hypotheses. The findings were particularly robust for the largest banking markets in the region, namely Brazil, Argentina and Chile. Also, capital ratios and bank size were found to be the most important factors in explaining profits for Latin American banks."

"In European Union, Berger's (1995) methodology was first applied in 1996 by Goldberg and Rai (1996) who studied the structure performance relationship in the European banking industry by employing data on banks across eleven European countries over the period 1988–1991. They found evidence in favour of the relative market power hypothesis for all banks except for those located in countries with low concentration ratios, where the evidence supported the X efficiency hypothesis."

"Punt and Rooij (1999) also followed Berger's approach empirically evaluate the profit-structure relationship of eight European banking markets for the period 1992 – 1997. The study revealed that, X–efficiency was the crucial factor explaining the profit-structure relationship. There were however, no indications of unfavorable price setting behavior as a result of increased market power. Aguirre and Lee (2001) again, examined the structure-performance relationship for banks operating under different regimes (separated vs universal banking) in ten developed countries in the European Union during the period of 1985-1999. The results

showed support for the efficient structure hypothesis and thus, suggested that, in an ever-growing integrated financial system, banks can benefit significantly from the implementation of a universal banking system."

"Conversely, in investigating the relationship between degree of concentration and performance in the Greece banking sector, the findings of Móré and Nagy (2003) in Central and Eastern Europe did not confirm the SCP hypothesis. The market concentration was found to have no positive correlation with either the net interest margin (proxy for price rate) or return on assets (proxy for profitability). This implies that, in a more concentrated market, banks did not earn higher profits by means of colluding with other banks, so their results provided support for the efficiency hypothesis. In the reviewed period, dominant banks in the region earned extra profits and caused a welfare loss by exploiting their pricing advantage arising from relative market and by behaving in a manner that limited competition."

"Responding to the wave of consolidation in the Euro area in 1990s, Kapopoulos and Siokis (2005) examined whether the consolidation process should be rationalized on the basis of the benefits of efficiency or it should be attributed to the attempt of banks using greater market power to generate monopoly rents. The empirical results supported three of the four distinct hypotheses, but did not support the SCP hypothesis. It implies that the European banking industries did not favor collusion. It gave limited support to the RMP hypothesis that only banks with large market share and well differentiated products are able to exercise market power in pricing and consequently enjoy higher profitability. Moreover, the empirical results

provided strong evidence for the efficiency hypothesis. This suggested that the rising concentration resulting from merger and acquisition activities were attributed to the faster growth exhibited by the more efficient banks."

"Berger's (1995) methodology has also been applied in the emerging economies in recent years. Notable studies include Al-Obaidan (2008) who between the market structure paradigm and the efficiency paradigm by incorporating a direct measure of technical inefficiency in the six Arab banking markets during 1996-2005. The result of the study provided an overwhelming support for the efficiency structure hypothesis. Al-Muharrami and Matthews (2009) conducted similar research to examine the profit structure relationship in the Arabian banking market over the period from 1993 to 2002. They however found that the Arabian banking industry is best explained by the SCP hypothesis." The evidence clearly supported the view that concentration was the principal structural determinant of profitability.

"Fu and Heffernan (2009) applied Berger's test of market structure and bank performance in China for the period 1985-2002. The empirical results found the relative market power hypothesis best described the Chinese banking sector during the first reform stage (1985-1992), but in the second phase (1993-2002), although the results supported the X-efficiency hypothesis, there was no evidence that efficiency has a positive effect on market structure. In addition, there was no evidence to support the quiet-life hypothesis, probably because strict interest rate controls prevented the domestic banks from earning monopoly profits. Quiet life hypothesis was proposed by Hicks (1935), which states that, firms increase

revenues as a result of increased market power, but because of higher inefficiencies, this does not lead to higher profitability. Thus, there is a weak or possible absence of a significant profit-structure relationship. If the quiet life hypothesis holds, then the positive profit-structure relationship is partially offset by cost increases from poorer efficiency."

**Economic and financial freedom and bank performance**

"Literature on economic freedom and growth performance is vast with most of these studies generally reporting a positive and significant relationship between these variables (De Haan& Sturm, 2000; Adkins *et al*., 2002; Bengoa& Sanchez-Robles, 2003; Ahmed, 2013 and Farhadi *et al*. 2015). However, same cannot be said about freedom and banks' performance relationship. This may probably due to lack of theoretical framework that provides direct linkage between the two variables. Nevertheless, the impact of restrictions on various aspects of banking activities have been well represented in the literature. Typical instance is the study conducted by Delis (2012) on financial liberalisation policies and market power of banks in developed economies. The study concluded that, increase in financial liberalisation reduces market power, but competition in banking does not improve at the same rate in countries where institutions are weaker and not well developed."

"Similarly, Mirzaei and Moore (2014) reported that less intervention of government contributes to bank competition in developing economies, but in developed economies, financial freedom drives increase in competition. Chen et. al. (2015) approach to the matter from a different perspective. They investigate the

effect of investment flexibility on equity valuation. Considering economic freedom for its enhancing effect on institutions, they concluded that economic freedom has an institutional impact, which provides a wider range of investment and growth options to firms. "

"In terms of bank's performance, Sufifian and Habibullah (2010) provided empirical evidence on the positive impact of economic freedom on banks' performance in the Malaysian banking sector during the period of 1999-2007." "They find overall economic and business freedom to be positively related to performance. Similarly, Smimou and Karabegovic (2010) examine economic freedom and equity market returns relationship for the Middle East and North Africa (MENA) markets. They reported that changes in economic freedom have a positive impact on equity market returns. To add up to the trend of the literature, Hafer (2013) in a study of the linkage between economic freedom and financial intermediary development concluded that, countries with higher levels of initial economic freedom, on average, exhibit greater levels of financial intermediary development in subsequent years."

"Chortareas*et al.* (2013) studied the dynamics of economic freedom and cost efficiency using freedom index drawn from the Heritage Foundation database. They concluded that, higher degree of an economy's financial freedom is associated with higher benefit for banks in terms of cost efficiency. Blau et. al. (2014), also studied the influence of economic freedom on stock price volatility. They concluded that economies with higher freedom tend to have more stable stock markets. Sufifian (2014) suggested that greater financial freedom positively

influence the profitability of Islamic banks operating in the MENA banking sectors."

"Sufifian and Habibullah (2014) also reported that, limitation of freedom on banking activities in Malaysia could have negative impact on their efficiency levels. Lin *et al*. (2015) examine how financial freedom moderates the relationship between bank ownership and cost efficiency among twelve Asian emerging markets during the period 2003- 2012. They reported that, in markets where there is adequate financial freedom, foreign presence improves bank efficiency. Additionally, they find evidence that, in economies with more financial freedom following the financial crisis, increased government (domestic) ownership of banks seems to enhance (hamper) bank efficiency.'

"Gropper, Jahera Jr., and Park (2015) also investigated the effect of economic freedom and political affiliations on bank performance using bank return on asset as performance indicator. Their initial finding was that political connections of a bank enhance its performance. However, this enhancing effect is negatively related to the level of economic freedom. More recently, Sarpong-Kumankoma*et al.* (2018) examine the effects of financial freedom and competition on bank profitability across eleven Sub-Saharan African countries during the period 2006-2012." "The study finds that, higher market power is positively related to bank profitability but operating efficiency is a more important determinant of profitability than market power. Also, the study finds that, both financial freedom and economic freedom show a positive impact on bank profits. The authors again find evidence that, banks with higher market power operating in countries with

higher freedom for banking activities are more profitable than their counterparts in countries with greater restrictions on banking activities."

**Conclusion and summary**

"The above literature reveals the following research gaps. First, the most of the studies that explore the linkage between structure, efficiency, freedom and bank performance studies have concentrated on advanced banking markets with less attention being paid to developing markets such as in the case of Ghana. Consequently, empirical evidence on this linkage on the developing countries banking sectors, particularly the banking sectors of Ghana is relatively scarce." "Again, virtually nothing has been published to examine the impact of economic and financial freedom on the banking sector of Ghana even though there have been some studies across countries in African. In light of these knowledge gaps, the present study provides new empirical evidence on the impact of market structure, cost efficiency and economic freedom on Ghana's banking sectors' profitability."

# CHAPTER FOUR

# RESEARCH METHODOLOGY

## Introduction

"This section details the research approach and design applied in the study, data source, sampling procedure, variables used in the study, the models employed and the estimation approach applied in achieving the study objectives. The section is organised as follows; first, the research approach used and the design employed in the study is described. This is followed by a description of the sampled banks included in the study together with the source of the data used for the study. The variables used in the empirical modelling are described followed by description of empirical models employed in estimating efficiency, competition and profitability in the Ghanaian banking industry over the study period and the estimation procedure applied in estimating each of the model specified."

## Research Approach and Design

In developing a framework within which the study was conducted, the positivist philosophy, which is based on scientific research principles, was adopted. As a research philosophy, the positivism adhered to the view that, research is a science and as such is deterministic and mechanistic; hence, factual knowledge is gained through observations and measurement. "Positivism dwells much of quantification of observations, which leads to statistical analysis, so it is in accordance with the empiricist view such that, knowledge is obtain from human experience."

"As a scientific philosophy, the positivist is free from individual beliefs and judgment and as a result, knowledge based on positivism is externally objective. In applying the positivism approach in this study, the findings of the study can be accurately be replicated following strictly, the methodological approach used and the same population, provided the assumptions of the positivist approach are all met. These assumptions include;"

(a) *Certainty in prediction and control.* The positivism is of the assumption that, the general pattern of cause and effect of the relationship between event A and event B, under certain circumstances, can be used for predicting and controlling natural phenomena. Thus, the role of the researcher is to discover the specific nature of the cause and effect relationships and base on which it can be used as a basis of prediction.

(b) *Empirically verifiable*. The positivism philosophy again assumes that, the data used for the study is accurate since the researcher relies on what is seen and then measured it. As such, observations and measurements are used in the scientific analysis which provides a basis for drawing conclusions. Results can therefore be replicated once the same methodology and data is used in a statistical analysis.

(c) *Value-free nature of research.* The positivist philosophy assumes that the findings from the empirical analysis are free from human interests ensuring a high degree of objectivity in the research. This philosophy therefore gives an objective and unbiased estimate as researchers take a strictly neutral hence knowledge is externally objective.

"The data obtained and results presented from the empirical analysis conducted in this study are strictly based on the evidence gathered on the financial statement of the selected banks and the interaction with the sample units and thus, the result are independent of the researcher's own subjective reasoning."

"This study adopts a quantitative research design in analyzing the data obtained from the banks. This is due to the quantitative nature of the input and output variables and also the cost efficiency scores estimated. The use of quantitative design is very suitable in achieving the study objective of examining the relationships between observed variables, such as examining the relationship between efficiency, market structure and profitability which is explanatory in nature hence, suitable design is the quantitative."

"Also, a panel data analysis was carried out which takes into account the characteristics of the sampling units and also the time varying effect which supersedes the use of either a cross sectional or time series analysis. When the features of the sampling units and the time varying effect are not considered in the analysis, it may result in an unobserved heterogeneity which can be overcome by using panel data analysis. Thus, all factors that influence the variables of concern are accounted for by combining both the time series and cross-sectional form of data."

**Sample and Data**

"The population of the study constitutes all universal banks in Ghana from the period 2009 to 2018. However, in selecting the sample for the study, focus was placed on banks that were in active operation as at the end of the study period (that

is, 31 December, 2018) and had operated for at least one financial year to this date." "Consequently, out of the 23 licensed commercial banks in Ghana as at 31 December, 2018 (Bank of Ghana, 2019), 22 banks were selected as these banks had been in operation for least a year to the end of 2018. The excluded bank was Consolidated Bank Ghana which was established in 2018 to take over seven existing banks (namely, Heritage Bank, Premium Bank, Sovereign Bank, Construction Bank, Beige Bank, Royal Bank and UniBank) due to solvency and corporate governance issues. The 22 selected banks consist of 14 foreign banks and 8 local banks."

"The time span considered in this study is from 2009 to 2018. The study period was chosen on the basis that, it provides a current time series observation. Also, it represents the period where significant reforms were undertaken within the banking sector which include the promulgation of the current law that regulate the banking industry known as the Deposit Taking Act 2016 (Act 930) which provide a sound legal framework for the industry and also increases the scope of financial liberalization and intermediation which is consistent with Bank of Ghana supervision policies." "Also, during this period, the regulator had embarked on massive increment in the minimum capital requirement from GHS60 million in 2009 to GHS120 million in 2013 and to GHS400 million in 2018 with the expectation of improvement in the efficiency level of the banking institutions and competitiveness of the industry. The choice of ten-year duration for the study was to ensure that individual heterogeneity, which can lead to inconsistent estimation due to the problem of endogeneity, are controlled for."

"An unbalanced panel data made up of 205 observations was used for the study to reflect firms' specific heterogeneity and also avoid loss of information had the data been restricted to a balanced panel. Although the sample data does not include all the Ghanaian commercial banks, the sample of banks show good representation of the whole banking industry of Ghana, as banks in the sample cover about 98.2% of the industry assets, 97.9% of the industry deposits and 96.8% of the industry loans. The fact that the sample covers the majority of the banking industry suggests that, the empirical findings of this study will present a major image of how efficiently and profitable Ghanaian banking system has been operated."

"Annual data is mainly collected from Bankscope database and Bank of Ghana banking supervision department which provides detailed financial information for banks all over the world and in Ghana respectively. Whenever Bankscope and supervision department of Bank of Ghana does not provide enough information or has missing data values, a careful check and double-check of the data is made from other alternative data sources as best as possible such as annual issues of Ghana banking survey, 2010 – 2019 and the annual reports provided by individual banks from their official websites as complementary sources in tracing missing or unavailable data points. Since all original data were collected on the nominal value, they were deflated by using GDP deflators obtained from the World Bank with the year 2013 as the base in accordance with the rebasing policy of Ghana Statistical Service."

**Variable selection, Model specification and Estimation approach**

"This section discusses the variables selected for the study, specification of models and estimation approach applied in estimating the parameters of the models. The section is structured as follows; first, a description of the variables, models for efficiency estimation and the estimation approach for the efficiency estimation is discussed. This is followed by description of the variables and models for estimating the level of competition in the Ghanaian banking industry. The final part of the section details out the variables and model specification as well as the estimation approach for determining the efficiency-competition-profitability relationship and the role played by freedom in such relationship."

**Measurement of bank efficiency**

"This section details of the variable used for estimating bank's cost efficiency and bank's cost sensitivity. It also provides details on specification of the models use in the estimation as well as approach adopted in estimating the parameters of the model."

***Selection of input and output variables***

"In modelling bank's efficiency, one of the most challenging tasks is the selection of the relevant inputs and outputs variables. Though, there are a number of approaches that has been proposed to guide in selection of inputs and output for efficiency computation, there is no accord in the literature as to what constitute inputs and outputs of a bank (Casu&Girardone, 2009; Sathye, 2003)." "However,

the most common approaches applied inefficiency modelling are production (or the value added) approach, operating approach and intermediation approach (Barry *et al.*, 2011; Hermes *et al.*, 2009). One common feature about these approaches is that, they all apply the traditional microeconomic theory of a firm to banking. They however differ in terms of their specification to banking activities."

"The production approach**,** as initiated by Benston (1965), viewed banks as institutions making use of traditional factors of production (such as land, labour and capital) to produce different products and services to customers. As such, the input constitutes variables required by the banks to produce the products or services to their customers and these includes physical asset, labour, material, space, information systems, operating cost, etc." "Output under this approach constitute the services provided to customers and is measured by the number and nature of transactions processed to serve customers or specialized services provided over a given time period." "Unfortunately, such transaction data is typically proprietary and inaccessible especially among Ghanaian banks. As such, where information on transaction flows is not available, loans and advances granted to customers and investments made by the banks are used as a proxy to represent the output of the bank. Moreover, the production approach indicates that, only physical inputs are needed to perform transaction and process documents, so physical inputs such as labor and fixed assets should be included." "And the total costs under this approach are expenses spent on labor and fixed assets, but interest expense is not included even though they are expenses incurred by the bank in producing output."

"The operating approach evaluates the bank efficiency from the perspective of management of cost and revenues. On the side of inputs are usually all significant costs of basic banking activities and main sources of bank revenues are on the side of outputs. As such, the inputs usually used are interest expenses, personel costs, capital costs, fees and commissions expense whereas interest revenues, received fees and commissions income are considered as output."

"The intermediation approach seems to be mostly applied in empirical research in the area of banking. The approach was proposed by Sealey and Lindley (1977) in which banks are treated as financial intermediaries whose prime object is to channel funds between surplus and deficit units. That is, a bank is considered as a unit that accepts deposits backed by their capital assets and invest or transfer them to deficit units, using labour and capital in a form of investments or loans respectively and gains profits in the process. Under this treatment, the value of loans and investments is the appropriate measure of bank output, while deposits and costs involving in the production process such as capital, labour should be measured as inputs. Consequently, the operating costs and interest expense are measured as the total costs."

"According to Berger and Humphrey (1997), none of these approaches is perfect as none of them is able to fully capture the dual role of banks as providers of transactions processing services and being financial intermediaries. Nevertheless, they are of the view that the intermediation approach is relatively preferred in analyzing bank level efficiency as most of the decisions that affect the bank efficiency are taken at the bank level rather than the agency level." "Again, in

practice, data required by the production and operating approach is usually cannot directly obtained from the published accounts of these banks except from the management accounts which due to information asymmetry, management usually are not willing to release such information." "Thus, most empirical literature employs the intermediation approach as opposed to the production or the operating approach in selecting input and output variables for computing efficiency scores for banks." "As we aim at evaluating efficiency for entire banks, following many previous studies on banking efficiency, the study adopts the intermediation approach." "In addition, our database lacks the necessary data for implementation of the production and operating approach, as outputs are measured under these approaches by the number of deposit and loan transactions processed over a given time period." "On this basis, the study adopts the intermediate approach in the selection of inputs and outputs for the study."

"Although the intermediation approach is adopted for the current study, different outputs and inputs are selected in banking literatures under the same approach. There is no disagreement on loan being treated as output, but there is a longstanding controversy about whether deposits should be counted as output or input. As deposits have both input and output characteristics, classifying deposits as either input or output cannot fully captures the dual role of the deposits." "Therefore, as argued by Berger and Humphrey (1997), the treatment of deposits in efficiency models can affect the efficiency estimates and thus deposits should be considered as both inputs and outputs, which is known as dual approach. Even though the dual approach can take into account both input and output characteristics

for deposits, the current study classifies deposits as input rather than output in our analysis due to both empirical and statistical reasons."

"Empirically, the banks in Ghana treat deposits as the base from which they derive loans for customers, and pay more attention to the input characteristics of deposits than the output ones. Moreover, from statistical point of view, although the dual approach is well explained in theory and applied in empirical studies, including deposits for both inputs and outputs does not satisfy the monotonicity condition of bank cost function (Shen *et al*. 2009). Based on these facts, it is more appropriate to consider the deposits as input alone in the current study."

***Specification of outputs and inputs and their prices***

"The next issue to discuss is the definition of the specific inputs and outputs variables. Within the intermediation approach, the exact set of inputs and outputs used in empirical studies depends largely on data availability. In this study, the variables selected for the study is largely based on previous studies for comparability and data availability."

"Consequently, the study adopts three outputs variables, namely total loans, other earning-bearing assets and non-interest income. Bank loans are widely considered as the most important output for commercial banks which operates as financial intermediaries that collect deposits from customers and lend to deficit units. The total loans (denoted by $y_1$) include short-, medium- and long-term loans, and other specialised loans issued by the banks to its customers from which the bank generates its principal source of income (interest income)." "Apart from

income generated from these bank loans, banks also conduct several investments which further contribute to bank profits. Thus, in addition to bank loans, other earning bearing assets (denoted by $y_2$) are included in the output. These includes short- and long-term investment, deposits with central bank and other banks." "To account for fee-based service and other non-banking related services such as asset-backed securitization, non-interest income is included as output as proxy for off-balance sheet activities. Thus, non-interest income (denoted by $y_3$) is obtained from fee, commission and other operating income."

"Three inputs were use in the study, namely total deposit, labour, and capital. Total deposit (denoted by $x_1$) are defined to include all customer demand deposits such as savings deposit, fixed deposits and current accounts from individuals and corporate institutions. Labour (denoted by $x_2$) is specified as the number of full-time employees of the bank. Physical capital (denoted by $x_3$) is defined to include property, plant and equipment (as defined by IAS 16) and investment properties (as defined by IAS 40) which provide the essential materials for bank operation." "Correspondingly, the input prices are defined as follows. The price of deposit (denoted by $w_1$) is calculated as the ratio of interest expenses to total deposits. The price of labour (denoted $w_2$) is calculated as the ratio of personnel expenses to total number of employees. The price of fixed asset (denoted by $w_3$) is measured by the ratio of other operating expenses to the fixed assets. The input variables, input prices and outputs variables are defined in Table 7."

"Besides the three inputs and three outputs variables, one additional variable is included to control for risk. In theory, comparison of bank's performance

should be conducted among banks with the same quality and risk level." "However, each bank is different in quality, and thus has different risk characteristics. These differences may not be captured by the input and output variables included in the efficiency model. Mester (1996) suggested that unless quality and risk are controlled for, one might easily miscalculate a bank's level of inefficiency."

"In empirical literature, the volume of non-performing loans (Hughes &Mester, 1993; Mester, 1996), non-performing ratio (Altunbaş*et al.,* 2000; Huang& Wang, 2002) and loan loss provision (Hasan &Marton, 2003) are used to control for asset quality. However, Berger and DeYoung (1997) suggest that whether it is appropriate to include non-performing loans and loan loss provisions in estimating the bank's cost function, and hence cost efficiency depends on the extent to which these variables are exogenous. Non-performing loans and loan loss provisions would be exogenous if caused by negative economic shocks or unpredicted events, and in that case, they could be considered in deriving the cost function." "However, they could also be endogenous, if caused by poor management and monitoring of the loan portfolio. In this case, quality of asset would be controlled for in the operating expenses.Therefore, in this study, it is believed that nonperforming loans in the Ghanaian banking system are generally considered endogenous due to poor risk management in assessing, screening and monitoring loans and hence is not considered in the cost function".

"In controlling for risk in efficiency measurement, equity capital is used (Mester, 1996). This is due to its ability to influence the probability of banks' failure (known as insolvency risk) and also equity capital acts as absorber which can fully

absorb the losses of non-performing loans (operational risk). Apart from concerns of risk, a bank's capital level will directly affect interest costs by providing an alternative funding source of loans as a substitute for deposits or other funding sources. As a result, the level of equity capital is included in the model."

Table 7: Variables for efficiency study

| Variable | Description |
|---|---|
| Output | |
| Total loan ($y_1$) | Term loans and other specialised loans to customers from which the bank generates its principal source of income |
| Other earning bearing assets ($y_2$) | Short- and long-term investment, deposits with central bank and other banks |
| Non-interest income ($y_3$) | Fee, commission and other operating income |
| Input: | |
| Total deposit ($x_1$) | Customer demand deposits such as savings deposit, fixed deposits and current accounts from individuals and corporate institutions. |
| Labour ($x_2$) | Number of full-time employees of the bank |
| Physical capital ($x_3$) | property, plant and equipment and investment properties |
| Input prices | |
| Price of deposit ($w_1$) | Interest expenses/total deposits |
| Price of labour ($w_2$) | Personnel expenses/number of employees |
| Price of fixed capital ($w_3$) | Operating expenses less personnel expenses/fixed assets |
| Endogenous | |
| Total cost ($c$) | Sum of interest expenses, personnel expenses and other operating expenses |
| Determinants of inefficiency | |
| Bank size (BS) | Total assets |
| Ownership (OS) | Foreign banks = 1; Local banks = 0. |
| Capital adequacy ratio (CR) | Ratio of shareholders fund to total asset base |
| Control | |
| Equity capital ($z$) | Shareholders fund |

Source: Author's compilation

***Model specification***

"As erudite from the extant literature, there is no single 'best' frontier method of estimating efficiency; each method has its specific strengths and drawbacks. Despite no consensus on the "best" frontier method, this study employs the stochastic frontier approach due to its ability to separate random noises that are outside control of firms from idiosyncratic error."

"The Stochastic Frontier Approach (SFA) was originally developed by Aigner *et al*. (1977) and then Meeusen and van den Broeck (1977). The main advantage of this approach is the allowance for inefficiency, and also take into account of random shocks outside the control of firm. Thus, by forming a composed error term, they separate the error term from the inefficiency by using different distribution assumption." "Therefore, inefficiency is not contaminated by the random noise that should not be considered as inefficiency. Although the stochastic frontier approach is criticized for imposing a strict functional form that presuppose the shape of an unknown frontier, the risk of mis-specifying the true frontier is less than the risk of completely ignoring it." "Moreover, the risk of misspecification could be controllable by running statistical and econometric test on the model, the use of explanatory variables and test on theoretical properties of the presumed functional form. On this basis, the SFA is employed in estimating the efficiency scores of the banks."

"Another difficulty in implementing SFA is to specify a certain functional form which the efficiency of the firms is likely to assume. In the extant efficiency literature, more flexible functional forms have been developed from the previously

prevailing Cobb-Douglas functional form to the widely employed translog functional form and more recently, the Fourier-Flexible (FF) function. In line with the trend of bank efficiency literature, the translog functional form is adopted rather than the Fourier-Flexible specification on the basis of the following;" "Firstly, for consistency, as most of the efficiency studies in banking employ translog cost function, following the same functional form would allow comparison. Secondly, the FF specification requires more degrees of freedom hence a larger observation, but the number of observations in the banking industry of Ghana and hence used in the study is limited. Thirdly, it is argued and justified in the literature that, the improvement obtained through the use of the FF specification is insignificant from an econometric viewpoint (Berger &Mester, 1997)." "The average improvement in goodness-of-fit is relatively small, indicating both functional forms yield basically the same measure of efficiency. Moreover, Altunbas and Chakravarty (2001) indicate that, the predictive ability of the FF form is worse than the translog form." "Finally, the FF form has no simple economic interpretation for the estimated coefficients. Thus, the translog cost function is preferred."

*The SFA cost model*

"A typical theoretical cost frontier model for panel data as proposed by Aigner *et al*. (1977) and Meeusen and van den Broeck (1977) is specified as follows;"

$$\ln c_{it} = \propto_0 + \sum_{m=1}^{M} \beta_m \ln y_{mit} + \sum_{j=1}^{J} \gamma_j \ln w_{jit} + u_{it} + v_{it} \quad (7)$$

"where $\ln c_{it}$ is the total costs for firm $i$ $(i = 1 \ldots N)$ at time t $(t = 1 \ldots T)$, $\ln y_{mit}$ is the $m^{th}(m = 1 \ldots M)$ output for the firm $i$ at time $t$, $\ln w_{jit}$ is the $j^{th}(j = 1 \ldots J)$ input price for the firm $i$ at time $t$. $u_{it} \geq 0$ is the cost inefficiency while $v_{it} \sim idd\ N(0, \sigma_v^2)$ is random errors that are beyond the control of the firms."

"On the assumption that cost efficiency is time-invariant, we adopt the fixed-effects (FE) and random-effects (RE) model and as a result, Equation (7) is modified as follows;"

$$\ln c_{it} = \propto_0 + \sum_{m=1}^{M} \beta_m \ln y_{mit} + \sum_{j=1}^{J} \gamma_j \ln w_{jit} + u_i + v_{it} \tag{8}$$

Under FE, the cost inefficiency, $u_i$ is treated as fixed and thus becomes a bank specific intercept to be estimated together with $\beta_m$ and $\gamma_j$. Thus, under FE, Equation (8) is modified as;

$$\ln c_{it} = \propto_{0i} + \sum_{m=1}^{M} \beta_m \ln y_{mit} + \sum_{j=1}^{J} \gamma_j \ln w_{jit} + v_{it} \tag{9}$$

where $\propto_{0i} = \propto_0 + u_i$. The FE model as specified in Equation (9) is estimated by the least square dummy variable (LSDV) method so as to ensure unbiased, consistent and efficient estimate.

Under RE, assuming the cost inefficiencies for each firm, $u_i$ is uncorrelated with the regressors and the mean of the cost inefficiency is $E(u_i)$, the RE model can be written as;

$$\ln c_{it} = [\propto_0 + E(u_i)] + \sum_{m=1}^{M} \beta_m \ln y_{mit} + \sum_{j=1}^{J} \gamma_j \ln w_{jit} + v_{it} + [u_i - E(u_i)]$$

$$= \propto^* + \sum_{m=1}^{M} \beta_m \ln y_{mit} + \sum_{j=1}^{J} \gamma_j \ln w_{jit} + v_{it} + u^* \quad (10)$$

"The RE model as specified in Equation (10) is estimated by the feasible generalized least square (FGLS)."

"So far, no distributional assumption is made on inefficiency term $u$. If such distributional assumption is tenable, the parameters of Equation (10) can be estimated by the maximum likelihood (ML) method, an approach originally proposed by Pitt and Lee (P&L) (1981). They made the following normal and half-normal distributional assumption on the error components in panel data stochastic frontier model as follows:"

Assumption 1: $v_{it} \sim idd\ N(0, \sigma_v^2)$

Assumption 2: $u_i \sim idd\ N^+(0, \sigma_u^2)$

Assumption 3: $v_{it}$ and $u_i$ are distributed independently of the other, and of the regressors.

"Cost inefficiency may be time invariant for a short period. However, considering the period under study, it is inappropriate and unrealistic to assume cost inefficiency to be time-invariant for such a long time period especially in financial market where variables change rapidly. Thus, for such a study period, it is more desirable to relax the time-invariant assumption. This, therefore leads to the

development of time-varying panel data models in which efficiency is allowed to change over time. Notable among them in the extant literature are Battese and Coelli (1992) model (herein referred to BC 92) and Battese and Coelli (1995) model (herein referred to BC 95)."

"BC 92 attempt to relax the assumption of time-invariant inefficiency by introducing additional term $u_{it} = u_i e^{-\eta(t-T)}$ into Equation (7). The inefficiency is said to decrease over time if $\eta > 0$ and increase over time if $\eta < 0$, or remain the same over time if $\eta$ =0 which returns to the time-invariant model. Even though, this resolve the time invariant problem, it created another problem, that is; the specific structure of $u_{it} = u_i e^{-\eta(t-T)}$ imposed on the model make inefficiency always increase or decrease." "To address this, BC 95 modified the previous model by not only relaxing the specific structure of time effect imposed on inefficiency, but also incorporating more variables that can affect inefficiency." "They specify that inefficiency is a function of any variables $z$ may influence it, that is; $u_{it} = h(z_{it})$.With this model, the level of inefficiency can be evaluated and at the same time access the factors that affect it, hence, the BC 95 is known as the one-stage estimation approach which is much preferred to the two-stage approach." "The two-stage estimation approach has been criticized on the basis that; it assumes variables not included in the first stage are uncorrelated with composite error term. But in the second stage, some of the variables may be regress on one of the composite error terms and assume they may correlate with it which suggest a built-in conflict within the two-stage estimation, hence, not always preferred."

"However, BC 92 and BC 95 tend to exclude time-invariant heterogeneities in the models. If time invariant heterogeneities are present and yet are excluded, it is likely to lead to overestimation of parameters." "According to Greene (2005), to account for observable heterogeneity in efficiency analysis, we apply the principle of orthogonality between the error term and the independent variables, where variable $z_{it}$ is identified and incorporated to the non-stochastic part of Equation (7) which has similar distribution properties for $u_{it}$." "Thus, so far as $u_{it}$ is expected to be uncorrelated with $x_{it}$ with a population mean of zero and constant variance, true estimate of $u_{it}$ will not be sufficient if the model cannot include variables $z_{it}$ whose variation has a strong effect on $u_{it}$". "The challenge is identifying whether such a variable exists, and if so, how to factor such influential effects in the initial stage of the modelling." "To deal with this, Greene (2005) proposes the true fixed effect and true random effect models, which are estimated by maximum likelihood techniques. In both cases, all the time invariant effects are reflected as unobserved heterogeneity, with inefficiency term allowed to decay freely with time."

"In the true fixed effect model, firm specific constant term, $\propto_{0i}$ is introduced in the stochastic frontier models. The firm specific constant term encompasses all the time-invariant produce-specific heterogeneities. It also allows the inefficiency term, $u_{it}$, to be uncorrelated with the random errors, and regressors. The true random effect model, on the other hand, exploits the random constant term to represent the individual producer time-variant heterogeneities"

*Empirical model specification*

"In formulating the empirical model for the study, the translog cost functional form with three output variables, three input prices with equity as a fixed input (see Table 7) is formulated as follows;"

$$\ln c_{it} = \propto + \sum_{m=1}^{3} \beta_m \ln y_{mit} + \frac{1}{2}\sum_{m=1}^{3}\sum_{n=1}^{3} \beta_{mn} \ln y_{mit} \ln y_{nit} + \sum_{j=1}^{3} \gamma_j \ln w_{jit} + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \gamma_{jk} \ln w_{jit} \ln w_{kit} + \sum_{m=1}^{3}\sum_{j=1}^{3} \delta_{mj} \ln y_{mit} \ln w_{jit} + \theta_1 t + \theta_2 t^2 + \sum_{m=1}^{3} \varepsilon_m \ln y_{mit}\, t + \sum_{j=1}^{3} \rho_j \ln w_{jit}\, t + \phi_1 \ln z_{it} + \phi_2 \ln z_{it} \ln z_{it} + \sum_{m=1}^{3} \lambda_m \ln y_{mit} \ln z_{it} + \sum_{j=1}^{3} \xi_j \ln w_{jit} \ln z_{it} + \psi \ln z_{it} t + u_i + v_{it} \quad (11)$$

"where $\ln c_{it}$ is the total cost of bank $i(i = 1, \ldots, 22)$ at time $t$ given as a function of three output $\ln y_{mit}$ $(m = 1,2,3)$ and three input prices $\ln w_{jit}$ $(j = 1,2,3)$ as defined in Table 7." "A time trend $t$ is included in the model to capture technological change in the study period. Equity capital $(\ln z_{it})$ is included as control variable to account for risk since equity capital may influence the probability of banks' failure." "Also, a bank's capital level will directly affect costs by providing an alternative funding source. Equity capital is the only control variable since the study place much interest on the effect of recapitalization on the shadow return on equity as recapitalization is one the most important reform carried

out in the recent banking reform." "Other factors affecting bank efficiency such as bank size, ownership and capital adequacy ratio (see Table 7) are included in the additional functions that affect mean in the case of BC 95 model." "The standard assumption: half-normal and normal distributions are imposed on the inefficiency and random error terms respectively since these are the most common assumptions in the efficiency literature."

"In order to ensure that cost efficiency estimates are truly estimated from the cost function as specified in Equation (11), the following properties of cost function as suggested by McFadden (1978) and Kumbhakar and Lovell (2000) should be satisfied:"

"The true cost function should be homogenous of degree one in input prices. This implies that, for a given level of output, an increase in all input prices leads to a proportionate increase in total cost. As such, the restrictions,"

$$\sum_{j=1}^{3} \gamma_j = 1; \qquad \sum_{j=1}^{3}\sum_{k=1}^{3} \gamma_{jk} = 0; \qquad \sum_{m=1}^{3}\sum_{j=1}^{3} \delta_{mj} = 0 \tag{12}$$

"were imposed on the cost function in Equation (11) to ensure that it satisfied the regularity condition of homogeneity in input prices and test of hypotheses were carried out."

"The estimators of the cost function as specified in Equation (11) should be symmetric. In other words, the cost function should be continuous. To satisfy this condition, the restriction $\beta_{mn} = \beta_{nm}$ and $\gamma_{jk} = \gamma_{kj}$ is imposed on the cost function."

"The cost function should be monotonic such that, it should be non-decreasing in $y$ and also in $w$. To impose this condition, the elasticity of output, $ey_m$ and elasticity of input price, $ew_j$ are computed such that;"

$$ey_m = \frac{\partial \ln c_{it}}{\partial \ln y_{mit}} \geq 0 \qquad ew_j = \frac{\partial \ln c_{it}}{\partial \ln w_{jit}} \geq 0 \tag{13}$$

"The cost function should be concave in input prices,$w$. That is, as the price of an input increases the proportion increase in total costs should be no higher because of the substitution among inputs. One of the main limitations of the translog cost function is that it cannot assure global concavity. However, sufficient condition for concavity is that the bordered Hessian matrix of the cost function with respect to the input prices $w$, is negative semi-definite." The Boarded Hessian matrix is derived as;

$$H_B(w) = \begin{bmatrix} 0 & \frac{\partial \ln c_{it}}{\partial \ln w_{1it}} & \frac{\partial \ln c_{it}}{\partial \ln w_{2it}} & \frac{\partial \ln c_{it}}{\partial \ln w_{3it}} \\ \frac{\partial \ln c_{it}}{\partial \ln w_{1it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln {w_{1it}}^2} & \frac{\partial^2 \ln c_{it}}{\partial \ln w_{1it}\, \partial \ln w_{2it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln w_{1it}\, \partial \ln w_{3it}} \\ \frac{\partial \ln c_{it}}{\partial \ln w_{2it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln w_{2it}\, \partial \ln w_{1it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln {w_{2it}}^2} & \frac{\partial^2 \ln c_{it}}{\partial \ln w_{2it}\, \partial \ln w_{3it}} \\ \frac{\partial \ln c_{it}}{\partial \ln w_{3it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln w_{3it}\, \partial \ln w_{1it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln w_{3it}\, \partial \ln w_{2it}} & \frac{\partial^2 \ln c_{it}}{\partial \ln {w_{3it}}^2} \end{bmatrix} \tag{14}$$

Equation (14) is evaluated at the sample mean of factor prices and concavity is achieved when $H_B(w)$ is negative semi-definite. A sufficient condition for a matrix to be negative semi-definite is a non- negative eigenvalue.

***Estimation of the empirical model***

"As explained in the earlier sections, Equation (11) is estimated under seven models, classed under time invariant models and time variant models; the time invariant models include the fixed effect panel model (FE), random effect panel model (RE) and the Pitt and Lee (1981) model (PL). The time varying models include the Battese and Coelli (1992) time decaying model (BC 92), Battese and Coelli (1995) time varying inefficiency model (BC 95), Green (2005) true fixed effect model and Green (2005) random effect model" "These models are summarized in Table 8 indicating their distribution of the error terms. The multiple parameter estimations are necessary for methodological cross check, comparability and consistency check and that panel data stochastic frontier estimation produce efficiency results that are sensitive to the composed error specification used." "Hence, by comparing different composed error specifications, the consistency of the efficiency results can be compared across different specifications and the arbitrary choice of specification can be avoided."

Table 8: Estimation models

| | Model | Estimation method | Time dimension | Distribution of error component |
|---|---|---|---|---|
| 1 | Fixed effect model (FE) (Schmidt & Sickles, 1984) | LSDV | Invariant | $v_{it} \sim idd\ (0, \sigma_v^2)$;$u_i$is randomly distributed intercept. |
| 2 | Random effect model (RE) (Schmidt & Sickles, 1984) | FGLS | Invariant | $v_{it} \sim idd\ (0, \sigma_v^2)$; $u_i \sim idd\ (0, \sigma_u^2)$. |
| 3 | Pitt and Lee model (PL) (Pitt & Lee, 1981) | MLE | Invariant | $v_{it} \sim idd\ N(0, \sigma_v^2)$; $u \sim idd\ (0, \sigma_u^2)$. |
| 4 | Random effect time decaying efficiency model (BC 92) (Battese&Coelli, 1992) | MLE | Variant | $v_{it} \sim idd\ N(0, \sigma_v^2)$; $u_{it} \sim idd\ N^+(0, \sigma_u^2)$; $u_{it} = u_i e^{-\eta(t-T)}$. |
| 5 | Random effect time varying inefficiency model (BC 95) (Battese&Coelli, 1995) | MLE | Variant | $v_{it} \sim idd\ N(0, \sigma_v^2)$; $u_i \sim idd\ N^+(0, \sigma_u^2)$; $u_{it} = \delta_0 + \delta_1 z_{it}$. |
| 6 | True fixed effect model (TFE) (Greene, 2005) | LSDV | Variant | $v_{it} \sim idd\ N(0, \sigma_v^2)$; $u_i \sim idd\ N^+(0, \sigma_u^2)$. |
| 7 | True random effect model (TRE)(Greene, 2005) | MLE | Variant | $v_{it} \sim idd\ N(0, \sigma_v^2)$; $u_i \sim idd\ N^+(0, \sigma_u^2)$. |

Source: Author's compilation

"In estimating BC 95 model, the inefficiency term, *u*, was assumed to be half-normally distributed with mean dependent on exogenous variables (**z**) such as bank size, loan loss provision, ownership, loan loss charge, age, liquidity ratio and capital ratio." "However, with the initial trial estimation of these models, only three variables (bank size, ownership and capital adequacy ratio) were retained due to their significance level and higher likelihood ratio." "All the other variables (loan

loss provision, loan loss charge, bank age and liquidity ratio) were insignificant and hence was not presented." "The retained variables are defined in Table 7. Consequently, the BC 95 on inefficiency distribution is stated as;"

$$u_{it} = \delta_0 + \delta_1 BS + \delta_2 OS + \delta_3 CR; \qquad u_{it} \sim idd\ N^{+}(0, \sigma_u^2) u_{it} \geq 0 \tag{15}$$

**Measurement of competition**

"Competition in this study is measured using the model proposed by Boone (2004) and further developed by Boone (2008) to measures the impact of efficiency on performance in terms of profit using a profit elasticity index known as the Boone indicator ($\beta$)." "For consistency and robust check, Panzar-Rosse model is also applied to estimate competition level in the industry. Panzar-Rosse is chosen over the Lerner index for consistency and robust check due to the following reason;" "first the Lerner Index is not a measure of competition in long term equilibrium as PanzarRosse model does so that the Lerner Index does well only for the shorter period of observation." "Secondly, Lerner index and Boone indicator uses similar variable in estimation of competition, hence would not be a robust checker on Boone indicator. Thus, this section provides the specification of model for estimating the Boone indicator and the Panzer-Rosse H statistic."

***Specification and estimation of the Bonne indicator***

"The Boone indicator rests on the assumption that, banks with superior efficiency (in terms of lower marginal cost) gain more benefits in terms of profit as a result of market share reallocation from less efficient banks to more efficient one and this effect becomes stronger in a highly competitive market structure. The basic model to estimate the Boone indicator for each market over the study period was stated in Equation (10) is empirically restated as follows;"

$$\ln ms_{mit} = \propto_m + \beta \ln mc_{mit} + \varepsilon_{mi} \tag{16}$$

"where $ln\ s_{mit}$ is the market share of bank $i$ $(i = 1 \ldots 22)$ in the $m^{th}(m = 1 \ldots 3)$ output market at time t. $\ln mc_{mit}$ denote the marginal cost of bank $i$ for output $m$. $\propto_m$ is the bank fixed effect for output $m$ and $\varepsilon_{mit}$ is an idiosyncratic shock."

"To estimate the annual Boone indicator for each market over the study period, following the approach of Leuvensteijn*et al*. (2007), we interact the time dummies variable, $d_t$, with the marginal costs so as to obtain $\beta_t$, over time. In this case, Equation (16) is restated as follows;"

$$ln\ ms_{mit} = \propto_m + \sum_{t=2009}^{2018} \beta_t\, d_t * \ln mc_{mit} + \varepsilon_{mit} \tag{17}$$

"In exploring the factors (denoted by $F_{itj}$) that affect the Boone indicator, the interaction terms of marginal cost and the factors are included to analyze the change of the Boone indicator due to the interaction with the factors (captured in the indicator)." "These factors include bank size ($SIZE_{it}$), ownership ($OWN_{it}$),

banking crisis ($CRISIS_t$), ICT ratio ($ICT_{it}$) and the effects of a mergers ($MERGED_{it}$), bank recapitalisation ($RECAP_{it}$) and interest rate spread ($IRSPD_{it}$) on the Boone indicator." These variables have been described in Table 9. In assessing the effect of these factors, only the loan market was considered as this constitute the core business of these banks. Consequently, Equation (16) is stated as;

$$ln\ ms_{it} = \propto + \beta \ln mc_{it} + \sum_j \beta_j F_{itj} * \ln mc_{it} + \varepsilon_{it} \quad (18)$$

"Higher market shares may lead to a fall in costs due to scale economies. Conversely, we believe that a fall in marginal cost will lead to a rise in market share so that, marginal costs may be endogenous, hence creating the possibility of endogeneity problem." "To correct for this possible endogeneity problem, estimation of Equation (16) to (18) were carried out using the Generalized Method of Moments (GMM) with one-year, two-year and three-year lagged values of the explanatory variable, marginal costs as instrument variable." "A test for overidentification of the instruments was done using the Hansen J-test for GMM (Hayashi, 2000), where the null hypothesis is that the instrument is a valid instrument, that is, uncorrelated with the error term. Also, we test the hypothesis of no autocorrelation in the error term and report the results together with the main results in Chapter 6."

"The market shares of banks with lower marginal costs are expected to increase so that, in theory, $\beta_t$ is expected to assume negative values i.e. the increase in costs reduces market share, which can be interpreted as a reduction in the ability

of the bank to affect its losses due to an increase in competition." "The market share is computed for the loan and advance market, other earning asset market and fee-based service market." "The stronger the competition, the stronger the effect and the larger in absolute terms the value of $\beta_t$,. The $\beta_t$, parameter is the Boone indicator." "For empirical reasons, Equation (16) to (18) have been specified in log-linear terms in order to deal with heteroskedasticity."

"Since marginal cost cannot be observed directly, Boone *et al.* (2004) approximate bank's marginal costs by the ratio of average variable costs and revenues." "Also, as dependent variable in Equation (16) Boone *et al.* (2004) consider *absolute* values of profit." "Consequently, the current study improves on Boone's approach in two ways." "First, the study use market share as dependent variable instead of profits." "This is so because we believe that, theoretically, efficient banks choose to translate lower costs into either higher profits or lower output prices in order to gain market share." "As a result, using market share for analyzing competition in the banking sector is considered more precise and appropriate." "An even greater advantage of using market shares is that they are always positive, whereas the range of profits (or losses) includes negative values." "A log linear specification would exclude negative profits (losses) by definition, so that the estimation results would be distorted by sample bias, because inefficient, loss-making banks would have to be ignored or transformed." "Secondly, marginal cost is computed instead of approximating this variable with average variable costs. This is done using a translog cost function as specified in Equation (11). Assuming

that inputs' prices are homogeneous (proved in Chapter 5), the marginal cost of the $m$th output is expressed as;"

$$mc_{mit} = \frac{\partial \ln c_{it}}{\partial \ln y_{mit}} \frac{c_{it}}{y_{mit}} \tag{19a}$$

$$= \left[ \beta_m + \sum_{n=1}^{3} \beta_n \ln y_{nit} + \sum_{j=1}^{3} \delta_j \ln w_{jit} + \sum_{m=1}^{3} \varepsilon_m t + \sum_{m=1}^{3} \lambda_m \ln z_{it} \right] \frac{c_{it}}{y_{mit}} \tag{19b}$$

$$= ey_{tm} \left( \frac{c_{it}}{y_{mit}} \right) \tag{19c}$$

An important advantage of computing marginal cost in this manner is that, these marginal costs allow focusing on segments of the market, such as the loan market, other earning asset market and fee-based services market where no direct observations of individual cost items are available.

***Specification and estimation of Panzer-Rosse model***

"As stated earlier, the robustness of the estimates using the Boone indicator is checked with a competing model, the Panzar-Rosse(P-R) model. In order to apply the Panzar-Rosse methodology to the Ghanaian banking industry, the model specification and estimation procedure is set out as follows;"

"The first step is to test the basic assumption underlying the P-R model which involves testing for long-run market (dis)equilibrium using the E-statistic,

defined as the sum of input price elasticities from a specified profit equation. Due to persistent effect of profit, a dynamic profit equation is specified in Equation (20) as follows;"

$$ln\ (1 + ROA_{it}) = \propto' + \beta_0' \ln(1 + ROA_{it-1}) + \sum_{j=1}^{3} \beta_j' \ln w_{it} + \sum_{j=1}^{3} \gamma_j' \ln Z_{jt} + \varepsilon_{it} \quad (20)$$

"where the subscript $i$ denotes bank $i$, the subscript $t$ denotes year $t$. $ROA$ denotes returns on asset defined in Table 9. The dependent variable is defined as $ln(1 + ROA)$ due to some banks having negative returns on asset at some point. $w_1$ denotes price of deposit, $w_2$ denotes the price of labour, $w_3$is the price of fixed asset." "Definition of these variables is captured in Table 9. Three bank specific variables are included the model as control variables to control for differences in risks and costs, which may affect bank's revenue." "These include ratio of total loans to total assets ($Z_1$) to control for risk associated with loans made by banks from which the bank generates much of its revenue, as such, the expected sign of its coefficient is positive." "The next variable is the ratio of equity to total assets ($Z_2$) which considers the leverage effect and solvency risk. More equity implies more earning should be retained, hence less funds being loaned out, which will imply less revenue." "Thus, the expected sign of its coefficient is negative even though Gunalp and Celik (2006) has pointed out the unclear relationship between capital adequacy ratio and the income generation ability of banks." "The third control variable is the ratio of loan loss provision to total loans ($Z_3$) as non-performing loans is a major factor that affects bank's revenue." "The expected sign

of this variable is negative, since as more loan loss provision required to write-off the bad loans, the more the tendency that less revenue bank can obtain. $\varepsilon$ denotes an error term."

"The dynamic profit function in Equation (20) provides the input to compute the E-statistic defined as;"

$$E = \sum_{j=1}^{3} \beta_j \tag{21}$$

If E = 0, it provides an indication of long-run market equilibrium, otherwise, the state of the market can be said to be at disequilibrium.

The next step, after identifying the state of the market, is to compute the long-run H-statistic by estimating a reduced form of the log-normal dynamic function of bank revenue specified in Equation (22) following the work of Kumar & Gulati (2018) as follows;

$$ln\, R_{it} = \propto'' + \beta_0'' \ln R_{it-1} + \sum_{j=1}^{3} \beta_j'' \ln w_{it} + \sum_{j=1}^{3} \gamma_j'' \ln Z_{jt} + \varepsilon_{it} \tag{22}$$

"where $R$ denotes total bank's revenue defined in Table 9. The parameter $\beta_0''$ is persistence coefficients; and all other variables are as explained above and defined in Table 9. Due to the problem of endogeneity, the estimation strategy applied by Goddard and Wilson (2009) and Daley and Matthews (2009) which was further developed by Kumar & Gulati (2018) is applied in estimating Equation (22). Consequently, in order to ensure an efficient estimator and also reduces the potential biases and inaccuracies associated with the traditional panel and first-

difference GMM estimators currently applied by several authors in the literature (Blundell & Bond 1998; Roodman 2009)," "the current study applied the two-step system GMM approach with the lag of the explanatory variables as instruments.The overall validity of the instruments is tested by using the Difference-in-Hansen test of exogeneity of instruments. The long-run H statistic then computed as;"

$$H = \sum_{i=1}^{3} \beta_j'' \tag{23}$$

"A higher value of H-statistic implies a higher degree of competition. Panzar and Rosse (1987) and Vesala (1995) show that $H \leq 0$ is consistent with a collusive or joint monopoly equilibrium or monopolistic competition without the threat of entry, $0 < H < 1$ is consistent with monopolistic competition with a free entry, and $H = 1$ indicates perfect competition."

"To estimate the annual H statistic for the banking industry over the study period, we interact the time dummies variable, $d_t$, with the input prices so as to obtain $\beta_{it}$, over time. In this case, Equation (23) is restated as follows;"

$$ln\, R_{it} = \propto''' + \beta_0''' \ln R_{it-1} + \sum_{j=1}^{3} \sum_{t=2009}^{2018} \beta_{jt}''\, d_t * \ln w_{it} + \sum_{j=1}^{3} \sum_{t=2009}^{2018} \gamma_{jt}''\, d_t * \ln Z_{it} + \varepsilon_{it} \tag{24}$$

Consequently, the annual H statistic is then computed as;

$$H_t = \sum_{i=1}^{3} \beta_{jt}''$$

(25)

The variables and the source from which the data on the variable was obtained is summarized in Table 9.

Table 9: Study variables for bank competition

| Variable | Description | Data source |
|---|---|---|
| Market share ($ms_{it}$) | The ratio of loan/advance (or other earning asset or fee-based income) of bank $i$ to the sum of total loan/advance ((or other earning asset or fee-based income) of all banks in the industry at year t | Ghana banking survey, Banking supervision department of Bank of Ghana |
| Return on asset ($ROA_{it}$) | Ratio of profit after tax and preferred charges to total asset | Annual reports (2009 to 2018) |
| Revenue ($R_{it}$) | Sum of interest income and other operating income such as fee and commission and other non-interest income | Annual reports (2009 to 2018) |
| Price of deposit ($w_1$) | Ratio of interest expenses to total deposit | Annual reports (2009 to 2018) |
| Price of labour ($w_2$) | Ratio of personnel expenses to number of employees | Annual reports (2009 to 2018) |
| Price of fixed capital ($w_3$) | Ratio of operating expense excluding personnel to fixed asset | Annual reports (2009 to 2018) |
| Loan ratio ($Z_1$) | Ratio of total loan to total asset | Annual reports (2009 to 2018) |
| Capital ratio ($Z_2$) | Ratio of shareholders' fund to total asset | Annual reports (2009 to 2018) |
| Loan loss provision ratio ($Z_3$) | Loan loss provision to total loan | Annual reports (2009 to 2018) |
| Bank size (SIZE) | The logarithm of total assets representing the proxy for the size | Annual reports (2009 to 2018) |
| Ownership (OWN) | Binary variable, for banks with foreign majority shareholding OWN= 1; for banks with local majority shareholding, OWN = 0 | Ghana banking survey 2008 to 2018 |

Table 9: Study variables for bank competition (Continued)

| Variable | Description | Data source |
|---|---|---|
| Banking crisis (CRISIS) | A dummy variable for banking crises in the industry, which takes value of 1 for period 2016–2018 and 0 otherwise | |
| ICT ratio (ICT) | Total information and communication technology expenditure to total bank expenditure | Annual reports (2009 to 2018) |
| Merger (MERGER) | A dummy variable that equals 1 if bank *i* was integrated with other institutions and 0 otherwise | Ghana banking survey 2008 to 2018 |
| Recapitalisation (RECAP) | A dummy variable that equals 1 during the year a new minimum capital requirement is to be met and 0 other wise | |
| Interest rate spread (INTSPD) | Closing bank borrowing rate less closing bank deposit rate at year t | Ghana banking survey 2008 to 2018 |

Source: Author's compilation.

**Efficiency, competition, freedom and banks' profitability relationship**

"Finally, we focus on the variables, specification and estimation procedure of the model employed in estimating the efficiency, competition, freedom and banks' profitability relationship. In this sub section, a description of the variables used in the empirical modelling is described followed by discussion of specification and estimation of bank profitability model employed in estimating the efficiency, structure, freedom and banks' profitability relationship in the Ghanaian banking industry over the study period."

***Variable selection***

"The variables selected for the study and their data source is summarized in Table 10. The following sections provides a description of the variables selected for the bank profitability study."

*Measure of profitability*

"Basically, structure-performance literature has relied on two accounting ratios to measure banks' profitability, that is; price (proxied by net interest margin (NIM)) and profit (proxied by return on assets (ROA) or return on equity (ROE))." "As suggested by Daley and Matthews (2009), the profit measure is preferable to price." "This is because, using the price of a single banking product as a measure of profitability may be misleading since banking is a multi-product business." "Again, profit measures may be more informative as all products profits and losses are consolidated into single figure." "Considering ROA and ROE, the ROA reflects management's ability to utilize the bank's assets to generate profits, specifically, it measures the profit earned per cedi of asset." "This ratio depends mainly on the bank's policy as well as some external factors related to the general state of the economy and government regulations (Hassan & Bashir, 2003)." "The ROE reflects the effectiveness of management in utilizing shareholders' funds." "In other words, it measures profit generated per cedi of equity capital. Although, the two measures reflect different aspect of profitability, the ROA is the preferred measure of bank profitability in this study."

"This choice is informed by the fact that, the equity of banks in Ghana has suffered numerous artificial changes due to recapitalization programs carried out by the regulator during study period, which has led to large variation in the ROE figures, which is likely to lead to poor regression fitness and insignificant estimates."

"Alternatively, the study innovates by using shadow return on equity (SROE) and economic value added (EVA) as an alternative measures of bank profitability." "SROE is obtained from the negative of cost elasticity with respect to equity capital ($z$). The advantages of using the SROE is that, it is estimated from the cost function of the banks which is more reliable and closer to the true return on equity," "while ROE is calculated from accounting figures in bank statement, which can be easily influenced and manipulated. EVA focuses on the concept of economic income, where reported accounting profits are adjusted to eliminate distortions encountered in measuring true economic performance." "It is based on simple concept that a business must make economic profit in excess of the cost of capital that has been invested to earn that profit in order to add to its economic value (DeYoung, 1997)." "EVA was computed by adjusting the accounting operating income of the banks for non-cash items such as depreciation and impairment charges and changes in working capital to obtain cash operating profit less imputed interest charge." "Imputed interest charge is computed based on the cost of capital of the bank and capital employed."

Table 10: Study variables for bank profitability

| Variable | Description | Data source |
|---|---|---|
| ***Profitability variables*** | | |
| Return on asset ($ROA_{it}$) | Ratio of profit after tax and preferred charges to total asset. | Annual reports (2009 to 2018) |
| Shadow return on equity ($SROA_{it}$) | Negative of cost elasticity with respect to equity capital. | Result from Figure 9 in Chapter 5 |
| Economic value added ($EVA_{it}$) | Net cash operating profit less imputed interest charges. | Annual reports (2009 to 2018) |
| ***Market structure variables*** | | |
| Market share ($ms_{it}$) | Proportion of individual bank's total assets to total asset of all banks included in the sample | Ghana Banking Survey (2010 to 2019) |
| Herfindahl–Hirschman index (HHI) | Sum of the squared market share of total assets for each bank | Ghana Banking Survey (2010 to 2019) |
| Boone indicator (BI) | Measure of competition in the banking industry | Result from Table 22 in Chapter 6 |
| ***Efficiency variables*** | | |
| X-efficiency (X-EFF) | Measure of bank cost efficiency | Estimated under the Battese and Coelli (1995) model in Chapter 5 |
| Scale efficiency (S-EFF) | Measure of efficiency due to size | Estimated using Equation 28 |
| ***Economic freedom variables*** | | |
| Overall economic freedom index (*eco_free*) | Index for measurement of economic freedom | Heritage Foundation's Index of Economic Freedom (www.heritage.org/efindex) |
| Financial freedom index (*fin_free*) | Index for measurement of financial freedom | Heritage Foundation's Index of Economic Freedom (www.heritage.org/ffindex) |
| ***Bank specific variables*** | | |
| Credit risk ($LP/TL$) | Loan loss provision to total loan | Annual reports (2009 to 2018) |
| Bank capital strength (EQ/TA) | Equity capital divided by total asset | Annual reports (2009 to 2018) |
| Income diversification (NI/TA) | Ratio of non-interest income to total assets | Annual reports (2009 to 2018) |
| Loan intensity (TL/TA) | Ratio of total loan to total assets | Annual reports (2009 to 2018) |
| Bank size (SIZE) | Logarithm of total assets | Annual reports (2009 to 2018) |

Table 10: Study variables for bank profitability (Continuation)

| Variable | Description | Data source |
|---|---|---|
| ***Macroeconomic variables*** | | |
| Economic development (GDP) | Logarithm of gross domestic product (GDP) | IMF Financial Statistics (IFS) and World Bank World Development Indicators (WDI) databases. |
| Financial sector development (SM/GDP) | Ratio of stock market capitalization | IMF Financial Statistics (IFS) and World Bank World Development Indicators (WDI) databases. |
| Macroeconomic risk (INFL) | Rate of inflation (INFL) | IMF Financial Statistics (IFS) and World Bank World Development Indicators (WDI) databases. |

Source: Author's compilation

*Market structure variables*

Three variables were employed to "measure the level of competition of the Ghanaian banking market, namely three-firm asset concentration index ($CR_3$), Herfindahl–Hirschman index (HHI) and the Boone indicator." "These variables were selected in line with the current trend of literature (Bishnoi & Devi, 2017; Sarkar &Sensarma, 2016; Tahir *et al*., 2016 and Apergis, 2015) and the fact that, the Ghanaian banking market appears to have been dominated by three major banks (namely GCB Bank, Barclays Bank (now Absa) and Ecobank)." "The Boone indicator is the main tool applied in this study to measure competition in the Ghanaian banking industry."

"Three-firm asset concentration ratio is the percentage of market share owned by the three largest banks in terms of ownership of total asset market share in the industry. The annual three-firm asset concentration ratio is expressed as:"

$$CR_{3t} = \sum_{i=1}^{3} ms_{it} \quad (26)$$

"where $ms_{it}$ is market share, defined as the proportion of individual bank's total assets to total asset of all banks included in the sample. Low-concentration ranges from 0 to 50 percent, medium concentration ranges from 50 to 80 percent, while 80-100 percent indicates extreme concentration such as oligopoly and/or monopoly market."

"In line with other industrial organizational studies, the Herfindahl–Hirschman index (HHI) is used to measure market concentration. The HHI is defined as the sum of the squared market share of total assets for each bank, that" is;

$$HHI = \sum_{i=1}^{n} {ms_{it}}^2 \quad (27)$$

"Generally, lower value of HHI is an indication of the more banks in the market. The HHI is considered over other concentration index due to its ability to account both the number of banks (includes all banks in the market) and the inequality of market shares, hence captures all movements of concentration." "The SCP hypothesis suggests that higher concentration in banking markets has a positive impact on bank profitability, because collusion among banks may result in higher rates on loans and lower interest rates on deposits." "However, if concentration is the result of tougher competition in the banking industry, this would suggest a negative relationship between performance and market concentration (Boone &

Weigand, 2000).” “Consequently, the overall effect of market concentration on bank performance is uncertain.”

“Competition is captured in the model using the Boone indicator (BI). The estimation of BI over the study period is obtained from the results in Chapter 6. Most banks generate majority of their profit from the provision of loans and similar facilities to customers, as such, the BI for the loan and advance market is used as proxy for competition in the banking industry.”

*Efficiency variables*

“Two efficiency measures are included in the profitability model in line with the ES hypothesis, that is; X-efficiency and scale efficiency. These measures are derived from a translog cost function using the SFA.

“X-efficiency is estimated under the BC 95 model in Chapter 5. Scale efficiency is obtained following the procedure adopted by Hughes, Mester and Moon (2001), where efficiency is calculated from the parameters of the translog cost function as follows;”

$$S - Eff_{it} = \frac{1 - \sum_{i=1}^{3} \frac{\partial \ln c_{it}}{\partial \ln z}}{\sum_{i=1}^{3} \frac{\partial \ln c_{it}}{\partial \ln y_{mit}}} \quad (28)$$

“S-EFF assuming value less than 1 indicate that banks are operating below the optimal scale levels and have the ability to lower costs by increasing output further, while S-EFF assuming value grater 1 is an indication that banks needs to downsize in order to achieve the optimal input combinations.”

*Economic and Financial freedom*

Economic and financial freedom variables are captured in the profitability model to examine their impact on profitability as well as the role they play. "In this direction, economic freedom index (*eco_free*), defined as aggregate of scores along multiple dimensions such as trade freedom, fiscal freedom, government size, investment freedom, property rights, labor freedom, and freedom from corruption is use in the study as a measurement of economic freedom." "Heritage Foundation defines economic freedom as "the absence of government coercion or constraint on the production, distribution, consumption of goods and services beyond the extent necessary for citizens to protect liberty" (Heritage Foundation, 2020)."

"Financial freedom (*fin_free*) measures banking security and independence from government control. Financial freedom index of an economy is dependent on the extent of government regulation of financial services, degree of state intervention in banks and other financial firms through direct and indirect ownership, the extent of financial and capital market development, government influence on the allocation of credit and openness to foreign competition. All indices have 0 to 100 scales, where 100 represents maximum freedom."

"There are two major measurement sources of freedom in the literature; the Economic Freedom of the World Index produced by the Fraser Institute (Gwartney*et al.,* 2019) and the Economic Freedom Index constructed by the Heritage Foundation (Heritage Foundation, 2020)." "As noted by Chortarea*set al.* (2013), both indices are highly credible and their results are compatible in general. Even though the Economic Freedom of the World Index has been used extensively

in the literature, the study uses data from the Heritage Foundation's Index of Economic Freedom (available at www.heritage.org/index) for since it decompose the economic freedom indices into various components which assess various aspect of freedom which is of interest to the study."

*Bank specific variables*

"In order to capture variation in banks' profitability due to variable other than the main variables of interest, the study include five bank specific variables to control for credit risk, capital strength, income diversification, loan intensity and size. These variables have been applied widely in explaining the variations in bank profitability in the literature, among policymakers and practitioners. These variables are discussed as follows;"

"The ratio of loan loss provisions to total loans (LP/TL) is used as a proxy of credit risk. Credit risk is expected to relate negatively with banks' profitability; hence, the coefficient of the LP/TL variable is expected to be negative. Miller and Noulas (1997) suggest that the decline in loan loss provisions are in many instances the primary catalyst to higher profit margins." "Furthermore, to better manage increasing credit risk, banks may incur additional expenses to intensify their monitoring of loans hence relating negatively with profitability (Barajas *et al*. 1999). "The ratio of equity capital to total asset (EQ/AS) is included in the profitability models as a proxy measure of bank capital strength." "Strong capital structure is essential for banks in developing economies, since it provides additional absorber to withstand financial shocks and also increased safety for depositors

during unstable macroeconomic conditions (Sufian, 2009).” “Furthermore, lower capital ratios in banking imply higher leverage and hence, higher risk, and therefore greater borrowing costs.” “Thus, the relatively better capitalized banks should exhibit higher profitability margins. The coefficient of EQ/AS is therefore expected to be positive.”

“The ratio of non-interest income to total assets (NI/TA) is included in the profitability model as a proxy measure of income diversification into non-traditional activities.” “Non-interest income consists of commissions, service charges and fees, net profit from sale of investment securities, and foreign exchange gains. Chiorazzo*et al.* (2008) and Elsas*et al.* (2010) assert that revenue diversification enhances bank profitability through higher margins from non-interest businesses.” “However, other previous studies (Stiroh& Rumble, 2006) show that greater diversification of the banking business does not necessarily translate into an improvement of the bank’s profitability. In fact, they are of the view that, such diversification may be detrimental to profitability. Nevertheless, following Chiorazzo*et al.* (2008) and Elsas*et al.* (2010), income diversification is expected to exhibit positive relationship with banks’ profits.”

“The ratio of total loan to total assets (TL/TA) is included in the profitability model as a proxy of loan intensity.” “The loans market, especially credit to households and firms, is risky and therefore has greater expected returns compared to other type of assets, such as government securities.” “A larger share of bank loans to total assets should imply more interest revenue due to the higher risk. Thus,

the variable is expected to show a positive relationship with banks' profit (Garcia-Herrero *et al*. 2009)."

"To capture for the possible cost advantages associated with size that may be arise from economies of scale, the variable, total asset (TA) defined as the natural logarithm of total bank asset is introduced in the profit model." "The relationship between size and bank profitability has been ambiguous at best." "Smirlock (1985) argues that a growing bank size is positively related to bank profitability as larger banks are in a better position to realize economies of scale and reduce the cost of gathering and processing information." "However, extremely large banks might show a negative relationship between size and profitability. This is because of agency costs, the overhead of bureaucratic processes and other costs related to managing large firms (Stiroh& Rumble, 2006; Pasiouras&Kosmidou, 2007)."

*Macroeconomic variable*

"Banks' profitability tends to be sensitive to macroeconomic conditions. Thus, the study controls some macro-economic variables in the profit model. First, to control for economic development, the study uses the natural logarithm of gross domestic product (GDP). Generally, higher economic growth encourages banks to lend more and permits them to charge higher margins. It also improves the quality of banks' assets." "However, high economic growth improves business environment and lowers bank entry barriers. This would result in competition to intensify and consequently dampens banks' profitability (Liu & Wilson, 2011). As

such, it is expected that, economic development would be positively related to banks' profitability."

"Again, in controlling for the impact of financial sector development on the banking sector profitability, as suggested by Ben Naceur and Omran (2011), the study uses the ratio of stock market capitalization to GDP (MKTCAP/GDP)." "This ratio may also indicate the complementarity or substitutability between bank and equity market financing. Demirguc-Kunt and Huizinga (1999) suggest that stock market capitalization is negatively related to bank profits, as a relatively well-developed stock markets can substitute for bank finance. We therefore expect the variable to be negatively related to bank profit margins."

"Macroeconomic risk is also accounted for by controlling for the rate of inflation (INFL). The extent to which inflation affects bank profitability depends on whether future movements of inflation are fully anticipated." "An inflation rate that is fully anticipated may increase bank profitability, while an unanticipated change would raise costs due to imperfect interest rate adjustment (Perry, 1992)."

***Empirical model specification***

"In order to examine the effect of market structure, efficiency and freedom on bank profitability, the study adopt the approach followed by Athanasoglou*et al.* (2008), Garcia-Herrero *et al.* (2009), Trujillo-Ponce (2013), Dietrich and Wanzenried (2014) and Sarpong-Kumankoma*et al.* (2018)." "Consequently, a dynamic linear regression model is specified as follows;"

$$\pi_{it} = \propto_0 + \beta\pi_{it-1} + \sum_{j=1}^{3} \gamma_j \, Stru_{jt} + \sum_{k=1}^{2} \delta_k \, Eff_{kt} + \sum_{m=1}^{2} \theta_m \, Free_{mt} + \sum_{j=1}^{3}\sum_{m=1}^{2} \lambda_{jm} \, Stru_{jt} * Free_{mt} + \sum_{k=1}^{2}\sum_{m=1}^{2} \rho_{km} \, Eff_{kt} * Free_{mt} + \sum_{n=1}^{4} \phi_n \, BSpeci_{nt} + \sum_{q=1}^{3} \psi_q \, Macro_{qt} + \eta_i + \varepsilon_{it} \quad (29)$$

"where the subscripts *i*, and *t* represent bank *i* at year *t*. $\pi_{it}$ denote a measure of bank profitability which is either return on asset (ROA), shadow return on equity (SROE) or economic value added (EVA). $\pi_{it-1}$ is the profit measure on the same bank in the previous year. $Stru_j$ measures the structure of the banking market." "Three proxies were employed to capture the nature of the market; three-firm concentration index and HHI as measures of market concentration and the Boones indicator as a measure of competition. $Eff_k$ measures banks efficiency captured in the form of X-efficiency and scale efficiency." "$Free_m$ measures the degree of freedom in the banking market and the economy at large and is captured in the form economic freedom and financial freedom." "$Stru_j * Free_m$ and $Eff_k * Free_m$ are interaction between market structure variables and freedom variables and then efficiency variables and freedom variables respectively. $BSpeci_n$ and $Macro_q$ are vectors representing bank specific and macroeconomic" "control variables. $\eta_i$ captures bank specific effect and $\varepsilon_{it}$ captures the random error where $\varepsilon_{it} \sim iid(0, \sigma_u^2)$. Table 18 gives the composition of each of the variables included in the model."

***Empirical model estimation procedure***

"In estimating bank performance models, Berger *et al*. (2000) suggests that, bank performance tend to persist over time reflecting impediments to market competition, informational opacity, and sensitivity to macroeconomic shocks." "Besides, Garcia-Herrero *et al*. (2009) pointed out that, potential endogeneity is highly possible when assessing bank performance drivers." "Thus, empirical works on the determinants of bank performance may suffer from several sources of inconsistencies, such as highly persistence performance, omitted variables, and endogeneity bias (Poghosyan & Hesse, 2009)." "Consequently, the standard fixed effects or random effects estimators would be inconsistent, since by construction, the individual bank effects are correlated with the lagged dependent variable."

"To account for these issues, a dynamic panel model is employed to examining the efficiency-structure-profitability relationship where the first lag of the dependent variable is introduced in the model as an explanatory variable and estimated by employing the system Generalized Methods of Moments (GMM) estimator introduced by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998)." "This estimation method allows the control for possible persistency and endogeneity; hence, estimation yields consistent estimates."

"The reliability of system GMM depends critically on its assumptions; the error terms are not autocorrelated, and that the instruments used are valid." "The presence of first-order autocorrelation in the differenced residuals does not imply that the estimates are inconsistent, rather the presence of second-order autocorrelation suggests that the estimates are inconsistent (Baum *et al*. 2010). As

a result, we test the hypothesis of no autocorrelation in the error term and report the results together with the main results in Chapter 7." "Also, the validity of the instrument is evaluated with the Hansen test of overidentifying restrictions, asymptotically distributed as $\chi^2$ in the number of restrictions. A rejection of the null hypothesis that instruments are orthogonal to the errors would indicate that the estimates are not consistent (Baum *et al*. 2010; Liu et al., 2013)"

**Chapter Summary**

"The chapter describes the data and the methods applied in achieving the objectives of the study. The research design adopted was discuss and the quantitative approach used was in line with fulfilling the objectives of the study. The data used was mainly obtained from bankscope, Bank of Ghana supervision department and financial reports of the sampled banks over the ten-year study period. The data collected was an unbalanced micro panel data meant to bring out the heterogeneity of the study units."

"In modelling bank efficiency, the choice of inputs and output variables was informed by the intermediary approach where the banking units were considered as an intermediary unit that transform input from the environment, process it and give it out to the environment. The theoretical and empirical specification of seven models applied in estimating efficiency scores were also discussed and justified. An approach to test the qualities of the cost function derived from the specified model was also discussed."

"In modelling competition of the banking industry, the recently Boone indicator following the non-structural approach of measuring competition was used with Panzer-Rosse model used as consistency checker. Discussions were also extended to measurement and justification of external variables that are likely to influence the Boone indicator."

"Finally, the bank profitability model was specified. A description of the variables used in the empirical modelling is described followed by discussion of specification and estimation of bank profitability model employed in estimating the efficiency, structure, freedom and banks' profitability relationship in the Ghanaian banking industry over the study period. The subsequent three chapters presents the discussion of the result obtained from estimation of the models discussed in this chapter."

# CHAPTER FIVE

# ESTIMATION OF COST EFFICIENCY AND COST ELASTICITY OF BANKS IN GHANA

## Introduction

"Studies on cost efficiency of Ghanaian banks is not vast given the importance bank cost efficiency in the global financial market. There have been few studies on the subject matter (Adjei & Chakravarty, 2012; Saka *et al.,* 2012) with inconsistent results. This provides an incentive based on which the current study is premised, that is, to fill literature gap and to add the latest evidence in the empirical literature on bank cost efficiency in Ghana. On this basis, the primary objective of this chapter is to explore the cost efficiency level of Ghanaian banks from 2009 to 2018, and to examine the changes in cost efficiency over this period. It also seeks to explore the factors that underlie efficiency of Ghanaian banks and how elastic cost efficiency of banks in Ghana are to changes in bank output, input prices, equity capital and time. Finally, the study seeks to compare the efficiency for different sub groups of banks based on ownership and also estimate the shadow return on equity of banks in Ghana."

"The rest of the chapter is organized as follows: the next section provides a descriptive statistic of the variables used in developing the banks' cost function. This is followed by presentation of the regression result for the seven models as specified in Table 8. Efficiency score for the entire sample and sub-samples based on ownership as well as ranking of the banks based on the estimated model is then presented. This is followed by the elasticity of cost with respect to output, input prices, time and equity and the scale economies in the Ghanaian banking industry.

Finally, robustness test for the results is presented in terms of properties of a 'good' cost function."

**Descriptive statistics**

"This section provides a descriptive of the data on the key variables used in the study. A summary of the descriptive statistics of the variables used in the cost efficiency estimation for both the total sample and the sub-samples is shown in Table 11."

"Considering the output of the banks, loans appears to form more than half of the total output of the banks with an average balance of GHS824.94 million forming over 55% of the average output value. Nevertheless, it shows a greater dispersion indicating a significant variation of size of the banks in the sample in terms of loans given out." T"he least component of the output comes from fee-based services indicating lack of diversified activities of the banks that form the sample. The relatively smaller coefficient of variation of the fee-based services showed that, banks in the sample are generating similar amount of income from this source." "This observation appears to be similar across the sub-samples. Considering the input variables, significant amount them in terms of value is customer deposit, which was defined to include all deposit forms taken by the bank over the study period. Data on deposit was based on the amount outstanding at the end of the year. Over the study period, customer deposit for all the banks considered ranged from GHS58.75 million to GHS6,685.99 million with both the lowest and the highest deposit obtained from a foreign bank." "With the foreign banks having a greater dispersion again shows the variation in size of the foreign banks in terms of deposits."

Table 11: Descriptive statistics of efficiency study variables

| | Obs. | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| *All banks (Total no. = 22)* | 205 | | | | |
| Total Loan* | | 2.06 | 3,420.28 | 824.94 | 598.10 |
| Other earning bearing asset* | | 21.50 | 2,767.61 | 594.88 | 528.13 |
| Non-interest income* | | 1.04 | 312.46 | 76.06 | 55.38 |
| Total deposit* | | 58.75 | 6,685.99 | 1,505.75 | 1,167.97 |
| Physical capital* | | 5.35 | 258.39 | 54.03 | 45.83 |
| Interest expense* | | 3.92 | 314.40 | 78.52 | 47.59 |
| Personnel expense* | | 6.92 | 219.00 | 61.21 | 47.90 |
| Operating expense* | | 7.47 | 263.24 | 67.63 | 49.80 |
| Total cost* | | 24.96 | 642.57 | 207.35 | 122.87 |
| Equity capital* | | 7.42 | 927.63 | 284.28 | 179.45 |
| Total asset* | | 147.49 | 7,527.26 | 1,999.75 | 1,395.58 |
| Price of deposit** | | 0.0135 | 0.1798 | 0.0660 | 0.0338 |
| Price of labour*** | | 8.30 | 858.16 | 109.47 | 115.32 |
| Price of capital*** | | 0.23 | 9.161 | 1.751 | 1.472 |
| No. of employees | | 125 | 2,311 | 689 | 471 |
| Capital ratio (%) | | 0.89 | 67.12 | 15.94 | 8.00 |
| *Foreign banks (Total no. =14)* | 133 | | | | |
| Total Loan* | | 2.06 | 3,420.28 | 796.30 | 678.12 |
| Other earning bearing asset* | | 21.50 | 2,167.39 | 579.55 | 473.97 |
| Non-interest income* | | 1.04 | 312.46 | 79.09 | 63.57 |
| Total deposit* | | 58.75 | 6,685.99 | 1,532.20 | 1,316.01 |
| Physical capital* | | 5.35 | 258.39 | 45.18 | 44.18 |
| Interest expense* | | 3.92 | 187.62 | 63.03 | 38.25 |
| Personnel expense* | | 6.92 | 201.67 | 57.28 | 47.49 |
| Operating expense* | | 7.47 | 202.49 | 60.63 | 44.90 |
| Total cost* | | 24.96 | 506.57 | 180.94 | 112.45 |
| Equity capital* | | 7.42 | 927.63 | 294.90 | 192.90 |
| Total asset* | | 147.49 | 7,527.26 | 1,995.20 | 1,528.37 |
| Price of deposit** | | 0.0135 | 0.1798 | 0.0567 | 0.0313 |
| Price of labour*** | | 8.30 | 858.16 | 123.68 | 139.63 |
| Price of capital*** | | 0.342 | 9.161 | 1.957 | 1.668 |
| No. of employees | | 125 | 1,575 | 572 | 322 |
| Capital ratio (%) | | 0.89 | 67.12 | 17.24 | 9.00 |

Table 11: Descriptive statistics of study variables (Continued)

| | Obs. | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| *Local banks (Total no. = 8)* | 72 | | | | |
| Total Loan* | | 156.83 | 2,962.35 | 877.85 | 410.52 |
| Other earning bearing asset* | | 48.91 | 2,767.61 | 623.18 | 618.47 |
| Non-interest income* | | 11.84 | 162.23 | 70.46 | 35.32 |
| Total deposit* | | 304.67 | 4,285.35 | 1,456.89 | 834.24 |
| Physical capital* | | 12.10 | 223.90 | 70.38 | 44.60 |
| Interest expense* | | 31.41 | 314.40 | 107.12 | 50.09 |
| Personnel expense* | | 12.14 | 219.00 | 68.45 | 48.13 |
| Operating expense* | | 14.39 | 263.24 | 80.56 | 55.81 |
| Total cost* | | 57.94 | 642.57 | 256.13 | 127.07 |
| Equity capital* | | 58.24 | 687.99 | 264.67 | 150.79 |
| Total asset* | | 379.06 | 5,512.04 | 2,008.16 | 1,119.42 |
| | | | | | |
| Price of deposit** | | 0.0218 | 0.1559 | 0.0830 | 0.0318 |
| Price of labour*** | | 13.11 | 170.75 | 83.21 | 29.63 |
| Price of capital**** | | 0.232 | 5.583 | 1.370 | 0.910 |
| | | | | | |
| No. of employees | | 234 | 2,311 | 905.10 | 610.19 |
| Capital ratio (%) | | 5.4 | 26.26 | 13.54 | 5.00 |

Source: computed from banksope database, data from BoG banking supervision department and annual financial statements.

All values are stated at constant prices with 2013 as the base year; *values stated in millions of Ghana cedis; **values stated in cedis per GHS1 of deposit per annum; ***values stated in thousands of cedis per employee per annum; **** values stated in cedis per GHS1 of fixed capital value per annum

Another aspect of the data that requires attention is the size of the banks in terms of total assets which ranges from GHS147.49 million to GHS7,527.26 million with an average asset stock of GHS1,999.75 million. The coefficient of variation of almost 70% is an indication of significant variation in size of banks in the sample. This observation is similar in both among the foreign bank sample and the local bank sample. It should however be stressed that, the data used in the efficiency estimation were transformed in their logarithm form necessary to achieve normality.

**Parameter estimation**

In estimating the parameters of the stochastic frontier cost function in Equation (11), seven models were considered (see Table 8) based their assumptions on time variation and on the error terms. The estimation of parameters was obtained using the *xtfrontier* and *sfpanel* command in Stata (Belotti*et al*., 2012) and result presented in Table 12.Generally, the direction and significance of the major estimated parameters is consistent first, across the models, secondly, with a priori expectation, the literature and finally, with theory.

"First and foremost, total cost increases initially with output at a decreasing rate. This is indicated by the negatively signed coefficients on the squared output terms. However, as diminishing returns set in, total cost increases with output at an increasing rate, which is consistent with economic theory." "This is indicated by the estimated parameters for the three outputs being positive with the parameter of $y_1$(total loan) and $y_2$(other earning assets) being statistically significant at 1% and 5% respectively but the parameter of $y_3$ (other income) is statistically insignificant. The result confirms the fact that, the Ghanaian banking sector is dominated by the traditional business of banking with less diversification into other areas that may generate income unrelated to their core business. It is therefore no surprise that interest expense of the banking industry accounting for 59% of the total banking cost (PricewaterhouseCoopers, 2018). Across all the models, the sum of the partial elasticities with respect to each output estimated is less than one, indicating the existence of decreasing returns to scale at the sample mean."

Table 12: Ghanaian banks cost efficiency estimated coefficients (22 banks for 205 observations)

| Model | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| | | FE | RE | PL | BC92 | BC95 | TFE | TRE |
| | | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ |
| $\ln y_1$ | $\beta_1$ | 0.708*** | 0.718*** | 0.817*** | 0.716*** | 0.786*** | 0.708*** | 0.734*** |
| | | (0.0602) | (0.0474) | (0.258) | (0.1795) | (0.2754) | (0.1418) | (0.2304) |
| $\ln y_2$ | $\beta_2$ | 0.115** | 0.211*** | 0.156** | 0.140** | 0.118** | 0.114* | 0.154*** |
| | | (0.0524) | (0.0745) | (0.0901) | (0.0659) | (0.0592) | (0.0623) | (0.0316) |
| $\ln y_3$ | $\beta_3$ | 0.093 | 0.014 | 0.018 | 0.099 | 0.069 | 0.092 | 0.078 |
| | | (0.3563) | (0.1538) | (0.0800) | (0.1298) | (0.1120) | (0.2958) | (0.0843) |
| $\ln y_1 \ln y_1$ | $\beta_{11}$ | -0.081 | -0.042** | -0.086 | -0.240 | -0.252 | -0.281 | -0.260 |
| | | (0.0674) | (0.020) | (0.0604) | (0.1578) | (0.2907) | (0.1896) | (0.5078) |
| $\ln y_1 \ln y_2$ | $\beta_{12}$ | -0.143 | -0.232* | -0.160** | -0.233** | -0.125** | -0.143* | -0.273* |
| | | (0.0888) | (0.1317) | (0.0750) | (0.1136) | (0.0542) | (0.0754) | (0.1567) |
| $\ln y_1 \ln y_3$ | $\beta_{13}$ | -0.108* | -0.640*** | -0.112*** | -0.242** | -0.268* | -0.108 | -0.252** |
| | | (0.0606) | (0.2183) | (0.0384) | (0.1079) | (0.1521) | (0.1163) | (0.1131) |
| $\ln y_2 \ln y_2$ | $\beta_{22}$ | -0.328 | -0.285 | -0.039 | -0.086 | -0.941* | -0.027 | -0.076** |
| | | (0.3783) | (0.2633) | (0.0414) | (0.0655) | (0.5213) | (0.0400) | (0.0319) |
| $\ln y_2 \ln y_3$ | $\beta_{23}$ | -0.173 | -0.117 | -0.152 | -0.116 | -0.213** | -0.173* | -0.156 |
| | | (0.1432) | (0.8178) | (0.1059) | (0.1516) | (0.0879) | (0.0985) | (0.2013) |
| $\ln y_3 \ln y_3$ | $\beta_{33}$ | -0.061* | -0.043 | -0.068 | -0.741 | -0.504 | -0.612 | -0.841 |
| | | (0.0364) | (0.0587) | (0.0877) | (0.7616) | (3.8473) | (0.9386) | (0.8512) |
| $\ln w_1$ | $\gamma_1$ | 0.013*** | 0.015*** | 0.026*** | 0.031** | 0.022*** | 0.055** | 0.061** |
| | | (0.0042) | (0.0037) | (0.0084) | (0.0110) | (0.0031) | (0.0276) | (0.0275) |
| $\ln w_2$ | $\gamma_2$ | 0.213*** | 0.306** | 0.285** | 0.128*** | 0.122** | 0.212** | 0.250*** |
| | | (0.0228) | (0.1383) | (0.1504) | (0.4090) | (0.5627) | (0.3745) | (0.3303) |
| $\ln w_3$ | $\gamma_3$ | 0.776*** | 0.680** | 0.688* | 0.842*** | 0.855* | 0.733** | 0.689** |
| | | (0.0816) | (0.2887) | (0.3615) | (0.3151) | (0.4912) | (0.3462) | (0.3273) |
| $\ln w_1 \ln w_1$ | $\gamma_{11}$ | -0.345 | -0.357 | -0.861 | -0.894 | -0.312 | -0.155 | -0.113 |
| | | (0.2182) | (0.3186) | (0.5681) | (0.6502) | (0.3521) | (0.1799) | (0.0956) |
| $\ln w_1 \ln w_2$ | $\gamma_{12}$ | 0.016 | 0.026 | 0.085 | 0.053 | 0.109 | 0.088 | 0.118 |
| | | (0.0125) | (0.1338) | (0.1158) | (0.0348) | (0.0766) | (0.0718) | (0.0886) |
| $\ln w_1 \ln w_3$ | $\gamma_{13}$ | 0.453 | 0.522 | 0.739 | 0.772 | 0.813 | 0.922 | 0.792 |
| | | (0.7134) | (0.7196) | (0.8410) | (0.5791) | (0.6582) | (1.4992) | (0.9706) |
| $\ln w_2 \ln w_2$ | $\gamma_{22}$ | -0.227 | -0.361 | -0.012 | -0.067 | -0.051 | -0.026 | -0.066 |
| | | (0.2472) | (0.3578) | (0.0341) | (0.0654) | (0.0633) | (0.0385) | (0.0568) |
| $\ln w_2 \ln w_3$ | $\gamma_{23}$ | 0.017 | 0.065 | 0.017 | 0.018 | 0.012 | 0.017 | 0.012 |
| | | (0.0580) | (0.0156) | (0.0536) | (0.0743) | (0.0207) | (0.0475) | (0.0714) |
| $\ln w_3 \ln w_3$ | $\gamma_{33}$ | 0.047 | 0.190* | 0.039 | 0.125** | 0.321** | 0.147 | 0.103*** |
| | | (0.0347) | (0.1103) | (0.0319) | (0.0560) | (0.1453) | (0.0923) | (0.0362) |

Table 12: Ghanaian banks estimated coefficients (continuation)

| Model | | FE | RE | PL | BC92 | BC95 | TFE | TRE |
|---|---|---|---|---|---|---|---|---|
| | | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ |
| $\ln y_1 \ln w_1$ | $\delta_{11}$ | 0.359 | 0.471 | 0.514 | 0.322 | 0.418 | 0.433 | 0.382 |
| | | (0.6130) | (0.5881) | (0.7118) | (0.2661) | (0.4363) | (0.3207) | (0.4316) |
| $\ln y_1 \ln w_2$ | $\delta_{12}$ | -0.118*** | -0.177** | -0.127*** | -0.077 | -0.073 | -0.118 | -0.075 |
| | | (0.0387) | (0.0888) | (0.0349) | (0.0509) | (0.1362) | (0.0732) | (0.0496) |
| $\ln y_1 \ln w_3$ | $\delta_{13}$ | 0.095*** | 0.093*** | 0.102*** | 0.089** | 0.081*** | 0.094*** | 0.088** |
| | | (0.0315) | (0.0394) | (0.0275) | (0.0385) | (0.02281 | (0.0264) | (0.0356) |
| $\ln y_2 \ln w_1$ | $\delta_{21}$ | 0.211 | 0.318 | 0.427 | 0.214 | 0.322 | 0.145 | 0.291 |
| | | (0.3188) | (0.4188) | (0.3318) | (0.2872) | (0.2633) | (0.1642) | (0.2201) |
| $\ln y_2 \ln w_2$ | $\delta_{22}$ | -0.781 | -0.984 | -0.902 | -0.563 | -0.694 | -0.701 | -0.053 |
| | | (0.7222) | (0.8581) | (0.8227) | (0.5440) | (0.6034) | (0.6013) | (0.036) |
| $\ln y_2 \ln w_3$ | $\delta_{23}$ | -0.008 | 0.104** | -0.105 | -0.101* | -0.144 | -0.007 | -0.099** |
| | | (0.0291) | (0.0442) | (0.1270) | (0.0612) | (1.2857) | (0.0053) | (0.0393) |
| $\ln y_3 \ln w_1$ | $\delta_{31}$ | 0.172 | 0.098 | 0.054 | 0.138 | 0.152 | 0.088 | 0.072 |
| | | (0.3229) | (0.1571) | (0.1150) | (0.1140) | (0.1543) | (0.0776) | (0.0506) |
| $\ln y_3 \ln w_2$ | $\delta_{32}$ | 0.086* | 0.033 | 0.084** | 0.034 | 0.054 | 0.086** | 0.034 |
| | | (0.0474) | (0.0732) | (0.0421) | (0.0627) | (0.0597) | (0.0401) | (0.0612) |
| $\ln y_3 \ln w_3$ | $\delta_{33}$ | -0.016 | 0.088 | -0.010 | -0.083 | -0.076 | -0.016 | -0.082 |
| | | (0.0431) | (0.0666) | (0.0368) | (0.0578) | (1.1176) | (0.0361) | (0.0601) |
| $t$ | $\theta_1$ | -0.397 | -0.104 | -0.372 | -0.081 | -0.050 | -0.397*** | -0.074 |
| | | (0.3775) | (0.2470) | (0.3560) | (0.1961) | (0.4000) | (0.1157) | (0.1989) |
| $t^2$ | $\theta_2$ | 0.005*** | -0.001* | 0.001 | 0.001 | 0.005 | 0.001 | 0.001 |
| | | (0.0017) | (0.0006) | (0.0009) | (0.0015) | (0.0073) | (0.0009) | (0.0030) |
| $t \ln y_1$ | $\varepsilon_1$ | -0.012* | -0.006 | -0.010 | -0.005 | -0.025 | -0.011** | -0.007 |
| | | (0.0070) | (0.0121) | (0.0062) | (0.0078) | (0.0312) | (0.0054) | (0.0088) |
| $t \ln y_2$ | $\varepsilon_2$ | -0.036 | -0.028 | -0.036 | -0.027 | -0.091 | -0.036 | -0.030 |
| | | (0.1216) | (0.1098) | (0.1353) | (0.0838) | (0.0930) | (0.0511) | (0.0802) |
| $t \ln y_3$ | $\varepsilon_3$ | 0.001 | 0.002 | 0.003 | 0.008 | 0.082 | 0.025 | -0.007 |
| | | (0.0043) | (0.1667) | (0.0119) | (0.1176) | (0.3241) | (0.2314) | (0.1228) |
| $t \ln w_1$ | $\rho_1$ | 0.007 | 0.009 | 0.011 | 0.021 | 0.019 | 0.031 | 0.022 |
| | | (0.0308) | (0.0218) | (0.0552) | (0.0211 | (0.0418 | (0.0276 | (0.0196) |
| $t \ln w_2$ | $\rho_2$ | -0.021 | -0.009 | -0.019 | -0.009 | -0.021 | -0.021 | -0.008 |
| | | (0.0605) | (0.0173) | (0.0805) | (0.0101) | (0.0850) | (0.0476) | (0.0083) |
| $t \ln w_3$ | $\rho_3$ | -0.005 | -0.027** | 0.004 | 0.023* | 0.089** | 0.004 | -0.018 |
| | | (0.0059) | (0.0134) | (0.0048) | (0.0142) | (0.0355) | (0.0039) | (0.0511) |
| $\ln z$ | $\emptyset_1$ | 1.514* | 2.879 | 1.887* | 2.886** | 0.935*** | 1.513* | 2.867* |
| | | (0.8314) | (1.794) | (0.002) | (1.4330) | (0.1802) | (0.7692) | (1.5074) |
| $\ln z \ln z$ | $\emptyset_2$ | 0.304 | 0.523 | 0.135 | 0.053 | 0.028 | 0.003 | 0.055 |
| | | (1.9613) | (0.4929) | (0.2668) | (0.0358) | (0.2642) | (0.0174) | (0.0354) |

Table 12: Ghanaian banks estimated coefficients (continuation)

| Model | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| | | FE | RE | PL | BC92 | BC95 | TFE | TRE |
| | | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ | $b/_{(se)}$ |
| $\ln y_1 \ln z$ | $\lambda_1$ | 0.083*** | 0.029** | 0.085 | 0.028 | 0.079 | 0.083 | 0.027 |
| | | (0.0201) | (0.0143) | (0.0642) | (0.0862) | (0.2642) | (0.0595) | (0.0849) |
| $\ln y_2 \ln z$ | $\lambda_2$ | 0.047 | 0.242*** | 0.064** | 0.241*** | 0.226** | 0.247*** | 0.248*** |
| | | (0.0571) | (0.0836) | (0.0276) | (0.0790) | (0.7902) | (0.0826) | (0.0768) |
| $\ln y_3 \ln z$ | $\lambda_3$ | -0.129 | -0.035 | -0.127 | -0.036 | -0.758 | -0.129 | -0.056 |
| | | (0.1030) | (0.1923) | (0.0951) | (0.1379) | (0.8311) | (0.0893) | (0.2090) |
| $\ln w_1 \ln z$ | $\xi_1$ | 0.382 | 0.411 | 0.631 | 0.335 | 0.413 | 0.528 | 0.319 |
| | | (0.4130) | (0.4281) | (0.8837) | (0.4117) | (0.4211) | (1.223) | (0.5290 |
| $\ln w_2 \ln z$ | $\xi_2$ | 0.109** | 0.029 | 0.104** | 0.029 | 0.447 | 0.109** | 0.049* |
| | | (0.0556) | (0.0841) | (0.0500) | (0.0734) | (1.1610) | (0.0469) | (0.0285) |
| $\ln w_3 \ln z$ | $\xi_3$ | -0.139** | -0.184** | -0.152*** | -0.187** | -0.146* | -0.139*** | -0.189** |
| | | (0.0628) | (0.0910) | (0.0531) | (0.0774) | (0.0793) | (0.0509) | (0.0780) |
| $t \ln z$ | $\psi$ | 0.044*** | 0.054** | 0.040*** | 0.054*** | 0.053*** | 0.044*** | 0.053*** |
| | | (0.0125) | (0.0211) | (0.0113) | (0.0160) | (0.0121) | (0.0106) | (0.0161) |
| _cons | $\propto$ | 2.828** | 4.742** | 2.351** | 4.491*** | 1.675*** | 5.128*** | 4.231*** |
| | | (1.2349) | (2.2128) | (1.0735) | (1.2672) | (0.4061) | (1.8722) | (1.2832) |
| $R^2$ | | 0.926 | 0.985 | | | | | |
| $\sigma_u$ | | 0.466 | 0.321 | 0.483 | 0.049 | 0.075 | 0.072 | 0.058 |
| $\sigma_v$ | | 0.101 | 0.098 | 0.091 | 0.014 | 0.021 | 0.023 | 0.013 |
| $\gamma$ | | 0.956 | 0.915 | 0.966 | 0.928 | 0.927 | 0.912 | 0.952 |
| LLR | | | | 144.241 | 152.327 | 144.125 | 203.51 | 187.85 |
| $\sigma^2$ | | | | 0.655*** | 3.125*** | 4.156*** | 3.158*** | 2.185*** |
| | | | | (0.2168) | (0.4028) | (0.3319) | (0.8234) | (0.5043) |
| eta | | | | | 0.158*** | 0.826*** | 0.428** | 0.162* |
| | | | | | (0.0257) | (0.0535) | (0.1772) | (0.0926) |
| $u_i$: | | | | | | | | |
| BS | | | | | | -3.218*** | | |
| | | | | | | (0.0179) | | |
| OS | | | | | | -0.255*** | | |
| | | | | | | (0.2455) | | |
| CR | | | | | | 0.125*** | | |
| | | | | | | (0.9914) | | |
| _cons | | | | | | -1.120* | | |
| | | | | | | (0.6356) | | |

*Source: computed from banksope database, data from BoG banking supervision department and annual financial statements.* ***$p<0.01$; **$p<0.05$;*$p<0.1$. Coefficients for dummies in the case of FE and TFE not presented.

"Also the parameters of the interaction term for $y_1y_3$ and $y_2y_3$ are negative and statistically significant across the model in the case of $y_1y_3$, but not significant in the case of $y_2y_3$which suggest that, there might be some scope economies in the joint production of loans with other off-balance sheet activities but same cannot be said about investing in other earning asset with off-balance sheet activities."

"The parameters of the input prices are also positive and significant which is expected and in line with cost theories. It is also observed that the estimated coefficient of the time trend ($t$) is negative across the models and is statistically significant suggesting that banks included in the sample experienced technical change over the sample period which, as a result, shift down the cost frontier."

"Moreover, the estimated parameter of equity ($z$) is positive and significant across all the models considered. This indicates that operating with equity capital in the Ghanaian banking industry is costly. A positive elasticity of cost with respect to equity capital at sample mean could be interpreted as negative of the shadow return on equity (Hughes, Mester& Moon, 2001) which intend indicate that, Ghanaian banks over the study period were showing relatively high level of capitalisation." "This observation is expected as banks over the study period has undergo three series of recapitalisation over the study, with the recent being the 2018 recapitalisation require by Bank of Ghana."

"Generally, the statistics such as R-square (in case of Model 1 and 2), and Likelihood ratio (in the case of Model 3 – 7) show goodness of fit for the regressions. The estimate for gamma ($\gamma$) across the models indicates that over 90% of the total error's variations in the data is accounted for by cost inefficiency rather

than by the random error." "This provides fascinating evidence that, the estimation of cost function as a frontier is appropriate for the data. Also, the estimate for *eta* across the time varying models is statistically significant, suggesting that, time varying models might be more appropriate for the data." "This is expected as efficiency in an industry such as banking is expected to change over time."

"Apart from the result discussed above, the estimation results from BC 95 in Table 12 provide additional information on factors that influence bank cost inefficiency. Highly significant estimated coefficients on three exogenous variables show that, bank size proxied by total asset, ownership proxied by dummy variable and equity capital ratio which is the ratio of shareholders fund to total asset affect the mean of the inefficiency term."

**Level of cost efficiency of banks in Ghana**

"This section discusses aggregate cost efficiency scores across the whole sample analysed into sub-samples based on ownership difference. It then looks at annual efficiency change for full sample and the sub-samples and finally rank the banks in terms of their efficiency scores. Efficiency scores presented in this section are based on time varying models (that is, BC 92, BC 95, TFE and TRE)." "This choice is influenced by the *eta,* the parameter for the change in cost efficiency over time, are found to be statistically significant for all the time varying models, which suggests that cost efficiency in the Ghanaian banking industry change across time. So, the time varying models might be more appropriate for our sample. On this basis, all the time invariant models were dropped."

*Average cost efficiency level of banks in Ghana*

"Summary of the cost efficiency score of banks in Ghana between 2009 to 2018, analyzed by ownership status for each time variant model employed is shown in Table 13. The aggregate estimates for cost efficiency scores are different under various models. The true fixed effect (TFE) model reports the lowest cost efficiency with the highest standard errors among all the models, this might be due to the sensitivity of the model's estimate to outliers (Barry *et al.,* 2011)." "The evidence from the TFE model suggests that the overall average cost efficiency score for Ghana's banking industry is 0.582 implying that, Ghanaian banks industry, on the average wasted 41.8% of their costs relative to the "best-practice" banks. In other words, on average, the industry could reduce their cost by 41.8% and still produce the same amount of output. The model suggests however, that local banks on the average are more cost efficient than their foreign counterparts."

"There is a considerable difference in efficiency scores obtained with the true fixed effect (TFE) model and the true random effect (TRE) model. As expected, the true fixed effect model reports lower efficiency scores than that from the true random effect model. More specifically, the level of cost efficiency estimated by the true random effect model is 19% higher than that produced by the true fixed effect model, which is 69.1% and 58.2% respectively. Moreover, the true random effect model produces lower standard errors than the fixed effect models."

Table 13: Average cost efficiency scores full and sub-samples from 2009 to 2018

| Model | Sample | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| BC92 | All | 0.700 | 0.162 | 0.419 | 0.991 |
| | Foreign | 0.707 | 0.161 | 0.419 | 0.991 |
| | Local | 0.688 | 0.164 | 0.425 | 0.962 |
| BC95 | All | 0.791 | 0.124 | 0.584 | 1.000 |
| | Foreign | 0.791 | 0.129 | 0.584 | 1.000 |
| | Local | 0.793 | 0.115 | 0.589 | 0.999 |
| TFE | All | 0.582 | 0.242 | 0.165 | 0.997 |
| | Foreign | 0.561 | 0.241 | 0.165 | 0.997 |
| | Local | 0.619 | 0.242 | 0.173 | 0.994 |
| TRE | All | 0.691 | 0.146 | 0.480 | 1.000 |
| | Foreign | 0.705 | 0.144 | 0.480 | 0.995 |
| | Local | 0.685 | 0.150 | 0.483 | 1.000 |

Source: Author's computation from models in Table 12.

"The BC 92 model which specifies inefficiency as a function of time alone produces roughly similar levels of cost efficiency to the BC 95 model which specifies the mean of inefficiency is a function of a set of environmental variables (total assets, ownership and equity capital ratio)." "Both of them report that the Ghanaian banks are at least 70% cost efficient relative to the best practice bank." "However, the BC 95 model reports even a higher average cost efficiency score (79.1%) with lower standard errors than the BC 92 model and the TRE model, suggesting that the Ghanaian banks could theoretically have produced the same output while incurring only about 79% of their actual cost."

***Annual cost efficiency of banks in Ghana***

"We now turn our attention to annual efficiency scores across the sample and the sub-sample, which enable us to identify the trend of efficiency changes over the time." "As indicated earlier, *eta* the parameter for the change in cost efficiency

through time are found to be statistically significant for all the time varying models, so in determining the annual efficiency scores, we focus on the results from the time varying models." "The annual mean cost efficiencies for the full sample and each sub-sample is presented in Table 14 and Figures 4 and Figure 5 which shows the yearly movement of cost efficiency scores under BC92, BC 95, TFE and TRE model respectively."

"The four models show different trend of changes in efficiency levels over the sample period. It can be observed from Figure 4 that, the TFE model and BC 92 model generally shows an improvement in cost efficiency over the sample period." "Conversely, The BC 95 model and TRE model shows initial deterioration of cost efficiency from the first half of the study period and then rises during the last part of the study period."

Table 14: Annual cost efficiency scores for full- and sub-samples

| Year | BC92 | | | BC95 | | | TFE | | | TRE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | All | Foreign | Local | All | Foreign | Local | All | Foreign | Local | All | Foreign | Local |
| 2009 | 0.661 | 0.690 | 0.607 | 0.789 | 0.793 | 0.781 | 0.532 | 0.484 | 0.620 | 0.726 | 0.746 | 0.715 |
| 2010 | 0.701 | 0.716 | 0.697 | 0.768 | 0.779 | 0.705 | 0.560 | 0.544 | 0.590 | 0.689 | 0.697 | 0.684 |
| 2011 | 0.708 | 0.695 | 0.713 | 0.753 | 0.837 | 0.735 | 0.560 | 0.531 | 0.589 | 0.685 | 0.710 | 0.640 |
| 2012 | 0.718 | 0.721 | 0.625 | 0.752 | 0.794 | 0.730 | 0.579 | 0.587 | 0.519 | 0.670 | 0.707 | 0.654 |
| 2013 | 0.732 | 0.750 | 0.698 | 0.749 | 0.775 | 0.735 | 0.581 | 0.521 | 0.692 | 0.661 | 0.740 | 0.628 |
| 2014 | 0.723 | 0.703 | 0.758 | 0.745 | 0.802 | 0.723 | 0.596 | 0.635 | 0.523 | 0.655 | 0.661 | 0.644 |
| 2015 | 0.749 | 0.754 | 0.670 | 0.749 | 0.751 | 0.720 | 0.615 | 0.614 | 0.617 | 0.679 | 0.750 | 0.673 |
| 2016 | 0.765 | 0.783 | 0.729 | 0.752 | 0.819 | 0.729 | 0.594 | 0.541 | 0.702 | 0.711 | 0.738 | 0.687 |
| 2017 | 0.776 | 0.794 | 0.639 | 0.782 | 0.807 | 0.761 | 0.618 | 0.567 | 0.706 | 0.707 | 0.709 | 0.705 |
| 2018 | 0.782 | 0.666 | 0.793 | 0.812 | 0.826 | 0.788 | 0.675 | 0.709 | 0.670 | 0.732 | 0.755 | 0.719 |

Source: Author's computation from models in Table 12.

"Even though the four time-varying models show an inconsistent trend of cost efficiency changes over time, we believe that BC 95 model gives a more reliable cost efficiency level and trend." "This is because, the structure specified by the BC 92 model artificially imposes the trend on efficiency change which either always increase or always decrease hence influence efficiency trend." "Also, the TFE model is sensitivity to outliers which may influence the trend of efficiency scores. Thus, the trend obtained by the BC 95 model and TRE are closer to the true efficiency changes for our sample." "In addition, the BC 95 and TRE models have lower standard errors suggesting that, there is small deviation in efficiency among the sampled banks."

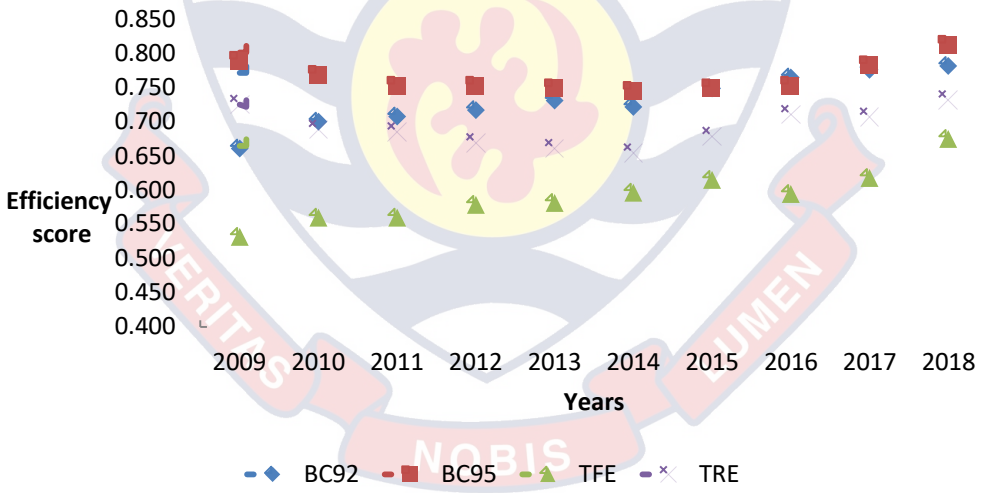


Figure 4: Annual efficiency score of the full sample from 2009 to 2018
Source: Efficiency scores computed from models in Table 12

"Additionally, the empirical justification of the trend shown by BC 95 and TRE is eminent and consistent with the happenings in the Ghanaian banking industry over the study period. During the early part of 2010, banks suffered

decrease in their cost efficiency due to the impact of the world financial crisis and as a result the balance sheet of most banks from 2010 to 2016 was fill with 'toxic assets'. Bank of Ghana as result instituted a lot of financial sector reforms meant to 'clean up' the financial sector which include recapitalization, asset quality audit and enhanced corporate governance structures which in effect saw an improvement in the cost efficiency of these banks during the latter part of the study period, hence the trend."

"With respect to the level of efficiency of the sub-samples, the results obtained from BC 92 and TRE models achieve a consensus, that the foreign banks are the most efficient from cost perspective relative to the local banks. The trend of efficiency level of the sub-samples is shown in Figure 5 which clearly demonstrate that the cost efficiency trend of foreign banks always lies above that of the local banks over the entire ten-year period. This finding is consistent with Fries and Taci (2005), Kumbhakar and Wang (2007) and Berger *et al*. (2009) who suggest that government owned banks are least efficient, while foreign-owned banks may be more efficient than domestic banks. In terms of trend, as shown by Figures 5, both samples appear to show a fall in cost efficiency in the early part of the study period till 2015 when the overall trend shows increment in cost efficiency for two types of banks."

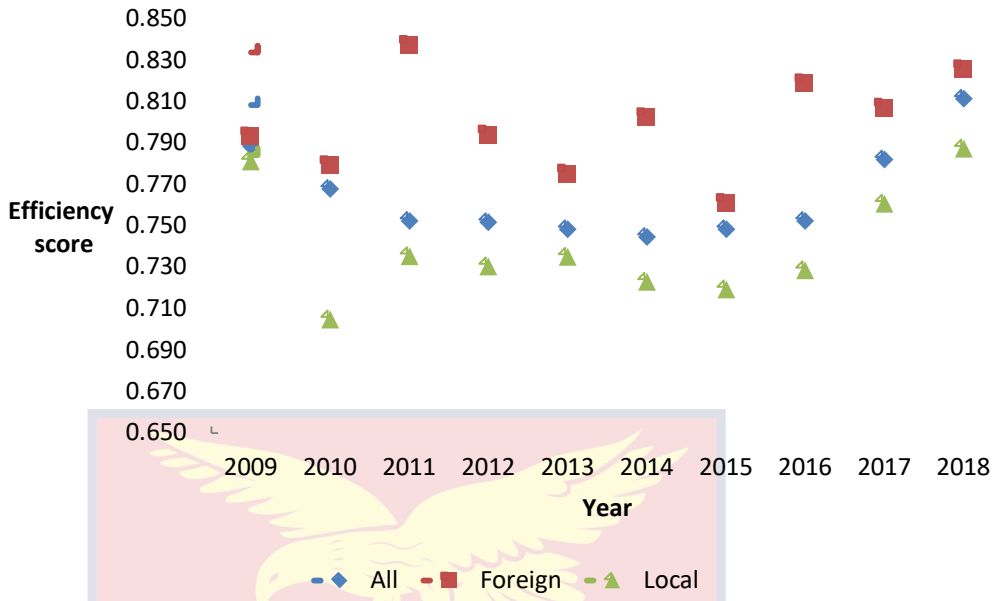


Figure 5: Annual efficiency score of full sample and sub samples based on BC 95 from 2009 to 2018
Source: Efficiency scores computed from models in Table 12

**Determinants of cost inefficiency of banks in Ghana**

As stated in the previous chapter, in estimating BC 95 model, the mean of the inefficiency term, *u*, was assumed to be dependent on exogenous variables (**z**). Three groups of variables were considered. "These include banks specific variables (such as bank size proxied by logarithm of total asset, credit risk proxied by ratio of loan loss provision to total loan , ownership proxied by dummy with 1 indicating foreign ownership and 0 indicating local ownership, age of bank operation, liquidity ratio and capital ratio), industry specific variables (such as level of concentration proxied by Herfindal-Hirschman index and recapitalisation proxied by dummy with 1 indicating year of recapitalisation and 0 indicate otherwise) and macroeconomic variables (such as inflation, economic development proxied by logarithm of gross

domestic product(GDP) and financial development proxied by the ratio of stock market capitalisation to GDP)." The negative or positive sign on a parameter efficiency indicate the directional relationship between the inefficiency effect variable and cost efficiency level of the bank. A positive sign means that increase in the exogenous variable will cause cost inefficiency to rise and if the sign is negative, inefficiency will decrease.

"Using the one-stage estimation approach, initial trial estimation of BC 95 model showed that only three variables (bank size, ownership and capital ratio) were retained due to their significance level and higher likelihood ratio. All the other were insignificant and hence was not presented."

"From Table 9, bank size is inversely related to cost inefficiency scores at significant level of 5%. Thus, as firm grows in total asset, the level of cost inefficiency reduces. This may be due to the economics of scale that it enjoys with increase in size. This observation is in line with Goddard *et al.* (2013) and Elsas*et al*. (2010) who applied the two-staged approach but observed that the size of banks is positively related to level of efficiency."

"The negative coefficient of the categorical variable *ownership*, indicates that, banks with majority of its shares owned by foreign parties are less cost inefficient than locally owned banks. This finding is follows that of Di Patti and Hardy (2005), Hauner and Peiris, (2008) and Berger, Hasan, and Klapper (2004) who discovered in their research into bank efficiency for banks in emerging economies that domestic banks are less efficient as compared to foreign-owned bank. However, this contradicts Frimpong (2010). Frimpong observed that banks

with majority domestic or local ownership are more efficient than banks with majority foreign ownership."

"Finally, capital ratio is positively associated with banks cost inefficiency. This indicate that, increase in bank capital is associated with higher cost, even though a capitalized bank is impervious to financial shocks. Nevertheless, this observation brings out the fact that, banks should not hold excessive capital as they come with cost and push banks to be cost inefficient."

**Frontier-based efficiency and accounting-based efficiency measures**

"Despite the parsimony in using the frontier approach in measuring bank's cost efficiency, regulators, managers, investors, analysts and consultants in the banking sector mostly rely on non-frontier approaches (mainly accounting ratios such as cost to income ratio) in measuring the relative efficiency of banks within" "the industry. The reason for usage of non-frontier-based efficiency measure has been simplicity and easy to understand by the target group. However, Halkos and Salamouris (2004) asserted that, non-frontier-based measure as a tool for performance evaluation allow comparison among similar-sized firms and also helps in controlling for sector-specific characteristics permitting the comparison of individual bank's ratios with some benchmark for the sector." "Also, the non-frontier-based performance measure do not take into account the heterogeneity in the businesses undertaken by different banks, which in the frontier-based approach reflects that in different combinations of inputs and outputs. Further, Berger (1993)

note that, non-frontier-based measures may be misleading as they do not control for product mix or input prices which frontier-based efficiency does."

"However, since the industry players are geared towards the non-frontier based efficiency measure, using the frontier-based measure may not be gladly welcomed except the frontier-based efficiency scores are tied to the industry norm of measuring performance, and with this, regulators and other industry players could be more confident that the frontier-based efficiency scores are accurate and robust indicators of performance and consistent with the industry norms. To do this, a non-frontier standard performance indicator commonly applied in the industry was defined and first, the banks were ranked based on both the efficiency score produced under frontier-based efficiency approach (using BC95 model and TRE model) and the non-frontier-based efficiency approach." "Secondly, the correlations between frontier efficiency scores and the non-frontier efficiency approach was assessed in order to evaluate their consistency."

"The non-frontier efficiency indicator used for this purpose is the efficiency ratio (ER) defined as the ratio of operating expense to total income of the bank. This ratio is considered most popular measure of bank's cost efficiency as it reflects operations of both on-the-balance sheet and off-the-balance sheet transactions". "The bank cost efficiency ratio indicates the cost the banks incurred in mobilizing factors of production to generate it revenue, hence it is an indication of expense per cedi of income generated." "A bank is therefore considered efficient in terms of better-cost management if it is able to maintain the efficiency ratio below the industry threshold (usually below the industry average ratio of 50%)." "Table 15

shows the average cost efficiency scores under BC95, TRE and ER of each bank under study over the study period and their rank with respect to the average scores."

Table 15: Average cost efficiency scores and bank ranking based on BC 95, TRE and ER

| Banks | BC95 Model | | TRE Model | | Industry indicator | |
|---|---|---|---|---|---|---|
| | Average score | Rank | Average score | Rank | Average ER | Rank |
| ADB | 0.758 | 21 | 0.633 | 21 | 0.898 | 21 |
| ABG | 0.804 | 6 | 0.752 | 6 | 0.528 | 8 |
| BBG | 0.899 | 1 | 0.780 | 1 | 0.383 | 3 |
| BOA | 0.777 | 14 | 0.717 | 12 | 0.643 | 14 |
| CAL | 0.794 | 8 | 0.693 | 15 | 0.436 | 6 |
| EBG | 0.811 | 5 | 0.734 | 7 | 0.527 | 7 |
| FBN | 0.763 | 18 | 0.657 | 19 | 0.807 | 20 |
| FBG | 0.776 | 15 | 0.650 | 20 | 0.560 | 11 |
| FAB | 0.776 | 16 | 0.677 | 17 | 0.745 | 18 |
| FNB | 0.754 | 22 | 0.631 | 22 | 0.926 | 22 |
| GCB | 0.788 | 11 | 0.721 | 11 | 0.612 | 13 |
| GTB | 0.894 | 2 | 0.778 | 2 | 0.382 | 2 |
| NIB | 0.792 | 9 | 0.729 | 9 | 0.536 | 9 |
| OBB | 0.775 | 17 | 0.666 | 18 | 0.726 | 17 |
| PBL | 0.761 | 20 | 0.691 | 16 | 0.806 | 19 |
| RBG | 0.762 | 19 | 0.715 | 14 | 0.664 | 16 |
| SGG | 0.791 | 10 | 0.725 | 10 | 0.591 | 12 |
| SCG | 0.815 | 4 | 0.771 | 4 | 0.404 | 4 |
| SBG | 0.786 | 12 | 0.729 | 8 | 0.539 | 10 |
| UBA | 0.819 | 3 | 0.771 | 3 | 0.231 | 1 |
| UMB | 0.779 | 13 | 0.716 | 13 | 0.663 | 15 |
| ZBG | 0.803 | 7 | 0.753 | 5 | 0.415 | 5 |

Source: Efficiency scores computed from models in Table 12 and banks financial statements

Observing the ranks of the banks, it can be noticed that, generally all the approaches are consistent in their ranking. That is, banks that are considered efficient by the industry standard are also considered efficient by the frontier-based approaches. "For instance, all the approaches ranked GTB as the second most efficient bank even though the industry consider UBA as the most efficient whiles

both frontier approach considered BBG as the most efficient bank. On the other hand, banks that are considered less efficient by the industry standard are also considered inefficient by the frontier approaches." "For instance, all the approaches considered FNB as the least efficient bank and hence ranked as the 22nd cost efficient bank. From this, it can therefore be concluded that, the ranking of the efficiency level of the banks seems to be consistent under frontier and the non-frontier approaches such that, banks generally ranked with high efficiency scores under BC95 and TRE is also ranked higher under the industry efficiency indicator." "Hence, using the Spearman's and Kendall's rank correlations coefficient as shown in Table 16, there is a positive significant correlation between the rankings under the frontier based approach and the non-frontier based approach which is an indication that, there is no significant differences between the rankings done by the two both approaches confirming that there is consistency between the rankings done by the frontier and non-frontier approach."

"In term of efficiency scores, under the frontier approaches, bank is considered efficient if it achieves a higher cost efficiency score. Conversely, under the non-frontier approach, a bank is considered efficient if it is able to maintain a minimum efficiency ratio. Hence, the non-frontier-based scores are expected to correlate negatively with the frontier-based efficiency scores if they are consistent." "Table 16 shows the correlation between the non-frontier-based efficiency ratio of the banks and the frontier-based efficiency ratio over the study period."

Table 16: Correlation of efficiency scores and rankings of frontier-based approach and non-frontier-based approach

| | Pearson's Correlation | | | Kendall's Rank Correlation | | | Spearman's Rank Correlation | | |
|---|---|---|---|---|---|---|---|---|---|
| | BC95 | TRE | EA | BC95 | TRE | EA | BC95 | TRE | EA |
| BC95 | 1.000 | | | 1.000 | | | 1.000 | | |
| TRE | 0.643*** | 1.000 | | 0.873*** | 1.000 | | 0.915*** | 1.000 | |
| EA | - 0.713** | - 0.413*** | 1.000 | 0.682* | 0.215 | 1.000 | 0.722* | 0.513** | 1.000 |

Source: author's computation. $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Comparing the non-frontier-based efficiency ratio with the frontier-based efficiency score, it is observed that, there is a negative correlation between them at 5% significant level in the case of BC95 model and 1% significant in the case of TRE model even though the relationship with "TRE appears to be weak. This observation generally indicates that, cost efficiency scores under frontier approach are comparatively consistent with the accounting-based measure of bank efficiency in the industry." "It can be observed that, generally, the magnitude of the correlation coefficient between the accounting based efficiency ratio and the frontier based efficiency ratio is generally lower and following that argument raised by Berger and Humphrey (1991), this may be attributable to the fact that, whiles the frontier based efficiency scores takes into account the effect of differences in inputs and outputs mix, the accounting based ratio do not."

**Marginal analysis**

"This section accesses the marginal effect on cost to changes in output, input price, equity and time and then explore the existence of scale economies in the banking industry over the study period. In accessing marginal effect and scale economies, the BC 95 model is chosen to illustrate the results as it includes time

varying inefficiency and also is the most general specifications of the composed error model."

***Cost elasticities of output and scale economies***

"The degree of change in cost to change in variables that affect cost is essential for managerial and policy decisions that affect profitability of the banks. The degree of changes in cost to a change in variables that affect it is measured by cost elasticity and is obtained by differentiating the logarithm of costs function with respect to the logarithm of each output, input price, equity and time."

"With respect to output, cost elasticity indicates the changes in bank cost to changes in output produce. To obtain cost elasticity with respect to output, we differentiate Equation (11) with respect to each output variable in the model. Consequently, the cost elasticity of the *m*th output is expressed as;"

$$ey_m = \frac{\partial \ln c_{it}}{\partial \ln y_{mit}} = \beta_m + \sum_{n=1}^{3} \beta_n \ln y_{nit} + \sum_{j=1}^{3} \delta_j \ln w_{jit} + \sum_{m=1}^{3} \varepsilon_m t + \sum_{m=1}^{3} \lambda_m \ln z \quad (30)$$

"Evaluating Equation (30) at the annual sample means for annual elasticities and full sample mean for the overall elasticity of the variables yield cost elasticity of output as shown in Table 17 (under output column) for the cost elasticity with respect to total loans ($ey_1$), cost elasticity with respect other earning asset ($ey_2$) and cost elasticity with respect to fee-based services ($ey_3$) respectively. This is illustrated in Figure 6."

Table 17: Estimate of cost elasticities evaluated at sample means

| sample | Elasticity of total cost with respect to: | | | | | | | | Scale economies |
|---|---|---|---|---|---|---|---|---|---|
| | Output | | | Input prices | | | Control variables | | |
| | $ey_1$ | $ey_2$ | $ey_3$ | $w_1$ | $w_2$ | $w_3$ | $t$ | $z$ | *Se* |
| Sub-samples | | | | | | | | | |
| 2009 | 0.934 | 0.232 | 0.045 | 0.332 | 0.286 | 0.207 | 0.055 | -0.334 | 0.826 |
| 2010 | 0.884 | 0.238 | 0.039 | 0.414 | 0.255 | 0.213 | 0.108 | -0.259 | 0.861 |
| 2011 | 0.802 | 0.296 | 0.044 | 0.488 | 0.238 | 0.231 | 0.144 | -0.211 | 0.876 |
| 2012 | 0.726 | 0.316 | 0.065 | 0.474 | 0.262 | 0.266 | 0.124 | -0.189 | 0.903 |
| 2013 | 0.717 | 0.346 | 0.058 | 0.481 | 0.237 | 0.293 | 0.123 | -0.147 | 0.892 |
| 2014 | 0.728 | 0.379 | 0.063 | 0.521 | 0.242 | 0.297 | 0.194 | -0.113 | 0.854 |
| 2015 | 0.711 | 0.394 | 0.074 | 0.618 | 0.269 | 0.298 | 0.242 | -0.098 | 0.848 |
| 2016 | 0.634 | 0.414 | 0.079 | 0.559 | 0.221 | 0.315 | 0.221 | 0.011 | 0.887 |
| 2017 | 0.623 | 0.423 | 0.088 | 0.634 | 0.197 | 0.322 | 0.285 | 0.151 | 0.881 |
| 2018 | 0.607 | 0.461 | 0.108 | 0.655 | 0.187 | 0.331 | 0.310 | 0.211 | 0.850 |
| Full sample | $0.763^{***}$ | $0.359^{***}$ | $0.065^{**}$ | $0.613^{***}$ | $0.248^{**}$ | $0.018^{**}$ | $0.181^{***}$ | $-0.098^{*}$ | 0.842 |
| | (0.1057) | (0.0295) | (0.0323) | (0.0756) | (0.1101) | (0.0081) | (0.0267) | (0.0649) | |

*Source: Author's computation.* $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$. *These elasticities were computed using Equation (30) for output, Equation (32) for input prices, Equation (33) for time and Equation (34) for equity. Asymptotic standard errors in parentheses and are obtained by estimating the cost elasticities at the fitted sample means.*

Cost appears to be inelastic with respect all the variables considered. Generally, from Table 17 and Figure 6, there is a continuous decline in the trend of cost elasticity with respect bank loans ($ey_1$) throughout the study period except in 2013 which showed some increment but continue to decline the following years. On the average, 1% increase in loan to customers increases cost by 0.76% and this observation is significant at 1%. As marginal cost is directly related to cost elasticity of output (see Equation (30)) the observe behaviour of cost elasticity of output suggest that, marginal cost of loans of Ghanaian banks declines over time and thus they are becoming more efficient at providing loan services.

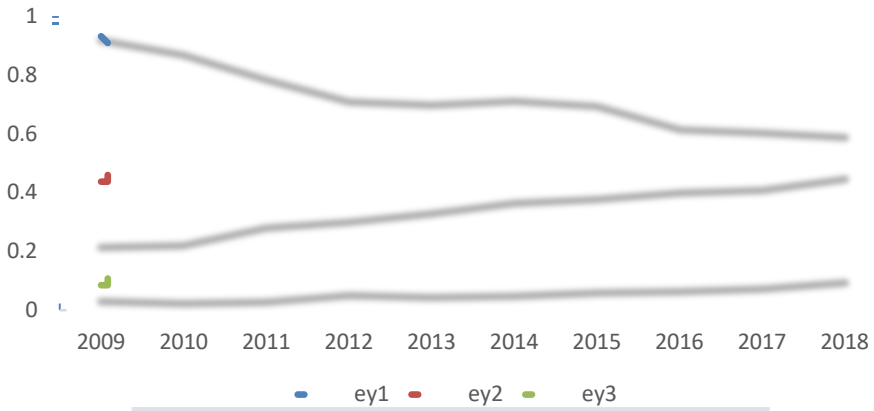


Figure 6: Annual cost elasticity of output
Source: Author's computation based on Equation (30)

The cost elasticity for other earning assets ($ey_2$) and fee-based services ($ey_3$) however, shows an increment over the sample period (see Figure 6), even though they fall below the levels of elasticity for bank loans. A percentage investment in other earning assets and fee-based bank services increase cost by 0.36% and 0.07% respectively at a significant level of 5%. "Despite the cost elasticity of bank loan exhibiting a significant fall over the study period, it has been generally higher than that of other two outputs which indicate that cost is more sensitive to bank loan production than it is to invest in securities and fee-based services."

"An important application of cost elasticity with respect to output is to determine the nature of scale economies or returns to scale which is usually defined in terms of relative increase in output resulting from a proportionate increase in all inputs (Hanoch, 1975; Brown &Chachere, 1980). Scale economies are measured by the relationship of average cost (AC) to marginal cost (MC). Following Baumol (1976) and Panzar and Willig (1977), a local measure of overall or aggregate scale

economies for the multi-product firm such as banking concern is defined as follows;"

$$Se = \frac{AC}{MC} = \frac{c_{it}}{\sum_m y_{mit}\, MC_{mit}} = \frac{1}{\sum_m ey_m} \tag{31}$$

"That is, overall scale economies is the reciprocal of the sum of the cost elasticities of individual outputs. If $Se > 1$, there exist economies of scale implying marginal cost is rising but fall below the average; if $Se = 1$, then constant returns to scale exist; and if $Se < 1$, there exist diseconomies of scale implying marginal cost lies above the average cost of production." "The scale economies for the Ghanaian banking industry is computed using Equation (31) evaluated at the annual means and factor prices for the annual scales and whole sample means and factor prices for the overall scale economies and shown in the last column on Table 17." "It can be observed that, throughout the study period, the banking industry has been operating under diseconomies of scale implying that, their marginal cost of operation is rising and lies above their average operational cost."

"With respect to input prices, cost elasticity indicates the change in bank cost to changes in input prices. This is obtained by differentiating Equation (11) with respect to each input price. Consequently, the cost elasticity of the *j*th input price is expressed as;"

$$ew_j = \frac{\partial \ln c_{it}}{\partial \ln w_{jit}} = \gamma_j + \sum_{k=1}^{3} \gamma_k \ln w_{kit} + \sum_{m=1}^{3} \delta_m \ln y_{mit} + \sum_{j=1}^{3} \rho_j\, t + \sum_{j=1}^{3} \xi_j \ln z \tag{32}$$

"Evaluating Equation (32) at the annual sample means yields annual cost elasticities with respect to inputs prices and at full sample mean yield cost elasticity of input prices over the study period as shown in Table 17 (under input price column) and Figure 7. Cost is inelastic with respect to input prices and the elasticity coefficient is significant. This implies that, an increase in input prices presents a less proportionate increase in cost. (for example, bank operating cost increases by 0.61% when there is 1% increase in price of deposit)." "Additionally, it can be observed that, the cost elasticity with respect to price of deposit ($w_1$) and price of capital asset ($w_3$) presents an increasing trend over the study period even though the cost elasticity with respect to deposit prices appears higher. Conversely, the elasticity of cost with respect to price of labour ($w_2$) shows a falling trend."

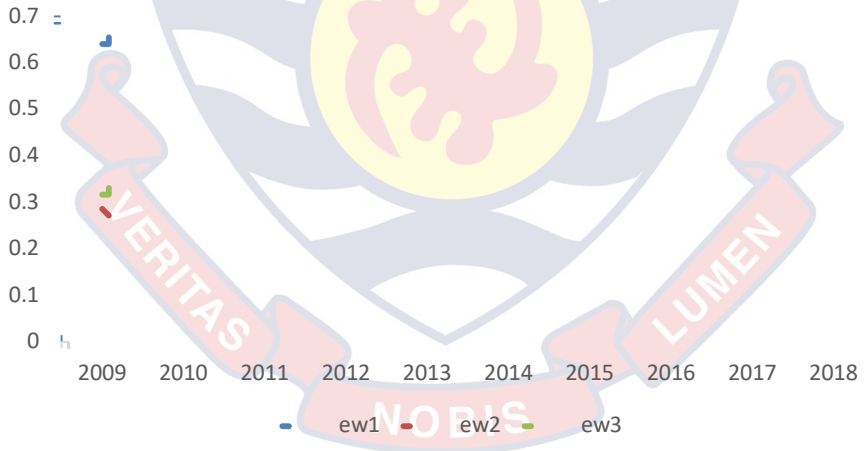


Figure 7: Annual cost elasticity of input price
Source: Author's computation based on Equation (32)

This observation suggests that, generally banks tends to cut down their labour budget but channel their resources into their traditional business of deposit taking and related activities and also into capital assets. This is true in the Ghanaian

banking industry as banks that has engaged in mergers and acquisitions had has to lay off most of their employees and rather operate with a lean employee size. Banks has also been engaging strategies to expand their market shares which includes opening new branches and improving their technology.

With respect to time ($t$), cost elasticity indicates the change in bank cost over time. This is equivalent to technological progress made by the industry in terms of cost over time which have the tendency of shifting the cost frontier depending on the efficiency of the production techniques employed by the banks in the industry. To obtain cost elasticity with respect to time, Equation (11) is differentiated with respect to time to obtain the following expression;

$$et = \frac{\partial \ln c_{it}}{\partial t} = \theta_1 + 2\theta_2 t + \sum_{m=1}^{3} \varepsilon_m \ln y_{mit} + \sum_{j=1}^{3} \rho_j \ln w_{jit} + \psi \ln z \quad (33)$$

Evaluating Equation (33) at the annual means and full sample means yields technological coefficients as shown in Table 17 and illustrated on Figure 8.

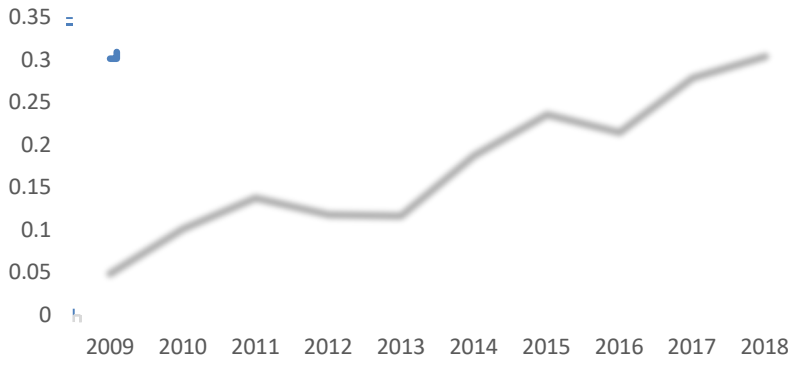


Figure 8: Annual cost elasticity over time
Source: Author's computation based on Equation (33)

Holding all other variables constant, at their sample means, bank cost is generally rising over time even though it showed a fall between 2011 and 2013 and then in 2016. This indicate a shift of the cost frontier of the Ghanaian banking industry upwards by 18.1% per year on average.

With respect to equity, cost elasticity indicates the change in bank cost to changes in regulatory capital held by the bank. This is obtained by differentiating Equation (11) with respect to equity as follows;

$$ez = \frac{\partial \ln c_{it}}{\partial \ln z} = \phi_1 + 2\phi_2 \ln z + \sum_{m=1}^{3} \lambda_m \ln y_{mit} + \sum_{j=1}^{3} \xi_j \ln w_{jit} + \psi t \tag{34}$$

From the envelope theorem, the negative of cost elasticity with respect to equity capital is interpreted as the shadow return on equity (SROE) (Hughes *et al*., 2001). That is;

$$SROE = -\frac{\partial \ln c_{it}}{\partial \ln z} = -ez \tag{35}$$

As intuitively put by Kenjegalieva*et al.* (2009), "for a given set of output and input prices, changes in total costs are the negative of the change in economic profit. Hence, in the short-run cost function, the negative of the derivative of costs with respect to the fixed level of capital is considered as the true implicit return on equity." "Thus, SROE measures how much banks are willing to pay as returns for their equity capital holders. It is an indication of capacity of banks in payment of returns to shareholders." "Banks that are highly geared or under-use equity capital shows a relatively high positive shadow return on equity (negative cost-elasticity

with respect to equity with a relatively high absolute value), while banks that are lowly geared or rely on their equity capital are likely to show a relatively low shadow return on equity (negative cost-elasticity with respect to equity with a relatively lower absolute value)." "Banks whose are overcapitalized or under a major recapitalization may be expected to show negative SROE (Duygun*et al.,* 2012). The cost elasticity with respect to equity capital is shown in Table 17 and annual SROE of the banks over the study period is shown in Figure 9."


Figure 9: Annual shadow return on equity (SROE)
Source: Author's computation based on Equation (35)

"There is a decreasing trend of shadow return on equity capital over the study period with the first eight years of the study period showing a positive SROE but showed negative after 2016. From 2009 to 2015, banks in Ghana appears to be highly geared as indicated by relatively higher positive values of the SROE despite Bank of Ghana effort to increase the minimum capital requirement of Ghanaian banks in 2009, 2014 and in 2018. The change in sign of the SROE marks the periods banks were making efforts to meet the minimum capital requirement in 2018 in an effort to fulfill Basel III accord."

"Consequently, banks injected equity capital to recapitalize which in effect increased their capital ratio, hence negative shadow return on equity." "This confirms the assertion that, recapitalization process imposes short run adjustment cost which makes the shadow return on equity turn to negative (Hughes *et al*., 2001)." "In a similar study, Fethi*et al* (2010) applied SROE to the massive recapitalization of the banking industry in Turkey in the period following that country's financial crisis of 2001and found out that the recapitalization was associated with the shadow return on equity turning negative." "This result suggests that, policy makers and regulators must be aware that the gains in efficiency improvement due to recapitalisation may be offset by the recapitalization costs."

**Robustness test**

"As stated in the earlier section, the robustness of a cost efficiency function depends on the extent to which the function satisfies the properties of a true cost efficiency frontier. These include continuity, homogeneity, monotonicity and concavity properties. This section presents the result of the test of these properties which would confirm or otherwise, the robustness of the efficiency scores. For the purpose of illustration, the tests were carried out using the result of BC 95 model."

"For continuity, Equation (11) was specified as a logarithmic function, hence is continuously differentiable over its domain. Consequently, by the Young's theorem, the parameters $\beta_{mn}$ and $\gamma_{jk}$ are symmetric."

"A well-behaved cost function should be homogeneous in input prices. On this basis, restrictions were placed on the parameters of the inputs as specified in Equation (12). Consequently, three separate hypotheses were tested and result is shown in Table 18. In each case, the t statistic and the associated significant level indicates that, the null hypothesis cannot not be rejected which provides evidence to support homogeneity of the cost model. This result confirms that, an increase in the input price would lead to increase in the cost function."

"Again, a well behave cost function should be monotonic such that, it should be non-decreasing in output and also input. From Table 17, it can be observed that, monotonicity conditions are satisfied as the cost elasticity with respect to output and input prices evaluated at the sample mean are higher than zero, which suggest that the cost function is non-decreasing in output and also in input."

"To assess the concavity of the cost function, Table 19 presents the bordered hessian matrix (evaluated at the means of the estimated factor scores) of the cost function with respect to the input prices." "From the table, the matrix of second derivatives of the cost function with respect to input prices is symmetric as expected and negative semidefinite (since the successive principal minors alternate in sign). Besides, the bordered hessian matrix presented in Table 19 have eigenvalue (last row of Table 19) greater than or equal to zero, indicating that the estimated cost function is concave." "This observation has two main implications; first, this implies that cross-price effects on cost are symmetric (in line with Young's theorem) and secondly, own-price effects on cost are negative."

Table 18: Test of homogeneity assumption restrictions

| Restriction | Hypothesis | t - statistic | Sig. | Homogeneity assumption |
|---|---|---|---|---|
| $\sum_{j=1}^{3}\gamma_j = 1$ | $H_0: \sum_{j=1}^{3}\gamma_j = 1$<br>$H_1: \sum_{j=1}^{3}\gamma_j \neq 1$ | 1.036 | 0.1063 | Supported |
| $\sum_{j=1}^{3}\sum_{k=1}^{3}\gamma_{jk} = 0$ | $H_0: \sum_{j=1}^{3}\sum_{k=1}^{3}\gamma_{jk} = 0$<br>$H_1: \sum_{j=1}^{3}\sum_{k=1}^{3}\gamma_{jk} \neq 0$ | 0.622 | 0.3191 | Supported |
| $\sum_{m=1}^{3}\sum_{j=1}^{3}\delta_{mj} = 0$ | $H_0: \sum_{m=1}^{3}\sum_{j=1}^{3}\delta_{mj} = 0$<br>$H_1: \sum_{m=1}^{3}\sum_{j=1}^{3}\delta_{mj} \neq 0$ | 0.328 | 0.4119 | Supported |

Source: Author's computation based on Equation (12)

Table 19: Bordered Hessian matrix, evaluated at sample means and eigenvalues

| | | | |
|---|---|---|---|
| 0 | 0.6132 | 0.2481 | 0.0183 |
| 0.6132 | -0.001 | 0.0133 | 0.0251 |
| 0.2481 | 0.0133 | -0.0310 | 0.1026 |
| 0.0183 | 0.0251 | 0.1026 | -0.007 |
| 0.0658 | 6.7354E-05 | 5.0719E-03 | 0.0201 |

Source: Author's computation based on Equation (14)

**Summary and Conclusion**

There have been extensive studies over the past decades in an attempt to measure the cost efficiency of banking institutions, particularly in the advanced economies such as the economies of the United States and in Europe even though, there appears to be gradual increase in the number studies probing into bank cost

efficiency in developing economies. However, the banking industry of Ghana, despite the rapid fast-growing rate, seems to have been left behind in terms of cost efficiency studies. Over the past three decades, Ghana has experienced significant banking sector reforms with the main focus being on recapitalization of banks and liberalization the banking system. This in effect is expected to enhance competition which is likely to impact on bank efficiency hence the performance of the industry at large.

"The main objective of this chapter is to bridge the identified gaps and contribute latest evidence to the literature by estimating and evaluating the level of cost efficiency of the banking sector of Ghana and the changes in it over time. In carrying out this study, the latest banking data was employed in an attempt to explore the level of efficiency of Ghanaian banks from the angle of cost during the period 2009 to 2018.To ensure consistency and robustness of the result of the study, seven models (fixed effect model, random effect model, Pit and Lee model, Battese and Coelli 1992, Battese and Coelli 1995 true fixed effect and true random effect) based on the stochastic frontier approach was employed to estimate and assess the level of efficiency and the trend of efficiency of banks as a whole over the sample period. Among these models, the four-time varying models were retained for further analysis due to the significance of the eta."

"With this, the true fixed effect model reports lowest cost efficiency score (58.2%) with the highest standard errors, while the Battese and Coelli (1995) model reports the highest efficiency score (79.1%) with the smallest deviations. The remaining two models report the overall average cost efficiency score between 60%

to 70% which provides an indication of banks within the industry having capability of reducing their costs up to 40% to 30% respectively relative to the cost efficiency of the best practiced bank in the sample." "In addition, efficiency was assessed based on ownership, and it was observed that, some models reported that on the average, the local banks are cost efficient than their foreign counterpart but models like Battese and Coelli (1995) and true random effect model reported otherwise. However, over time, the cost efficiency of the banks appears to be increasing especially after 2016 where the regulator embarked on the banking sector clean up." "The study again finds out that, shadow return on equity is positive for a major part of the study period but assumed negative after 2016 during the period of the banking sector recapitalisation." "The observed behaviour of the shadow return on equity was attributed to increase in capital ratio due to the recapitalisation of banks as required by the regulator in an effort to meet the requirement of Basel III accord. Banks were also ranked based on the frontier models and also on the efficiency ratio as applied in the banking industry."

"The consistency between the frontier models and the accounting-based model was confirmed by Pearson's, Kendall's and Spearman's rank order tests. The correlation coefficients show that efficiency estimates and ranks are consistent between the frontier-based techniques and the non-frontier-based approach." "Finally, the properties of the translog cost function was assessed in order to check the robustness of the study results by assessing continuity, homogeneity, monotonicity and concavity tests." "All the properties were duly satisfied at the sample mean, which provides a strong indication that the fitted models are true cost

functions of the Ghanaian banking industry and that cost efficiency estimates are reliable."

"In conclusion, the empirical results obtained from this study confirms the assertion of the regulator, Bank of Ghana, that cost efficiency of banks in Ghana is enhanced considering the trend of efficiency over the sample period and that, the efficiency gap between the local and foreign banks is reducing over time."

# CHAPTER SIX

# MEASUREMENT OF COMPETITION IN THE BANKING INDUSTRY OF GHANA

## Introduction

"The degree of competition in a banking industry is of high interest to various players due to the significant role it plays in the operations and management of financial institution and the economy as whole." "Competition in the banking industry is expected to compel banks to be cost efficient, which intend leads to more efficient allocation of financial resources and consequently increasing investment to stimulate economic growth."

"To a large extent, competition influences managerial decisions in respect to service costs and other related operational costs, profitability of production of financial services, quality of financial products, and innovation in the sector." Davcev and Hourvouliades (2013) pointed out that, lower level of competition among financial institutions, generally, have the tendency of developing oligopolistic markets which, in effect, prevents customers from enjoying more competitive products and services alongside competitive pricing. In a similar study, Fernández and Garza-Garcíab (2012) posited that, lower levels of competition in the financial sector can lead to declining levels of interest for products and operational innovation and for covering the true needs of consumers. It is therefore, seen as a key driver of efficient market which intend leads to efficient allocation of resources and better product pricing decisions. "These arguments take their

theoretical ground from the 'quiet life' hypothesis of Hicks (1935) which is of the view that firms in less competitive markets enjoy monopoly rent which serves as a disincentive to control cost and hence lead to inefficiencies." "Thus, lower degree of competition promotes inefficient behaviour by firms leading to deterioration in consumer welfare."

Conversely, other studies have viewed competition in the banking industry from different angle (Berger, *et al.*, 2008; Boyd & De Nicolo, 2005)." Generally, the contrary view on competition suggests that, a more competitive banking sector is prone to financial crises than a less competitive banking sector. Berger, et al., (2008) attempt to link competition to financial stability such that, a higher degree of competition in the banking sector is seen as a major driver of instability of the financial system in that economy." The basis of this assertion is that, as competition in the banking sector heightens, profit margins of the banks are more likely to shrink, resulting in banks being motivated to endorse riskier investments for purposes of boosting their profit margins which may lead to loss of their investment. Similarly, Boyd and De Nicolo (2005) supported the fact that, higher competition levels in banking industry have the tendency of increasing financial instability by way of increased financial risks. These arguments also take their root from the 'noise market hypothesis which is of the view that, competition have the tendency of breeding inefficient practices among firms. "High level of competition is likely to drive efficient firms who are producing at lower cost to abandon their pursuit of efficiency" goals and engage in price wars which would eventually leads to adverse selection and moral hazard in investment market such as venturing into

high risk bank loan agreements in the case of banking, which expose them to high probability of default, thereby affecting the stability of the industry. Thus, market noises (competition) could also results in declining efficiencies (Diamond, 1984). Despite the inconclusive argument on the impact of competition on the player of the banking industry, accurate measurement of competition is key in determining the level of competition so as to assess it impact on the industry. The banking industry of Ghana provides a classical example of an environment where the measuring competition is crucial. Experiencing several reforms, undertaken by the regulator since the banking crises in 1980's (details of these reforms have been discussed in chapter two) with the aim of ensuring a stable and competitive banking environment, a change in the nature of the market structure and improvement in the level of competition in the banking industry of Ghana is expected. Figure 10 shows the trend of market concentration using HHI as a measure of concentration over the past 10 years.

Even though concentration (in terms of loans and advances, other earning asset and fee-based services) in the banking industry has generally been low (HHI less than 0.15), it appears to be higher in the early part of the study period but decreases in the middle part of the study period until recently where it has begun to show some significant of increment. The recent increase in market concentration can be attributed to the recapitalization and the banking sector clean up during 2016 to 2018, which led to revocation of licenses of some banks and also some couple of mergers and acquisitions being witnessed in the industry, thereby increasing the level of concentration.

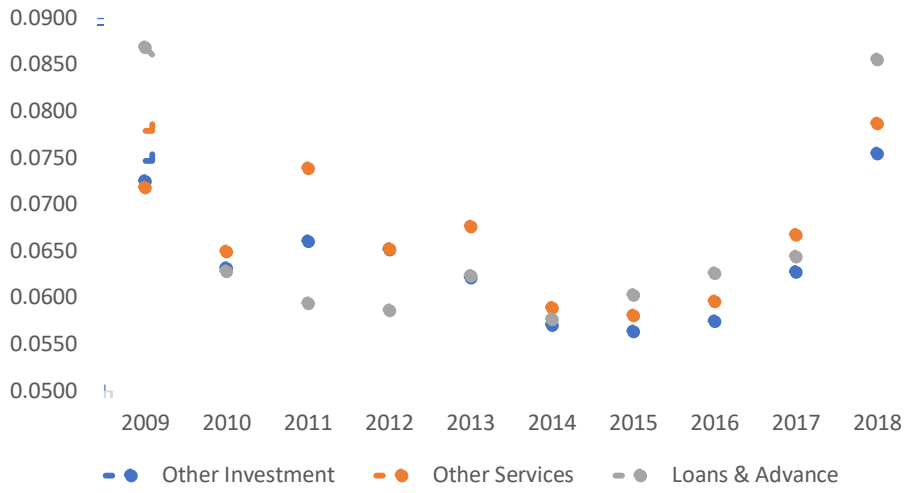


Figure 10: Market concentration of Ghana banking industry from 2009 to 2010
Source: Author's computation from figures produced by Ghana banking survey (2018, 2014)

"With the current rising in concentration ratio coupled with high interest rate spread, concerns have been raised about the soundness and competitiveness of the banking sector once again with stakeholders such as Association of Ghana Industries (AGI), advocating for further reforms by the regulator to improve competitiveness of the industry and its effect on interest rate spread."

"On the basis of the above motivation, this study investigates the degree of competition in the loans market, other asset earning market and fee-based service market of the Ghanaian banking industry using the improved recently introduced measure of competition known as Boone indicator (BI) developed by Boone (2000, 2004; 2008) and Boone *et al.* (2004) and explore the factors that influence the indicator in the banking industry of Ghana."

"The remaining part of the chapter is organised as follows; the next section presents descriptive statistics of the variables used for the study. This is followed by estimation of the Boone indicator and the factors affecting the indicator. The estimation result of Panzer-Rosse model is also presented as a means of consistency check. This is followed by summary and conclusion of the chapter."

**Descriptive statistics**

"This section provides a descriptive of the data on the key variables used in the study. A summary of the descriptive statistics of the variables used in the estimation of degree of competition in the banking industry of Ghana is shown in Table 20." Bank revenue, which consist of interest income and other operating income depicts a large variation among the banks with coefficient of variation exceeding 100%. This variation suggests a significant level of concentration in the market, such that, whiles some banks holds higher market share in some portions of the market, others are struggling to gains and maintain the market share they have, hence reporting a very low revenue. As a result, some banks are generating a negative return on their investment in terms of returns on asset. This as a result have led to a greater variation in the return on asset by the banks with coefficient of variation running to over 200%. Banks in Ghana are operating with a relatively higher interest spread ranging from 8% to 20.5%, an average spread of 14.6% which suggest that, banks should be reporting higher profit margins. The fact that profitability is not that high as expected may be attributable to the level of cost inefficiency and how demand for bank services is elastic. On the average, banks are

investing 18.7% of their total cost in ICT developments in order to keep the pace of development in the technology market which is increasingly giving competitive edge to other institutions. Variations in the market share holdings for the three-market considered is relatively low indicating that, the concentration level in these markets is not much over the study period. Nevertheless, comparatively, the loan markets appear to be concentrated than the other markets with average market share holding of 15.8% over the study period. An average of loan ratio of 42.7% present an appealing picture that, not all asset of banks is translated into loans to customers. Some part of the asset is channeled to other investment avenue which may also generate significant returns.

Table 20: Descriptive statistics of competition study variables

| | Obs. | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| *All banks (Total no. = 22)* | 205 | | | | |
| Revenue* | | 14.81 | 2,280.14 | 1,424.91 | 1,976.99 |
| Total asset* | | 147.49 | 7,527.26 | 1,999.75 | 1,395.58 |
| Price of deposit** | | 0.0135 | 0.1798 | 0.0660 | 0.0338 |
| Price of labour*** | | 8.30 | 858.16 | 109.47 | 115.32 |
| Price of capital**** | | 0.23 | 9.161 | 1.751 | 1.472 |
| ROA | | -0.132 | 0.278 | 0.127 | 0.329 |
| Interest rate spread | | 0.080 | 0.205 | 0.146 | 0.039 |
| ICT ratio | | 0.059 | 0.265 | 0.187 | 0.338 |
| Capital ratio | | 0.0089 | 0.671 | 0.159 | 0.0813 |
| Loans market share | | 0.102 | 0.203 | 0.158 | 0.034 |
| Other earning asset market share | | 0.094 | 0.198 | 0.148 | 0.033 |
| Fee-based services market share | | 0.014 | 0.213 | 0.152 | 0.031 |
| Loan ratio | | 0.012 | 0.948 | 0.427 | 0.162 |
| Loan loss provision ratio | | 0.013 | 0.326 | 0.162 | 0.144 |

Source: computed from banksope database, data from BoG banking supervision department and annual financial statements.

All values are stated at constant prices with 2013 as the base year; *values stated in millions of Ghana cedis; **values stated in cedis per GHS1 of deposit per annum; ***values stated in thousands of cedis per employee per annum; **** values stated in cedis per GHS1 of fixed capital value per annum

**Estimation of the Boone indicator**

"The Boone indicator is estimated by first, estimating marginal cost from the translog cost function from the banking industry." "Given the estimated annual marginal costs for each firm over the study period and their associated market share, the Boone indicator both for the entire period, referred to as full sample period estimates, and for each year separately, referred to as annual estimates is then estimated."

***Estimation of marginal cost***

"The estimation of the Boone indicator requires the computation of the marginal cost, so the first step in the estimation procedure is to compute the marginal costs of each bank for each year over the study period by estimating Equation (19b) from the translog function as specified in Equation (11)." " For this purpose, the explanatory variables described in Chapter 4 are used, namely bank outputs (loans and advances, other earning asset and fee-based income), input prices (wages cost, funding rates and prices of other non-interest expenses) and the control variable (equity ratio)." "Time trend is included to capture changes in technological efficiencies. The result of estimation of the translog cost function in Equation (11) is presented in Table 12 in Chapter 5 following BC 95 model."

Marginal cost is computed by substituting parameter estimates from the translog cost function in Table 12 into Equation (19b) and evaluated at the sample means of the factor prices to obtain the annual marginal cost for all firms in the sample and at individual factor prices to obtain the marginal cost for each bank over

the study period necessary to compute the Boone indicator. The marginal cost (as a percentage of the output values) for the three outputs considered for each year is presented in Figure 11.

Observation from Figure 11 depicts that, marginal cost of providing loans and advances initially diminishes between 2009 and 2012, remain virtually constant until 2014 after which it shows increment. The initial decrement in the marginal cost may be attributable to the efficiency in providing loans services but over time, the result obtained confirms that, the additional cost incurred in providing loan services to clients are becoming expensive. This may be due to the ever-rising risk associated with clients and the increase in impaired loans which become common from 2012 as reported by the 2013 Ghana banking survey. Also, following the recapitalisation exercise by the regulator, the additional cost of providing loan service has shown some improvement which is depicted in Figure 11 as a fall in the marginal cost of providing loan services.

"The increasing marginal cost of other earning assets indicates that taking investing in government securities and other assets was becoming more expensive operation for the banks until 2015 where the marginal cost of managing other earning asset showed a significant fall hence improvement in efficiency." "Also, the marginal cost of obtaining fee-based income is generally increasing over the sample period as high as 35% of the average annual income generated." "This indicates that it is more resource consuming to provide an additional service other than the core business of banking than it is to invest in loans and security

investment." "This explains why banks appears not to be committed to the provision of fee-based services but rather stick to the tradition banking activities".

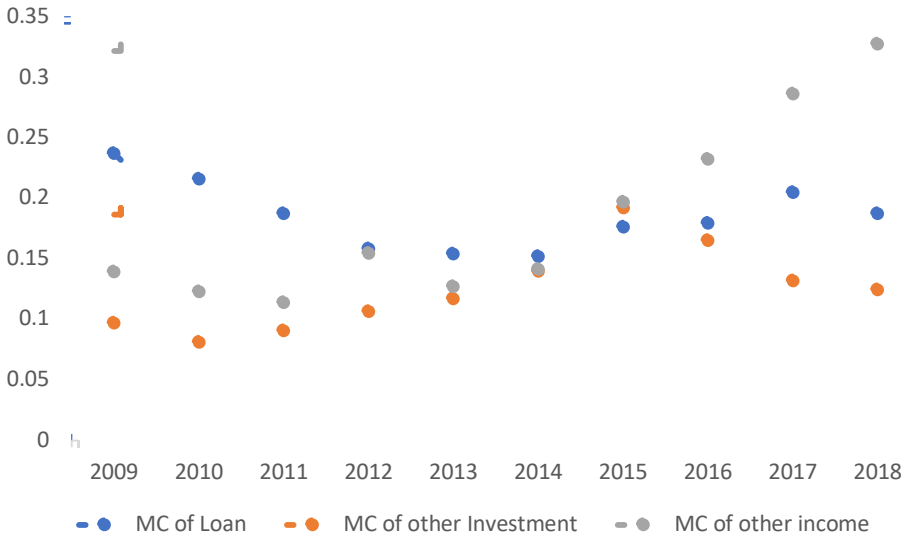


Figure 11: Average year-by-year marginal cost (as a % of output value)
Source: Author's computation from Equation (19b)

***Full sample estimation of the Boone indicator***

"The full sample estimates for each market is derived by estimating a single $\beta$ for the entire study period, through the estimation of Equation (16) using the marginal cost derived in previous section. This can be interpreted as averages of the year-on-year estimates over the entire 2009 - 2018 period, weighted by the number of observations in each year." "The lagged instrument variables also cover the study period 2009 – 2018 period. As indicated by the Hansen's J test and auto correlation test in Table 21, in the case of each market, we fail to reject the null hypothesis and conclude that the chosen instruments are a valid instrument, and that, it is uncorrelated with the error term."

Table 21: Full sample estimates of the Boone indicator over 2009-2018 for various markets

| Market | Boone Indicator | | Hansen's J test | | F-test | AR(2) (p-value) |
|---|---|---|---|---|---|---|
| | $\beta_m$ | Robust std error | $X^2$ | Sig | | |
| Loan market | -0.2116*** | 0.0193 | 0.759 | 0.685 | 10.213*** | -0.841(0.401) |
| Other earning asset market | -0.0485* | 0.0259 | 1.855 | 0.395 | 5.162*** | -0.371(0.171) |
| Fee-based services market | -0.0149* | 0.0058 | 0.161 | 0.923 | 6.122*** | -1.062(0.291) |

Source: Author's computation from Equation (16)
****p<0.01; **p<0.05;*p<0.1. Estimation method is GMM using one-year lag, two-year lag and three- year lag of the marginal cost in each market as IVs.*

From the full sample period estimates, the loan market in Ghana is the most competitive compared to the other earning asset market and the fee-based services market. The fee-based services market appears to be the least competitive market. These findings differ somewhat from empirical evidence from alternative measures of competition applied to the Ghanaian banking sector, such as HHI and Panser-Rosse model. For instance, Busch and Mathisen (2005), found the Ghanaian banking industry to be a monopolistic market over the period 1998 to 2003 measuring competition using the Panser-Rosse Model. This finding differs from the finding of this study probably due to first, the differences in timing of study and secondly, the method applied in estimating competition. The current study makes use of recent data covering 2009 to 2018, it could be an indication that, the sector has become more competitive over time. Again, the Boone indicator applied in the current study, have the tendency of overcoming most of the weaknesses that are inherent in the other methods, hence differences in the results. Overcoming timing

of the study and methodology differences, a more recent study is Alhassan and Ohene-Asare (2016) who applied the Boone indicator to the loans market of the Ghanaian banking industry. The authors found an average Boone indicator of -0.354 over the period 2004 to 2011. Again, the findings of Alhassan and Ohene-Asare may have been suffered from not very recent data. Between 2011 and 2018, there have been a series of reforms and development in the Ghanaian banking sector (see chapter 2) which may have altered the competitive structure of the industry. Thus, it is not surprising if the results of Busch and Mathisen (2005) and Alhassan and Ohene-Asare, (2016) differ from the result of the current study.

***Development in degree of competition over time***

The estimation of the Boone indicator in the previous section was based on the entire sample period, and as a result may conceal considerable differences over time. It is therefore necessary to investigate developments in the level of competition over time. Table 22 and Figure 12 gives the estimates of the Boone indicator across the three markets and over time based on Equation (17). Hence, the Boone indicator, in this case, is assumed to be time dependent.

From Table 22, it can be observed that, the Bonne indicator, $\beta t$'s, did not differ significantly from zero for all years for the other earning assets and fee-based services market as with the exception of 2017 and 2018, the Boones indicator was not statistically significant. Also, the Wald Chi-square test (the *test* command in Stata) conducted failed to reject the null hypothesis of no significant change in the

beta values for these market at 5% level of significant. It is only for the loan market that the betas (the Boone indicator) differ significantly from zero for all years.

Table 22: Development of the Bonne indicator over time for various markets

| Market | Loan market | Other earning asset | Fee-based service market |
|---|---|---|---|
| Boone indicator | $\beta_{1t}$ | $\beta_{2t}$ | $\beta_{3t}$ |
| 2009 | -0.1824*** | -0.0985* | -0.0072 |
| | (0.0483) | (0.0585) | (0.0585) |
| 2010 | -0.1913*** | -0.0622 | -0.0091 |
| | (0.0564) | (0.0495) | (0.0495) |
| 2011 | -0.2188*** | -0.0711 | -0.0106 |
| | (0.0544) | (0.0591) | (0.0591) |
| 2012 | -0.2186*** | -0.0239 | 0.0086 |
| | (0.0635) | (0.0341) | (0.0341) |
| 2013 | -0.2106*** | 0.0015 | 0.0151*** |
| | (0.0284) | (0.0024) | (0.0024) |
| 2014 | -0.2117*** | -0.0332 | 0.0153 |
| | (0.0448) | (0.0279) | (0.0279) |
| 2015 | -0.2013*** | -0.0411 | -0.0126 |
| | (0.0454) | (0.0438) | (0.0238) |
| 2016 | -0.1933*** | -0.0498 | -0.0262 |
| | (0.0609) | (0.0308) | (0.0308) |
| 2017 | -0.1894** | -0.0312** | -0.0208* |
| | (0.0697) | (0.0134) | (0.0124) |
| 2018 | -0.1721** | -0.0547*** | -0.0412*** |
| | (0.0723) | (0.0115) | (0.0115) |
| F-test | 23.740 | 23.120 | 22.314 |
| (p-value) | (0.000) | (0.001) | (0.006) |
| Hansen J-test | 0.348 | 0.179 | 0.108 |
| (p-value) | (0.451) | (0.673) | (0.742) |
| Wald Chi-square | 13.16*** | 1.774 | 0.988 |
| No. of banks | 22 | 22 | 22 |
| No. of observations | 205 | 205 | 205 |

Source: Author's computation from Equation (17). ***$p<0.01$; **$p<0.05$;*$p<0.1$.

Also, for the other earning asset market and the fee-based service market, at some point over the study period (between 2012 and 2014), the Boone indicator assumed positive the values instead of, as expected, negative values, in line with the rationale behind Equation (17). In this case, it is an indication that competition in these market during these periods led to both higher marginal costs and higher market shares which technically indicate presence of market concentration.

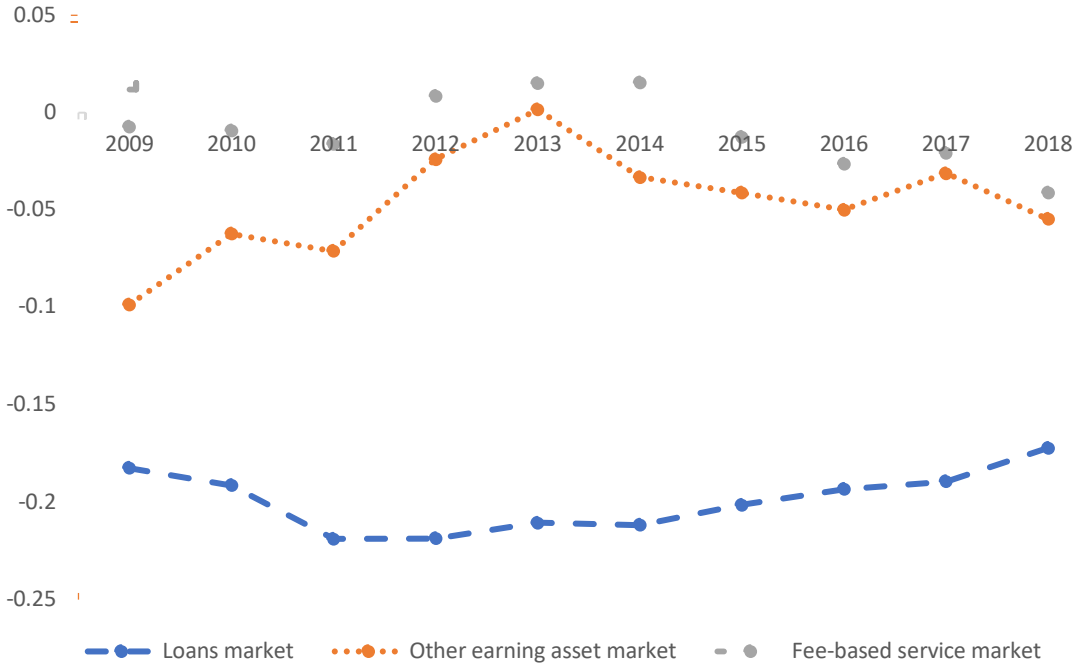


Figure 12: Level of competition in the various markets of Ghanaian banking industry between 2009 and 2018 based on the Boone's indicator

Source: Author's computation based on Table 20

Observation of the Boones indicator for the loans market, however, shows a significant increasing trend (indicating a decline in competition though) especially after 2011 where the level of competition consistently falls comparative

to other markets. Despite the fall in the level of competition in the Loans market, it still shows a high level of competition comparative to the other markets. The Wald test conducted rejected the null hypothesis of no significant change at 5% level of significant. A possible explanation for this gradual decline of competition may be due to some mergers and acquisition during these periods and also during the latter part of the study period some banks which were not able to meet the conditionalities of the regulator were liquidated and taken over by some existing banks. Typical instance is the case of GCB bank which took over UT bank and capital bank during 2016 and 2017 due to UT bank and Capital bank inability to meet some conditionalities of the regulator. This led to increase in in market share of some banks hence lead to gradual reduction in the level of competition in the industry.

***Factors affecting competition in the Ghanaian banking industry***

As expected, the regression result from Table 19 shows that marginal cost is negatively and significantly associated with the market share of banking institutions in Ghana with the Boone indicator showing a moderately intense competition in the banking industry.

Exploring the factors that influence the Boone indicator (result shown in Table 23), it was observed that, the interaction term of dummy variable, CRISIS and marginal cost, (CRISIS*ln $mc$), is negatively and statistically significantly associated with market share but the value of the Boone's indicator is smaller in magnitude than the industry Boone's indicator. This implies that, the degree of competition during the banking crisis is lower than in normal times. This

observation is consistent with the result of studies such as Sun (2011), Rughoo and Sarantis (2014), and Hasan and Marinč (2013). These studies concluded, among others, that during financial crises, financial institutions face severe pressure and potentially loses the confidence of the public if their financial system is not strong enough to match the impact of the crisis. Hence banks with less financial strength are forced out of the market leaving the market less competitive.

Table 23: Estimation of factors affecting the Boone's indicator in the loans market

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|---|
| ln $mc$ | $\beta_1$ | -0.181*** | -0.201*** | -0.041 | -0.413*** | -0.205*** | -0.073*** | -0.164** | -0.206** |
| | | (0.0667) | (0.013) | (0.031) | (0.130) | (0.061) | (0.051) | (0.060) | (0.065) |
| CRISIS*ln $mc$ | $\beta_2$ | -0.150** | | | | | | | -0.102** |
| | | (0.074) | | | | | | | (0.051) |
| OWN*ln $mc$ | $\beta_3$ | | -0.222*** | | | | | | -0.204*** |
| | | | (0.017) | | | | | | (0.040) |
| SIZE*ln $mc$ | $\beta_4$ | | | -0.033** | | | | | -0.015* |
| | | | | (0.017) | | | | | (0.009) |
| MERGE*ln $mc$ | $\beta_5$ | | | | 0.285** | | | | 0.202** |
| | | | | | (0.129) | | | | (0.100) |
| ICT*ln $mc$ | $\beta_6$ | | | | | -0.212** | | | -0.240* |
| | | | | | | (0.095) | | | (0.024) |
| RECAP*ln $mc$ | $\beta_7$ | | | | | | -0.103** | | -0.102** |
| | | | | | | | (0.048) | | (0.048) |
| IRSPD*ln $mc$ | $\beta_8$ | | | | | | | -0.109 | -0.131 |
| | | | | | | | | (0.106) | (0.213) |
| Hansen J-test | | 2.351 | 5.397 | 8.717 | 8.562 | 5.451 | 6.955 | 8.187 | 3.411 |
| | | (0.498) | (0.798) | (0.464) | (0.479) | (0.793) | (0.418) | (0.515) | (0.327) |
| F statistic | | 13.192 | 14.11 | 12.87 | 12.63 | 14.21 | 12.88 | 13.02 | 12.13 |

Source: Author's computation from Equation (17). In each of the regression, dependent variable is the log of market share following Equation (18). All the regressions are estimated using system GMM with IV estimation. Robust standard errors are reported in parentheses. ***$p<0.01$; **$p<0.05$;*$p<0.1$.

The interaction term between dummy variable OWN and marginal cost (OWN*ln $mc$), is negatively and statistically significantly related to market share and higher in absolute terms than the Boone's indicator for the industry. This

indicates that competition is intense among the foreign firms than among the entire banking industry. Consequently, foreign banks face higher competition than their counterpart local banks.

The interaction term between bank size and marginal cost (SIZE*ln $mc$), is negatively and statistically significantly related to market share of the banks in Ghana. However, the magnitude of the indicator is smaller comparative the industry. This implies that, as banks expand in size, it reduces the degree of competition in the market, probably, due to increase in its market share. This may be due to increase in wider range of services, instruments, and products that bring more business and customers, hence increase in market share. This finding is consistent with studies such as Bikker and Bos (2005) and Bikker*et al.* (2006) which confirms a positive relation between the market power and size. Conversely, smaller institutions operate primarily on local markets with weaker competition whereas larger institutions primarily operate on international level with generally a higher level of competition. According to Mester (1987), larger institutions also engage in multimarket contact, which increases competition which appears to contrast the result of the current study. Thus, the result obtained in this study holds if banks are operating within the domestic market.

The interaction term between merger and marginal cost (MERGE*ln $mc$) is positively and significantly related to market share. The positive Boone indicator is an evidence of collusion and this reduces competition in the industry. Previous theoretical studies in industrial organization literature did not provide clear cut implications of the effect of merger on competition. Rather, Tirole (1988) stipulated

that, the effect of merger on competition depends on the nature of merger. Several studies show that horizontal mergers increase market power of firms towards their customers (Akhavein*et al.,* 1997; Bhattacharyya & Nain, 2011) whereas others refute such concerns and stress the benefits and spill-over effects of efficiency improvements in horizontal mergers (Fee & Thomas, 2004; Shahrur, 2005; Devos *et al*., 2009). However, the merger implied in this study refers to one of horizontal merger and consistent with other studies, this increases market power whiles diminishes the level of competition in the industry.

The interaction term between technological development and marginal cost (ICT*ln $mc$) is negatively and significantly related to market share. The Boone indicator is higher in magnitude than the indicator in the industry implying that, as a firm invest heavily in ICT, it improves it the degree of competition in the industry. This observation is in line with the findings of Boot (2014) and Marinč (2013) who concluded that, the developments of information technology might also lead to substantial transformation of the financial industry, which intend increase efficiency but may also increase transaction nature of financial services, which is associated with higher competition. Also, the finding is consistent with Hasan et al. (2003), who find that, investments in standardization and new technologies increase the productivity of the financial industry through competition. Knieps (2006) also argues that, implementation of new systems and developments in banking technology makes players in the banking market more cost effectiveness. It also promotes integration of financial markets (Hasan &Malkamäki, 2001; Schmiedel*et*

*al.*, 2006), and foster a single market especially if regulatory barriers are removed (Gehrig &Stenbacka, 2007).

The interaction term between bank recapitalisation and marginal cost (RECAP*ln $mc$), is negatively and statistically significantly related to market share of the banks in Ghana. The interaction has a higher magnitude of Boone indicator as compare to the indicator without recapitalisation effect. This is an indication that well capitalized banks improve competition within the banking industry. This implies that, higher regulatory capital requirements make banks well-capitalized and this leads to improvement of buffer for risk absorption, hence banks are able to pay higher interest on deposits to attract depositors because of the high yield on other investments that they are able to support. This finding supports the view that well-capitalized banks are more competitive and is consistent with the finding by Turk-Ariss (2009) who also finds negative and statistically significant effect of bank capitalization on market power on the Middle East and North Africa banking sectors. Moreover, it is also consistent with the results of Bikker and Haaf's (2002) study on 23 European and non-European countries. However, the result differs from the finding of Simpasa (2010) where higher regulatory capital requirement appears to increase bank market power and therefore reduces bank competition in Zambia. Similarly, Delis and Pagoulatos (2009) find a positive impact of bank capitalization on bank market power using bank data from 15 EU and 17 Central and Eastern countries.

The interaction term between bank interest rate spread and marginal cost (IRSPD*ln $mc$), is negatively and statistically insignificantly related to market

share of the banks in Ghana. Even though the Boone indicator associated with this interaction is not significant, considering the magnitude of the indicator shows that, interest rate spread reduces the level of competition in the industry. The insignificance of the result is due to the significant role the regulator plays in setting the interest rate, hence all the banks within the banking industry are exposed to similar margin, hence not significantly affect competition.

**Estimation of result from Panzer Rosse model**

This section presents the estimation results of dynamic profit function based on Equation (20) and dynamic revenue function based on Equation (22) necessary for determining market equilibrium and level of competition in the market respectively.

***State of equilibrium of the Ghanaian banking industry***

Panzer-Rosse model operates on the assumption that, the market for which its competition is to be determined should be in a state of long run equilibrium. If not, the dynamic version of the model is applied in estimating competition level in the industry. The state of equilibrium in the industry is determined by first estimating Equation (20) and secondly, obtain the E-statistic as defined in Equation (21). The estimation result of Equation (20) and E-statistic is presented in Table 24. The Wald test was performed under the null hypothesis, $E = 0$: the market is under long run equilibrium, to ascertain whether the E-statistic obtained is significantly different from zero.Table 24 reports a negative and a value which is statistically different from zero, suggesting that the hypothesis of long-run equilibrium is

rejected for the Ghanaian banking industry over the study period.The existence of market disequilibrium in the Ghanaian banking industry seems not to be surprising, as the market has been experiencing significant structural changes due to major financial, technological and regulatory developments which has led to a series of merger and acquisitions over the study period. In light of these results, the use of dynamic specification of the P-R model is more appropriate which accommodates persistence role of the dependent variable in competition determination, hence, the dynamic P-R model is applied.

***Competition in the Ghanaian banking industry***

After establishing the presence of market disequilibrium, we go ahead to estimate the revenue equation as specified in Equation (22) using the two-step system GMM approach to compute the values of H-statistic the entire study period. Using the unscaled values of dependent variable, bank total revenue is used to address the issue of misspecification following the procedure of Bikker*et al*. (2006; 2012). The result of estimation of Equation (22) is presented in Table 24 under Model 2. From Part A of Model 2 in Table 24, it can be noticed that the input prices of deposit (w1) and labour (w2) are positively and significantly related revenue whiles the input price of capital (w3) is negatively and significantly related to revenue with the price of deposit being the largest contributor to the value of H-statistic.With respect to the control variables, the ratio of total loans to total asset is positively and significantly related total revenue. This indicate that, granting of loan and hence, interest income plays significant role in the bank revenue.

Table 24: Equilibrium and competitive test in the banking industry of Ghana from 2009 to 2018

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | Parameter | Value | Parameter | Value |
| **Part A: Model coefficients** | | | | |
| Con_ | $\propto'$ | -8.178*** | $\propto''$ | 4.113*** |
| | | (2.619) | | (0.571) |
| $\ln R_{t-1}$ | | - | $\beta_0''$ | 0.613** |
| | | - | | (0.298) |
| $\ln ROA_{t-1}$ | $\beta_0'$ | -0.322* | | - |
| | | (0.187) | | - |
| $\ln w_1$ | $\beta_1'$ | -0.819*** | $\beta_1''$ | 0.502*** |
| | | (0.277) | | (0.132) |
| $\ln w_2$ | $\beta_2'$ | -0.221 | $\beta_2''$ | 0.281*** |
| | | (0.225) | | (0.092) |
| $\ln w_3$ | $\beta_3'$ | 0.203** | $\beta_3''$ | -0.122* |
| | | (0.092) | | (0.054) |
| $\ln Z_1$ | $\gamma_1'$ | 0.932** | $\gamma_1''$ | 0.629* |
| | | (0.459) | | (0.294) |
| $\ln Z_2$ | $\gamma_2'$ | -3.155** | $\gamma_2''$ | 0.013 |
| | | (1.586) | | (0.012) |
| $\ln Z_3$ | $\gamma_3'$ | -0.115** | $\gamma_3''$ | -0.024* |
| | | (0.053) | | (0.015) |
| **Part B: Model statistics** | | | | |
| No. of observations | | 205 | | 205 |
| No. of banks | | 22 | | 22 |
| 1st stage F statistic | | 25.268*** | | 34.159*** |
| E-statistic | | -0.838 | | - |
| H-statistic | | - | | 0.661 |
| **Part C: Long run equilibrium test** | | | | |
| $H_o: E = 0$ | | | | |
| Wald Chi$^2$ *(p-value)* | | 4.113***(0.001) | | |
| State of market | | Disequilibrium | | |
| **Part D: Test for competitiveness** | | | | |
| $H_o: H = 0$ | | | | |
| Wald Chi$^2$ *(p-value)* | | | | 8.137***(0.002) |
| $H_o: H = 1$ | | | | |
| Wald Chi$^2$ *(p-value)* | | | | 3.173**(0.041) |
| Market condition | | | | Monopolistic competition |

Source: Author's computation from Equation (20) and Equation (22). Dependent variable is the log of (1+ ROA) following Equation (20) for model 1 and Revenue for Model 2 following Equation (22). All the regressions are estimated using two stage system GMM with IV estimation. Robust standard errors are reported in parentheses in Part A and level of significant in Part C and Part D. ***$p<0.01$; **$p<0.05$;*$p<0.1$.

Similarly, the ratio of shareholders' fund to total asset is "positively and significantly related to revenue indicating that, well capitalized banks are able to finance the investment which contributes significantly to their income.Loan provision ratio is inversely and significantly related to revenue." "This observation is expected due to the banking sector in the economy being reeling under the pressure of increasing burden of non-performing assets which has come about due to the high rate of interest spread thereon which hampers the banks' total income." "The estimated value of H-statistic is 0.661 over the study period." "The observed higher magnitude of H-statistic implies that the degree of competition is higher in both core and non-core banking business." "The results of the Wald test indicate that the hypotheses of H = 0 (banking market is monopoly) and H = 1 (banking market is perfect competition) are rejected at 1% and 5% level of significant." "The hypothesis of $0 < H < 1$ (the banking market is monopolistic competition) is validated for the Ghanaian banking industry."

"Observing development in competition over time, Equation (24) was estimated and H statistic for each year was computed based on Equation (25). The result of the H-statistic and the Wald test of the null hypotheses of H = 0 (banking market is monopoly) and H = 1 (banking market is perfect competition) is presented in Table 25.Almost all the observed years have a positive H statistic, except in 2012 and 2013 where the H statistic assumed negative values. During these years, the Wald test showed that, the null hypothesis H statistic = 0 cannot be rejected as the H statistic is not significant.It can therefore be concluded that the banking competition during 2012 and 2013 were of oligopolistic nature."

Table 25: Development of competition over time using P-R model

| Year | H-statistic | Wald test *(p value)* | | Market condition |
|---|---|---|---|---|
| | | $H_0: H = 0$ | $H_0: H = 1$ | |
| 2009 | 0.621 | 0.031 | 0.000 | Monopolistic |
| 2010 | 0.135 | 0.006 | 0.000 | Monopolistic |
| 2011 | 0.015 | 0.333 | 0.001 | Collusive oligopoly |
| 2012 | -0.003 | 0.572 | 0.003 | Collusive oligopoly |
| 2013 | -0.015 | 0.113 | 0.021 | Collusive oligopoly |
| 2014 | 0.131 | 0.021 | 0.000 | Monopolistic |
| 2015 | 0.011 | 0.001 | 0.000 | Monopolistic |
| 2016 | 0.215 | 0.004 | 0.000 | Monopolistic |
| 2017 | 0.635 | 0.027 | 0.002 | Monopolistic |
| 2018 | 0.537 | 0.004 | 0.034 | Monopolistic |

Source: Author's computation from Equation (25)

"Similar observation can be made in 2011 where, even though H-statistic is positive, the acceptance of the null hypothesis (H=0) suggest that, the market structure of the Ghanaian banking industry in 2011 is of oligopolistic type." "This confirms the observation of the Boones indicator where in 2012 and 2013, there was a fall in competition in the Ghanaian banking industry." "However, competition in 2014 to 2018 could be described as monopolistic competition as the Wald Test showed two hypotheses H statistic = 0 and H statistic = 1, both are rejected," "thus it is concluded that H statistic lies between 0 and 1. This again confirms the Boones indicator's observation of the market as the market competition condition, as per Boones, showed an improvement in the competition level especially in the loans market."

## Summary and conclusion

"Over the past two decades, the Ghanaian banking industry has gone through a series of significant transformations which aimed at accelerating and the strength of financial stability and stimulating competitive market so as to make the industry more robust. During the period covered by the study, concentration level of banking activities appears to have been consistently decreasing with the entry of foreign banks and also springing up of local banks as indicated by both three-firm concentration ratio (Ghana Banking Survey, 2010 – 2019) and HHI. This issue raised an important issue as to whether the decreased concentration in the Ghanaian banking sector lead to an increase in competition."

"To address this issue, the current study examines the competition condition in the Ghanaian banking industry by using the Boone indicator and the Panzar-Rosse methodology as consistency check. It was observed that, from the full sample period estimates, the loan market in Ghana is the most competitive compared to the other earning asset market and the fee-based services market. Also, over time, competition tends to increase during the latter part of the study period." "This observation was confirmed by the Panzar-Rosse model which observed that, even though there appears to be evidence of oligopolistic competition in the middle of the study period, the market exhibited monopolistic competition towards the end of the study period which is consistent with the observation of the Boones indicator." "This implies that, given the improvement in the regulatory and supervision structures," "there is still much room for improvement of competition condition in Ghanaian banking sector." "This sort of conclusion may help policy makers and

regulators in making more efforts for improving efficiency of the banking system by further liberalizing and creating a more suitable environment for competition."

# CHAPTER SEVEN

# EFFECT OF COST EFFICIENCY, MARKET STRUCTURE AND FREEDOM ON PROFITABILITY OF BANKS IN GHANA

## Introduction

Determining profitability of a banking system have received considerable attention both in the literature and among practitioners. This is mainly because, a highly performing banking system is able to withstand negative economic shocks and also the crucial role they play in economic growth and financial stability of every economies (Athanasoglou*et al.*, 2008). It is an undeniably fact that, determining bank's profitability is a complex issue. In as much as higher bank profitability may be an indication of higher operational efficiency, it may raise concerns about higher risk taking by banks to realize these profits and also abuse of market power. "This is so because, as suggested by the capital asset pricing model, existence of arbitrage ensures that, riskier assets are compensated with higher returns, so banking aiming to achieve higher profitability should be willing to accept additional risk."

"Also, if banks experience high profitability through attainment of market power, there is the tendency of customer welfare loss due to the pricing advantage arising from such power in a form of higher interest spread, credit rationing and poor quality of financial services, hence, customers would be at disadvantage (Chortarea*set al.,* 2011)." "Thus, higher bank profitability may require policy interventions and regulations necessary to reduce market power in the form of removing barriers to entry and enhancing competition, in an effort to protect

customer welfare or reduce the risk exposure of banks to protect customers' assets." "Nevertheless, higher bank profits arising from efficient operation may be reinvested to produce a stable returns and safer banks which would intend promote financial stability (Flamini*et al.,* 2009). Conversely, a low profitability in the banking industry may suggest an excessively competition or operational inefficiencies which is a threat to financial growth of the economy at large, hence, would require appropriate policy interventions to restrict entry into the market, reduce the level of inefficiencies and attract quality factors of production into the industry."

"Despite the numerous literatures on the linkage between bank efficiency, market structure and profitability, literature on the effect of economic and financial freedom on the efficiency-structure-profitability nexus virtually do not exist." "The limited studies in this area seems startling, considering the role banking sector plays in the economic development and the fact that government coercion beyond a minimal level may be detrimental to the financial industry." "Economic and financial freedom measures the degree of restrictions and controls in the financial sector. When financial institutions operate in a less restricted environment, they are more likely to engage in competitive policies, resulting in higher levels of efficiencies, hence improved profitability."

"This chapter seeks to fill the identified gap by building on the earlier contributions on factors influencing banks profitability. Measuring bank profitability with return on asset (ROA), shadow return on equity (SROE) and economic value added (EVA), the chapter seeks to explore the influence of bank

cost efficiency, competition and freedom on banks' profitability. It also investigates the extent to which banks profitability is influenced by internal factors (i.e. bank specific characteristics) and external factors (i.e. macroeconomic conditions)."

"The rest of the study is organised as follows; following this section provides a descriptive statistic of the study variables specified in Table 10. The empirical findings on the efficiency-structure-profitability relationship is presented together with the mediating role played by economic and financial freedom." "Finally, the chapter presents the result on efficiency-structure-profitability relationship from the perspective of ownership. This followed by summary and conclusion on the chapter."

**Descriptive statistics and intercorrelations**

"This section describes the data on the variables used in the bank profitability study. A summary of the descriptive statistics of the variables used in the estimation of profitability of the banks in of Ghana is shown in Table 26."

"On the average, the banks showed an average profit of 12.7% of their net asset over a range of a loss of 13.2% of net asset to 27.8% of net asset. This indicates a greater level of variations in the data considering a coefficient of variation of over 200%." "Similar stories could be told on the other profitability measures, that is, shadow return on equity and economic value added to total asset which showed a coefficient of variation exceeding 200% and 100% respectively." "However, even though some firms recorded negative returns in the case of return on asset and shadow return on equity, due to the adjustments for non-cash items in generating

the economic value added, all firms appear to have added value during the period of the study."

"Market structure variables appears to be clustered around the mean as a relatively lesser coefficient of variation is reported for most of the market structure variables." "With the market share of the largest three firms holding about 20% to 34% market share indicates a significant level of concentration in the market. Average cost efficiency recorded 79.1% with a standard deviation of 12.4% (coefficient of variation of 16%) indicating most of the data values clustered around the mean." "The average scale efficiency of 1.121 is an indication of firms operating above the optimal size relative to the resources available to them."

"Both freedom variables show an average value of above 50% indicating some significant level of freedom in the economy and in the financial market. The relatively low level of standard deviation provides an indication of the data points clustered around the average values. See Table 24 for the descriptive statistics of the selected variables."

"To satisfy the assumption of no multicollinearity among the explanatory variables, Table 27 shows the correlation matrix of the explanatory variables which shows that, in general the correlation between the explanatory variables is not strong (highest absolute correlation efficient being 0.58) suggesting that multicollinearity problems are not severe." "As suggested by Kennedy (2008), multicollinearity is a problem when the correlation coefficient between explanatory variables is above 0.80, which is not the case here. As such, we proceed with the estimation of the model parameters."

Table 26: Descriptive statistics of study variables

| Variable | Min | Max | Mean | Std dev. |
|---|---|---|---|---|
| ***Profitability*** $(\boldsymbol{\pi})$ | | | | |
| Return on asset $(ROA_{it})$ | -0.132 | 0.278 | 0.127 | 0.329 |
| Shadow return on equity $(SROA_{it})$ | -0.211 | 0.334 | 0.098 | 0.213 |
| Economic values added on total asset $(EVA_{it})$ | 0.013 | 0.297 | 0.081 | 0.131 |
| ***Market structure variables*** $(\boldsymbol{Stru})$ | | | | |
| Three-firm concentration $(CR_3)$ | 0.198 | 0.341 | 0.262 | 0.113 |
| Herfindahl–Hirschman index (HHI) | 0.053 | 0.109 | 0.089 | 0.019 |
| Boone indicator (BI) | -0.217 | -0.021 | -0.190 | 0.087 |
| ***Efficiency variables*** $(\boldsymbol{Eff})$ | | | | |
| X-efficiency (X-EFF) | 0.584 | 1.000 | 0.791 | 0.124 |
| Scale efficiency (S-EFF) | 0.617 | 1.988 | 1.121 | 0.315 |
| ***Freedom variables*** $(\boldsymbol{Free})$ | | | | |
| Economic freedom index (*eco_free*) | 51.32 | 58.12 | 53.13 | 3.125 |
| Financial freedom index (*fin_free*) | 48.15 | 53.15 | 50.13 | 6.121 |
| ***Bank specific variables*** $(\boldsymbol{BSpeci})$ | | | | |
| Credit risk $(LP/TL)$ | 0.013 | 0.336 | 0.162 | 0.144 |
| Bank capital strength (EQ/TA) | 0.009 | 0.672 | 0.159 | 0.080 |
| Income diversification (NI/TA) | 0.005 | 0.017 | 0.009 | 0.102 |
| Loan intensity (TL/TA) | 0.012 | 0.948 | 0.427 | 0.162 |
| Bank size (SIZE) | 2.171 | 12.136 | 7.215 | 1.812 |
| ***Macroeconomic variables*** $(\boldsymbol{Macro})$ | | | | |
| Economic development (GDP) | 3.157 | 13.217 | 9.321 | 2.113 |
| Financial sector development (SM/GDP) | 0.213 | 0.713 | 0.413 | 0.172 |
| Macroeconomic risk (INFL) | 0.070 | 0.231 | 0.172 | 0.115 |

Source: Computed from official figures obtained from the various data source

Table 27: Correlation matrix of explanatory variables

| | CR3 | HHI | BI | XEFF | SEFF | Eco_free | Fin_free | Credit Risk | Capital Strength | Income Div | Loan Intensity | Size | Eco Dev | Fin Dev |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CR3 | 1.000 | | | | | | | | | | | | | |
| HHI | 0.366** | 1.000 | | | | | | | | | | | | |
| BI | -0.366 | -0.480 | 1.000 | | | | | | | | | | | |
| XEFF | -0.065* | -0.496 | 0.089 | 1.000 | | | | | | | | | | |
| SEFF | -0.179 | -0.057 | 0.039 | 0.211* | 1.000 | | | | | | | | | |
| Eco_free | -0.423 | -0.358** | 0.081 | 0.350 | 0.341* | 1.000 | | | | | | | | |
| Fin_free | -0.024** | -0.187 | 0.089* | 0.033** | 0.089 | 0.390 | 1.000 | | | | | | | |
| Credit Risk | 0.057** | 0.268 | -0.122* | -0.033 | -0.488 | -0.423** | -0.024* | 1.000 | | | | | | |
| Capital Strength | -0.463 | -0.504* | 0.488** | 0.398* | 0.293** | 0.545 | 0.041 | 0.520 | 1.000 | | | | | |
| Income Div | 0.130 | 0.358 | 0.545 | 0.293 | -0.325 | 0.228 | 0.016 | -0.431** | 0.154* | 1.000 | | | | |
| Loan Intensity | 0.073 | 0.146 | -0.301 | 0.049** | 0.390 | 0.447 | -0.366 | -0.154 | 0.049 | 0.528 | 1.000 | | | |
| Size | 0.114*** | 0.358** | 0.244** | 0.293 | 0.545** | 0.220* | 0.130** | 0.146 | 0.415** | 0.130 | 0.049* | 1.000 | | |
| Eco Dev | 0.122 | 0.480 | 0.073 | 0.276 | 0.398 | 0.374 | 0.122 | -0.390 | 0.293 | 0.146 | 0.350 | 0.407 | 1.000 | |
| Fin Dev | 0.041** | 0.154* | 0.252* | 0.520* | 0.146 | 0.488 | 0.171 | 0.537* | 0.390 | 0.528** | 0.106 | 0.374* | 0.252 | 1.000 |
| Inflation | 0.033 | 0.398 | -0.041 | 0.317 | 0.195 | -0.211 | -0.106 | 0.049 | 0.081 | 0.447 | 0.333 | 0.341** | 0.228 | 0.106 |

Source: Author's computation from official figures obtained from the various data source

**Empirical Results**

"The result of the empirical analysis of the data is presented in this section. The results are presented under four headings; first is the presentation of the regression result to analyze the effect of market structure and efficiency on banks' profitability. Secondly, the study assesses the role economic freedom plays in the market structure-efficiency-profitability relationship. Thirdly, we control for ownership in the Ghanaian banking industry to assess how these variables would influence the relationship. "

**Market structure, efficiency and profitability**

"In estimating the relationship between market characteristics, bank efficiency and profitability, Equation (29) was estimated using the system GMM for each of the profitability measure considered." "The result of the estimation is presented in Table 28. Observation of the result obtained warrant some general comments as follows;" "Firstly, the coefficients of the main variables of interest remains stable across the various regressions models in terms of direction and magnitude. Secondly, the highly significant and positive lagged profitability variable's coefficient across the models suggest that, profitability of Ghanaian banks in the current year is significantly and positively affected by its previous year's profitability." "This confirms the dynamic nature of the model specification, thus justifying the use of dynamic panel data model estimation. Finally, the F-test result shows that, the model generally fits the data."

Table 28: Panel GMM result of market structure, efficiency and freedom on profitability

| | Model 1 | | | Model II | | | Model III | | |
|---|---|---|---|---|---|---|---|---|---|
| Dependent Var. | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA |
| **Part A: Model coefficients** | | | | | | | | | |
| con_ | 5.154* | 3.154* | 4.308* | 3.077* | 4.385* | 3.923** | 3.231*** | 3.308* | 4.231** |
| | (3.035) | (1.867) | (2.362) | (1.568) | (2.237) | (2.146) | (1.146) | (1.917) | (1.831) |
| Lag dep. var | 0.079*** | 0.064*** | 0.036*** | 0.093*** | 0.057*** | 0.059*** | 0.071*** | 0.057*** | 0.057** |
| | (0.021) | (0.004) | (0.006) | (0.032) | (0.005) | (0.013) | (0.014) | (0.12) | (0.023) |
| CR3 | -0.024*** | -0.044** | -0.005** | -0.008** | -0.053** | -0.007* | -0.003*** | -0.062*** | -0.008* |
| | (0.007) | (0.021) | (0.002) | (0.003) | (0.022) | (0.004) | (0.001) | (0.026) | (0.005) |
| HHI | -0.182*** | -0.077* | 0.255* | -0.214*** | -0.034** | 0.198* | -0.229*** | -0.025 | 0.182** |
| | (0.057) | (0.042) | (0.155) | (0.044) | (0.016) | (0.108) | (0.069) | (0.045) | (0.033) |
| Boone indicator | 0.067*** | 0.168** | 0.068* | 0.076*** | 0.067*** | 0.051*** | 0.068* | 0.094 | 0.085*** |
| | (0.007) | (0.082) | (0.031) | (0.028) | (0.024) | (0.006) | (0.035) | (0.082) | (0.017) |
| X-Efficiency | 0.065** | 0.149*** | 0.056** | 0.064** | 0.131*** | 0.043** | 0.049** | 0.198* | 0.048** |
| | (0.025) | (0.058) | (0.020) | (0.019) | (0.045) | (0.017) | (0.012) | (0.130) | (0.016) |
| Scale-Efficiency | 0.205*** | 0.189** | 0.362*** | 0.142*** | 0.220** | 0.386** | 0.276*** | 0.236*** | 0.326** |
| | (0.058) | (0.071) | (0.091) | (0.044) | (0.110) | (0.186) | (0.064) | (0.037) | (0.148) |
| Eco_free | | | | 0.107*** | 0.053 | 0.031*** | | | |
| | | | | (0.051) | (0.006) | (0.007) | | | |
| Eco_free* CR3 | | | | -0.107 | -0.084 | -0.038 | | | |
| | | | | (0.136) | (0.064) | (0.041) | | | |
| Eco_free*HHI | | | | -0.015 | -0.115 | -0.084 | | | |
| | | | | (0.029) | (0.115) | (0.121) | | | |
| Eco_free*Boone | | | | -0.076** | 0.092 | -0.053 | | | |
| | | | | (0.034) | (0.029) | (0.018) | | | |
| Eco_free*X-Efficiency | | | | 0.023** | 0.038 | 0.046 | | | |
| | | | | (0.008) | (0.013) | (0.016) | | | |
| Eco_free*Scale-Efficiency | | | | -0.107 | -0.053 | -0.099 | | | |
| | | | | (0.146) | (0.016) | (0.084) | | | |
| Fin_free | | | | | | | 0.088** | 0.162 | 0.086 |
| | | | | | | | (0.034) | (0.128) | (0.063) |
| Fin_free* CR3 | | | | | | | -0.037 *** | -0.103*** | -0.213** |
| | | | | | | | (0.009) | (0.035) | (0.160) |
| Fin_free*HHI | | | | | | | -0.074** | -0.066** | -0.191** |
| | | | | | | | (0.024) | (0.027) | (0.081) |
| Fin_free*Boone | | | | | | | -0.074 ** | -0.110** | -0.092 |
| | | | | | | | (0.032) | (0.076) | (0.192) |
| Fin_free*X-Efficiency | | | | | | | 0.132 | 0.088*** | 0.043** |
| | | | | | | | (0.087) | (0.026) | (0.018) |
| Fin_free*Scale-Efficiency | | | | | | | 0.191 | 0.044 | 0.328** |
| | | | | | | | (0.158) | (0.030) | (0.128) |
| Credit risk | -0.087 | -0.087** | -0.039** | -0.039** | -0.087 | -0.087** | -0.079 | -0.055 | -0.031** |
| | (0.066) | (0.045) | (0.015) | (0.020) | (0.082) | (0.024) | (0.075) | (0.021) | (0.015) |
| Capital strength | 0.194*** | 0.064*** | 0.072*** | 0.127** | 0.049*** | 0.062*** | 0.261*** | 0.034* | 0.246** |
| | (0.050) | (0.023) | (0.016) | (0.052) | (0.013) | (0.007) | (0.087) | (0.017) | (0.104) |
| Income Div. | 0.262*** | 0.180* | 0.287*** | 0.198*** | 0.279** | 0.179*** | 0.164* | 0.138*** | 0.287* |
| | (0.092) | (0.127) | (0.107) | (0.033) | (0.076) | (0.013) | (0.094) | (0.058) | (0.168) |
| Loan intensity | 0.021*** | 0.169 | 0.077** | 0.106*** | 0.035* | 0.176* | 0.085** | 0.134 | 0.276 |
| | (0.006) | (0.111) | (0.030) | (0.030) | (0.014) | (0.097) | (0.038) | (0.121) | (0.167) |

Table 28: Panel GMM result of market structure, efficiency and freedom on profitability (Continuation)

| | Model 1 | | | Model II | | | Model III | | |
|---|---|---|---|---|---|---|---|---|---|
| Dependent Var. | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA |
| Bank Size | 0.176** | 0.170 | 0.078 | 0.196*** | 0.131 | 0.203*** | 0.079 | 0.065 | 0.098 |
| | (0.091) | (0.070) | (0.057) | (0.069) | (0.073) | (0.051) | (0.075) | (0.054) | (0.110) |
| Economic dev't | 0.310* | 0.219 | 0.161** | 0.290* | 0.194 | 0.168* | 0.261*** | 0.335 | 0.165* |
| | (0.176) | (0.062) | (0.078) | (0.156) | (0.097) | (0.097) | (0.087) | (0.087) | (0.088) |
| Fin. Sec dev't | -0.297 | -0.192 | -0.249 | -0.209 | -0.180 | -0.243 | 0.164* | -0.262 | -0.227 |
| | (0.348) | (0.110) | (0.229) | (0.192) | (0.104) | (0.233) | (0.094) | (0.311) | (0.159) |
| Macro. Risk | -0.196 | -0.190 | -0.170 | -0.124** | -0.072 | -0.105** | 0.085** | -0.131 | -0.124** |
| | (0.162) | (0.190) | (0.111) | (0.033) | (0.022) | (0.041) | (0.038) | (0.050) | (0.051) |
| **Part B: Model statistics** | | | | | | | | | |
| F-test | 28.714*** | 22.571 | 25.857** | 31.714** | 23.143 | 22.857** | 14.429*** | 10.571 | 22.857** |
| AR(1) p-value | 0.092 | 0.086 | 0.033 | 0.026 | 0.079 | 0.105 | 0.092 | 0.099 | 0.046 |
| AR(2) p-value | 0.216 | 0.216 | 0.245 | 0.147 | 0.176 | 0.137 | 0.167 | 0.216 | 0.137 |
| Hansen p-value | 0.265 | 0.265 | 0.176 | 0.255 | 0.176 | 0.167 | 0.225 | 0.118 | 0.186 |

Source: Author's computation. $^{***}p<0.01$; $^{**}p<0.05$;$^{*}p<0.1$. Robust standard error in parenthesis

"Again, for all the regression models estimated, the Hansen test statistics for overidentifying restrictions shows that, at 5% level of significance, the instruments used are appropriately orthogonal to the error terms. Besides, the Arrelano–Bond $AR(2)$ test shows that, at the 5% significance level, no second order serial correlation can be detected."

***Market structure and profitability***

Market structure was measured from the angle of concentration and competition. "Two proxies we used to denote market concentration; CR3 and HHI and one proxy for measurement of competition; the Boone indicator for the loans market. The result of regression of these variables is shown in Table 26."

"Concentration appears to be inversely related to profitability given the proxies selected. Both CR3 and HHI showed a negative and significant relationship with profitability of banks in Ghana, suggesting that, as the Ghanaian banking market becomes more concentrated, returns generated on their assets tends to fall." "The observed relationship between CR3 and profitability is contrary to the SCP hypothesis (which suggest that banks in a concentrated market earns higher return on asset). In the case of banks in Ghana, higher CR3 is associated with lower profitability. Higher CR3 means the three biggest banks have acquired a higher market share and hence have higher domination in the market." "To increase dominance, the biggest three banks need to perform expansion. Market expansion creates expenses to the bank, and some of the expansion does not create profit during the early years. For example, a bank that introduces a new product or expands to a new market has high expenses, but the profitability may still be relatively low. In this regard, an increase in market shares of the three biggest banks would be followed by a decrease in return on asset." "Moreover, bigger banks tend to have a better economic of scale which may be associated with a lower marginal cost. Such banks may have the option to reduce its price to gain more market shares. A decline in price can reduce bank profitability in term of percentage, especially if the market is highly inelastic."

"Similarly, the estimated coefficient of HHI is negative and significant for ROA and SROE but positive and significant when EVA is used as a measure of profitability. Thus, in terms of ROA and SROE, the result tends to be inconsistent with the RMP hypothesis, which postulate that, as firms gain higher market power

through increased market share, profitability tend to increase." "The negative relation between HHI and banks' profitability can be explained by the fact that banks with larger market share suffer low profitability due to massive accumulated non-performing loans, although the amount has been reduced substantially in recent years." "Conversely, considering profitability as value addition to the firm which seems to be a stricter means of measuring performance, the result tends to provide an overwhelming support for the RMP. Thus, the applicability of the RMP hypothesis on the Ghanaian banking market largely depends on how banks' performance is defined."

"The observed relationship between market concentration and profitability indicates that, Ghanaian banking industry is not controlled by a few banks who can exploit the market to gain abnormal profits." "This finding contradicts earlier work by Busch and Mathisen (2005) who found the Ghanaian banking sector to be controlled by few firms over the period 1998 to 2003. The present study however uses recent data covering 2009 to 2018, thus, it could be an indication that the sector is becoming more and competitive over time." "Between the time of Busch and Mathisen study and now, there have been a lot of reforms that has aimed at varying the market structure to make it more competitive, hence could be a possible reason for the varied result from Busch and Mathisen (2005)." "This finding are however, consistent with that of Athanasoglou*et al.*(2005) and Garza- Garcia (2011) who found an inverse and significance relationship between market concentration (measured by HHI) and bank profitability in Greece and Mexico respectively."

"In respect to competition and profitability, competition was focused on the loans market and is measured using the Boones indicator. The coefficient of competition measure in the regression models exhibit a positive and significant relationship with banks' profitability across all models." "This implies that, higher Boones indicator is associated higher the value of the profitability proxies. As high Boone indicator shows low competition, the regression result suggests that, lower competition in the loan market is associated with higher profitability." "The observed relation between competition and profitability tends to confirm the assertion of Berger, *et al*. (2008) and Boyd and De Nicolo (2005) who are of the view that, as competition in the banking sector heightens, profit margins of the banks are more likely to shrink, resulting in banks being motivated to endorse riskier investments for purposes of boosting their profit margins which may lead to loss of their investment."

"This result contrast the observed market concentration–profitability relationship that shows a higher concentration in the market breeds lower return on asset. All other thing being equal, a highly concentrated market is expected to be an indication of low competition and the regression result again suggest an inverse relationship between competition and banks' profitability which somewhat suggest a contradiction between concentration-profitability relationship and competition-profitability relationship." "The opposite result of both regressions result suggests a U-shaped relationship between market structure of the Ghanaian banking industry and banks' profitability. This implies that, concentrated market or highly competitive market does not create avenue for firms operating in the Ghanaian banking industry to make profit."

***Efficiency and profitability***

"In assessing the relationship between bank efficiency and profitability, both X-efficiency and scale -efficiency were used. Both efficiency measures were included in order to assess the applicability of X-efficient structure hypothesis (ESX) and scale efficient structure hypothesis (ESS) respectively. The regression result showed a positive and significant relationship between X-efficiency and all the profitability variables." "This observation suggests strongly that, X-efficiency explains variations in banks' profits, indicating the acceptance of ESX. Thus, banks that are able to control costs more efficiently earn higher profits, and those that are inefficient have reduced profits. The finding is in consonance with the *bad management* hypothesis of Berger and DeYoung (1997) which postulate that, low measure of cost efficiency is a signal of poor senior management practices, which apply to input usage and day-to-day operations." "Moreover, the relatively efficient banks should be operating at lower costs, which feed through higher profitability."

"For the scale efficient structure (ESS) hypothesis, the estimated coefficient of scale efficiency (S-EFF) was found to be positive and significant across all the dependent variables specified, indicating the acceptance of the ESS. This implies that, when management is able to choose the optimum size of resources to support its scale of production, it is likely to translate to increased profitability." "This result is in line with the result obtained by Berger*et al.* (2004) and Garza- Garcia (2012) who found similar results concluded that scale efficiency is an important driver of banks' profitability."

***Control variables***

"In addition to the main variables of interest, the study controlled for other variables that seek to explain the variability in banks' profitability. Model (I) in Table 28 shows the result of the extent to which other variables explain the variability of banks profitability."

"With respect to credit risk (measured as the ratio of loan loss provision to total loans), it consistently showed a negative relationship (though not significant across all dependent variables) with banks' profitability, suggesting that banks with higher loan loss provision tend to report lower returns on asset." "The observed result is consistent with the literature (Sarpong-Kumankoma*et al.*, 2018; Delis, 2012; Elsas*et al*., 2010) and theory, the *skimping* hypothesis (Berger & DeYoung, 1997) which postulate that, it would be detrimental to bank's profitability if bank seeks to be efficient in the short run by reducing it expenses devoted to loan screening, underwriting and monitoring as it is likely to end in adverse selection of borrowers." "The findings clearly suggest that, banks operating in the Ghanaian banking sectors should focus on managing credit risk exposure in the quest to improve their profitability, which has been proven to be problematic in the recent past."

"Capital strength (measured as the ratio of equity capital to total asset) showed a positive and significant relationship with bank profitability across the dependent variables, result of which is consistent with observation by Goddard *et al*. (2013), Pasiouras and Kosmidou (2007), and Kosmidou (2008)" and argument in the literature which provides that well capitalized banks face lower costs of going

bankrupt, rather are able to fund huge. “Furthermore, strong capital base is essential for banks in developing economies necessary to provide a shock absorber in times of financial crises and also provide safety for depositors during unstable macroeconomic conditions (Sufian, 2009).”

“As expected, income diversification (measured as the ratio of non-interest income to total asset) has consistently exhibited positive and significant impact on bank profitability. The results imply that banks that derives a significant proportion of its income from non-interest sources such as fee-based services and other income tend to report improve profit. This observation may be attributable to synergetic effect between core and related activities, which makes diversified banks much more competitive advantageous over their less diversified counterparts (Goddard *et al*., 2013).” “Besides, non-core banking activities are associated with limited losses as compared to the core banking activities which is generally characterised by huge losses on loans. This empirical finding provide support to earlier studies such as Chiorazzo*et al.* (2008), Elsas*et al.* (2010) Stiroh and Rumble (2006) who suggested that revenues generated from new business units have significantly contributes to improve bank performance.”

“Loan intensity (proxied by the ratio of total loan to total asset) measures liquidity risk of the bank, basically focus on the proportion of banks assets converted to loans investment. A higher loan intensity is detriment to the bank’s liquidity but assuming these loans translate to interest income, is expected to improve profitability.” “Thus, the intensity of loans showed a positive and

significant relationship with banks profitability indicating that, higher loans provided by the banks translate to interest revenue which intend translate to profit." "Banks size seems to be positively and significantly associated with profitability. Hauner (2005) offers two potential explanations for which size could have a positive impact on bank performance." "First, it is assumed that, size is associated with market power and as such, through the enjoyment of economies of scale, large banks should pay less for their inputs which directly translate to profitability. Secondly, as firm expands, there may be increasing returns to scale through the allocation of fixed costs over a higher volume of services or from efficiency gains from a specialized workforce." "However, the result should be interpreted with caution since the coefficient of the variable is only statistically significant across the reduced models but not significant in the full model where we control for freedom variables."

"The results of the relationship between GDP and banks' profitability appears to provide evidence in support the argument on the linkage between economic growth and financial sector's performance. The result suggests that, a high economic growth encourage banks operating in in Ghana to lend more, charge appropriate margins, and improve the quality of their assets. The level of financial development (proxied by the ratio of stock market capitalisation to GDP) is largely insignificant in determining bank return on assets, but the negative coefficients clearly advocate that, during the period under study, Ghana stock markets offers substitution possibilities rather than complements the products and services offered by banks to borrowers." "Similarly, the coefficient of the macroeconomic risk

(proxied by inflation) seems to be negatively association with bank's return. Rising inflation reduces the real value of non-performing loans and since most bank contracts are not inflationary adjusted, it tends to be detrimental to banks' profitability."

**Role of economic and financial freedom**

"To determine whether or not economic freedom influences bank profitability and the role it plays in the structure-efficiency-profitability relationship, equation (29) is re-estimated to include the overall economic freedom(*Eco_free*) index and financial freedom (*Fin_free*) as computed by the Heritage Foundation. The indices are constructed such that higher values denote greater economic freedom. The results are presented in Model (II) and Model (III) of Table 26 for overall economic freedom and financial freedom respectively."

"As observed, the empirical findings in Model II of Table 28 seem to suggest a positive relationship between *overall economic freedom* (*Eco_free*) and banks' profitability. This empirical finding comes not as a surprise and is consistent with current studies such as Sarpong-Kumankoma*et al*. (2018) and Holmes *et al*. (2008) who concluded that, economic freedom is key to the creation of an environment that allows virtuous cycle of entrepreneurship, innovation, sustained economic growth and development to flourish." "Furthermore, economies with higher levels of economic freedom are likely to enjoy better living standards. It can again be observed in Model II that, the interaction between economic freedom and concentration variables is not significant indicating that, overall economic freedom

does not play any significant role in the concentration-profitability relationship." "However, the interaction between the economic freedom and competition is negative and significant, indicating that, as overall economic freedom is improved, the inverse relationship between competition and profitability is likely to reduced, such that, in an environment of higher overall economic freedom, increase in competition will bring about improvement in banks' profitability." "Thus, overall economic freedom has a conditioning effect on the impact of competition on bank profits. When overall economic freedom is interacted with efficiency variables, Model (II) showed that, whiles economic freedom has a significant positive impact on the efficiency-profitability relationship in the case of X-efficiency, it exhibited an insignificant negative impact in the case of scale efficiency." "The observed result seems to suggest that, more cost-efficient banks operating in an environment with higher overall economic freedom tends to generate a higher return on their investment as compare to a situation where there is a restricted overall freedom."

"As expected, the coefficient of financial freedom (*Fin_free*) variable in the regression model in Model (III) is positive signed, suggesting that banking security as well as independence from government control exerts positive influence on bank margins. The result seems to suggest that, as financial institutions are excessively controlled by the government, they are not able to freely engage in essential financial activities that would facilitate private sector–led economic growth and diversify their income base." "It can again be observed in Model III that, the coefficient of the interaction between financial freedom and concentration variables is negative and significant indicating that, financial freedom when improved would

have the tendency of reducing the inverse relationship between concentration and profitability." "This implies that, higher level of financial freedom would provide a drive for reduction in concentration level which would intend leads to increase in profitability. However, the interaction between the financial freedom and competition is negative and significant." "This is an indication that, as financial freedom is improved, the inverse relationship between competition and profitability is likely to reduced. Same applies to effect of financial freedom on both cost efficiency and scale efficiency."

"In essence, the empirical findings from this study highlight that certain government roles are conducive to the banking sector, while some others serve as hindrance. When banking institutions are provided with secure property rights, fair and balanced financial system, and effective constitutional limits on government's ability to transfer wealth through taxation and regulation, it would go a long way to improve the profitability of these institutions."

**Does ownership matter?**

"In the preceding section, the study empirically showed that, economic and financial freedom significantly influence banks' profitability and also moderate the structure-efficiency-profitability relationship." "However, the impact of freedom on profitability and it associated moderation role in structure-efficiency-profitability relationship may not be uniform across banks with different ownership status." "Consequently, we control for the possibility that bank profitability are inherently different across banks with different ownership status. Specifically, the study focuses on interaction of the overall economic freedom and financial freedom

with market structure and efficiency variables and distinguish between locally owned and foreign owned banks. Table 29 presents the regression result."

Generally, the results from Table 29 for both foreign banks and local banks is consistent with the base line regression result in Table 28. The "coefficients of the variables considered stay mostly the same as in the baseline regression models, they keep the same sign, the same order of magnitude, and remain significant as in the baseline regression models (even though sometimes, the level of significance is at different levels)." "It is interesting to note that greater economic freedom (*Eco_free*) and financial freedom (*Fin_free*) is associated with low profitability for the local banks operating in the Ghanaian banking sector (as indicated by Model III and Model IV respectively). The empirical findings from this study to a large extent lend support to Laeven (2005) who find that, greater freedom in the banking sector exert some form of pressure on the local banks to march up the strength brought in by their foreign counterpart who have been able to gain access to the industry due to the freedom that have been enhanced." "However, if the local banks have much financial strength to march up, enhance freedom in the sector is likely to be a booster to financial performance of these banks."

Table 29: Panel GMM result of market structure, efficiency and freedom on profitability by ownership

| | Foreign Banks | | | | | | Local Banks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | | Model II | | | Model III | | | Model IV | | |
| | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA |
| con_ | 2.692* | 2.615*** | 3.077*** | 4.923*** | 3.923*** | 3.154** | 2.769 | 4.692 | 3.769 | 3.923 | 4.538 | 2.385 |
| | (1.456) | (0.738) | (0.513) | (1.128) | (0.814) | (1.620) | (1.762) | (2.244) | (1.536) | (1.876) | (0.979) | (0.525) |
| Lag dependent var | 0.040** | 0.029*** | 0.044** | 0.027** | 0.036** | 0.043** | 0.045 | 0.039 | 0.037 | 0.042 | 0.047 | 0.030 |
| | (0.012) | (0.004) | (0.028) | (0.013) | (0.018) | (0.016) | (0.045) | (0.036) | (0.048) | (0.025) | (0.031) | (0.035) |
| Market Share | -0.106 | -0.014 | -0.064* | -0.035** | -0.044** | -0.033 | -0.106 | -0.115 | -0.044 | -0.027 | -0.106 | -0.027 |
| | (0.080) | (0.012) | (0.027) | (0.012) | (0.020) | (0.060) | (0.096) | (0.037) | (0.036) | (0.012) | (0.053) | (0.016) |
| HHI | -0.234** | -0.234** | -0.135* | -0.198** | -0.167** | -0.124** | -0.188 | -0.167 | -0.208 | -0.109 | -0.177 | -0.141 |
| | (0.041) | (0.053) | (0.081) | (0.036) | (0.038) | (0.046) | (0.040) | (0.048) | (0.104) | (0.043) | (0.033) | (0.058) |
| Boone | 0.021** | 0.013 | 0.009** | 0.007** | 0.016** | 0.025** | 0.020 | 0.014 | 0.013 | 0.008 | 0.007 | 0.030 |
| | (0.006) | (0.008) | (0.004) | (0.003) | (0.007) | (0.010) | (0.015) | (0.009) | (0.005) | (0.002) | (0.002) | (0.019) |
| X-Efficiency | 0.020*** | 0.034*** | 0.024*** | 0.015*** | 0.025*** | 0.021** | 0.031 | 0.031 | 0.020 | 0.031 | 0.034 | 0.022 |
| | (0.006) | (0.007) | (0.007) | (0.004) | (0.006) | (0.007) | (0.011) | (0.006) | (0.007) | (0.008) | (0.007) | (0.005) |
| S-Efficiency | 0.068*** | 0.112*** | 0.144*** | 0.152*** | 0.076** | 0.136*** | 0.092 | 0.092 | 0.160 | 0.200 | 0.172 | 0.112 |
| | (0.011) | (0.033) | (0.028) | (0.033) | (0.025) | (0.016) | (0.038) | (0.025) | (0.096) | (0.058) | (0.070) | (0.019) |
| Eco_free | 0.046*** | 0.046*** | 0.115*** | | | | -0.008 | -0.007 | -0.004 | | | |
| | (0.023) | (0.006) | (0.015) | | | | (0.005) | (0.016) | (0.018) | | | |
| Eco_free*Market Share | -0.031** | -0.061** | -0.031** | | | | -0.053 | -0.015** | -0.046 | | | |
| | (0.017) | (0.032) | (0.012) | | | | (0.025) | (0.004) | (0.036) | | | |
| Eco_free*HHI | -0.107* | -0.023* | -0.031* | | | | -0.084 | -0.046 | -0.038 | | | |
| | (0.063) | (0.013) | (0.018) | | | | (0.045) | (0.036) | (0.055) | | | |

Table 29: Panel GMM result of market structure, efficiency and freedom on profitability by ownership (Continuation)

| | Foreign Banks | | | | | | Local Banks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | | Model II | | | Model III | | | Model IV | | |
| | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA |
| Eco_free*Boone | 0.053 | 0.038 | 0.107 | | | | 0.092 | 0.069 | 0.053 | | | |
| | (0.018) | (0.011) | (0.028) | | | | (0.024) | (0.057) | (0.021) | | | |
| Eco_free*X-Efficiency | 0.061 | 0.015 | 0.069 | | | | 0.076 | 0.061 | 0.107 | | | |
| | (0.045) | (0.010) | (0.030) | | | | (0.031) | (0.023) | (0.088) | | | |
| Eco_free*S-Efficiency | -0.053 | -0.099 | -0.076 | | | | -0.069 | -0.053 | -0.023 | | | |
| | -0.014 | 0.050 | 0.058 | | | | 0.023 | 0.051 | 0.010 | | | |
| Fin_free | | | | 0.059 | 0.162 | 0.066 | | | | 0.110 | 0.125 | 0.022 |
| | | | | -0.025 | -0.073 | -0.018 | | | | -0.048 | -0.103 | -0.014 |
| Fin_free*Market Share | | | | 0.059 | 0.081 | 0.059 | | | | 0.191 | 0.051 | 0.088 |
| | | | | -0.040 | -0.061 | -0.017 | | | | -0.066 | -0.035 | -0.029 |
| Fin_free*HHI | | | | -0.037 | -0.103 | -0.125 | | | | -0.096 | -0.059 | -0.132 |
| | | | | -0.009 | -0.036 | -0.043 | | | | -0.114 | -0.022 | -0.148 |
| Fin_free*Boone | | | | 0.088 | 0.162 | 0.103 | | | | 0.051 | 0.162 | 0.081 |
| | | | | -0.043 | -0.106 | -0.031 | | | | -0.034 | -0.042 | -0.067 |
| Fin_free*X-Efficiency | | | | 0.206 | 0.191 | 0.103 | | | | 0.096 | 0.176 | 0.206 |
| | | | | -0.057 | -0.202 | -0.030 | | | | -0.076 | -0.102 | -0.115 |
| Fin_free*S-Efficiency | | | | 0.147 | 0.074 | 0.169 | | | | 0.184 | 0.118 | 0.044 |
| | | | | -0.049 | -0.022 | -0.078 | | | | -0.052 | -0.080 | -0.029 |
| Credit risk | -0.024 | -0.071 | -0.063 | -0.039 | -0.047 | -0.063 | -0.024 | -0.047 | -0.047 | -0.039 | -0.071 | -0.071 |
| | -0.020 | -0.035 | -0.017 | -0.011 | -0.036 | -0.018 | -0.016 | -0.014 | -0.047 | -0.034 | -0.036 | -0.032 |

Table 29: Panel GMM result of market structure, efficiency and freedom on profitability by ownership (Continuation)

| | Foreign Banks | | | | | | Local Banks | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | | Model II | | | Model III | | | Model IV | | |
| | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA | ROA | SROE | EVA |
| Capital strength | 0.119 | 0.216 | 0.239 | 0.112 | 0.127 | 0.187 | 0.142 | 0.231 | 0.216 | 0.142 | 0.134 | 0.231 |
| | -0.037 | -0.133 | -0.126 | -0.032 | -0.083 | -0.054 | -0.077 | -0.107 | -0.054 | -0.041 | -0.128 | -0.126 |
| Income Diversification | 0.139 | 0.270 | 0.336 | 0.270 | 0.344 | 0.189 | 0.262 | 0.336 | 0.172 | 0.311 | 0.344 | 0.107 |
| | -0.080 | -0.161 | -0.188 | -0.122 | -0.327 | -0.050 | -0.178 | -0.103 | -0.182 | -0.152 | -0.160 | -0.027 |
| Loan intensity | 0.127 | 0.141 | 0.063 | 0.197 | 0.077 | 0.063 | 0.127 | 0.134 | 0.085 | 0.070 | 0.183 | 0.113 |
| | -0.042 | -0.036 | -0.033 | -0.078 | -0.059 | -0.016 | -0.044 | -0.121 | -0.070 | -0.022 | -0.089 | -0.035 |
| Bank Size | -0.105 | -0.105 | -0.111 | -0.183 | -0.092 | -0.137 | -0.098 | -0.183 | -0.150 | -0.170 | -0.065 | -0.098 |
| | -0.086 | -0.044 | -0.051 | -0.076 | -0.026 | -0.069 | -0.078 | -0.070 | -0.039 | -0.147 | -0.041 | -0.030 |
| Economic dev't | 0.239 | 0.245 | 0.277 | 0.297 | 0.335 | 0.271 | 0.277 | 0.271 | 0.316 | 0.271 | 0.239 | 0.135 |
| | -0.072 | -0.085 | -0.096 | -0.085 | -0.136 | -0.126 | -0.108 | -0.078 | -0.088 | -0.077 | -0.101 | -0.044 |
| Financial Sec dev't | -0.163 | -0.169 | -0.140 | -0.134 | -0.145 | -0.215 | -0.087 | -0.151 | -0.186 | -0.337 | -0.297 | -0.256 |
| | -0.097 | -0.087 | -0.040 | -0.094 | -0.047 | -0.061 | -0.029 | -0.082 | -0.107 | -0.377 | -0.171 | -0.131 |
| Macro. Risk | -0.085 | -0.196 | -0.098 | -0.170 | -0.085 | -0.144 | -0.085 | -0.137 | -0.124 | -0.065 | -0.105 | -0.203 |
| | -0.022 | -0.075 | -0.026 | -0.065 | -0.033 | -0.045 | -0.067 | -0.036 | -0.043 | -0.040 | -0.124 | -0.133 |
| F-test | 22.714 | 22.000 | 31.000 | 24.857 | 23.143 | 26.143 | 26.714 | 31.429 | 30.143 | 31.714 | 23.429 | 25.857 |
| AR(1) p-value | 0.033 | 0.072 | 0.099 | 0.059 | 0.026 | 0.053 | 0.026 | 0.066 | 0.046 | 0.026 | 0.033 | 0.033 |
| AR(2) p-value | 0.127 | 0.147 | 0.157 | 0.206 | 0.216 | 0.245 | 0.206 | 0.186 | 0.118 | 0.186 | 0.235 | 0.127 |
| Hansen p-value | 0.265 | 0.245 | 0.235 | 0.265 | 0.118 | 0.157 | 0.176 | 0.157 | 0.118 | 0.167 | 0.216 | 0.137 |

Source: Author's computation. $^{***}p<0.01$; $^{**}p<0.05$;$^{*}p<0.1$. Robust standard error in parenthesis

Concerning the impact of the economic and financial freedoms on profitability of foreign banks, the story tends to be the other way round. Enhancement of economic and financial freedom tends to positively impact on banks' profitability across all the measures and consistent with the base line regression model. Laeven (2005) again attributed this to the extent to which the foreign firms can diversify and hence needs some level of freedom to operate within the industry, even though, excessive freedom seems to threaten the performance of the local banks. In all cases however, the moderation role of economic and financial freedom in the structure-efficiency-performance relationship appears to be consistent across all the profitability measures in terms of magnitude of coefficients and direction.

"Within the context of the domestic banks, the empirical findings seem to deduce that the costs of excessive freedom in the economy (such as taxes laxities, regulation relaxations and subsidies) may outweigh the social benefits, which could be due to severe resource misallocations. In essence, whenever there are excessive freedom costs involved, the market lead to a level of production and consumption which is below the socially efficient level, even though there may create opportunities for the foreign banks to excel in terms of return on investment." "This is in contrast with a free market, whereby the prospects of monopoly or oligopoly profits may stimulate firms to enhance their research and development activities."

**Summary and Conclusion**

"This study provides new empirical evidence on the potential effect of financial and economic freedom on the market structure -efficiency- profitability relationship in the Ghanaian banking sector. The study covered periods between 2009 and 2018 and controls for a wide array of bank specific characteristics and macroeconomic and financial market conditions variables." "Using system GMM and data from 22 banks in Ghana, we found that concentrated market has a detrimental effect on bank profitability (ROA, SROE and EVA) rejecting the applicability of the structure-conduct-hypothesis in the Ghanaian banking sector." "Also, highly competitive market has an inverse relationship with bank profitability suggesting the rejection of the relative market power hypothesis." "The study observed that, market structure does not have a linear relationship with banks' profitability rather a U-shaped relationship. Also, the study observed a positive relationship between efficiency and banks' profitability, which is an endorsement of the efficiency structure hypothesis." "In addition, both financial freedom and economic freedom show a positive impact on bank profits, even though the negatively mediate the relationship between structure and profitability and positively mediate the relationship between efficiency and profitability."

"The result of the study affirms that financial freedom and economic freedom have conditioning effects on the impact of market structure characteristics on bank profits. It suggests that, that banks operating in a higher concentrated market with higher freedom for banking activities tends to be more profitable than

when operated in highly competitive markets. The empirical findings clearly lend support for greater freedom on the activities which banks could undertake." "The findings is consistent with the view that less regulatory control allows banks to engage in various activities enabling banks to exploit economies of scale and scope and generate incomes from non-traditional sources."

"Controlling for bank specific characteristics and macroeconomic variables, the study observed a pro-cyclical impact of GDP growth on banks' profitability. Likewise, the impact of inflation rate is negative, implying that inflation reduces banks profitability in real terms." "We find that stock markets development is negatively related to banks' profitability, implying that during the period under study, the stock markets in Ghana offer substitution possibilities to the products and services offered by banks to potential borrowers." "Controlling for ownership, it was observed that, restricting economic and financial freedom is detrimental to foreign banks in terms of their profit generating abilities but serves as profitability booster for the local banks."

"It can therefore be concluded that allowing banks greater freedom to operate would enhance their performance, without necessarily damaging the economy, since operating efficiency appears to be a more important reason for the observed profitability than market power." "This suggests that banks may not be earning their income at the expense of the rest of the economy but through more efficient management. Caution should however be exercise not to grant excessive freedom which would be detrimental to the domestic banks."

# CHAPTER EIGHT

# SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

## Summary of findings

Over past four decades, Ghanaian banking industry has undergone through a significant reform which has brought full openness of the banking market to foreign competitors.Over this period, the regulator has been in the process of implementing new rounds of banking reform in an attempt to roll out the Basel III accord and these reforms have been designed to modernise the banking sector of Ghana and enable domestic banks to compete well with foreign banks." "It is argued that, strict regulations and lack of freedom to operate in any economy is an impediment to the growth of the various sectors in the economy in which the banking sector is of no exception.

In this study, it is believed that, the banking reform implemented by the regulator which covers recapitalization, liberalisation and deregulation, have a potential impact on the structure of the banking market, efficiency and performance of the banking sector. Again, it is also believed that, increasing the extent of economic and financial freedom would go a long way of fostering the performance of these banks. In such a context, the regulator, policy makers and bank managers are concerned with whether the banking reform is effective in improving the market structure characteristics and cost efficiency as a way of improving the overall bank performance.Therefore, the primary objective of this thesis is to provide empirical evidence on how market structure and cost efficiency relate to banks' performance

in terms of profitability and the role freedom plays in such relationship. To fulfil this objective, the study used unbalanced panel dataset which covers 22 banks in Ghana with total 205 observations during the period 2009 to 2018.

In providing empirical evidence, first, the cost efficiency level of banks operating in the Ghanaian banking sector was estimated. Seven model were used in such estimation in order to ensure consistency and robustness of the result. These include the fixed effect model, random effect model, Pit and Lee model, Battese and Coelli 1992, Battese and Coelli 1995 true fixed effect and true random effect all of which were based on the stochastic frontier approach. Among these models, the four-time varying models were retained for further analysis due to the significance of the eta. The following findings were made;

(a) The true fixed effect model reports lowest cost efficiency score (58.2%) with the highest standard errors, while the Battese and Coelli, 1995 model reports the highest efficiency score (79.1%) with the smallest deviations. The remaining two models report the overall average cost efficiency score between 60% to 70% which provides an indication of banks within the industry having capability of reducing their costs up to 40% to 30% respectively relative to the cost efficiency of the best practiced bank in the sample.

(b) Efficiency was assessed based on ownership, and it was observed that, some models (such as fixed effect model) reported that on the average, the local banks are cost efficient than their foreign counterpart but models like Battese and Coelli, 1995 and true random effect model reported otherwise.

However, over time, the cost efficiency of the banks appears to be increasing especially after 2016 where the regulator embarked on the banking sector clean up.

(c) It was observed that shadow return on equity is positive for major part of the study period but assumed negative after 2016 during the period of the banking sector recapitalisation. The observed behaviour of the shadow return on equity was attributed to increase in capital ratio due to the recapitalisation of banks as required by the regulator in an effort to meet the requirement of Basel III accord.

(d) Banks were also ranked based on the frontier models and also on the efficiency ratio as applied in the banking industry. The consistency between the frontier models and the accounting-based model was confirmed by Pearson's, Kendall's and Spearman's rank order tests. The correlation coefficients show that efficiency estimates and ranks are consistent between the frontier-based techniques and the non-frontier-based approach.

In conclusion, the empirical results obtained from this study confirms the assertion of the regulator, Bank of Ghana, that cost efficiency of banks in Ghana is enhanced considering the trend of efficiency over the sample period and that, the efficiency gap between the local and foreign banks is reducing over time.

Secondly, market structure characteristics was examined by studying the competition condition in the Ghanaian banking industry by using the Boone indicator with the Panzar-Rosse methodology used as consistency check. It was observed that, from the full sample period estimates, the loan market in Ghana is

the most competitive compared to the other earning asset market and the fee-based services market. Also, over time, competition tends to increase during the latter part of the study period. This observation was confirmed by the Panzar-Rosse model which observed that, even though there appears to be evidence of oligopolistic competition in the middle of the study period, the market exhibited monopolistic competition towards the end of the study period which is consistent with the observation of the Boones indicator.

Finally, the study provides empirical evidence on the potential effect of financial and economic freedom on the market structure -efficiency- profitability relationship in the Ghanaian banking sector using return on asset, shadow return on equity and economic value added as proxies for bank profitability." "The following observations were made;

(a) Concentrated market has a detrimental effect on bank profitability (rejecting the applicability of the structure-conduct-hypothesis in the Ghanaian banking sector). Conversely, a highly competitive market has an inverse relationship with bank profitability suggesting the rejection of the relative market power hypothesis. The study observed that, market structure does not have a linear relationship with banks' profitability rather a U-shaped relationship.

(b) A positive and significant relationship was observed between efficiency and banks' profitability, which is an endorsement of the efficiency structure hypothesis.

(c) In addition, both financial freedom and economic freedom show a positive impact on bank profits, even though the negatively mediate the relationship between structure and profitability and positively mediate the relationship between efficiency and profitability. Thus, the result of the study affirms that financial freedom and economic freedom have conditioning effects on the impact of market structure characteristics on bank profits.

(d) Controlling for ownership, it was observed that, restricting economic and financial freedom is detrimental to foreign banks in terms of their profit generating abilities but serves as profitability booster for the local banks.

It was therefore concluded that allowing banks greater freedom to operate would enhance their performance, without necessarily damaging the economy, since operating efficiency appears to be a more important reason for the observed profitability than market power.

**Policy recommendation**

The empirical findings of this study are not meant only to fill the gap in the literature, but also could be generally applied to emerging economies whose banking system undergoes through a series of reforms similar to that of Ghana. More so, the empirical findings of this study have fundamental implications for policy makers, regulators and managers of bank institutions. The policy implications from this study are summarized as follows.

**Policy recommendation from efficiency study**

The empirical findings of efficiency study indicate that, throughout the study period, the banks in Ghana, as industry, has been operating under diseconomies of scale implying that, their marginal cost of operation always lies below the average operational cost. This suggests that, banks in Ghana are too large to efficiently use their resources available to then and earn profits. Ghanaian banks, especially domestic banks, are considerably over-sized relative to the resources available to them, and hence could improve their scale efficiency by reducing the size in terms of assets to commensurate with their activities.

Moreover, the evidence also shows that domestic banks are less cost efficient than foreign banks. This suggests that domestic banks could mimic or adopt innovative means to enhance their cost efficiency in order to compete well with their foreign counterpart. This may include diverting resources that are not in full employment in other diversified avenues. For instance, moving labour to other diversified activities of the banks could be necessary to improve cost efficiency.

More interestingly, we find a negative shadow return on equity after the re-capitalization process, which drives the level of equity capital away from the long run equilibrium. In other words, banks are required to hold higher level of equity capital than they should in long run equilibrium. As a consequence, holding excessive equity impose significant cost for bank, which will in turn reduce the profitability and efficiency.Therefore, policymakers and regulators should be cautious in implementing recapitalisation programme by comparing the benefit gained from increased capital adequacy ratio with the associated impacts on the banks. Bank of Ghana could also consider implementing ranged minimum capital

requirements where banks are grouped based on either size or ownership, and minimum capital requirement are implemented depending on the size or ownership status rather than the current system of implementing the minimum capital programme.

**Policy recommendation from competition study**

Observations from the study using the Boone indicator shows that, competition tends to increase at the latter part of the study period. This observation was confirmed by the Panzar-Rosse model which also observed that, even though there appears to be evidence of oligopolistic competition in the middle of the study period (2012 and 2013), the market exhibited monopolistic competition towards the end of the study period. This implies that there is still much room for improvement of competition condition in the Ghanaian banking sector in the future. A much more fundamental institutional changes may be required before Ghana can reap the full benefits of increasing competition after this series of reforms. This sort of conclusion may help policy makers and regulators make more efforts for improving competition of the banking system by further liberalizing and creating a more suitable environment for competition such as encouraging the innovation and diversity of financial products and services. The more products and services banks can offer, the more choices customer can have, the more competitive the market is. In addition, although the government has liberalized most of interest rates and deregulated several business segments, the government should reduce the intervention further in order to make banks truly look after interests for the

shareholders rather than government, and let market mechanism play dominant role.

**Policy recommendation from profitability study**

The findings of the study revealed that that there is no strong evidence to support the SCP hypothesis in Ghanaian banking sector as coefficients for market concentration measured were found to be negatively related to bank profitability and statistically insignificant. In contrast, the findings with respect to efficiency hypothesis depicted that the coefficient of efficiency indicators were found to be positively related to bank profitability and statistically significant.

Thus, based on the results, we recommend that, banks should cut down cost in order to be more cost efficient so as to be more profitable because firms with lower costs consequently gain a higher market share. This implies that Ghanaian commercial banks do not earn higher profits by means of colluding with other banks to apply higher profitability; rather, the efficiency of the banks presents an opportunity to earn higher profits. Besides, as argued by Quaden (2002), a more efficient banking sector benefits the real economy by allowing higher expected returns on surplus and lower borrowing costs for investing in new projects that requires external financing. If the banking sector interest rate spread is large, it discourages potential savers due to low returns on deposits and thus limits the financing for potential borrowers. Valverde*et al.* (2007) suggests that only a small fraction of savings will be mobilized into investments by the banking sector if the costs of financial intermediation are high. Therefore, the higher the inefficiency of the banking sector, the higher would be the intermediation costs, thereby increases

the tendency for a larger fraction of savings to be lost in the process of financial intermediation. This would ultimately reduce lending, investment, and consequently economic growth of these countries.

The results of the study have shown that allowing banks greater freedom to operate would enhance their profitability, without necessarily damaging the economy, since operating efficiency appears to be a more important reason for the observed profitability than market power. Specifically, the findings from this study seem to suggest that *overall economic freedom* and *financial freedom* exert positive impacts on the profitability of the Ghanaian banking sector. The positive sign of the coefficient indicates that higher (lower) freedom on the activities that banks can undertake increases (reduces) banks' profitability, which is consistent with the view that less regulatory control allows banks to engage in various activities, enabling them to exploit economies of scale and scope and generate income from non-traditional sources. It is therefore recommended that, government enhance freedom in the financial sector in terms of banking transactions and businesses banks can engage. Caution should however should be exercise not to excessively open up the banking sector which in this case likely to expose the sector to possible threat and risk of money laundering which may eventually lead to the breakdown of the banking system.

**Suggestions for the Future Research**

For future research, the study may be conducted by considering a cross country studies instead of single country." "Cross country studies may be necessary to bring out differences in determinants of bank profitability."

Research on economic freedom is still at an early stage and therefore much more remains to be done. As a suggestion for future studies, a refined statistical tests and further development of the economic freedom index could be adopted. Besides, an analysis of which components of the economic freedom index could further be developed in order to determines the scope of economic freedom.

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