UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

PROFIT EFFICIENCY AND CAPITAL STRUCTURE OF BANKS IN GHANA: A DEA APPROACH

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DEPARTMENT OF FINANCE

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DECLARATION

I do hereby declare that this work is the result of my own research undertaken under supervision and has not been presented by anyone for any academic award in this or any other university. All references used in the work have been fully acknowledged.

I bear sole responsibility for any shortcomings.

…… ……

SANDRA NAANA AYIKU DATE

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CERTIFICATION

I hereby certify that this thesis was supervised in accordance with procedures laid down by the University of Ghana.

…….. ……..

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DR. GODFRED ALUFAR BOKPIN DATE

(CO-SUPERVISOR)

DEDICATION

This work is dedicated to my beloved parents, Mr. Alan Doe Ayiku and Mrs. Felicia Owusu Ayiku for their encouragement throughout the period of my studies.

ACKNOWLEDGEMENT

I thank the Almighty God for all His wisdom, strength, and mercies throughout the period of this study.

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ACCESS	-	Access Bank Ghana Limited
ADB	-	Agricultural Development Bank
AMAL	-	Amalgamated Bank
ATM	-	Automated Teller Machines
BARODA	-	Bank of Baroda
BBG	-	Barclays Bank Ghana
BCC	-	Banker, Charnes and Cooper
BI	-	Boone Indicator
BOA	-	Bank of Africa
BOG	-	Bank of Ghana
BS	-	Bank size
BSIC	-	Banque Sahelo-Saharienne
CAL	-	Cal Bank Ghana Limited
CCR	-	Charnes, Cooper and Rhodes
CRS	-	Constant Returns to Scale
CSFP	-	Capital Structure-Firm Performance
DEA	-	Data Envelopment Analysis
DGP	-	Data Generating Process
DMU	-	Decision Making Units
EBG	-	Ecobank Ghana Limited
ECAP	-	Equity Capital
ENERGY	-	Energy Bank
ERP	-	Economic Recovery Program
EU	-	European Union

FABL	-	First Atlantic Bank
FBL	-	Fidelity Bank
FEAR	-	Frontier Efficiency Analysis with R
FINSAP	-	Financial Sector Adjustment Program
GCB	-	Ghana Commercial Bank Limited
GDP	-	Gross Domestic Product
GM	-	Gross Profit Margin
GMM	-	Generalized Method of Moments
GSS	-	Ghana Statistical Service
GTB	-	Guaranty Trust Bank
HFC	-	HFC Bank
HHI	-	Herfindahl Hirschman Index
IBG	-	Intercontinental Bank
ICB	-	International Commercial Bank
IMF	-	International Monetary Fund
METRO	-	Metropolitan and Allied Bank
NIB	-	National Investment Bank
NPV	-	Net Present Value
OLS	-	Ordinary Least Squares
OWN	-	Ownership
PBL	-	Prudential Bank
REG	-	Regulation
ROA	-	Return on Assets
ROE	-	Return on Equity
ROYAL	-	Royal Bank
SCB	-	Standard Chartered Bank

SFA	-	Stochastic Frontier Analysis
SG-SSB	-	Societe Generale Ghana Limited
SME	-	Small and Medium Scale Enterprises
STANBIC	-	Stanbic Bank
TE	-	Technical Efficiency
TTB	-	The Trust Bank
UBA	-	United Bank of Africa
UMB	-	Universal Merchant Bank
UNIBANK	-	Unibank Ghana Limited
UT	-	UT Bank
VIF	-	Variance Inflation Factor
VRS	-	Variable Returns to scale
ZENITH	-	Zenith Bank

ABSTRACT

Using a nonparametric DEA approach, this study estimates the profit efficiency of 26 banks in Ghana over the period 2000 to 2013. This is compared to the estimates of two profitability ratios, ROA and ROE. The study then examines the influence of capital structure on the estimated profit efficiency and the extent to which the degree of competition measured by the Boone Indicator and the Herfindahl Hirschman Index influences the capital structure-profit efficiency nexus. The extent to which a bank's ownership of a subsidiary (conglomeration) impacts the capital structure-profit efficiency link is also investigated. Two competing hypotheses-the efficiency risk and franchise value hypothesis are also tested to summarize the bi–causal relationship that exists between profit efficiency and capital structure.

The results reveal that banks in Ghana operate close to the benchmark profit frontier and are 79% profit efficient. A comparison of the nonparametric DEA profit efficiency indicator with the profitability ratios suggest that these methods agree weakly on the performance of a bank. For the impact of capital structure on profit efficiency, the study found support for the trade-off and agency cost theories of capital structure. It was also found that competition and conglomeration do not necessarily influence the link between capital structure and profit efficiency of the banks. The study further found support for the efficiency risk hypothesis which indicates that profit efficient banks in Ghana choose more leverage relative to equity in financing their operations.

CHAPTER ONE
INTRODUCTION

1.1 Research Background

One of the important decisions a firm must make towards achieving its objective of value maximization pertains to its capital structure (Fosu, 2013; Margaritis & Psillaki, 2010; Berger & Bonaccorsi di Patti, 2006; Modigliani & Miller, 1958). This is because, the ability to choose the appropriate combination of equity and debt can help the firm solve some of the challenges it faces in its quest to maximize the returns of its stakeholders. For instance, in an attempt to solve the problems of agency which originates from the separation of power between managers and owners, a firm may employ more debt as opposed to equity in financing its operations (Armen, Gayane & Hassan, 2004; Harvey, Lins & Roper, 2004; Williams, 1987; Grossman & Hart, 1982). Wruck (1995) contended that the use of greater debt (125% and 65% of the book and market values of their assets respectively) placed management under pressure to make efficient gains which kick started a remarkable improvement in Sealed Air Corporation's performance.

Capital structure decisions are also important because firms operate in open systems (Pearce & Robinson, 2009). This means, each firm is dependent on other institutions which provide essential resources for its operations. In this regard, for a firm to strategically position itself in the competitive industry, suitable decisions regarding its capital structure must be adopted (Abor, 2005). One industry where capital structure decisions are particularly important is the banking industry. This is because unlike other industries, agency costs are large in the banking industry. This stems from the fact that banks are informationally opaque (banks hold confidential information regarding their borrowers and other creditors) and this makes them vulnerable to

increased agency costs. In addition, deposit insurance by government gives banks the incentives to increase risks (Margaritis & Psillaki, 2010, 2007; Pennacchi, 2006) which they can achieve by either increasing their assets or their leverage (Berger & Bonaccorsi di Patti, 2006). These risk-increasing-methods may increase the costs of agency for both equity holders and debt holders. For instance, the cost incurred in appointing board of directors to efficiently monitor and provide valuable advice for running the bank by equity holders (de Andres & Vallelado, 2008).

Similarly, banks, by their nature engage in multiple and seemingly opposing roles which leaves them exposed to runs (Cebenoyan & Strahan, 2004; Diamond & Dybvig, 1983). These roles include, providing liquidity on demand to depositors and extending credit to borrowers (Berger & Bouwman, 2009; Kashyap, Rajan & Stein, 2002). Due to these fundamental roles, banks are usually apprehensive with their liquidity and solvency risks (Amidu, 2007). Traditionally, banks have reduced these risks by holding capital as a buffer for insolvency and liquid assets to meet unexpected withdrawals by depositors (Saidenberg & Strahan, 1999). Today, the risks associated with banks have come under increasing scrutiny with regulators setting minimum capitals (equity) for bank operations consistent with the provisions stipulated under the Basel Capital Accords. Thus, the success of banks depends largely on their ability to effectively and efficiently utilize the debt (leverage) they generate from their customers and other financiers.

It has been argued in the banking and finance literature that, financial intermediation pursued by banks, play crucial roles in the economic development and growth of most countries (Levine, Loayza & Beck 2000; Levine, 1997). For example, banks ignited industrialization in England through the mobilization of capital and spurred technological advancement by recognizing and funding individuals capable of implementing state-of-art production processes and products

(Schumpeter, 1912; Hicks, 1969). In the Ghanaian context, the banking industry is considered to be the driver of the services sector, which contributed about 49.5% of Gross Domestic Product (GDP) in 2013 (GSS, 2014). This implies that bank efficiency may have positive ripple effects on other sectors of the economy. Nonetheless, these value-enhancing effects of banks may not be fully attained without a careful consideration of banks' capital structure.

Within the capital structure-firm performance (CSFP) nexus, literature argues that, over-reliance on outside financing may impede the ability of a firm to fight competition and in turn allow its contenders to pursue predacious market strategies (Fosu, 2013; Campello, 2003). For example, in a perfectly competitive (unconcentrated) banking industry characterized by fixed prices of outputs, the more leverage a bank uses relative to its competitors, the higher interest incomes it is expected to generate. This is because in perfectly competitive markets, the success of business entities depends on their abilities to generate more outputs relative to their rivals. Conversely, in an uncompetitive industry, the use of more leverage given a constant demand may allow rivals to predate. Thus, the effect of leverage on performance/efficiency may depend on the degree of competition in the related industry (Campello, 2003, 2006; Kovenock & Phillips, 1997).

The literature further argues that, conglomeration or diversification has potential benefits and costs effects on firm performance (Low & Chen, 2004; Berger & Ofek, 1995). For instance, the size of a diversified firm may enable it enjoy greater debt capacity than a firm that focuses on single product lines (Amihud & Lev, 1981; Lewellen, 1971). Further, through diversification, unsystematic risks are reduced and the interest tax shield related to debt utilization is higher. Conversely, a diversified firm has the potential of investing in projects with negative Net Present Values (NPV) due to its accessibility to discretionary cash flows. It may also engage in cross

subsidization, where the firm disgorges cash from a well performing business segment to a less performing segment (van Lelyveld & Knot, 2009; Rajan, Servaes & Zingales, 2000) which may be detrimental to its value. These arguments suppose therefore that highly levered firms such as banks could reduce the chances of costly financial distress and bankruptcy (Berger, Hasan & Zhou, 2010) if benefits accrue from diversification. Thus, the performance effect of capital structure may also depend on whether or not the firm in question is a conglomerate or has a subsidiary.

Studies on the CSFP nexus have particularly paid attention to listed firms (Antwi, Atta Mills & Zhao, 2012; Cheng, Liu & Chien, 2010; Chakraborty, 2010). It is important, however, to consider the CSFP link among service firms, including banks due to the level of risks associated with banks and their contribution to the overall GDP. Moreover, with the level of competition in the banking industry, which stems from globalization, liberalization (Addison, 2003) and technological advancement (Berger, 2007), it is essential to assess how competition and capital structure jointly affect bank efficiency. The increasing trend toward bank consolidation also necessitates a study into the interaction effects of capital structure and conglomeration/consolidation on the efficiency of banks (Nicoló, Bartholomew, Zaman & Zephirin, 2004).

The central aim of this study therefore is to estimate the non-parametric profit efficiency of banks in Ghana, to examine the impact of capital structure on the estimated profit efficiency via a bootstrapped truncated regression (Simar & Wilson, 2007). The study also considers the potential reverse causation between capital structure and profit efficiency, investigates the joint effects of capital structure and competition, and capital structure and conglomeration on the estimated profit efficiency of banks. Policy implications and recommendations are provided. The novelty and contributions of the study are discussed in due course.

1.2 Problem Statement

Over the past decades, several authors have investigated the CSFP nexus. However, the evidence from empirical studies on this nexus are mixed. For example, whereas some studies report a positive relationship (Fosu, 2013; Kyereboah-Coleman, 2007; Ghosh, Nag & Sirmans, 2000; Champion, 1999; Roden & Lewellen, 1995) others report a negative relationship (Chakraborty, 2010; Booth, Aivazian, Demirguc-Kunt & Maksimovic, 2001; Rajan & Zingales, 1995; Titman & Wessel, 1988) and still others report no significant relationship (Ebaid, 2009). Other studies also report varied results for the different leverage ratios (Arbabiyan & Safari, 2009; Abor, 2007). Arbabiyan and Safari (2009), for instance, report a positive nexus between profitability and short term debt and a negative nexus between profitability and long term debt.

The mixed empirical findings on the CSFP link is probably because previous studies employed financial ratios as proxies for performance and did not consider potential reverse causation from performance to capital structure (Margaritis & Psillaki, 2010; Berger & Bonaccorsi di Patti, 2006). Ohene-Asare (2011) argued that although financial ratios make it easier to assess firm performance, they are sometimes difficult to interpret when firms are from different industries (see also Sherman & Gold, 1985). Besides, the number of ratios that can be generated from financial statement data are unlimited and sometimes provide contradictory and confusing results (Paradi & Zhu, 2013).

Similarly, Paradi, Yang and Zhu (2011) argued that, in computing each ratio, a single input and output are employed, which may confound the result to an aspect of the firm's operations. This is because, firms use several inputs and outputs in their operations. Thus, assessing their efficiency necessitates the use of more than a single ratio (Smith, 1990). Furthermore, financial and

accounting ratios tacitly assume constant returns to scale which imply that size does not matter (Smith, 1990). But in real market systems like that of banking, where competition is not perfect and market power differs (Ohene-Asare, 2011), financial ratios may not always be applicable and useful. Rather, a technique capable of capturing several inputs and outputs concurrently, such as the Data Envelopment Analysis (DEA) developed by Charnes, Cooper and Rhodes (1978) can be employed to assess relative efficiency/performance. To the best of the author's knowledge, only Margaritis and Psillaki (2010) have used DEA to evaluate productive efficiency in the CSFP nexus.

However, Margaritis and Psillaki (2010) failed to bootstrap the second-stage truncated regression analysis in which the efficiency scores obtained were regressed on capital structure and some other environmental factors. Bootstrapping is a computer intensive method which through replications or resampling, simulates the data generating process and applies the original efficiency estimator to every replicated sample so that the efficiency estimator can imitate the sampling distribution of the original efficiency estimator (de Borger, Kerstens & Staat, 2008; Simar & Wilson, 1998). Simar & Wilson (2007, 2011) proposed a double-bootstrapped truncated regression when undertaking a second-stage regression where the efficiency estimates are regressed on some environmental covariates. These are necessary because the first stage efficiency estimates are serially correlated with the inputs and outputs in an unknown (in a statistical sense) and complicated way This dependency issue, also imply that the stochastic error is correlated with the environmental variables making inferences inconsistent and bias. But, the bootstrapping helps to conduct statistical inferences and correct statistical biases associated with this analysis (Simar & Wilson, 2011, 2007, 2000; Barros & Assaf, 2009)

On the issue of reverse causation, Margaritis and Psillaki (2010) and Berger and Bonaccorsi di Patti (2006) argued that, there is a two-way relationship between capital structure and performance. As such, not only does the choice of a firm's capital structure influence its efficiency but also, the efficiency of a firm influences the choice of capital structure. For instance, when a firm is efficient (that is when it is able to use given resources to generate more outputs or is able to reduce inputs while maintaining the outputs), it is more likely to earn a higher return. This places the firm in a better position to employ more debt since the cost of bankruptcy and financial distress diminishes (Berger & Bonaccorsi di Patti, 2006). In effect, considering just one aspect of the nexus as have been examined by most authors in previous studies (Fosu, 2013; Antwi et al., 2012; Kyereboah-Coleman, 2007; Abor, 2005) violates the assumption of the 'classical linear regression' that the explanatory variables should be exogenous (Brooks, 2008 pp. 44) and biases the results they generated.

Another limitation of earlier studies is that, they failed to incorporate conglomeration or diversification, which may interact with capital structure to impact on firm performance (Amihud & Lev, 1981; Lewellen, 1971). Theoretical arguments pertaining to diversification propose that, diversification can either enhance or reduce the value of a firm's performance (Low & Chen, 2004; Berger & Ofek, 1995). One of these value-enhancing effects are the tax benefits associated with the greater debt capacity that the firm enjoys. This seems to suggest that, the value of a diversified firm one way or the other depends on the benefits and costs that it generates from operating as a conglomerate. Owing to these benefits and costs therefore, it is important that, in assessing the performance (specifically, in this case, the profit efficiency) of a diversified firm, the joint effects of conglomeration and leverage be considered.

Besides, Chevalier and Scharfstein (1996) argued that leverage constrains a firm's ability to compete in a highly concentrated market (uncompetitive industry). This is because with leverage, the firm may be compelled to charge a higher price than its rivals, which limits the profits it generates and hence its performance. Conversely, Brander and Lewis (1986) suggested that, leverage enables a firm to compete aggressively in a concentrated product market because leverage offset costly agency problems. These arguments presuppose that competition must be incorporated in analysing the CSFP nexus. However, to the best of the author's knowledge, with the exception of Fosu (2013) who proxied competition with both Herfindahl Hirschman Index (HHI) and Boone Indicator (BI), none of the earlier studies considered CSFP nexus in the presence of competition.

Another essential issue is that, preceding studies employed samples pertaining to different industries. Most of the studies with the exception of Fosu (2013) and Berger and Bonaccorsi di Patti (2006) included firms from different industries despite the differences in firm-specific conditions. Using samples from different industries can make it difficult to choose appropriate proxies (Griffin & Mahon, 1997). This stems from the fact that, each industry may have different regulatory systems, different stakeholders and peculiar attributes that distinguish it from other industries (Rowley & Berman, 2000). In effect, combining these industries would warrant disentangling the individual industry specific effects for accurate results to be generated.

Primarily, this study reconciles the irregularities in previous studies by employing profit efficiency as a proxy for the performance of banks in Ghana to complement the standard financial and accounting ratios e.g. Return on Assets (ROA) and Return on Equity (ROE). In addition, the study bootstraps the second-stage regression analysis, which appears to have been neglected in both the banking efficiency literature and the CSFP nexus literature. The study advances prior methodology

by considering the likelihood of reverse causation from profit efficiency to capital structure which has also not been examined in Ghana. Furthermore, it considers how competition and capital structure jointly influence the profit efficiency of banks and how conglomeration and capital structure jointly affect the profit efficiency of banks.

1.3 Gaps and Contributions

From the problem statement, five (5) gaps have been identified in the literature on banking efficiency and CSFP link. The first, which is a methodological gap is the use of financial ratios in assessing firm performance (Fosu, 2013; Kyereboah-Coleman, 2007; Abor, 2005) as opposed to efficiency measures using DEA. The second gap is the limited use of bootstrapping in the second-stage non-parametric frontier estimations. The third gap is the failure to consider the interaction effect of capital structure and competition on profit efficiency. The fourth gap is the failure to incorporate the interaction effect of capital structure and conglomeration on profit efficiency. The final gap is the lack of consideration of the reverse causation from profit efficiency to capital structure.

This study contributes to the existing literature by complementing the financial ratios employed in exploring the CSFP link with frontier efficiency techniques and bootstrapping the second-stage regression to resolve the potential serial correlation. The study also incorporates the interaction effect of conglomeration and capital structure as well as the effect of competition and capital structure on the profit efficiency of banks. Finally, it considers reverse causality of CSFP nexus and provides policy recommendations.

1.4 Research Objectives

The central objective of this research is to assess the profit efficiency of banks and to investigate the CSFP nexus. The specific research objectives are:

a. To evaluate the performance of banks in Ghana using a non-parametric measure of profit efficiency.
b. To examine the marginal effect of capital structure on bank performance using both profit efficiency estimates and profitability ratios.
c. To investigate the interaction effect of capital structure and competition on the profit efficiency of banks in Ghana.
d. To investigate the interaction effect of capital structure and conglomeration on the profit efficiency of banks in Ghana.
e. To analyse the effect of profit efficiency on capital structure using two competing hypotheses (the efficiency-risk and franchise value hypotheses).

1.5 Research Questions

To achieve the research objectives, the following questions are addressed.

a. What are the profit efficiency estimates of banks in Ghana?
b. Does capital structure have a significant effect on the profit efficiency and profitability of banks in Ghana?
c. To what extent does the impact of capital structure on the profit efficiency of banks in Ghana depend on the degree of competition?

d. To what extent does the impact of capital structure on the profit efficiency of banks in Ghana depend on conglomeration?
e. What is the bi-directional relationship between profit efficiency and capital structure?

1.6 Significance of the Study

There are immense benefits toward research and practice. For starters, this study contributes to the existing body of knowledge on the CSFP nexus in a non-parametric frontier efficiency framework by using profit efficiency scores to proxy firm performance instead of the currently used financial ratios. Furthermore, the study contributes to the existing literature by examining the interaction effect of capital structure and conglomeration as well as that of capital structure and competition on the profit efficiency of banks in Ghana. With respect to practice, the study provides the bank with a more holistic depiction of how performance can be improved based on its leverage decisions. Moreover, in computing the HHI and the BI, management is informed about the competitive nature of the industry and how it affects their performance. The interaction effect of conglomeration and capital structure also informs management on whether conglomeration decisions influence the bank's performance significantly.

1.7 Limitations of the Study

Although, the study contributes significantly to both practice and research, there are a few challenges. One of these challenges pertains to the fact that the study uses only universal banks without including rural banks which causes dimensionality problems. This problem can be mitigated by augmenting the sample to include banks from other African countries. With this,

more policy recommendations centered on the African financial landscape can be brought to bear on the analysis. But this is not possible due to data unavailability. Further, the disintegration of profit efficiency into technical and allocative efficiencies would have helped to determine the real source of performance. The study looks at static profit efficiency, but could have been extended to profit productivity which could reveal patterns and trends of performance over time. Finally, the quality of this study to a large extent depends on the reliability and accuracy of the data sourced from the Bank of Ghana (BOG).

1.8 Chapter Disposition

The study is divided into six chapters with sub-chapters. Chapter one covers the background of the study area, problem statement, gaps and contributions, the objectives of the study, research questions, the significance of the study and its limitations. Chapter two reviews the scholarly literature and considers the opinion of several authors on the CSFP nexus. In chapter three, an overview of the banking industry since the year 2000 is provided. The methodology of the research is discussed in chapter four. This chapter highlights the study area, source of data, study population and the mode of data analysis. Chapter five entails the data presentation, analysis, discussion and findings. Chapter six consists of the summary, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews scholarly articles and books published by researchers on capital structure and firm performance. For starters, it focuses on the various capital structure theories and firm performance, and the hypotheses related to the reverse causation of performance from capital structure. Subsequently, the chapter discusses the literature pertaining to the interaction effects of competition and conglomeration on the CSFP nexus and then empirically reviews studies on the various objectives of this study. Relevant literature on profit efficiency in the banking industry is also reviewed.

2.2 Theoretical Review

2.2.1 Capital Structure Theories and Firm Performance

The CSFP nexus has been the focus of considerable debate, both theoretically and empirically. Since the seminal work of Modigliani and Miller (1958) who argued that, in a frictionless world (a perfect market characterized by no transaction costs and taxes and the existence of homogenous expectations), the value of a firm is independent of its capital structure, the emphasis throughout prior literature has been whether there is an optimal capital structure for a firm and whether or not the use of debt relative to equity is relevant for a firm (Hatfield, Cheng & Davidson, 1994). To understand the CSFP link, preceding studies have explored the trade-off, the pecking order and the agency cost theories of capital structure.

The classical version of the trade-off theory dates back to Kraus and Litzenberger (1973), Scott (1976) and Kim (1978). This theory is based on the idea that, bankruptcy costs and taxes constitute market deficiencies which are fundamental in determining the effect of leverage (capital structure) on market value. The theory postulates that, there exists an optimal level of capital structure for the maximization of firm value (Frank & Goyal, 2009). At this optimal level, the marginal benefits and costs of debt are equal (Fama & French, 2002). Again, the use of debt is cheaper than the use of equity to finance a firm because interest charges on debt are tax deductible. This notion of tax deductibility implies that, debt-financed firms are capable of increasing their performance or efficiency than their counterparts who are highly equity financed. This is because, the amount to be paid as corporate taxes are lower for levered than for unlevered firms.

Similarly, corporate interest deductibility encourages profitable and less volatile firms to use higher leverage suggesting a positive link between firm performance and leverage. However, the excessive use of debt is risky due to the possibility of bankruptcy and its accompanying costs (bankruptcy costs) (Titman, 1984). Bankruptcy costs are the costs incurred when the perceived tendency of default on debt financing is positive (Abor, 2005; Haugen & Senbet, 1978). To ensure that they do not employ debt to a point where they may default on their debt obligations, firms fix a target ratio, which is determined by the trade-off between the advantages (tax deductions) and the costs (bankruptcy) of debt. In effect, the value of a levered firm using the trade-off theory, includes the value of an unlevered firm plus the present value of the advantages related to tax minus the discounted value of bankruptcy and agency costs (Cheng et al, 2010).

Another theory of capital structure is the pecking order theory, a concept attributable to Myers (1984) and Myers and Maljuf (1984). The theory contends that, there is no optimal target ratio - a

ratio that balances the tax savings on debt with the costs of bankruptcy. Instead, to minimize the existence of information asymmetry (the fact that managers are better informed about the profitability and prospects of the firm than outside investors) and its associated financing costs, there is a hierarchy for firms with regards to financing their investments. For example, with private information, managers are more likely to issue risky securities when they are overpriced than when they are underpriced.

Due to this information asymmetry, the issue of new equity to finance new projects by firms are underpriced by the investors (Harris & Raviv, 1991). This is to enable the investors gain more on the project's value resulting in a loss to existing shareholders. In anticipation of these price discounts by investors, managers may forgo profitable projects where these projects are required to be financed by risky securities leading to underinvestment. In order to avoid this problem of underinvestment, the onus lies on the firm to finance with a security that may not be underpriced by the market such as retained earnings and riskless debt (Baker & Wurgler, 2002).

The pecking order theory therefore stipulates that, firms, finance their needs with internal funds (retained earnings) first, then debt if extra funds are required and finally equity to cover any additional capital requirements (Myers & Maljuf, 1984). This does not mean the theory denies the significance of taxes and bankruptcy costs in the choice of capital structure. It does suggest however that, managers consider taxes and bankruptcy costs less important than their dispositions for internal over external funds and debt over new issues of stock in financing their operations (Brealey, Myers & Marcus, 2001). Thus, profitable firms use more internal funds in financing their operations, suggesting a negative link between capital structure and firm performance.

Similarly, with the existence of information asymmetry between investors and managers, the relative costs of different sources of finance vary. For example, with retained earnings where the fund provider is the firm, and hence has an advantage of acquiring available information relative to outside investors, these investors would prefer higher return rates on their investments (Abor, 2005). This implies that, the costs of the various financing options to the firm depend on the hierarchy of its financing preferences. To avoid paying higher rates of returns to investors therefore, it behoves on a firm to make appropriate decisions regarding its capital structure in order to be more profitable and efficient.

Based on the theory of asymmetric information, Ross (1977) introduced the signalling effect theory. The theory postulates that managers are aware of the return distribution of their firms than outside investors. In view of this managers are advantaged when security issues are highly priced by the market but are punished if the firm goes bankrupt. The theory also presumes that, participants in the market interpret higher levels of debt as signals of higher future cash flows and quality of the firm. Thus, an efficient firm which is capable of avoiding bankruptcy costs will resort to more debt than a less efficient firm (Barclay, Smith & Watts, 1995).

Building on the early works of Fama and Miller (1972), Jensen and Meckling (1976) initiated the agency cost theory. The agency theory postulates that there is a conflict of interest between shareholders (principals) and managers (agents) of firms. Managers have a tendency to waste free cash flow. Thus, the greater the amount of discretionary funds available to a manager, the higher the likelihood of empire building (Jensen, 1986). This implies that, managers are more likely to increase the scale of their firms even if that means reducing the value of the firm or engaging in poor projects. To mitigate this problem of overinvestment, debt financing is used as a control

mechanism and thus assumes a positive nexus between leverage (capital structure) and firm performance.

The costs associated with agency problems also exist between shareholders and debt holders. This conflict primarily arises from the risks of default associated with employing higher leverage which in turn creates the underinvestment problem hypothesized by Myers (1977). Shareholders prefer higher risks since these risks translate into higher returns. On the other hand, higher risks are detrimental to debt holders who are the residual claimants of returns in bad states due to the limited liability nature of firms (Brander & Lewis, 1986). Hence, in situations where a firm is already levered, debt holders may require higher rates of return on their investments. This decision upsurges the cost of borrowing of the firm and reduces its efficiency/value.

2.2.2 Hypothesis on Reverse Causality from Firm Performance to Capital Structure

The CSFP linkage literature has argued that there exists a bi-directional causal relationship between leverage and firm performance (Harvey, Lins & Roper, 2004; Demsetz & Villalonga, 2001; Rajan & Zingales, 1995). On one hand, the amount of leverage employed by a firm determines how well it would perform. On the other hand, the performance of the firm can determine the proportion of leverage that the firm would employ in financing its operations. Put simply, the degree of a firm's efficiency may place it in a better position to replace equity with debt. This leads to the efficiency-risk and franchise value hypotheses of the reverse causation of performance from capital structure introduced by Berger and Bonaccorsi di Patti (2006).

The efficiency-risk hypothesis states that, an efficient firm would employ higher leverage in its operations than a less efficient firm. This is because higher efficiency reduces the cost of financial

distress and bankruptcy. The efficiency-risk hypothesis is therefore a byproduct of the trade-off theory in that, the dissimilarities in the levels of efficiency allow the optimal capital structure of a firm to be altered (Berger& Bonaccorsi di Patti, 2006). The franchise value hypothesis presumes that, in the attempt to protect the economic rents associated with higher efficiencies from the threat of insolvency, firms that anticipate high rates of efficiency into the future select lower debt ratios (Berger & Bonaccorsi di Patti, 2006; Demsetz, Saidenberg & Strahan, 1996; Demsetz, 1973).

2.2.3 Capital Structure, Competition and Firm Performance

Theoretical extensions of the CSFP relationship propose that over-reliance on outside financing may prevent a firm from competing well with its contenders who will take advantage of that to pursue predacious market strategies since they may have lesser costs to repay (Dasgupta & Titman, 1998; Chevalier & Scharfstein, 1996; Bolton & Scharfstein, 1990; Telser, 1966). This suggests that, the effect of leverage on performance should be conditioned on the extent of competition in the related industry (Fosu, 2013). Brander and Lewis (1986) argue that, given the limited liability nature of firms, which makes debt holders the residual claimants of returns, the use of debt enables a firm to compete aggressively in a concentrated (uncompetitive) product market. This in turn mitigates the agency conflicts that exist between shareholders and managers and improves the performance of the firm. At the same time, the use of debt, which induces firms to produce more may improve the performance of the firm in a Cournot environment (Bolton & Scharfstein, 1990). In view of this, the effect of leverage on firm performance may not be direct. It may depend on the level of competition in the related industry.

Chevalier and Scharfstein (1996) also note that leverage restricts the ability of a firm to invest in market shares due to the risk of default. In the case of a concentrated market for example, this

restriction may allow rivals to predate on the leveraged firm. Consistently, firms that are highly leveraged charge higher prices than the less leveraged ones during a downturn. In this regard, leveraged firms are anticipated to be underprivileged in terms of competition in concentrated or uncompetitive industries. In another development, Opler and Titman (1994) suggest that highly leveraged firms lose market shares to their less leveraged counterparts when there is a dip in the industry and this lost is intense for firms in concentrated product markets.

Further, the debt contracts associated with debt financing create opportunities for other firms to have a competitive advantage over the leveraged firms (Fosu, 2013). This is because, the use of debt obliges the firm to make periodic interest payments to the creditors. This has the tendency of reducing current period profits, which enable rivals to predate on the leveraged firm for the period in which positive benefits accrue to the rival firm (Bolton & Scharfstein, 1990). For example, in a highly concentrated industry characterized by lower competition, it is expected that the rival firms would predate more on the leveraged firm than they would if the leveraged firm were operating in an unconcentrated industry. In effect, the magnitude of losses that accrues to the leveraged firm decreases with the degree of competitiveness in the industry (Fosu, 2013). Put differently, the performance effect of leverage for a firm may depend on the interaction between leverage and the extent of competition in the firm's industry. Thus, it is essential to consider these interactions when examining the link between capital structure and firm performance.

2.2.4 Conglomeration and Firm Performance

The concept of conglomeration and its effect on firm performance has also been discussed in the banking and finance literature. Conglomeration in general can be traced to the emergence of environmental factors such as technology (which has reduced information and telecommunication

costs) and deregulation in the modern era (Nicoló et al., 2004). The motives for conglomeration in firms have been predicted to include diversification and economies of scope (Chronopoulos Girardone & Nankervis, 2011). Theoretical arguments stipulate that, conglomeration or diversification have both value-maximizing and reducing effects (van Lelyveld & Knot, 2009; Low & Chen, 2004; Berger & Ofek, 1995).

Among the arguments for the value maximization effect of conglomeration include revenue and cost economies of scope (Chandler, 1977), lower tax burdens (Lewellen, 1971), efficient internal markets and better control and monitoring of capital expenditures (Schmid & Walter, 2009). Lewellen (1971) arguing in support of the value maximizing capability of conglomeration suggests that, diversified firms enjoy greater debt capacity than their counterparts that focus on single product lines. This is because, a byproduct of greater debt is the interest tax shield that the firm can enjoy. In the same line, Weston (1970) and Chandler (1977) argue that, with conglomeration, firms enjoy economies of scale which make them efficient in their operations.

Less optimistic theories followed by Berger and Ofek (1995) and Rajan et al. (2000) contend that conglomeration is associated with significant reductions in firm value. This originates from the fact that, conglomerates are more likely to support investments in segments with poor growth opportunities. To bolster this argument, Meyer, Milgrom and Roberts (1992) suggest that a firm that focuses on a single product line produces lower losses as compared to diversified firms because they are less likely to invest in negative cash flow projects. These debates presuppose that, diversification or conglomeration relative to focus has the tendency of influencing firm performance. In effect, when examining the relationship between capital structure and firm

performance, it is imperative to consider the joint effect of conglomeration and capital structure on the performance of a firm where the firm in question engages in multiple product lines.

2.3 Empirical Review

2.3.1 Capital Structure Theories and Firm Performance

Empirical studies on the CSFP nexus have provided mixed and murky results. There is no consensus on the direction of association as empirical evidence have pointed towards positive (trade-off theory), negative (pecking theory), and no relationship (irrelevance theory). For example, whereas Fosu (2013), Margaritis and Psillaki (2010) and Berger and Bonaccorsi di Patti (2006), report a positive relationship, Chakraborty (2010) and Chung et al., (2013) document a negative relationship and Ebaid (2009) report no significant relationship. These differences in empirical reasoning seem to be influenced by the sample selected, the methodological approach used and most especially the context of the study.

As regards the sample selected as a reason for the differing results established in previous studies, emphasis would be placed on the papers by Shyam and Myers (1999), Frank and Goyal (2003) and Lemmon and Zender (2010). By employing a smaller sample (157 firms), Shyam and Myers (1999) in testing the trade-off theory against the pecking order model of capital structure in the United States, over the 1971-1989 period, found support for the pecking order theory. This means that, due to the costs associated with the various financing preferences, the firms in their sample resorted to retained earnings as the primary source of financing before considering debt and then equity. Thus, a negative relationship was established between capital structure and profitability.

Contrary to this view, Fama and French (2002) and Frank and Goyal (2003) established that, the pecking order theory did not persist when a larger sample and a longer time series was employed. For example, using publicly traded U.S firms which included the sample employed by Shyam and Myers from 1971 to 1998, Frank and Goyal, documented that, high and small growth firms, which were more likely to face potential information asymmetry problems, were the primary issuers of equity whereas, large and mature firms, which were less likely to face problems of information asymmetry, issued debt which contradicts the predictions of the pecking order theory.

However, Lemmon and Zender (2010) suggested that, the issue of equity by the small and high growth firms does not necessarily contradict the pecking order theory. Rather, the issue of debt or equity by a firm depends largely on its debt capacity constraints which are mostly motivated by demand and supply considerations (Holmstrom & Tirole, 1997). In view of this, they assessed the impact of debt capacity on the trade-off and pecking order theories between 1971 and 2001 and concluded that the small and high growth firms issued equity because they were constrained in their debt capacities. Following these arguments and focusing on banks in Ghana, it is expected that less equity relative to debt will be used by profitable banks. In this case, the more profitable the banks are, the more debt they are expected to use in their operations which follows the lines of the trade-off and the agency cost theories.

Prior studies also seem to suggest that, the mixed empirical findings on CSFP link are attributable to the proxy for performance. Employing a different measure of performance (profit efficiency) as opposed to the frequently used financial ratios, ROE, ROA and Tobin's *q*, Berger and Bonaccorsi di Patti (2006) assessed the CSFP nexus of 7,548 commercial banks in the U.S from 1990 through 1995 and found a positive relationship between leverage and profit efficiency which follows the

agency cost and the trade-off theories of capital structure. Similarly, Margaritis and Psillaki (2010) employed technical efficiency to examine the CSFP link of French manufacturing firms from 2002 to 2005 and found higher leverage to be positively associated with improved efficiency which follows the agency cost and trade-off theories. These consistencies signal that, studies which employed efficiency measures as proxies for performance obtained similar results as opposed to those that used financial ratios. This may be because, different ratios can be fashioned out of a firm's financial statement data and these ratios tend to be contradictory and undistinguishable.

Also, those performance ratios examine only an aspect of a firm, contrary to the multifaceted nature of firms (Paradi et al., 2013) which require the use of a composite index to take simultaneous account of all resources (Thanassoulis, Boussofiane & Dyson, 1996) when assessing performance. Again, the use of leverage by a firm affects all aspects of the firm's operations. Thus, examining the relationship between performance measures, like ratios, that focus on just a unit of a firm's activities against leverage which affects the overall firm may not produce concrete results. To resolve these anomalies therefore, this study adopts a non-parametric profit efficiency (which would be discussed in subsection 2.3.5) measure to assess the relative efficiency of banks in Ghana. Thus, the study comes closest to the studies by Berger and Bonaccorsi di Patti (2006) but employs a non-parametric profit efficiency measure as opposed to the parametric one used by these authors.

The studies reviewed also reveal that, the varied results established in the CSFP link may be due to the context in which the research was undertaken. It must be noted that, this research interest has not only focused on foreign countries. There has been quite a number of studies on CSFP link purposely targeting African countries, including Abor (2005, 2007), Kyereboah-Coleman (2007), Ebaid (2009), and Fosu (2013). Starting with Abor (2005), the impact of capital structure on the

profitability of 22 listed firms on the Ghana Stock Exchange was assessed over a 5 year period from 1998 to 2002. He concluded that, short term and total debt were positively related to profitability whereas long term debt was negatively related to profitability. Contrary to his view, Kyereboah-Coleman (2007) documented an insignificantly positive relationship between long term debt and performance, but consistent with Abor (2005), found a positive relationship between performance and both short term debt and total debt for microfinance institutions over the years 1995 to 2004 in Ghana. The differences in their conclusions may be attributable to the samples employed. Whereas Abor concentrated on non-financial listed firms, Kyereboah-Coleman focused on some unlisted financial firms suggesting that, the reaction of long term leverage to performance may differ across sectors.

Ebaid (2009), on his part, used three performance measures, ROA, ROE and Gross profit margin (GM) to evaluate the effect of capital structure on the performance of 64 non-financial listed firms in Egypt between 1995 and 2005. The author reported a negative relationship between short term debt and ROA and no relationship between long term debt and ROA. He also documented no relationship between both short term and long term debt and ROE and GM. In tandem with Kyereboah-Coleman, long term debt follows the Modigliani and Miller irrelevance theory of capital structure. Unlike the Ghanaian situation, there are clear differences in the Egyptian case, especially for the short term debt. Due to these inconsistencies, Abor's (2007) paper provides a better conceptual link for differences in capital structure between countries. By assessing the reaction of the performance of Small and Medium Scale Enterprises (SMEs) in Ghana and South Africa to leverage, a positive nexus for short term debt in Ghana and negative nexus for short term debt in South Africa was found. However, for long term debt, both Ghana and South Africa experienced a negative elasticity to performance.

Empirical findings are clearly mixed probably due to the nature of the samples used or the different proxy measures used for performance. Most of these studies used heterogeneous samples making it difficult to consistently and accurately measure the effect of leverage on performance in a particular industry. It is therefore important to consider this effect in a specific industry such as the banking industry, within which firms are homogenous in behavior, a gap this study fills in the African context.

2.3.2 Reverse Causation from Performance to Capital Structure

Although a study has incorporated the reverse causation between performance and capital structure in econometric modelling (Fosu, 2013), to the best of the author's knowledge, only three studies stand out as they directly test this theoretical relationship (Margaritis & Psillaki, 2010, 2007; Berger & Bonaccorsi di Patti, 2006). Berger and Bonaccorsi di Patti (2006) tested the efficiency-risk and franchise value hypotheses on the U.S banking industry. On the other hand, Margaritis and Psillaki (2007, 2010) tested the same hypotheses on firms in New Zealand and France respectively. Berger and Bonaccorsi di Patti found that, in the U.S banking industry, none of these hypotheses dominated themselves, implying, efficiency presents only an infinitesimal effect on leverage. This is consistent with findings from New Zealand firms which also revealed that, both the efficiency-risk and franchise value hypotheses operate (Margaritis & Psillaki, 2007).

Conversely, for France, it was established that, the market is dominated by the efficiency-risk hypothesis. This suggests that, for French manufacturing companies, the higher the efficiency of the firm, the higher the leverage. As yet, only these three papers have purposely and empirically tested these two hypotheses. Other researchers only incorporate econometric assumptions that nullify the effect of this perceived reverse causality. For example, Fosu (2013) used a lag structure

and Generalized Method of Moments (GMM) to deal with this bi-directional causality. To complement these studies, this research directly test both hypotheses on the Ghanaian banking industry. This is to ensure that the effect of leverage on the performance of banks in Ghana is not confounded by the effect of performance on leverage leading to simultaneous-equation bias.

2.3.3 Capital Structure, Competition and Firm Performance

The interaction effects of capital structure and competition on the performance of firms have been explored in literature in both developed and developing economic context. However, this seems skewed towards the developed economies. For example, whereas Campello (2003), Dasgupta and Titman (1998), Kovenock and Phillips (1997), Chevalier (1995) and Opler and Titman (1994) focused on developed economies, only Fosu (2013) focused on a developing economy from papers reviewed. Empirical evidence on the relationship between performance and the joint effects of competition and capital structure has tended to be different for developing and developed economies. These mixed findings can be attributed to the different competition measures employed in the studies. Employing four-concentration based ratios as measures of competition, Opler and Titman (1994) established that, firms which are highly leveraged lose market shares to their less leveraged competitors in industries experiencing economic distress in the U.S. Similar analysis was undertaken by Chevalier (1995).

Employing different measures of competition, HHI and BI, Fosu (2013) found that, leverage in the presence of competition positively affected 257 South African listed firms. These reviews appear to suggest that, the direction of the relationship between performance and the joint effects of leverage and capital structure may depend on the proxy employed for competition. In this regard, this study employs the HHI and the BI in examining the relationship between profit

efficiency unlike profitability ratios and the joint effects of competition and capital structure in a homogeneous industry (the banking industry of Ghana) which is distinct from the studies by Fosu (2013).

2.3.4 Capital Structure, Conglomeration and Firm Performance

One of the predominant concerns in the finance discussion on conglomeration as used in this study or diversification as used in prior studies has been whether diversification creates or destroys value (Schmid & Walter, 2009; Laeven & Levine, 2007; Menendez- Alonso, 2003; Berger & Ofek, 1995; Comment & Jarrell, 1995; Lang & Stulz, 1994). As yet, studies on the effects of diversification on firm value or performance have produced varied results and as well, have particularly been geared towards the developed economies. In relation to the varying results for example, whereas some authors report a negative relationship (Berger & Ofek, 1995; Lang & Stulz, 1994), others report a positive relationship (Hubbard & Palia, 1999; Lewellen, 1971). Emphasizing on the negative relationship, some authors are of the opinion that, the discount experienced by firms is not caused by diversification. It may be as a result of endogeneity problems, selection biases, measurement errors and most importantly, the fact that most of the firms that diversify are already discounted firms (Graham, Lemmon &Wolf, 2002; Lamont & Polk, 2002; Whited, 2001; Fluck & Lynch, 1999).

Schmid and Walter (2009) in assessing the effect of diversification on the financial services industry in U.S recognized that, financial conglomeration destroys firm value except for investment banking. Similar negative nexus was documented by Laeven and Levine (2007) in a study of 43 countries, of which 3 were developing countries (South Africa, Kenya and Egypt). These studies on the financial sector did not explicitly address the causal factors underlying the

diversification discount although their results were consistent with theories on diversification. Along the same lines, but focusing on non-financial firms in U.S., Berger and Ofek (1995) documented a diversification discount (a fall in firm value) of between 13% and 15%. Equally, Lins and Servaes (1999) found a diversification discount of 15% in U.K, 10% in Japan and no discount in Germany. The discount of 15% realized in both U.S and U.K was attributed to the common ownership structure (dispersed ownership structure) in these countries. Although Lins and Servaes (1999) did not explicitly identify the cause of the value loss, Berger and Ofek (1995) accredited the value loss in U.S to overinvestment and cross subsidization.

On the positive effects of diversification on firm value, Hubbard and Palia (1999) found that financially unconstrained firms that acquired firms that were constrained generated positive returns in a study of some firms in the U.S. Simply put, firms that did not have any debt obligations at the time of acquisition ended up bearing the burden of the debts of the firms they acquired. However, the positive returns gained could be attributable to tax advantages they enjoyed due to the additional debts in their capital structure. Hadlock, Ryngaert and Thomas (2001) also found that the reaction of the market on average to equity issue announcement was less negative for diversified than it was for focused firms which confirm the value-enhancing effects of diversification. This was so probably because; diversified firms come with economies of scope, especially if their product lines are uncorrelated. The net effect is that, investors seem more interested in benefiting from such scope advantages than investing in a focused firm, especially in such volatile markets.

Also, Lewellen (1971) and Amihud and Lev (1981) suggested that with diversification, firms enjoy greater debt capacity than their counterparts who focus on single product lines. With this, they

benefit from lower tax burdens which may translate into higher performance. Thus the performance effect of leverage (capital structure) depends on whether the firm is diversified or focused which suggests an interaction between capital structure and diversification.

From the review, it seems that the diverse findings documented originate from the opposing theoretical underpinnings of diversification. This implies that, where diversification translates into positive effects such as economies of scope, tax benefits and better monitoring for example, its effect on firm performance would be positive. On the other hand, where diversification informs such decisions as overinvestment and cross subsidization, it is expected that its effect on firm performance would be negative. It can therefore be concluded that, although a firm may experience both the costs and benefits associated with diversification, the true value of the firm will depend on the dominating effect. In this regard, it is necessary that, the positive or negative effects that emanate from conglomeration be interacted with capital structure in assessing performance where the firm under consideration has other segments performing other activities beside its core or traditional activities, a gap this study fills.

2.3.5 Relevant Literature on Profit Efficiency in Banking

Substantial research has been conducted on the efficiency of financial institutions, particularly banks over the years. In the banking sector, 3 survey papers exist (Fethi & Pasiouras, 2010; Berger, 2007; Berger & Humphrey, 1997). The efficiency of these financial institutions have been analysed in terms of technical, cost, revenue and profit (Berger & Humphrey, 1997). Of these methods, profit efficiency has been thought to be the ultimate efficiency measure since it constitutes an essential source of information for bank management than the partial assessment offered by cost and technical efficiency analysis (Ariff & Can, 2008; Maudos, Pastor, Perez & Quesada, 2002). A

survey by Berger and Humphrey (1997) indicated that, of the 130 studies conducted in 21 countries, only 14 were on profit and or revenue efficiencies. This implies that empirically, there are very limited profit and revenue efficiency studies than there are for cost and technical efficiency studies (Fethi & Pasiouras, 2010). One reason for the limited studies on profit efficiency is the difficulty in obtaining reliable and transparent information on output price which is required in the analysis of standard profit efficiency (Fethi & Pasiouras, 2010).

Studies on profit efficiency in the banking industry have particularly focused on U.S (Fare, Grosskopf & Weber, 2004; Akhigbe & McNulty, 2003; Clark & Siems, 2002; Berger & DeYoung, 2001; Rogers, 1998; Berger & Mester, 1997), India (Ray & Das, 2010; Das & Ghosh, 2009), Spain (Maudos & Pastor, 2003; Vivas, 1997), China (Berger, Hasan & Zhou, 2010; Ariff & Can, 2008), Greece (Delis, Koutsomanoli-Fillipaki, Staikouras & Katerina, 2009), Turkey (Isik & Hassan, 2002) and Europe (Chronopoulos et al, 2011; Kasman & Yildirm, 2006; Bonin, Hasan & Wachtel, 2005; Bos & Schmiedel, 2003; Maudos et al., 2002; Vander Vennet, 2002). These studies have examined profit efficiency using parametric and non-parametric approaches. For example, whereas Berger and Mester (1997), Rogers (1998), Berger and DeYoung (2001), Clark and Siems (2002), Akhigbe and McNulty (2003) employed parametric approaches, Maudos and Pastor (2003), Fare et al. (2004), Ariff and Can (2008), Das and Ghosh (2009), Ray and Das (2010) and Chronopoulos et al. (2011) applied non-parametric approaches.

Adopting a parametric technique (the thick frontier approach) and focusing on 54 Spanish savings banks, Vivas (1997) documented a decrease in profit inefficiency by 40% from an average of 28% between the years 1986 and 1991 (inefficiency fell from 32% in 1986 to 19% in 1991). This was a period in which the Spanish banking industry was experiencing considerable deregulation.

Extending the work of DeYoung (1994) and employing the distribution free approach, Rogers (1998) estimated the cost, revenue and profit efficiency of over 10,000 Commercial banks in U.S from the year 1991 to 1995. He concluded that, standard models that omitted nontraditional activities as outputs in modelling bank profit efficiency understated these efficiencies. Contrary to this view, Clark and Siems (2002) concluded that profit efficiency remained unaffected with the inclusion of off-balance sheet items in their study of some publicly trading commercial banks in U.S from 1992 to1997. They analysed profit efficiency using the distribution free approach adopted by Rogers in addition to Stochastic Frontier Analysis.

Employing a non-parametric approach DEA, Maudos and Pastor (2003) estimated the profit and cost efficiency of commercial and savings banks in Spain between 1985 and 1996. The results obtained showed that, profit efficiency levels (52.9% for commercial banks against 34.7% for savings banks) were below those of cost efficiency (90.9 % for commercial banks and 80.2 % for savings banks). Using the same technique (DEA) but focusing on banks in India, Ray and Das (2010) documented lower profit efficiency levels relative to cost efficiency for 71 commercial banks studied between 1997 and 2003 which is consistent with the findings by Maudos and Pastor.

In a broader setup, Maudos et al. (2002) estimated the profit and cost efficiency of commercial banks in 10 countries of the European Union (EU) between 1993 and 1996. They noted that, the profit efficiency of the banks were lower than their cost efficiency. Similar results were documented by Bonin et al. (2005) in their analysis of commercial banks of 11 countries of the EU between 1996 and 2000, Kasman and Yildirim (2006) who analysed 8 countries of the EU between 1995 and 2002 and Chronopoulos et al. (2011) in a research conducted on 10 countries of the EU between 2001 and 2007. The difference between these cited papers is that two applied parametric

techniques (Kasman & Yildirim, 2006; Bonin et al., 2005) and the other two (Maudos et al., 2002; Chronopoulos et al., 2011) used the non-parametric DEA technique.

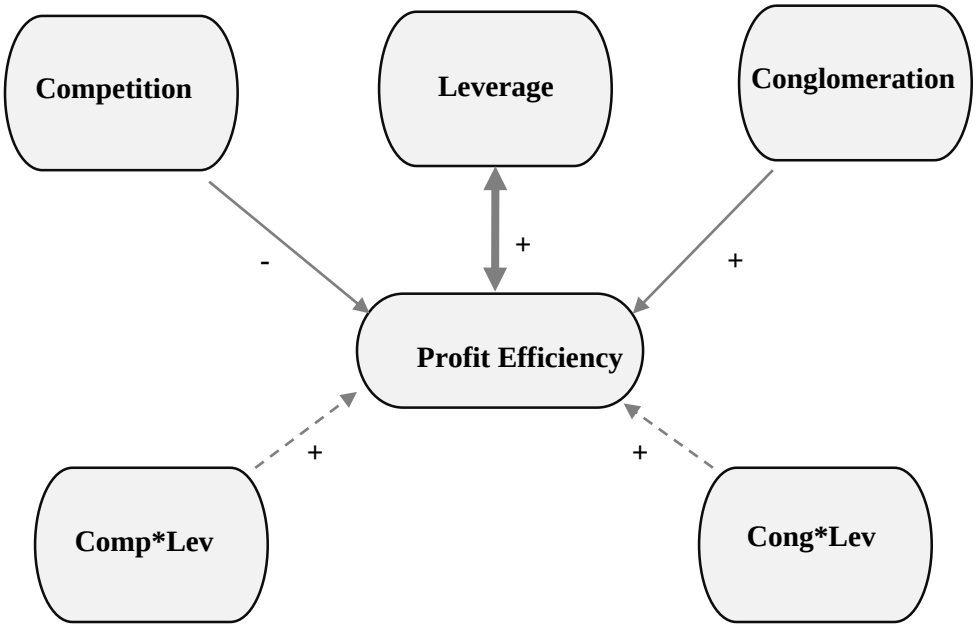
Previous studies have also explored the link between conglomeration / diversification and profit efficiency. A general finding of these studies is that diversified banks are more profit efficient than their counterparts who focus on single product lines (Chronopoulos et al., 2011; Casu & Girardone, 2004; Vander Vennet, 2002). Overall, although studies have measured the profit efficiency of banks in advanced countries, no study have been conducted on the profit efficiency of banks in Africa using DEA. This study fills this gap in the literature by estimating the profit efficiencies of banks in Ghana using a non-parametric approach.

2.3.6 Banking Efficiency Studies in Ghana

A number of researches have also been conducted on the efficiency of banks in Ghana. Whereas some authors employed the nonparametric DEA technique (Saka, Aboagye & Gemegah, 2012; Adjei- Frimpong & Gan, 2014), others used the parametric SFA technique (Alhassan, 2015; Bokpin, 2013). Saka et al. (2012) assessed the impact of foreign bank entry and bank concentration on the technical efficiencies of 23 banks in Ghana from 2000 to 2008 and found that the entry of foreign banks positively influenced the efficiency of domestic banks. Bokpin (2013) also examined the impact of ownership structure, and corporate governance on the cost and profit efficiencies of 25 banks in Ghana over the period 1997 to 2007 and established that banks with inside ownership are cost and profit inefficient and foreign banks are more efficient in terms of cost than their local/domestic counterparts.

Using an unbalanced panel data from 2001 to 2010, Adjei- Frimpong and Gan (2014) estimated the cost efficiencies of 25 banks in Ghana and examined the impact of capitalization, size, loan loss provision, inflation rate and GDP growth rate on the estimated efficiency scores. The findings of the study revealed that banks in Ghana operated farther away from the cost efficiency frontier. In a recent study however, Alhassan (2015) found banks in Ghana to exhibit high levels of efficiency in cost in a study of 26 banks from 2003 to 2011 which contradicts the study by Adjei-Frimpong et al. (2014). This is probably because the authors employed different techniques and time horizons in their estimations of cost efficiency in Ghana's banking industry.

2.4 Conceptual Framework



Based on theoretical predictions, preceding empirical evidence and the Ghanaian banking context, six (6) main testable hypotheses are formulated.

Stulz (1990) and Jensen (1986) developed a model that envisages that, debt has both positive and negative effects on firm performance. Following this model, both effects of debt would be allowed

in specifying the model for capital structure and profit efficiency. It is expected, however, that, the effect of leverage on the profit efficiency of banks in Ghana is positive as represented by H_1. This is probably because, the regulatory environment within which banks operate in Ghana require banks to be solvent at all times in order to meet the needs of customers. In this regard, banks in Ghana are less likely to use leverage to the extent that it will cause them to be bankrupt.

H_1: Leverage has a positive effect on profit efficiency

Over the years, the banking industry of Ghana has been characterized by certain structural and regulatory reforms. These reforms include, the introduction of the Universal Banking License in 2003, the abolishment of the secondary reserve requirement in 2006, the redenomination of the local currency 'the Cedi' to 'Ghana Cedi' in 2007, the increase in minimum capital requirements from 60 million to 120 million Ghana cedis in 2013 (Ghana Banking Survey, 2008), and the consistent entry of foreign banks from 2005 to 2011(Akomea & Adusei, 2013). Following these reforms, it is expected that, the industry is highly competitive. This competitive ambience may result in lower charges on loans which may reduce the profit efficiency. In view of this, it is hypothesized that:

H_2: Competition has a negative effect on profit efficiency

Extant literature has suggested that, the use of debt allows rival firms to predate on the leveraged firm (Opler & Titman, 1994; Campello, 2003). The intensity of the predation depends on the level of competition in the related industry. In a concentrated industry where competition is usually low, leverage firms are less susceptible to rivalry predation than when they operate in unconcentrated industries (Fosu, 2013). The banking industry in Ghana is expected to be competitive

(unconcentrated). In view of this, banks that use more leverage relative to their counterparts are expected to be less vulnerable to rivalry predation in Ghana. This is because in competitive environments where prices are usually fixed, profits emanate from the amount of output that the business entity is able to produce. In view of this, the performance effect of the interaction between leverage and competition is expected to be positive.

H_3: The interaction effect of leverage and competition on profit efficiency is positive and significant

Theories on conglomeration suggest that diversification has both benefits and costs on firm performance. To the extent that the regulatory environment requires banks to be solvent, banks are less likely to expand their product lines or engage in other activities besides those stipulated in the Banking License if the resultant effect of this diversification is reduction in profits. Hence a positive effect of conglomeration on profit efficiency is expected.

H_4: Conglomeration has a positive effect on profit efficiency

Further, the expected positive effect of conglomeration on profit efficiency suggests that when conglomeration is interacted with leverage, the overall effect on profit efficiency is likely to be positive.

H_5: The interaction effect of conglomeration and leverage on profit efficiency is positive

Berger and Bonaccorsi di Patti (2006) postulate that there is a reverse causation from performance to capital structure. They tested this reverse causality using two hypotheses (the efficiency-risk and the franchise value hypotheses). Following these authors, hypotheses six is formulated.

$H6_a$: More efficient banks employ higher leverage in their operations (efficiency-risk)

$H6_b$: More efficient banks employ lower leverage in their operations (franchise value)

2.5 Chapter Summary

This chapter provided a review (both theoretical and empirical) of the theories underlying capital structure and firm performance, the hypotheses related to the reverse causation between capital structure and performance, the theories supporting the interaction between capital structure and competition on one hand and the interaction between capital structure and conglomeration on the other. Relevant literature on profit efficiency in banking studies was also reviewed. Based on these, a conceptual framework from which certain hypotheses were developed was provided to serve as a guide for the analysis.

CHAPTER THREE

THE BANKING INDUSTRY IN GHANA

3.1 Introduction

This chapter provides an overview of the Ghanaian banking industry. It provides a historical background on the industry and highlights the key financial improvements and regulatory reforms introduced to enhance competition, financial conglomeration and efficiency. This is to ensure a better understanding of the arguments presented in this study.

3.2 Historical Background

Banking activities in Ghana commenced in 1896 with the establishment of the British Bank of West Africa (Amidu, 2007). The main aim of the bank was to deliver principal services of lending and borrowing of money. In 1918, another bank, the Colonial bank commenced operation, but merged with other foreign banks under the leadership and name Barclays Group to compete with the British Bank of West Africa (Gatsi, 2012). In 1953, the Bank of Gold Coast emerged and was later divided into Ghana Commercial Bank and BOG.

In 1957, the BOG assumed the role of managing the currency in existence. This led to the issuance of the first currency, the Cedi, to substitute the old West African currency notes in 1965 (BOG). The introduction of a new government in 1957 saw the establishment of the Ghana Investment Bank, the Merchant Bank, the Agricultural Development Bank and the Social Security Bank. In 1983, the economy experienced economic difficulties which led the government to seek assistance from the World Bank and the International Monetary Fund (IMF). Subsequently, the Economic Recovery Program (ERP) was launched. The program led to the removal of financial restrictions,

divestiture of government interest in Public Corporations and the liberalization of trade (Sowa, 2003).

As part of the ERP, the Financial Sector Adjustment Program (FINSAP) was enacted in 1988 with the aim of removing financial restrictions, introducing new capital, strengthening competition and efficiency within the banking sector (Quartey & Afful-Mensah, 2014; Aboagye, Akoena, Antwi-Asare & Gockel, 2008). In 1989, the Banking Law (PNDL 225) was enacted to enable local entities file applications for licenses to operate as banking institutions (Ghana Banking Law, 1989). Consequently, various corporate bodies were licensed to function as banks, including CAL Merchant Bank, Allied and Metropolitan, Meridien (BIAO) Trust Bank, and Ecobank.

Although there had been attempts at enhancing the banking sector through the legislative and regulatory reforms made, the industry did not see much progress. This was evidenced in the liquidation of Ghana Co-operative Bank, Bank for Housing and Construction, and the Bank for Credit and Commerce in 2000 (Amidu, 2007). Since 2000, there has been major developments in the Ghanaian banking industry as depicted in Table 1 to strengthen bank operations.

Table 1: **Key Developments in the Ghanaian Banking Industry from 2000 to 2013**

Year	Key Developments
2002	The Bank of Ghana Act (Act 612) was enacted
2002	Introduction of Bank of Ghana Prime Rate as the policy rate
2002	Inauguration of the Monetary Policy Committee
2003	Introduction of Universal Banking License. Banks with capital of GH¢7 million were allowed to undertake any form of banking.
2003	Abolishment of maintenance, transactions and transfer fee charges by Commercial banks.
2004	Replacement of the Banking Law 1989 (PNDCL 225) with Banking Act 2004 (Act 673)
2006	Abolishment of 15% secondary deposit reserve requirement.
2006	Enactment of Foreign Exchange Act 2006 (Act 723) and Whistle Blowers Act 2006 (Act 720).
2007	Approval of Credit Reporting Act 2007 (Act 726) and Banking (Amendment) Act 2007 (Act 738).
2007	Abolishment of National Reconstruction Levy
2007	Redenomination of the Cedi (10,000 = 1Ghana Cedi)
2008	Approval of Borrowers and Lenders Act 2008 (Act 773), Non-Bank Financial Institutions Act 2008 (Act 774), Home Mortgage Finance Act 2008 (Act 770) and Anti-Money Laundering Act 2008 (Act 749).
2008	Requirement of a minimum capital of GH¢60 million to maintain Class 1 banking status by the BOG
2008	Requirement for banks to adopt International Financial Reporting Standards
2009	Cheque code-line clearing system was introduced by the Ghana Inter-bank Payment and Settlement Systems (GhIPPs)
2011	Requirement to maintain the statutory reserve requirement of 9% in Ghana cedis only
2013	Increase in the reserve requirement and monetary policy rate to 10% and 16% respectively
2013	Requirement for a minimum stated capital of GH¢120 million for banks.

Source: Ghana Banking Survey, 2008

3.2.1 Overview of the Ghanaian Banking Industry

The Ghanaian banking industry comprises of the Bank of Ghana as the regulating body, 27 Universal banks and 140 rural and community banks (BOG Annual Report, 2013). With respect to ownership, 15 of the Universal banks are foreign-owned and 12 are domestically-owned. The structure of the banking industry is depicted in Figure 1.

3.2.1.1 Implications of Some Key Developments on the Ghanaian Banking Industry

Universal Banking

The Universal banking system in Ghana was introduced in 2003. This system allowed banks to undertake development, commercial, investment and/ merchant banking activities without the need for separate licenses. The purpose of this policy was to ensure that banks became versatile in providing services to their customers (Quartey & Afful-Mensah, 2014). To perform these roles of universal banking, the BOG increased the minimum capital requirement to GH¢7 million to ensure that the banks were adequately capitalized. This was to encourage a more competitive and dynamic banking industry capable of intermediating effectively to support growth in the expanding economy (BOG Annual Report, 2004). Since the introduction of this policy, competition in the industry has heightened as is evidenced in the increase in the number of banks from 18 in 2003 to 26 in 2013.

Abolishment of the Secondary Reserves Requirement

In order to make funds available to the private sector, the BOG abolished the secondary reserve requirement in 2006. The secondary reserve requirement mandated banks to hold a percentage of their deposits in the form of medium term securities (BOG, 2006). With this policy, the ability of

the banks to create more loans was limited. The abolishment of this requirement freed up significant liquidity for lending to businesses which has had diverse implications in terms of, for example, profits in the banking industry (Ghana Banking Survey, 2007).

Currency Redenomination

In an attempt to make Ghana's economy attractive to both local and foreign investors as well as achieve the convergence criteria set by the West African Monetary Zone, the Bank of Ghana undertook the redenomination (BOG Annual Report, 2007) exercise. The redenomination exercise was also envisaged to increase efficiency in payment systems, banknote processing and improve the accounting records of banks in Ghana. A survey conducted by the research department of the BOG in 2009 (two years after the redenomination) suggested that, the objectives of the redenomination had been achieved.

Minimum Capital Requirement

The minimum capital requirement was increased from GH¢7 million in 2003 to GH¢60 million in 2008 and GH¢120 million in 2013 (KPMG, 2012; Ghana Banking Survey, 2014). Although, these recapitalization directives had received mixed feelings in the financial circle, the Ghana Banking Survey (2011) report indicate that, the move towards higher minimum capitals improved the liquidity and the operating assets of the industry.

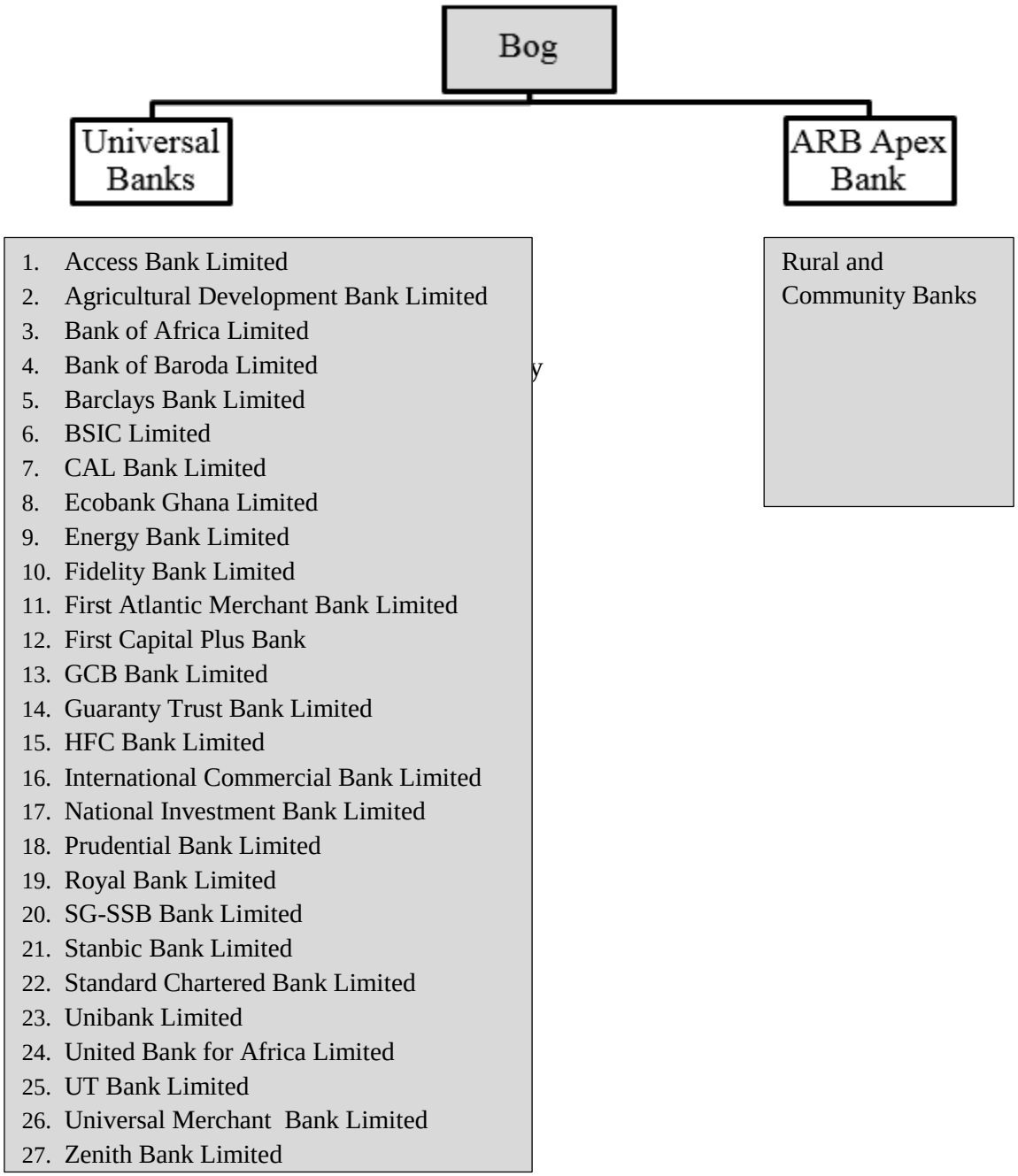


Figure 1: Structure of the Banking Industry

(Source: Bank of Ghana)

3.2.1.2 Performance of the banking industry between 2000 to 2013

Despite increasing competition in the banking industry, it remained a sector with the brightest opportunities for the year 2000 to 2013. Net interest income increased from ¢1.09 trillion in 2000 to ¢2.67 trillion in 2004. Similarly, industry net profit increased from ¢694 billion to ¢1170 billion. As regards capital structure, shareholders' funds increased by 177% from ¢1.3 trillion to ¢3.6 trillion with total deposits increasing from ¢7.6 trillion to ¢21 trillion (176% increase) (Ghana Banking Survey, 2005). ROE on the other hand, decreased from 53.2% to 32.3%, while ROA decreased from 7.3% to 4.2%. This suggests that although equity funds increased, the utilization of these funds by management in the industry on average was ineffective. In essence, management's decision on asset composition, liquidity position and cost management was poor.

The industry continued to experience reductions in both ROE and ROA in the subsequent years except from 2010 to 2013 where it experienced upturns in its performance. ROE increased from 12.1% in 2009 to 16.7% in 2010, 17.97% (2011), 23.8% (2012), 27.5% (2013). Likewise, ROA increased from 1.6% in 2009 to 2.3% in 2010, 2.4% (2011), 3.5% (2012) and 4.2% (2013). This gain was partly due to the injection of capital by the local banks in their quest to meet the increase in the stated minimum capital by the BOG in 2008. In view of this, funds were made available to finance the operations of the banks in terms of investment and loan portfolios (Ghana Banking Survey, 2011, 2012, 2013, 2014) which increased the profitability of the banks. Figures1 and 2 are representations of the key performance indicators, ROE and ROA of the Ghanaian banking industry from the year 2004 to 2013.

This paper argues however that, the ratios (ROA and ROE) do not provide a holistic view of the performance of banks in Ghana since they do not consider the multiple inputs and outputs used by the banks in their operations. It is to this effect that, this study employs profit efficiency, which takes a simultaneous account of the inputs and outputs used by the banks to estimate performance.

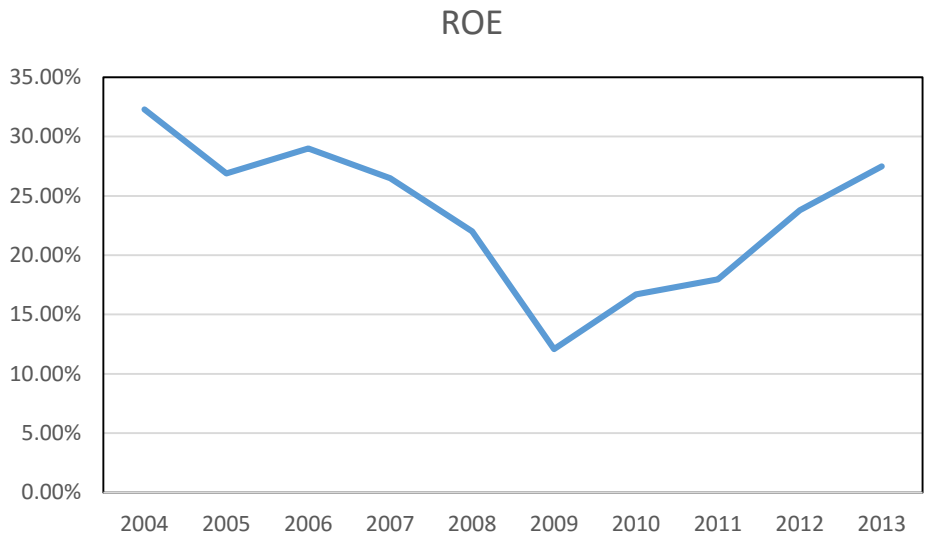


Figure 2: ROE from 2004-2013
Source: Author (2015)

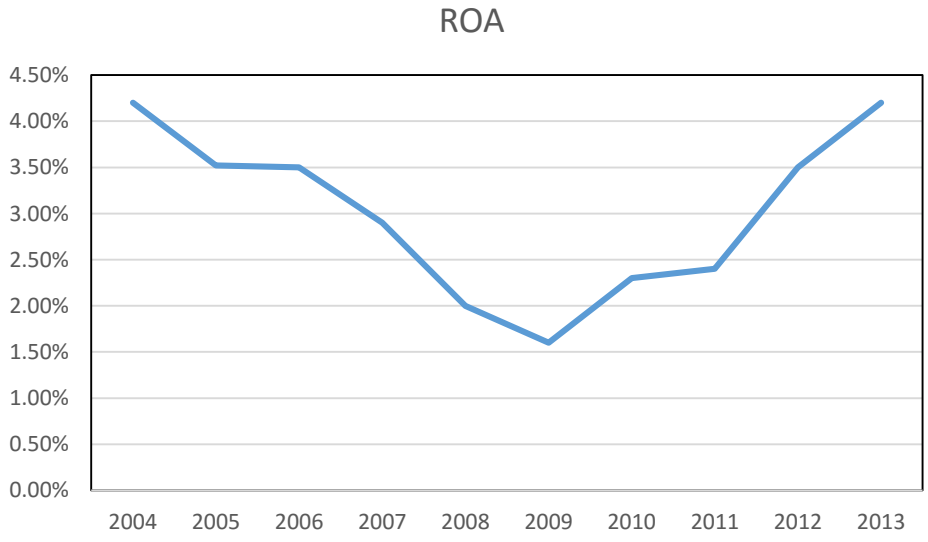


Figure 3 : ROA from 2004-2013

Source: Author (2015)

Chapter Summary

The chapter provided an overview of the Ghanaian banking industry. Overall, the Ghanaian banking industry has undergone major transformations which have had diverse implications on its performance. It experienced downturns in performance in the early and mid-parts of the 2000's and upturns in the later parts. The number of banks also increased tremendously, especially with the introduction of the universal banking system. This has intensified competition in the industry and has led some banks to diversify into other activities aside their core banking activities.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

This chapter describes the procedures used to collect and analyse the data in order to answer the research questions. Specifically, it considers the design of the research, the sampling technique, the sources of data and the methods used in analysing the data.

4.2 Research Design

The quantitative approach to research is adopted in this study. This is because, it helps to understand the best predictors of outcomes (Creswell, 2012). It also makes it possible to deduce, since the inferences from test of statistical hypotheses lead to general inferences about the features of the population (Harwell, 2011). A panel data methodology is employed in this study. This is because, the study comprises repeated observations on the same cross section of units over time (Wooldridge, 2012). Further, the panel data methodology is more informative, provides more degrees of freedom and less collinearity among the independent variables (Baltagi, 2008). A panel dataset also controls for cross-sectional unobserved heterogeneity (Brooks, 2008) which, when ignored can lead to biased results.

4.3 Sampling and Sources of Data

The population for the study constitutes all the 26 banks operating in Ghana. Data covering the years 2000 to 2013 is extracted from the annual reports of the banks under consideration. Since not all these banks were in existence for the entire study period, an unbalanced panel method is

used. Primarily, data is sourced from the Banking Supervision Department of the Bank of Ghana and cross-validated with similar data from banks' annual reports.

4.4 The DEA Methodology

Based on the inspiration of Farrell's (1957) estimation of relative technical efficiency of Decision Making Units (DMUs), DEA was first propounded by Charnes, Cooper and Rhodes (1978) and extended by Banker, Charnes and Cooper (1984). DEA is a non-parametric linear programming optimization-based technique for assessing the relative efficiency of homogeneous DMUs that use multiple inputs to produce multiple outputs (Cook & Seiford, 2009; Fried, Lovell & Schmidt, 2008). The DMUs can be airlines, oil firms, insurance firms, football clubs, universities, hospitals and banks. The technique creates a production or cost or profit frontier which is a "best practice" frontier from observed units. The units forming the frontier become efficient because no other firm dominates them. Then, the generated efficiency or inefficiency scores of those units enveloped by the frontier or interior to it are determined relative to the boundary of the constructed frontier.

Due to its powerful ability to optimize, DEA enables management to objectively recognize the best-practice units and the areas of improvement within the firms' multidimensional operating situations. For a comprehensive discussion on the evolution and details of frontier methods and DEA, the reader is referred to Cooper, Seiford and Zhu (2011), Daraio and Simar (2007), Coelli, Rao, O'Donnell and Battese (2005), Kumbhakar and Lovell (2003) and Førsund and Sarafoglou (2002). For DEA applications in banking see Tzeremes (2015), Staub, da Silva e Souza, and Tabak (2010), Fethi and Pasiouras (2010), Ray and Das (2010), Berger (2007), Berger and Humphrey (1997).

A number of reasons account for the use of DEA in this study. For starters, DEA is able to handle multiple inputs and outputs of homogenous DMUs (Charnes et al, 1978). Banks use various inputs such as workers, deposits, fixed assets, etc. and produce various outputs, including investments, loans and advances, securities, etc. The use of DEA will therefore be an appropriate method in such multifaceted operations of a business activity. The technique can also disintegrate efficiency scores into several components, including profit, revenue, cost, technical, pure technical, scale, allocative and mix efficiencies, etc. which help to identify the key sources of inefficiencies of firms.

Moreover, with DEA, restrictive functional forms for the production, cost or profit technology or distributional assumptions underlying the observations need not be specified, unlike in some parametric approaches such as Stochastic Frontier Analysis (Fried et al., 2008; Coelli et al., 2005). In other words, DEA allows the 'data to speak for themselves' instead of imposing a structure on the data to avoid errors related to specification (Cummins, Weiss, Xie & Zi, 2010). Further, DEA is unit invariant (Lovell & Pastor, 1995) which means that the inputs and outputs that can be used for the DEA analysis do not necessarily have to be in the same metric units. For instance, although labour is measured in man-hours, whilst size is measured by space (square meters) and operating expenses is measured in a currency unit, these can be used as inputs for a particular analysis. DEA can also identify reference sets or peers for each inefficient unit which is imperative for managerial policy making.

Despite these merits of DEA, the method is not a panacea for the problems that may be encountered by other performance assessment tools. DEA undoubtedly evaluates the relative efficiency of a DMU, not necessarily absolute efficiency. Hence, the extreme point of expectation to be reached

in order to be efficient is determined by the best in the sample, not the ideal best point, implying, that the exclusion and/ inclusion of some DMUs can affect the efficiency estimates from the analysis (Avkiran, 1999). The method is deterministic which makes it prone to identification problems. This emanates from the fact that all deviations from the efficient frontier are attributed to inefficiency without the consideration of statistical noise. These problems have however been addressed through the emergence of bootstrapping (Simar & Wilson, 1998, 2000, 2007) which helps to solve the problem of sampling variations and serial correlations in DEA and second-stage efficiency analysis. Again, DEA is subtle to outliers and random noise from missing explanatory variables or measurement errors which can influence the efficiency estimates (Ohene-Asare, 2011).

Finally, some inputs or outputs, though, heterogeneous in nature are sometimes treated as homogenous. This causes biases in the efficiency scores (Coelli et al, 2005). An example is the case where skilled and unskilled labour is not distinguished in an input orientation analysis, but is generally considered as labour, in the assessment, meanwhile, they can have different impacts on the efficiency of the DMUs. To formalize DEA method, suppose there are n observed DMUs to be evaluated, each using varying amounts of m inputs to generate different amounts of s outputs, a specific DMUj consumes x_{ij} amount of input i and produces y_{rj} amount of output r. The technology set, T, can be defined as:

$$T = \{(x, y) : y \text{ can be produced from } x\} \quad (1)$$

Charnes et al (1978) defined the input-oriented efficiency of a target DMU$_o$ as maximum of the ratio of weighted sum of outputs to weighted sum of inputs subject to the condition that similar ratios representing the efficiency measures for each DMU be equal or less than one.

Mathematically, the Charnes, Cooper and Rhodes (CCR) fractional programming model (2) can be formalized as:

$$\max h_o(u,v) = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

$$s.t \qquad (2)$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, \; j = 1,\ldots,n$$

$$u_r, v_i \geq 0; \; \forall r, r = 1,\ldots,s; \forall i, i = 1,\ldots,m$$

It should be noted that $y_{rj}, x_{ij} \geq 0$ are the observed outputs and inputs of DMUj whereas $u_r, v_i \geq 0$ are the weights allocated to the outputs and inputs respectively, and are to be determined by solving the optimization problem. These shadow prices or weights are the relative value system for each firm that makes that firm as efficient as possible. This depends on the idea that the resulting value system is feasible for all other firms and that none achieves an efficiency score below one (Ohene-Asare, 2011; Berger & Mester, 1997). The CCR fractional programming model (2) can be transformed into a corresponding linear model (3) using the Charnes-Cooper transformation (Charnes & Cooper, 1962), under the assumptions of free disposability and convexity:

$$
\begin{aligned}
&\theta^{*} = Min_{\lambda_j,\theta}\ \theta \\
&subject\ to: \\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{i0}; \qquad i = 1,2,...,m \\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{r0}; \qquad r = 1,2,...,s \\
&\sum_{j=1}^{n} \lambda_j = 1 \quad (vrs) \\
&\lambda_j \ge 0; \qquad j = 1,2,...n \quad \theta \ \ free
\end{aligned}
\tag{3}
$$

Where, θ^{*} denotes the radial input-oriented efficiency score of the DMU under evaluation, a value between 0 and 1; λ_j is the optimal weight of referenced sets for unit *j*; x_{ij} and y_{rj} are the amount of the *ith* input used and *rth* output generated by the *jth* DMU. The formula of the BCC (or variable returns to scale) model is different from that of the CCR (or constant return to scale) with the activation of the convexity constraint, $\sum_{j=1}^{n} \lambda_j = 1$. The introduction of this constraint changes the reference set from a conical hull, as will be in the case of CRS model, to convex hull (Luo, 2003). By solving this linear programming problem, the efficiency estimates of each DMU can be obtained, inefficient units are identified, targets identified, and bank policy guidelines provided. Based on the assumptions of free disposability and convexity as well as the technology set, *T*, other measures of efficiency can be estimated.

4.5 Profit Efficiency Using the Non-parametric DEA Methodology

Profit efficiency measures how close the profit of a bank is to the profit of a "best-practice" bank producing similar outputs (*y*) using similar inputs (*x*) given particular levels of input prices (*w*) and

output prices (p) (Ray & Das, 2010; Das & Ghosh, 2009; Cooper et al., 2006; Maudos & Pastor, 2003).

To formalize, given that we have n banks $(j=1,\ldots,n) \in \mathbb{R}_+^n$ that use a vector of x_i inputs $(i=1,\ldots,m) \in \mathbb{R}_+^m$ to produce a vector of y_r outputs $(r=1,\ldots,s) \in \mathbb{R}_+^s$ for which they pay a price $w_i = (i=1,\ldots,m) \in \mathbb{R}_+^m$ for each input and a price p_r $(r=1,\ldots s) \in \mathbb{R}_+^s$ for each output , the maximum profit can be expressed in the linear programming form as follows.

$$\begin{aligned}
\prod^* &= \max\ py - wx \\
&= \sum_{r=1}^{s} p_{ro} y_{ro} - \sum_{i=1}^{m} w_{io} x_{io} \\
&\quad s.t \\
\sum_{j=1}^{n} \lambda_j x_{ij} &\le x_{io} \qquad i = 1,2,\ldots,m \qquad (4) \\
\sum_{j=1}^{n} \lambda_j y_{rj} &\ge y_{ro} \qquad r = 1,2,\ldots,s \\
\sum_{j=1}^{n} \lambda_j &= 1 \ (vrs) \\
\lambda_j &\ge 0 \qquad j = 1,2,..n
\end{aligned}$$

To obtain the profit efficiency (PE_o), the maximum profit ($\prod^*$) is estimated by solving the linear programming problem. The profit efficiency of the 0th bank then becomes the ratio of the actual profit, $\prod^o$ to the maximum profit, $\prod^*$.

$$PE_O = \frac{\prod^0}{\prod^*} = \frac{\sum_{r=1}^{s} p_{ro} y_{ro} - \sum_{i=1}^{m} w_{io} x_{io}}{\sum_{r=1}^{s} p_{ro} y_{ro}^* - \sum_{i=1}^{m} w_{io} x_{io}^*} \qquad (5)$$

Although, the model in equation (4) is commonly used in the literature, it has been established that, it makes assumptions which are not practical in real market systems (Cooper et al, 2006). For example, it assumes that the prices of inputs and outputs are constant, prices are known with

certainty and inputs and outputs are homogenous. To eliminate these shortcomings, Cooper et al. (2006) based on some theorems postulated by Tone (2002) introduced a new profit efficiency model. This is given by:

$$\begin{aligned}
\overline{\prod}^{*} &= \max\ p\bar{y} - w\bar{x} \\
&= \max \sum_{r=1}^{s} p_{ro}\bar{y}_{ro} - \sum_{i=1}^{m} w_{io}\bar{x}_{io} \\
&\quad s.t \\
\sum_{j=1}^{n} \lambda_j x_{ij} &\le \bar{x}_{io} \qquad i = 1,2,\ldots,m \\
\sum_{j=1}^{n} \lambda_j y_{rj} &\ge \bar{y}_{ro} \qquad r = 1,2,\ldots,s \qquad (6) \\
\sum_{j=1}^{n} \lambda_j &= 1\ (vrs) \\
\lambda_j &\ge 0 \qquad j = 1,2,..n
\end{aligned}$$

where $\bar{x}$ and $\bar{y}$ are cost-based inputs and price-based outputs respectively and account for the heterogeneous nature of inputs and differences in the unit prices of outputs. The new profit efficiency then becomes:

$$NPE_O = \frac{\overline{\prod}^{0}}{\overline{\prod}^{*}} = \frac{\sum_{r=1}^{s} p_{ro}\bar{y}_{ro} - \sum_{i=1}^{m} w_{io}\bar{x}_{io}}{\sum_{r=1}^{s} p_{ro}\bar{y}^{*}_{ro} - \sum_{i=1}^{m} w_{io}\bar{x}^{*}_{io}} \qquad (7)$$

Cooper et al. (2006) and Tone (2002) further argue that, in certain circumstances, equation (7) gives negative values (refer to Table 3 column 4 for an illustration) which are difficult to deal with in terms of its interpretation and the adjustments in inputs and outputs required to achieve the maximum profit target (Fried et al., 2008). For example, although it is feasible to say that, reducing the inputs of a technically efficient bank by 40% implies reducing its cost by 40%, in a profit scenario changing the bank's outputs and inputs by a certain percentage does not guarantee the

same percentage change in profit. To solve this negativity problems, Cooper et al. (2006) and Tone (2002) propose the profit ratio model (revenue /cost efficiency ratio) as indicated in equation 8 to 10 below. Using the MaxDEA Pro 6 software which solves the negativity issues (see Table 3 column 5 for an illustration) in line with Cooper et al (2006), the revenue/cost efficiency ratio is adopted in this study.

$$\begin{aligned} &\max_{x,y,\lambda} \frac{p_{ro} y_{ro}}{w_{io} x_{io}} \\ &s.t \\ &\sum_{j=1}^{n} \lambda_j x_{ij} \le x_{io} \qquad i = 1,2,...,m \\ &\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{ro} \qquad r = 1,2,...,s \\ &\sum_{j=1}^{n} \lambda_j = 1 \ (vrs) \\ &\lambda_j \ge 0 \qquad\qquad j = 1,2,..n \end{aligned} \tag{8}$$

Equation (8) is transformed into a linear programming form by introducing a variable t $\in \mathcal{R}$ and using the Charnes-Cooper transformation of fractional programming which sets $\hat{y}_{ro} = ty_{ro}$, $\hat{x}_{io} = tx_{io}$, $\hat{\lambda} = t\lambda$.Multiplying all the terms by t> 0, equation (8) changes to:

$$\max_{\hat{x},\hat{y},\hat{\lambda},t} p_{ro}\hat{y}_{ro}$$

$$s.t$$

$$w_{io}\hat{x}_{io} = 1$$

$$\sum_{j=1}^{n} \hat{\lambda}_j x_{ij} \leq t x_{io} \qquad i = 1,2,...,m$$

$$\sum_{j=1}^{n} \hat{\lambda}_j y_{rj} \geq t y_{ro} \qquad r = 1,2,...,s \qquad (9)$$

$$\sum_{j=1}^{n} \hat{\lambda}_j = 1 \ (vrs)$$

$$\hat{\lambda}_j \geq 0 \qquad j = 1,2,...n$$

Let an optimal solution for equation (9) be $t^*, \hat{x}^*, \hat{y}^*, \hat{\lambda}^*$.Given that t*>0, an optimal solution for equation 8 can be derived by reversing the transformation from $x_{io}^* = \hat{x}_{io}^*/t^*$, $y_{ro}^* = \hat{y}_{ro}^*/t^*$, $\lambda^* = \hat{\lambda}^*/t^*$. The revenue /cost efficiency, E_{RC} of the 0th bank then becomes

$$E_{RC} = \frac{\sum_{r=1}^{s} p_{ro} y_{ro} \Big/ \sum_{i=1}^{m} w_{io} x_{io}}{\sum_{r=1}^{s} p_{ro} y_{ro}^* \Big/ \sum_{i=1}^{m} w_{io} x_{io}^*} \qquad (10)$$

Profit efficiency is bounded between 0 and 1 except in the case where the maximum profit is positive while the actual profit is negative (Ray & Das, 2010). The profit efficiency estimate indicates that, there is the potential of increasing the profits of the bank by $(1-E_{RC})*100$ given input and output prices (Maudos & Pastor, 2003).

4.5.1. An Illustrative Example of Profit Efficiency Using DEA

Assume that there are 11 banks, producing one output (y), using two inputs, x1 and x2 for which w1 and w2 are paid as prices of the inputs and p for the output. To illustrate the calculation of profit efficiency using DEA, the sample data shown in Table 2 is used.

Table 2: A hypothetical sample data

Bank	x1	x2	y	w1	w2	p
1	5	17	12	6	8.5	25
2	42	25	26.5	5.5	9.5	22
3	37	14	31	4	10.5	23
4	27	22	30	8	10	21
5	25	10	27	7.5	9	18
6	23	6	9	6.5	5	19
7	18	14	8	5.5	8	23
8	17	15	26	4	6	25
9	16	26	25	5	7.5	24
10	16	12	14	7	8	22
11	5	13	12	6	9	20

Source: Portela and Thanassoulis, 2007

The linear programming model in equation 4 is used in solving the maximum profit for each bank.

For example, for bank 1, we have:

$$\prod^{*} = \max\ py - wx$$

s.t.

$$Deposit\ \ Constraint: 5\lambda_1 + 42\lambda_2 + 37\lambda_3 + 27\lambda_4 + 25\lambda_6 + 23\lambda_6 + 18\lambda_7 + 17\lambda_8 + 16\lambda_9 + 16\lambda_{10} + 5\lambda_{11} \le 5$$

$$Labour\ \ Constraint: 17\lambda_1 + 25\lambda_2 + 14\lambda_3 + 22\lambda_4 + 10\lambda_5 + 6\lambda_6 + 14\lambda_7 + 15\lambda_8 + 26\lambda_9 + 12\lambda_{10} + 13\lambda_{11} \le 17$$

$$Loan\ \ Constraint: 12\lambda_1 + 26.5\lambda_2 + 31\lambda_3 + 30\lambda_4 + 27\lambda_5 + 9\lambda_6 + 8\lambda_7 + 26\lambda_8 + 25\lambda_9 + 14\lambda_{10} + 12\lambda_{11} \ge 12$$

$$VRS\ \ Constraint: \lambda_1 + \lambda_2 + \lambda_3 + \lambda_4 + \lambda_5 + \lambda_6 + \lambda_7 + \lambda_8 + \lambda_9 + \lambda_{10} + \lambda_{11} = 1$$

$$Non-negativity\ Constraint: \lambda_1, \lambda_2, \lambda_3, \lambda_4, \lambda_5, \lambda_6, \lambda_7, \lambda_8, \lambda_9, \lambda_{10}, \lambda_{11} \ge 0$$

The actual profit ($\prod^{o}$) of bank 1 is computed as {(25*12)-[(6*5) + (17*8.5)]} =125.

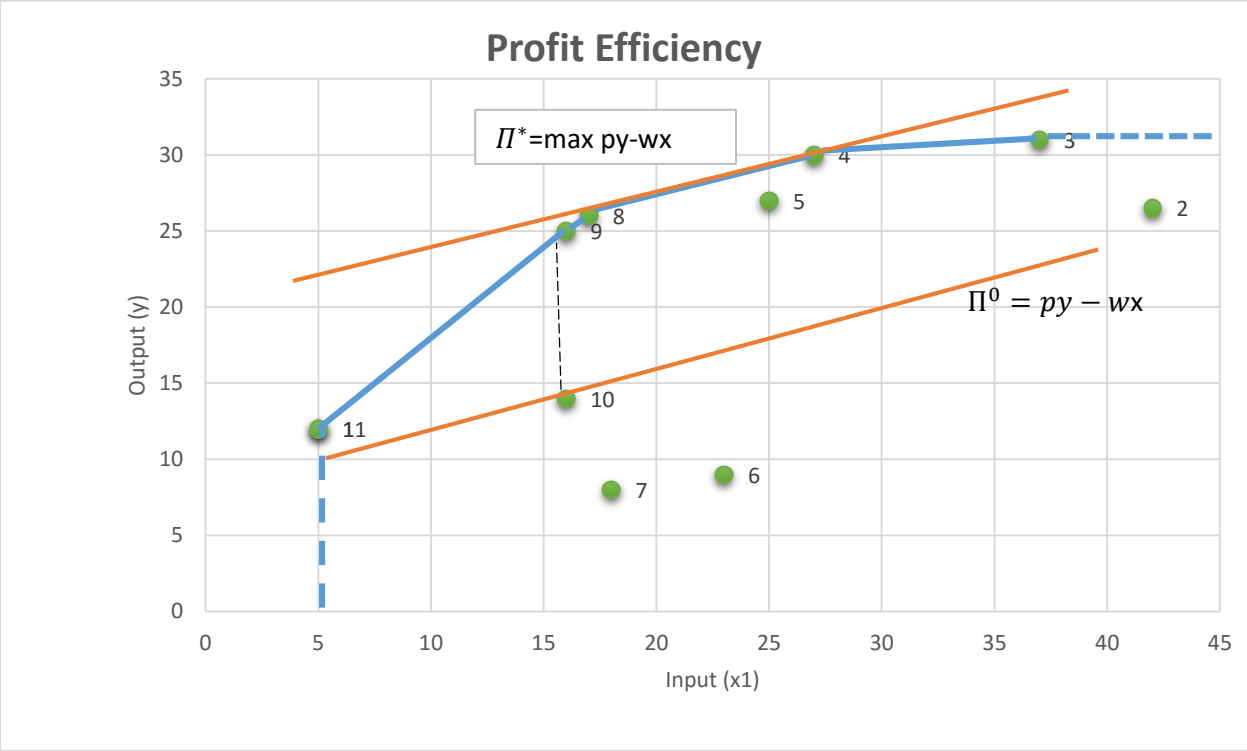


Figure 4: A graphical representation of Profit Efficiency using one input and one output

Using the MaxDEA Pro 6 software, the maximum profits generated by each bank is depicted in the second column of Table 3

Table 3: Results for maximum profit, actual profit and profit efficiency scores.

Bank	Maximum Profit Π^*	Actual Profit Π^0	Profit Efficiency $= \frac{\Pi^0}{\Pi^*}$	Profit Efficiency $= \frac{Revenue}{Cost}$
1	159.5	125.5	0.78683	1
2	361.5	114.5	0.31674	0.3025
3	418	418	1	1
4	194	194	1	0.3512
5	208.5	208.5	1	0.4257
6	-8.5	-8.5	1	1
7	378.526	-27	-0.07133	0.2120
8	492	492	1	1
9	325	325	1	0.5304
10	256.316	100	0.39014	0.3600
11	93	93	1	1

The profit efficiency estimates indicate that banks 3, 4, 5, 6, 8 and 9 are efficient in the industry. To be efficient, banks 1, 2, 7 and 10 would be required to increase their profits by approximately 21%, 68%, 107% and 61% respectively.

4.6 Modelling Of Inputs and Output Variables

In modelling the inputs and outputs of the banks, the intermediation approach by Sealey and Lindley (1977), unlike the production approach (Berger & Humphrey, 1991; Benston, 1965), is employed. This is because the intermediation approach does not only consider the minimization of production costs but the entire total cost of a bank which is necessary in profit maximization (Berger & Humphrey, 1997). The approach views banks as agents mediating funds between investors and supply sources. In this regard, labour and physical capital (and sometimes equity) are considered as inputs used to convert deposits into loans and investment (Halkos & Tzeremes, 2013; Ataullah & Le, 2006). Following Das and Ghosh (2009) and Moffat and Valadkhani (2011), this study considers deposits, physical capital and labour as inputs and loans and investments as outputs as indicated in Table 4

Table 4**: Inputs, Outputs, Input and Output Prices for Profit Efficiency Estimation**

Variables	Description
Inputs:	
Deposits	Customer deposits
Labour	Personnel Expenses
Physical Capital	Fixed assets or property, plant and equipment
Outputs:	
Loans and Advances	Total customer's loans and advances
Other Earning Assets	Bank's investment in different types of securities (bonds etc.)
Input Prices:	
Price of deposits	Interest expense divided by total deposits
Price of Labour	Personnel expenses divided by total assets
Price of capital	other operating expenses divided by total fixed assets
Output Prices	
Price of loans and advances	Interest received on loans and advances divided by total loans and advances
Price of Other Earning Assets	Investment income divided by total investments

4.6.1 Inputs

4.6.1.1 Deposits

Deposits are essential resources for banks in Ghana. They aid in credit creation and investment by these banks. However, there has been a long standing debate on whether deposits are inputs or outputs of banks. This is because, deposits have both input and output features (Fethi & Pasiouras, 2010). Some studies consider deposits as inputs because they are partly paid for using interest expenses. Also, banks 'buy' instead of 'sell' deposits and deposits are used next to other funds to generate loans and investments (Nahm &Vu, 2013; Berger & Humphrey, 1997; Hughes & Mester, 1993; Elyasiani & Mehdian, 1990). Conversely, they are considered as outputs because they are linked to safekeeping, payment services and liquidity provided to depositors (Luo, 2003). To resolve this controversy, some studies employed both approaches in their models (Tortosa-Ausina,

2002). Following several others, this study, however, considers deposits as inputs and represents it as the summation of all monies in customer savings accounts, current accounts and time deposits.

4.6.1.2 Labour

The theory of production in microeconomics considers labour as an important resource for the generation of outputs. Some banking efficiency studies define labour as the expenses incurred by banks on their staff (Kenjegalieva, Simper, Weyman-Jones & Zelenyuk 2009; Drake, Hall & Simper, 2006). These expenses include wages and salaries, pension costs, staff provident fund contributions, staff loans and other training expenses. Other studies define labour as the average number of employees documented in the bank's annual report during the year (Halkos & Tzeremes, 2013; Fukuyama & Matousek, 2011). The former definition of labour is applied in this study due to the data unavailability on the average number of employees for each bank in Ghana for the entire study period. Besides, using labour cost instead of the number of employees indirectly captures labour quality by virtue of the value/cost attached to the labour.

4.6.1.3 Physical Capital

Physical capital, proxied by the cost of fixed assets is also an essential factor of production. In the banking literature, it refers to the book value of all property, plant and equipment, machinery, fixtures and premises acquired by the bank either through an outright purchase or by means of a lease. It is valued at cost less accumulated depreciation and impairment losses. Empirical application of this input includes studies conducted by Tortosa-Ausina et al. (2012), Assaf et al. (2011), Kenjegalieva et al. (2009) and Havrylchyk (2006).

4.6.2 Outputs

4.6.2.1 Loans and Advances

Loans and advances refer to debt provided by banks to households and other business entities. In this study, loans and advances is a summation of the monetary values of customer loans, corporate loans, staff loans, mortgage loans and other loans (Das & Ghosh, 2009; Havrylchyk, 2006). To ensure loan portfolio quality, provisions for bad and doubtful debt is subtracted from the loans and advances (Grigorian & Manole, 2002).

4.6.2.2 Other Earning Assets

Other Earning Assets refer to the bank's investments in different types of securities. In this study, it is an aggregate of investment in government securities (treasury bills and notes, government bonds), investment securities-available for sale, investment in other securities, investment in associate companies and subsidiaries and equity investments.

4.6.3 Input Prices

The price of deposits is obtained by dividing the interest expenses incurred by the bank on any demand deposits, call deposits, time or fixed deposit, savings account and current accounts by its total deposits. The price of labour is estimated by dividing the expenses incurred by the bank on its personnel or staff by total assets (Delis et al., 2009). The price of physical capital is estimated as other operating expenses divided by total fixed assets (Ray & Das, 2010). Other operating expenses in this case are the operating expenses less the staff costs of the bank

4.6.4 Output Prices

The price of loans and advances is estimated by dividing the interest income on loans and advances by the total loans and advances of the bank. The price of investment is estimated by dividing the interest income on investment by the sum of all the investments made by the bank in the year under consideration.

4.7 Bootstrapping the Second-Stage Regression with environmental variables

Many studies have regressed DEA efficiency estimates on certain covariates or environmental variables in the so-called two-stage processes to determine how the exogenous variables can affect the efficiency levels of firms (Simar & Wilson, 2007; 2011). These variables are usually not controlled by management, but may influence the efficiency estimates generated in the first stage such as the profit efficiency estimate of equation (10). Simar and Wilson (2007) argued that DEA efficiency estimates from the first stage are serially correlated in an unknown (in a statistical sense) and complicated way. Thus, regressing these estimates on certain exogenous covariates without recognizing this deficiency could lead to invalid inferences.

To resolve the deficiency of serial correlation, preceding studies adapted Tobit regression models (in the two-stage, DEA plus regression approach) due to the censored nature of DEA scores (which are constrained from above on the right at 1). Simar and Wilson (2007) criticized these studies because of their failure to expound the underlying Data Generating Process (DGP) that allow uncontrollable covariates to affect firm's efficiencies. They also contended that the first stage dependency issue suggests that the stochastic error term of the Tobit regression is correlated with the environmental variables making Tobit estimation inappropriate. The outcome is that inferences

on the second-stage parameters will be biased and inconsistent. Also, although, employing maximum likelihood in the stage-two analysis implies that this correlation vanishes asymptotically, it occurs at a very slow pace and may produce invalid inference.

Hirschberg and Lloyd (2002) and Xue and Harker (1999) had proposed a single bootstrap approach to handle the issue of correlation, which was used by Casu and Molyneux (2003), but, Simar and Wilson (2007) critiqued this "naive" bootstrap technique for resampling without considering the peculiar distributions of efficiency scores derived via non-parametric DEA approach. To address these, Simar and Wilson (2007) have proposed a double-bootstrapped truncated regression when undertaking a second-stage regression whereby the efficiency estimates are regressed on some environmental covariates instead of OLS or Tobit estimates. This is to allow valid inferences and improve statistical efficiency of the second-stage estimates

Denoting θ_j as the true unobserved profit efficiency score of bank *j* and T_j as the row vector of specific covariates or environmental factors for bank *j* (that is, those factors anticipated to affect the bank's profit efficiency score), the second-stage truncated regression model can be specified as:

$$\theta_j = \alpha + \beta T_j + \varepsilon_j, \qquad j = 1, \ldots, n \tag{11}$$

Using Algorithm 2 of Simar and Wilson (2007) double-bootstrapped truncated regression procedure, the distribution of ε_j is assumed to be constrained by the condition $\varepsilon_j \geq 1 - \alpha - T_j\beta$. The distribution of ε_j is also assumed to be truncated normal with a mean of zero (before truncation), an unknown variance and a left truncation point determined by constraint imposed on it. The true unobserved θ_j is substituted by the profit efficiency E_{RC} estimated in the first stage

(equation 10). Since Simar and Wilson (2007) argued against Tobit estimation, a truncated econometric regression model is followed which is given by.

$$ERC_o \approx \alpha + \beta T_j + \varepsilon_j, \quad j = 1,...,n \tag{12}$$

where $\varepsilon_j \sim N\left(0, \sigma_\varepsilon^2\right)$, such that $\varepsilon_j \geq 1 - \alpha - \beta T_j, \quad j = 1,...,n$

The estimated parameter $\hat{\beta}$ is obtained via maximizing the correspondent likelihood function in relation to $\left(\beta, \sigma_\varepsilon^2\right)$ given the obtained data set. Simar and Wilson's (2007) algorithm 2 parametric bootstrap for regression which includes information on the parametric structure and distributional assumption to obtain the bootstrap confidence intervals for the estimates of parameters β and σ_ε^2 is followed. They argued using a Monte Carlo simulation that this procedure ensured feasible, unbiased and consistent estimates of the second-stage truncated regression. For a comprehensive explanation of the estimation algorithm, readers are referred to Simar and Wilson (2007, 2011).

McDonald (2009) and Banker and Natarajan (2008) have in recent times argued that Ordinary Least Squares (OLS) produces consistent estimates in the second-stage regression. Similarly, Banker and Natarajan (2008) and Ramalho, Ramalho and Henriques (2010) have noted the computational burden of bootstrapping and the fact that more bootstrap replications and larger sample size are required for convergence to be achieved. McDonald (2009) indicated that the estimates are created from fractional data and not a censoring process and thus Tobit regression is inconsistent with the data generating process. Saxonhouse (1976) noted that heteroscedasticity can occur if estimated parameters are used as explained variables in regression analysis. McDonald (2009) showed that if White's (1980) heteroskedastic-consistent-standard errors are calculated, large sample tests can be performed which are robust to heteroscedasticity and the distribution of

the disturbances. Hoff (2007) however, argued, that the Tobit (censored) and OLS regressions adequately represented DEA second-stage analysis using the case study of Danish fishery.

By comparing and contrasting the assumptions underlying their truncated regression model and the OLS suggested by Banker and Natarajan (2008), Simar and Wilson (2011) showed that the second-stage OLS estimation by Banker and Natarajan (2008) is consistent only under unusual and peculiar assumptions on the DGP that limit its applicability. In view of this, despite attempts to criticize Simar and Wilson's (2007, 2011) second-stage regression, their double-bootstrapped-truncated regression is adopted in this study since it provides the only possible means for inference in the second-stage regression.

4.8 Capital Structure and Profit Efficiency

The regression model for the capital structure-profit efficiency nexus is given by:

$$ERC_{i,t} = \beta_1 ECAP_{i,t} + \beta_2 ECAP^2{}_{i,t} + \varphi Z_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \qquad (13)$$

where $ERC_{i,t}$ is the profit efficiency of bank i at time t; μ_i represents firm-specific fixed effects; λ_t captures time effects and controls for macroeconomic events; $ECAP_{i,t}$ is equity capital; $ECAP_{i,t}^2$ is the squared term of equity capital, $Z_{i,t}$ is a set of control variables; $\varepsilon_{i,t}$ is the error term (Fosu, 2013; Magaritis & Psillaki, 2010; Berger & Bonaccorsi di Patti, 2006). The control variables include size, sales growth, ownership structure, bank regulations and technical efficiency.

4.8.1 Variable Measurements

4.8.1.1 Equity capital and Equity capital squared

In banking research, equity capital, an inverse measure of leverage captures the capital structure of banks. It is computed as the ratio of total equity to total assets. Equity capital is used as an inverse measure of leverage due to the regulations surrounding the choice of capital ratios in the banking industry. A study by Berger and Bonaccorsi di Patti (2006) established a positive nexus between leverage (lower equity) and profit efficiency which follows the agency cost hypothesis of capital structure. Equity capital squared is introduced to account for possible nonlinear effects of leverage on bank performance (Berger & Bonaccorsi di Patti, 2006).

4.8.1.2 Bank Size

Bank size is measured by taking the natural logarithm of the bank's total assets. Size is introduced to determine whether possible economies and diseconomies of scale exist in the banking industry of Ghana. The findings of preceding studies on the relationship between bank efficiency and size are inconsistent. Whereas Tecles and Tabak (2010) and Ataullah and Le (2006) report a significantly positive relationship, Pasiouras and Kosmidou (2007), Altunbas, Carbo, Gardener and Molyneux (2007) report a significantly negative relationship. Other authors, including Staub, de Silva e Souza and Tabak (2010) and Ariff and Can (2008) report insignificant influence of bank size on efficiency.

4.8.1.3 Sales Growth

Following Gatsi (2012), percentage change in net interest income is used as a proxy for sales growth. A positive relationship implies operational efficiency in the bank. A negative relationship would demonstrate that banks do not gain from their core business activities.

4.8.1.4 Ownership Structure

As regards ownership structure, a dummy variable is used. A dummy of 1 is allocated to a foreign bank and 0 to a domestic bank. A domestic bank is one in which not less 60% of equity capital is owned by Ghanaians whereas a foreign bank is one in which at least 60% of equity capital is owned by foreigners (Banking Act, 2004). Some studies espouse that, banks that are foreign-owned perform better than their domestic counterparts (Bokpin, 2013; Berger et al., 2010; Bonin, Hassan & Wachtel, 2005; Fries & Taci, 2005) because they are well diversified and possess better technologies while others report the opposite (Berger, DeYoung, Genay & Udell, 2000).

4.8.1.5 Regulation

Consistent with existing literature (Pasiouras, Tanna & Zopounidis, 2009; Pasiouras, 2008; VanHoose, 2007), capital is introduced to determine the impact of regulation on the profit efficiency of banks in Ghana. Specifically, the natural logarithm of the minimum capital requirement or stated capital for the banks in Ghana is used as the proxy for capital. Pasiouras et al. (2009) for example established a positive and statistically significant relationship between capital requirement and profit inefficiency suggesting that higher requirements lower the profits obtained by the banks.

4.8.1.6 Technical Efficiency

Technical efficiency which measures the ability of a bank to use given resources to generate more output or reduce inputs while keeping the same level of output (Sathye, 2003) is also used as a control variable. Miller and Noulas (1996) established that, profitable banks have higher levels of technical efficiency than their less profitable counterparts.

4.9 Measures of Competition

The HHI which computes the degree of competition from the product market concentration viewpoint (Chong, Lu & Ongena, 2013) in conjunction with the BI which measures competition from the behavior of the market (Boone, 2008; Griffith, Boone & Harrison, 2005; Boone, 2000) are employed to evaluate competition in the Ghanaian banking industry. HHI is computed as the sum of the squared market shares of each bank.

$$HHI = \sum_{i=1}^{N} \left(MS_i\right)^2 \quad (14)$$

MS_i is the market share of bank *i*. The market shares of the banks are calculated based on three criteria .These are, industry total assets, industry deposits and industry net advances.

The BI is premised on the idea that, given two firms in an industry, where one of the firms is efficient (has a lower marginal cost) and the other is inefficient, with an increase in competition in this industry, the profits of the more efficient firm will increase relative to that of the inefficient firm (Boone, 2000). Following Ohene-Asare and Latif (2014) and Van Leuvensteijn, Bikker and Rixtel (2011), the BI which measures competition is estimated using the equation below

$$lnROA_i = \alpha + \beta lnMc_i + \varepsilon_i \quad (15)$$

Where ROA_i is the return on asset for bank i, Mc_i is the marginal cost of bank i, β is the BI and ε_i is the unobserved error term. Following the leads of Schaek and Cihak (2014), marginal cost is estimated as the ratio of average cost (interest expenses, staff cost and other operating expenses) to total income since marginal costs are not directly observable. When $\beta < 0$, it implies a competitive banking industry and $\beta > 0$ indicates an uncompetitive industry.

4.9.1 Capital Structure, Profit Efficiency and Competition.

In estimating the effect of capital structure and competition on the profit efficiency of a bank, the following model is used.

$$ERC_{i,t} = \alpha_1 ECAP_{i,t,} + \alpha_2 ECAP^2{}_{i,t} + \alpha_3 Com_t + \alpha_4 ECAP_{i,t} * Com_t + \varphi Z_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (16)$$

Where $ERC_{i,t}$ is the profit efficiency of bank i at time t; $ECAP_{i,t}$ is the equity capital of bank i at time t:Com_t is the level of competition in the industry at time t proxied by the HHI and the BI alternatively; $ECAP_{i,t} * Com_t$ is the interaction of equity capital and competition; $Z_{i,t}$ is a set of control variables (see section 4.8); μ_i represents firm-specific fixed effects; λ_t captures time varying effects; $\varepsilon_{i,t}$ is the error term.

To obtain the effect of capital structure on profit efficiency amidst competition, the first derivative of equation (16) with respect to $ECAP_{i,t}$ is taken. This is shown in equation 17. In summarizing the effect of capital structure on profit efficiency, interesting values such as the mean value and lower and upper quartiles of equity capital and competition must be used to evaluate equation 17. To test whether the estimate is statistically different from zero, the model must be rerun with the sample mean values of equity capital and competition (Wooldridge, 2012).

$$\frac{dERC_{i,t}}{dECAP_{i,t}} = \alpha_1 + 2\alpha_2 ECAP_{i,t} + \alpha_4 Com_t \quad (17)$$

If HHI is used as a proxy for competition in equation (16), then $\alpha_1 + 2\alpha_2 ECAP_{i,t}$ captures the effect of capital structure on the efficiency of banks in an unconcentrated (perfectly competitive) industry whiles $\alpha_1 + 2\alpha_2 ECAP_{i,t} + \alpha_4 Com_t$ captures the effect of capital structure at specified levels of concentration (competition). If BI is used then $\alpha_1 + 2\alpha_2 ECAP_{i,t}$ captures the effect of capital structure in a concentrated (uncompetitive) industry whiles $\alpha_1 + 2\alpha_2 ECAP_{i,t} + \alpha_4 Com_t$ captures the effect of capital structure at specified levels of competition.

4.9.2 Capital Structure, Conglomeration and Profit Efficiency

Vander Vennet (2002) and Nicoló et al., (2004) defined a financial conglomerate as a bank that engages in other activities (e.g. insurance, securities related activities) aside the traditional banking activities of deposit taking and lending. In Ghana, given the introduction of the Universal Banking License in 2003 (Ghana Banking Survey, 2008) which permits the banks to perform other activities besides the traditional banking activities of borrowing and lending, this study proxies a conglomerate as a bank that has subsidiaries performing activities other than those stipulated as permissible banking activities by the Banking Act 2007 (Act 738). A dummy of 1 is assigned to a bank that is a conglomerate and zero (0) to a non-conglomerate/focused bank.

$$ERC_{i,t} = \gamma_1 ECAP_{i,t} + \gamma_2 ECAP^2{}_{i,t} + \gamma_3 (Cong) + \gamma_4 ECAP_{i,t} * Cong + \psi Z_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (18)$$

where *Cong* is a binary variable capturing conglomeration.

4.9.3 Reverse Causation between Profit Efficiency and Capital Structure

Consistent with Berger and Bonaccorsi di Patti (2006), the reverse causation between profit efficiency and capital structure is tested using a simultaneous equation model. In doing so, a two-equation structural model is constructed and estimated using two stage least squares (2SLS).

$$ERC_{i,t} = \delta_1 ECAP_{i,t} + \varphi Z_{1i,t} + \mu_{1i} + \lambda_{1t} + \varepsilon_{1i,t} \quad (19)$$

$$ECAP_{i,t} = \rho_1 ERC_{i,t-1} + \phi Z_{2i,t} + \mu_{2i} + \lambda_{2t} + \varepsilon_{2i,t} \quad (20)$$

$Z_{1i,t}$ includes bank size, sales growth, ownership structure, bank regulation, and technical efficiency. $Z_{2i,t}$ includes bank size, sales growth, bank regulation and asset structure. The simultaneous equations model is identified because the appropriate number of variables are excluded from each of the Z vectors.

4.9.4 Instruments for Data Analysis

Data is analysed using MaxDEA Pro 6.3 and R codes with censReg (Henningsen, 2012), FEAR (Wilson, 2008) and Benchmarking (Bogetoft & Otto, 2011) packages.

4.9.5 Chapter Summary

This chapter provided an in-depth explanation of the methods adopted in achieving the objectives of this study. This included clarity on the design of the research, the sources of data and the assumptions underlying DEA. Further, the chapter provided justification for the inputs and outputs selected in estimating profit efficiency and the reason for bootstrapping the second-stage regression. Instruments needed for analysing the data was also presented.

CHAPTER FIVE

DATA ANALYSIS

5.1 Introduction

This chapter presents the results derived from analysing the data set for this study. First, it presents and analyses the descriptive statistics of the inputs, outputs, input prices and output prices used in estimating the profit efficiencies of banks in Ghana. It then presents and provides preliminary analyses and discussions on the objectives of the study.

5.2 Descriptive Statistics of Variables

In the banking and finance efficiency literature, there are controversies surrounding the specification of inputs and outputs for frontier modelling. The literature recognizes that the choice of variables in efficiency studies can influence the results significantly. It is necessary therefore that, variables used for efficiency be described to ensure they are in tandem with the assumptions required for effective estimations. The data set used in this study was sourced from BOG and the annual reports of 26 banks. For generalization, pooled summary statistics of the variables used in the estimation of profit efficiency for the banks in Ghana are reported in Table 5. A year-by-year summary statistics of these variables have been attached in Appendix A.

Table 5: Summary statistics of variables used-pooled data (GH¢)						
	Variables	**Mean**	**Std. Dev.**	**Min**	**Max**	**F-stat across time**
Pooled Data-N-304						
Inputs	*Deposits*	347,000,000	463,000,000	532,192.1	3.221E+09	12.78***
	Labour	17,530,602	25,937,965	49,094	169,996,000	8.53***
	Fixed Assets	13,228,737	15,780,213	59,111	94,756,640	10.4***
Input Prices	*Deposits*	0.08	0.05	0.01	0.4	5.29***
	Labour Cost	0.04	0.08	0	1.47	0.91
	Fixed Assets	1.71	1.65	0.15	17.72	1.50
Outputs	*Loans and Advances*	217,000,000	281,000,000	154,708	2.125E+09	13.53***
	Investment	129,000,000	226,000,000	61,000	1.747E+09	8.07***
Output Prices	*Loans and Advances*	0.19	0.07	0.02	0.52	8.43***
	Investment	0.23	0.59	0	8.45	0.79
Others	*Total Assets*	503,645,096	653,752,686	884,009	4.624E+09	11.99***
	Equity	67,946,016	89,061,008	-1,606,000	557,106,000	21.56***

An examination of the prices of inputs suggest that on average, the most expensive factor of production in Ghana's banking industry is capital or fixed assets (GH¢1.71) which is typical of most developing countries. The results reported also suggest that, banks in Ghana on average price their deposits (GH¢0.08) much lower than the loans (GH¢0.19) they grant their customers. The implication of this pricing strategy is that, *ceteris paribus*, on average, banks in Ghana generate more from loans and incur less expenses on the deposits. The results also reveal that, banks in Ghana gave out approximately 62.54% of their deposits as loans to their customers and invested about 37.18% for the period under consideration.

The minimum and maximum values of the variables, particularly that of total assets (min=GH¢884,009, max=GH¢4,624,405,000) and their relatively high standard deviations indicate that banks in Ghana have different sizes. This justifies the use of the Variable Returns to Scale (VRS) assumption of Banker et al. (1984) in the profit efficiency estimation. Further, the relatively high standard deviations of the inputs, outputs and equity indicate that the actual

averages of these variables are largely dispersed from the expected suggesting volatility in the variables over the 14 year period.

A test of differences in the variables across time using a one way anova reveals significant differences of each input and output across time. This is also presented in Table 5. This suggests that, pooling data across years for the purposes of generalization as have been done in Table 5 may be flawed. This is because pooling tacitly implies that all the banks in Ghana operated in the same environment or under a common condition. However, the variables may have been affected by certain yearly factors including changes in the regulatory framework which may not be visible when the data is pooled or other macroeconomic conditions peculiar to some years. To resolve this potential unobserved year-specific factors, a trend analysis of the variables is provided in Figures 5 and 6.

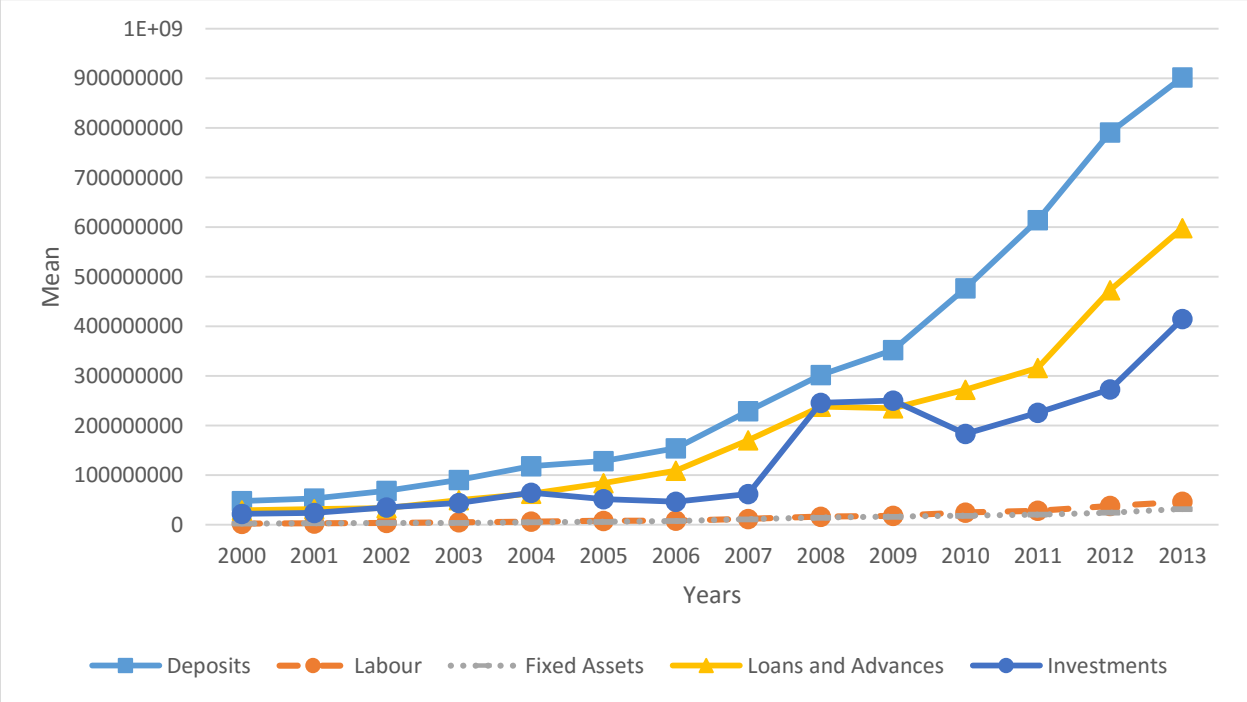


Figure 5: **Trend Analysis of Average Inputs and Outputs from 2000 to 2013**

Figure 5 shows that with the exception of investments which fell between 2005 and 2007 and in 2010, there has been a steady rise in the inputs and the other output. The fall in investment is probably because of the decrease in the discount rate of the 91 day Treasury bill from 25% in 2002 to 10.7% in 2006 (Ghana Banking Survey, 2007) which made investments less attractive to the banks.

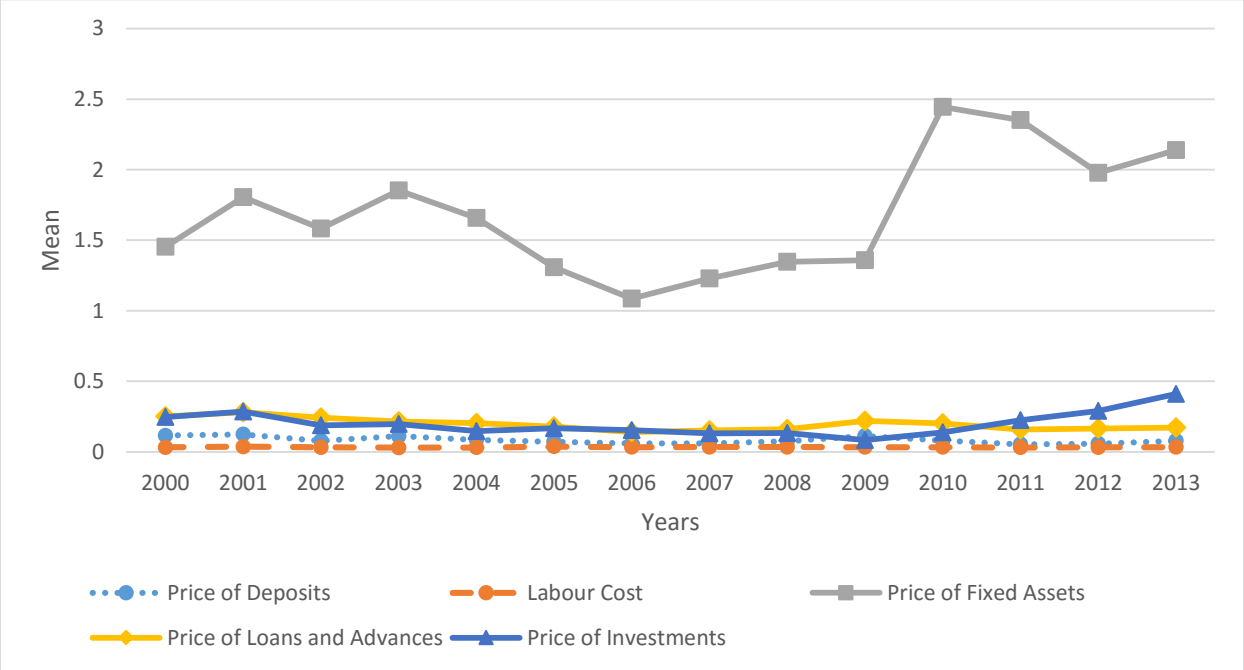


Figure 6: **Trend Analysis of Average input and output prices from 2000 to 2013**

Notable observations in Figure 6 are the prices of deposits and the prices of loans and advances**.** The price of deposits fell in 2002, 2004, 2010 and 2011. Similarly, the price of loans and advances fell between 2002 and 2006 and between 2010 and 2011. This is probably because, the economy experienced falls in inflation rates during these periods. For example, the inflation rate fell from 40.5% in 2000 to 15% in 2002 and 12% in 2004 (Ghana Banking Survey, 2005). It also fell from 16.9% in 2009 to 8.6% in 2010 and 2011. Likewise, the monetary policy rates fell from 18% in 2009 to 13.5% in 2010 and 13% in 2011 (Ghana Banking Survey, 2011, 2012). Thus, the fall in

prices (interest rates) mirrored the fall in inflation and the changes in the monetary policy rates. The year 2006 was also characterized by the abolition of the secondary reserve requirement of 35%. This increased the amount of deposits in the industry and thus the amount of loans that could be created. Given a constant demand, it is expected that the excess supply of loans would lead to a fall in the prices of loans and advances.

Table 6 shows summary statistics of the variables by accounting for bank ownership. Although, the yearly average prices of labour (see Appendix A) seem to suggest that local banks pay more salaries per worker than foreign banks, the aggregate of these observations indicate that, foreign banks pay higher salaries per employee and invest more in expensive capital than the local banks. This substantiates the perception that, foreign banks have enhanced the human resources quality in the banking industry. However, as denoted by the standard deviations, the staff costs incurred by foreign banks is volatile. This is probably because these foreign banks differ in terms of origin.

Table 6: Summary statistics of variables for local and foreign banks

Variable Name	Ownership	Pooled Data			
		Mean	Std Dev.	Min	Max
Inputs					
Deposit	Local	32,7481,345	430,908,027.2	2,172,653.1	263,0283,000
	Foreign	365,569,503.9	491,850,232.7	532,192.1	3,220,777,000
Labour	Local	18,532,582.51	28,441,355.04	153,358.8	169,996,000
	Foreign	16,580,336.52	23,371,322.05	49,094	140,748,000
Fixed Assets	Local	13,998,499.26	16,074,029.87	264,843.9	94,756,640
	Foreign	12,508,003.74	15,516,793.37	59,111	82,726,830
Input Prices					
Deposit	Local	0.1*	0.05	0.02	0.4
	Foreign	0.06*	0.04	0.01	0.26
Labour	Local	0.03	0.01	0.01	0.07
	Foreign	0.04	0.11	0	1.47
Fixed Assets	Local	1.38*	0.87	0.32	5.34
	Foreign	1.99*	2.05	0.15	17.72
Outputs					
Loans and Advances	Local	229,684,428.4	268,448,625.3	646,601.5	1,265,517,000
	Foreign	205,127,027.5	293,460,737.3	154,708	2,124,530,000
Investments	Local	109,775,452.7	226,612,072.4	61,000	1,747,087,000
	Foreign	147,308,672.1	225,504,143.3	114,786	1,229,731,000
Output Prices					
Price of Loans and Advances	Local	0.21*	0.07	0.07	0.49
	Foreign	0.18*	0.08	0.02	0.52
Price of Investments	Local	0.16*	0.06	0	0.4
	Foreign	0.3*	0.82	0	8.45
Total Assets	Local	472,346,036.3	567,446,443.6	2,712,278.6	3,391,100,000
	Foreign	532,950,585.8	725,937,822.7	884,009	4624,405,000
Equity	Local	56,551,757.31*	71,165,468.79	405,446.4	447,156,000
	Foreign	78,614,526.54*	102,124,229.6	-1,606,000	557,106,000
Observations		304	304	304	304

** indicates that there are significant differences in the mean of the variable for local and foreign banks at 5%*

An independent sample t-test of the means of the variables also indicated that there are significant differences in the prices of deposits, prices of fixed assets, prices of loans and advances, prices of investments and equity between local and foreign banks. Table 7 reports the summary statistics of the variables according to the degree of conglomeration. A conglomerate in this context refers to

a bank that engages in other activities aside those stipulated by the Banking Act 2004 (Act 673). In other words, it is a bank that has a subsidiary performing non-banking activities. A focused bank is one that engages solely in the activities stated in Act 673 and has no subsidiary. Weston (1970) and Chandler (1977) argue that with conglomeration, firms enjoy economies of scale which make them efficient in their operations. The total assets of conglomerates (mean=GH¢706,797,749) exceed that of the focused banks (mean= GH¢381,753,505) on average. An independent sample t-test of the means implies that in Ghana, banks that are conglomerates are significantly larger than their focused counterparts.

Table 7:Summary statistics of variables for conglomerates and focus banks

Variable Name	Degree of conglomeration	Pooled Data			
		Mean	Std Dev	Min	Max
Inputs					
Deposit	Conglomerate	524,038,255*	597,034,365	12,725,429	3,220,777,000
	Focus	241,020,046*	316,835,670	532,192.1	1,592,324,000
Labour	Conglomerate	27,894,943*	34,423,376	284,481.2	169,996,000
	Focus	11,245,842*	16,176,370	49,094	92,667,010
Fixed Assets	Conglomerate	18,749,607*	18,161,973	340,725.4	82,726,830
	Focus	9,916,214.4*	13,137,079	59,111	94,756,640
Input Prices					
Deposit	Conglomerate	0.08	0.05	0.02	0.28
	Focus	0.08	0.05	0.01	0.4
Labour	Conglomerate	0.03	0.01	0.01	0.01
	Focus	0.04	0.11	0	1.47
Fixed Assets	Conglomerate	1.3*	0.63	0.32	4.8
	Focus	1.95*	1.99	0.15	17.72
Outputs					
Loans and Advances	Conglomerate	331,211,089*	350,034,709	3,206,220	2,124,530,000
	Focus	148,476,264*	202,855,195	154,708	975,584,000
Investments	Conglomerate	186,471,918*	288,051,418	4,953,578.8	1,747,087,000
	Focus	94,771,866*	171,551,720	61,000	1,229,731,000
Output Prices					
Price of Loans and Advances	Conglomerate	0.19	0.07	0.07	0.48
	Focus	0.19	0.08	0.02	0.52
Price of Investments	Conglomerate	0.16*	0.06	0.05	0.35
	Focus	0.28*	0.75	0	8.45
Total Assets	Conglomerate	706,797,749*	792,182,406	17,228,548	462,4405,000
	Focus	381,753,505*	519,761,008	884,009	293,0852,000
Equity	Conglomerate	90,283,252*	107,113,842	702,313	557,106,000
	Focus	54,543,675*	73,313,645	-1,606,000	445,232,000
Observations		304	304	304	304

** indicates that there are significant differences in the mean of the variable for conglomerate and focused banks at 5%.*

5.3 Profit Efficiency of Banks in Ghana

To achieve the first objective of this study, the profit efficiency scores of each bank under consideration is estimated under VRS. This is attached in Appendix B. For generalization, the means and standard deviations of the profit efficiencies estimated are reported in Table 8. Considering the fact that there were significant differences in the variables for estimation (see Table 5), the profit efficiency estimates are estimated relative to each year-specific frontier.

Table 8**: Average Profit Efficiencies of Banks in Ghana**

Year	Number of Banks	PROFIT EFFICIENCY		
		Geometric Mean	Arithmetic Mean	Std Dev.
2000	16	0.77	0.79	0.20
2001	17	0.80	0.84	0.24
2002	17	0.76	0.79	0.21
2003	18	0.90	0.91	0.13
2004	18	0.81	0.83	0.19
2005	19	0.94	0.94	0.11
2006	23	0.90	0.92	0.16
2007	23	0.89	0.90	0.15
2008	24	0.89	0.90	0.13
2009	27	0.80	0.83	0.20
2010	26	0.77	0.80	0.21
2011	25	0.68	0.73	0.25
2012	25	0.66	0.72	0.26
2013	26	0.60	0.66	0.28
Average		**0.79**	**0.82**	**0.22**

Table 8 presents the average year wise distribution of profit efficiency of banks in Ghana. Both the arithmetic and geometric means are computed. This is because for normalized benchmark scores, using arithmetic mean alone may lead to wrong inferences (Ohene-Asare & Asmild, 2012). The high levels of profit efficiencies accompanied by lower standard deviations suggest that most banks in Ghana lie close to the benchmark profit frontier. On average, 79% of the potential profits

that a best practice bank could make under similar conditions are earned by most of the banks in Ghana.

Compared to other banking industries in other countries, the Ghanaian banking industry has recorded higher profit efficiency results. The average profit efficiency was found to be 57.5% for Spanish banks (Maudos & Pastor, 2003), 50.5% for Chinese banks (Ariff & Can, 2008) and 52.14% for Indian banks (Ray & Das, 2010). This is probably because, unlike these countries, Ghana's capital market is underdeveloped. Thus, the disintermediation process that has triggered declines in these banking industries has not yet threatened Ghana.

To test whether there are significant differences in the profit efficiency estimates over time, both the non-parametric Kruskal Wallis test and the parametric anova as well as Tukey HSD multiple comparison tests were conducted. Both the Kruskal Wallis ($\chi^2 = 35.786, p = .001$) and the anova ($F$=3.905, p=.000) reveal significant differences over time. Profit efficiency since 2009 has fallen monotonically over the years. This is probably because of the change in government in 2009 as well as the global financial crisis in 2008. Changes in economic management policies of the new government may have had adverse effects on banks. The global financial downturn may also have influenced banks in Ghana potentially because of their direct exposure to their partners abroad in the form of nostro placements and balances.

Further, rankings of the average profit efficiencies of each bank over time indicate that, the best performing banks are GCB and BARODA. These are followed by SCB, BBG and UT.

Table 9: Average Profit Efficiency Rankings Of banks in Ghana from 2000 to 2013

Bank	OWN	AM	GM	Rank[a]	Bank	OWN	AM	GM	Rank[a]
GCB	L	1.00	1.00	1	FABL	L	0.82	0.77	16
BARODA	F	1.00	1.00	1	CAL	L	0.81	0.79	17
SCB	F	0.96	0.95	3	ZENITH	F	0.81	0.79	18
BBG	F	0.96	0.95	4	EBG	F	0.80	0.78	19
UT	L	0.92	0.90	5	PBL	L	0.79	0.77	20
TTB	L	0.91	0.90	6	UMB	L	0.78	0.70	21
UNIBANK	L	0.89	0.88	7	ADB	L	0.76	0.74	22
GTB	F	0.87	0.85	8	UBA	F	0.72	0.68	23
ACCESS	F	0.87	0.85	9	STANBIC	F	0.71	0.68	24
SG-SSB	F	0.87	0.85	10	IBG	F	0.70	0.68	25
HFC	L	0.85	0.84	11	NIB	L	0.68	0.65	26
ICB	F	0.85	0.81	12	BSIC	F	0.46	0.41	27
AMAL/BOA	F	0.85	0.82	13	ENERGY	F	0.29	0.28	28
FBL	L	0.84	0.82	14	ROYAL	F	0.21	0.21	29
METRO/BPI	F	0.83	0.80	15	-		-	-	-

[a] *The ranking is from 1 - 29. The value 1 represents the best performing bank and 29 the least performing bank. OWN-Ownership; F-Foreign bank; L-Local bank; AM-Arithmetic mean; GM-Geometric mean*

In terms of ownership, local banks have been more profit efficient (0.8375) than foreign banks (0.7506) over the years on average. However, a Wilcoxon rank sum test (*W=89.5, p=0.5945)* shows that the difference is infinitesimal and insignificant.

Also, the scores of the non-parametric DEA approach are compared with two traditional profitability ratios, ROA and ROE in Table 10. This is to determine whether DEA scores give similar rankings as the traditional ratios. Whereas the DEA scores are the geometric means of the profit efficiency scores, ROA and ROE scores are the arithmetic means of each bank for the entire study period (2000 to 2013). The geometric mean instead of arithmetic mean is used for the DEA scores because DEA scores are benchmarked scores which may be biased when arithmetic mean is used.

Table 10 : Comparison of DEA and traditional profitability ratios

	DEA		ROA		ROE	
Bank	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**
ACCESS	0.8531	8	0.0489	7	0.2207	12
ADB	0.7403	21	0.0373	11	0.2084	15
AMAL/BOA	0.8215	13	-0.0059	27	-0.1905	29
BARODA	1.0000	1	0.0680	2	0.2487	11
BBG	0.9484	4	0.0684	1	0.6113	2
BSIC	0.4139	27	-0.0492	29	-0.0969	28
CAL	0.7926	17	0.0460	9	0.3006	10
EBG	0.7824	18	0.0526	5	0.4978	5
ENERGY	0.2781	28	0.0304	12	0.1812	17
FABL	0.7693	19	0.0155	20	0.2100	14
FBL	0.8230	12	0.0123	21	0.1506	21
GCB	1.0000	2	0.0458	10	0.4372	7
GTB	0.8496	9	0.0052	24	0.0821	24
HFC	0.8368	11	0.0290	14	1.0565	1
IBG	0.6799	25	0.0099	22	0.1651	18
ICB	0.8074	14	0.0301	13	0.1609	19
METRO/BPI	0.8000	15	-0.0210	28	-0.0289	26
NIB	0.6530	26	0.0288	15	0.1209	22
PBL	0.7668	20	0.0230	17	0.3512	8
ROYAL	0.2083	29	0.0068	23	0.1201	23
SCB	0.9517	3	0.0622	3	0.5479	3
SG-SSB	0.8454	10	0.0530	4	0.3376	9
STANBIC	0.6821	23	0.0486	8	0.4507	6
TTB	0.8994	5	0.0512	6	0.5037	4
UBA	0.6811	24	0.0051	25	-0.0485	27
UMB	0.7048	22	0.0197	19	0.1956	16
UNIBANK	0.8755	7	0.0008	26	0.0180	25
UT	0.8988	6	0.0261	16	0.2144	13
ZENITH	0.7935	16	0.0227	18	0.1550	20

[a] *The ranking is from 1 - 29. The value 1 represents the best performing bank and 29 the least performing bank. Wilcoxon signed rank test(DEA-ROA):V=212, p=0.8462 Wilcoxon signed rank test (DEA-ROE):V=211,p=0.8643*

A careful comparison of DEA and the other profitability ratios reveal that the techniques generally do not present similar rankings. Except for SCB, the ranks of most of the other banks are not precisely the same. Out of the 29 banks, 14 are ranked highly for DEA than ROA and 15 for DEA

than ROE. A correlation matrix of the three techniques as presented in Table 11 also shows that the techniques are positively correlated but the association is generally weak.

Table 11: Correlation between DEA, ROA and ROE

	DEA	ROA	ROE
DEA	1		
ROA	0.4633	1	
ROE	0.3372	0.6697	1

This is probably because, DEA provides a more holistic picture of a bank's performance by taking simultaneous account of their inputs and outputs than the profitability ratios. A Wilcoxon signed rank test (see Table 10) however, reveal no significant differences in the pairwise comparison of DEA scores and the two profitability ratios. This implies that DEA scores provide similar conclusions as the profitability ratios, but incorporates other factors into its computation. The weak correlation between the DEA and the profitability ratios suggests however that using only profitability ratios to assess bank performance may not capture their true overall performance.

5.4 Effect of Capital Structure on Profit Efficiency

To investigate the marginal effect of capital structure on the profit efficiency of banks in Ghana (the second objective of this study), a bootstrapped truncated regression is estimated. This involves regressing profit efficiency on capital structure and other control variables. To do this, the study first tests for the degree of multicollinearity among the independent variables by including a correlation matrix in Tables 12 and 13.

Correlation Matrix

Table 12: Pearson Correlation

	ERC	ECAP	$ECAP^2$	BS	SG	REG	OWN	TE
ERC	1							
ECAP	-.116*	1						
$ECAP^2$	-0.078	.905**	1					
BS	-0.037	-0.103	-.130*	1				
SG	0.061	.167**	.158**	-0.053	1			
REG	-.183**	.230**	.175**	.641**	0.109	1		
OWN	-0.009	.196**	.181**	-0.017	.168**	.172**	1	
TE	.362**	-0.103	-.125*	0.059	-0.066	-0.102	-0.078	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 13: Spearman's rho

	ERC	ECAP	$ECAP^2$	BS	SG	REG	OWN	TE
ERC	1							
ECAP	-.157**	1						
$ECAP^2$	-.176**	.989**	1					
BS	-0.044	0.009	-0.009	1				
SG	0.084	-0.055	-0.075	-.116*	1			
REG	-.193**	.247**	.237**	.667**	0.062	1		
OWN	0.013	.152**	.164**	0.005	0.107	.217**	1	
TE	.349**	-0.059	-0.078	0.068	-0.03	-0.099	-0.026	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix shows a positive and statistically significant correlation between profit efficiency (ERC) and technical efficiency (TE) but a negative and statistically significant correlation with equity capital (ECAP) and regulation (REG). Bank size (BS) and Ownership (OWN) correlate negatively with profit efficiency but these results are insignificant. Sales growth has a positive, but insignificant correlation with profit efficiency. Equity capital has a positive and statistically significant correlation with sales growth, regulation and ownership, but has a

statistically insignificant negative correlation with size and technical efficiency. Size correlates positively with regulation and technical efficiency and negatively with sales growth and ownership. With the exception of regulation, the correlation between size and the other variables are insignificant. Sales growth has a positive correlation with regulation and ownership but a negative correlation with technical efficiency. The correlation between sales growth and regulation is significant but insignificant for ownership and technical efficiency. Regulation is statistically positively correlated with ownership but negatively correlated with technical efficiency. Ownership correlates negatively with technical efficiency but this is insignificant.

In the specification of a model, independent variables that are correlated (have values exceeding 0.50) cannot be placed in the same model (Cohen, 1988). This is because they play similar roles and including them in the same model may make the regression sensitive to small changes in specification. With this, the confidence intervals for the parameters will be wide and the conclusions that might be made from the significance tests may be inappropriate (Brooks, 2009). To resolve this issue of multicollinearity, it is required that one of the highly correlated independent variables be dropped from the model to avoid misspecification. This can be done through the use of the Variance Inflation Factor (VIF) which quantifies the severity of multicollinearity through a stepwise procedure.

However, some econometricians have argued that, dropping an independent variable that belongs to the population model can lead to biases (Wooldridge, 2012). Also, setting an arbitrary cutoff point for the VIF above which multicollinearity is a problem is questionable and not particularly useful. Thus, if the model is adequate in terms of the coefficients having the appropriate signs and being of plausible magnitude, the multicollinearity problem can be ignored. Further,

multicollinearity is less a problem with the model than with the data (Brooks, 2009). In view of these, the multicollinearity between regulation and size (0.64) is ignored.

Findings from Bootstrapped Truncated Regression

Summary statistics of the variables used in the bootstrapped truncated regressions are presented in Table 14 and the results for the regressions in Tables 15 and 16.

Table 14: Summary Statistics of variables used in truncated regression

	N	Mean	Std. Dev	Min	Max
ERC	304	0.82	0.22	0.18	1
ECAP	304	0.15	0.12	-0.13	0.97
$ECAP^2$	304	0.04	0.08	0	0.94
BS	304	19.17	1.54	13.69	22.25
SG	289	44.4	62.18	-134.94	507.11
REG	304	0.09	0.018	0.06	0.10
OWN	304	0.54	0.5	0	1
TE	304	0.9	0.15	0.31	1
HHI	304	0.09	0.03	0.06	0.15
BI	304	-2.40	1.72	-7.32	0.01
CONG	304	0.37	0.48	0	1
ROA	304	0.03	0.04	-0.21	0.18
ROE	304	0.27	0.7	-4.4	9.58

The original results of the bootstrapped truncated regression shows that, the effect of equity capital and equity capital squared on profit efficiency are both statistically insignificant at 5% (see Table 20 Appendix C) but the first derivative $\frac{dERC_{i,t}}{dECAP_{i,t}}$ is statistically significant and negative at the sample mean of 0.15 (see Table 15). This is consistent with the predictions of the trade-off and the agency cost theories that lower equity (higher leverage) is related to improved performance (profit efficiency). It is also in line with the findings of Berger and Bonaccorsi di Patti (2006) on U.S commercial banks and Fosu (2013) on South African firms. The result also satisfies hypothesis

one (H_1) and implies that, in Ghana, capital structure is important in determining the profit efficiency of banks. The more leverage a bank uses relative to equity, the more profit efficient it becomes. This is probably because, leverage reduces their tax burdens as indicated by the trade-off theory and helps them give out more loans from which they generate higher interest incomes. It is also possible that leverage reduces the agency costs predominant in these banks leading to higher profit efficiency.

Table 15: Regression Results: Profit Efficiency and Capital Structure (At Sample Mean)

	ERC		ROA		ROE	
(Intercept)	0.1951		-		-0.9101	
	(0.1767)		-		(0.5945)	
ECAP	-0.3299		0.1719	***	-1.0497	
	(0.1626)	*	(0.0467)		(1.3671)	
$ECAP^2$	0.3917		-0.0719		3.3223	
	(0.337)		(0.045)		(2.088)	
BS	0.0192		0.0022		0.073	
	(0.0107)	.	(0.0068)		(0.0484)	
SG	0.0004		0.0001		0.0002	
	(0.0002)	*	(0)		(0.0003)	
REG	-0.015		-0.0027		-0.0437	
	(0.0054)	**	(0.0025)		(0.0281)	
OWN	0.0143		-		-0.025	
	(0.0234)		-		(0.0944)	
TE	0.5421		0.0493		0.6177	
	(0.0823)	***	(0.0215)	*	(0.2621)	*
Sigma	0.191		-		-	
	(0.008)	***	-		-	
Log Likelihood	68.46					
R squared			0.1603		0.0562	
F-statistic			8.1157***		2.3898*	

*Profit Efficiency estimates are truncated at zero. '***' 0.001 '**' 0.01 '*'0.05 '.' 0.1*
Standard errors are white robust to serial correlation and heteroscedasticity
Coefficients have been bootstrapped

To buttress the main argument of the study that, the proxy for performance may be a cause of the inconclusive results in the CSFP link, two financial ratios, ROA and ROE were used. The Hausman specification test, a test performed to determine whether the researcher should choose the fixed effects or random effects model estimation prior to running a panel regression was used. The rule of thumb for this test is that when $p < 0.05$, there is a correlation between the error terms and the explanatory variables and a fixed effects estimation is adopted else the random effects estimator is more appropriate. The test showed that, a fixed effects estimator is appropriate for using ROA as the dependent variable and a random effects estimator for ROE (see Appendix C for results on the Hausman Test).

The panel regression results suggest a statistically significant and positive relationship between equity capital and ROA (see Table 20 Appendix C). A similar relationship is documented when the first derivative $\frac{dROA_{i,t}}{dECAP_{i,t}}$ is taken and the model is rerun at the sample equity capital mean of 0.15 (see Table 15). The results imply that, profitable banks in Ghana rely less on leverage than equity, which is consistent with the pecking order theory of capital structure. It is also in tandem with the results documented by Amidu (2007) in his study of 19 banks in Ghana. However, equity capital has a negative and insignificant impact on ROE**.** This is in line with Modigliani and Miller's irrelevance theory of capital structure. It is evident therefore that, although ROA and ROE are created from the same financial statements, they provide differing results on the relationship between capital structure and bank performance. This is probably because each of these ratios examine only a part of the bank's operations and thus ineffective for assessing the overall performance of banks (Paradi & Zhu, 2013). In view of this, employing financial ratios as proxies

for performance in the CSFP link may not be appropriate. Instead, a measure that takes simultaneous account of the inputs and outputs used in the bank such as profit efficiency is effective.

From Table 15, bank size has a positive effect on profit efficiency and significant at 10%. This means that the larger a bank is in Ghana, the higher its profit efficiency. One reason for this relationship may be the fact that, bigger banks enjoy economies of scale, are more diversified and develop better means and prospects for diversifying risk than smaller banks (Tecles & Tabak, 2010; Isik & Hassan, 2002).

Sales growth also has a positive and statistically significant relationship with profit efficiency. This implies that, in Ghana, profit efficient banks gain from their core activity which is taking deposits and granting loans. In other words, they are operationally efficient. As Gatsi (2012) posit, the strong link between sales growth of banks and performance is probably as a result of improvement in the general economic climate thereby translating into the banking sector.

Regulation as measured by the natural logarithm of the minimum capital requirement has a negative and statistically significant impact on profit efficiency. This suggests that higher capital requirements decreases the profit efficiency of banks in Ghana. This finding is consistent with Pasiouras et al (2009). The decrease in profit efficiency is probably because, banks substitute loans which generate interest incomes with equity which does not bear interest incomes to meet the higher requirements (VanHoose, 2007). This finding is different from a similar work by Bokpin (2013) who saw that regulation has a positive effect on profit efficiency of banks in Ghana. Perhaps, the difference is as a result of the differing proxies for measuring regulation. Whereas, Bokpin (2013) uses the capital adequacy ratio, this study uses the minimum capital requirement.

Similar to Bokpin (2013), a positive but statistically insignificant relationship is found between ownership and profit efficiency. This means that, the type of ownership is irrelevant in determining the profit efficiencies of banks in Ghana. This supports the argument by Molyneux and Thornton (1992) and Bourke (1989). The results imply however that, foreign banks are more profit efficient than local banks which is consistent with studies by Berger et al. (2010) and Bonin et al. (2005). This is probably because foreign banks are well diversified and possess better technologies than local banks (Berger et al, 2000).

Technical efficiency has a positive and statistically significant impact on profit efficiency. This suggests that in Ghana, banks that are capable of producing more outputs (loans and advances, investments) given fixed inputs (deposits, fixed assets and labour) or use lesser inputs to produce given outputs are more profit efficient. Miller and Noulas (1996) documented same findings in their study of technical efficiency of large bank production.

5.5 Capital Structure, Competition and Profit Efficiency.

To achieve objective three, which is examining the marginal effect of capital structure on profit efficiency amidst the degree of competition, a bootstrapped truncated regression was run. In a unique contribution of this study, two measures of competition, HHI and BI were used to proxy the levels of competition in the Ghanaian banking industry (see Appendix D for yearly HHI and BI scores). The results for using HHI are presented in models 1 to 3 in Table 16 and models 4 to 6 in Table 17 for BI. Models 1 and 4 present the original results of the bootstrapped truncated regression. In models 2 and 5, the results for the first derivative of profit efficiency with respect to equity capital at a mean of 0.15 for equity capital, 0.09 for HHI and 2.40 for BI are presented.

Models 3 and 6 show the first derivative of profit efficiency with respect to competition for HHI and BI respectively.

The partial effect of equity capital on profit efficiency is significant at 10% and negative (see model 2). The partial effect of competition measured by the degree of concentration, HHI, is negative and insignificant (see model 3). This does not provide support for hypothesis two (H_2) of this study. The result implies that, bank concentration has a negative impact on profit efficiency. This means that, the more monopolistic the banking industry becomes, the lesser its ability to convert its resources into profits. This is probably because of the inefficiencies and deadweight losses attributable to monopolistic markets (Baye, 2010). In less concentrated industries, firms are able to utilize the resources in order to stay competitive.

Table 16: Regression Results : Capital Structure, Competition and Profit Efficiency

	Herfindahl Hirschman Index (HHI)					
	Model 1		**Model 2**		**Model 3**	
(Intercept)	0.6402	*	0.6306	.	0.6402	*
	(0.324)		(0.3233)		(0.324)	
ECAP	-0.5521		-0.3162	.	-0.5521	
	(0.574)		(0.1627)		(0.574)	
$ECAP^2$	0.4257		0.4257		0.4257	
	(0.3839)		(0.3839)		(0.3839)	
BS	0.0169		0.0169		0.0169	
	(0.0108)		(0.0108)		(0.0108)	
SG	0.0004	*	0.0004	*	0.0004	*
	(0.0002)		(0.0002)		(0.0002)	
REG	-0.0304	**	-0.0304	**	-0.0304	**
	(0.011)		(0.011)		(0.011)	
OWN	0.0213		0.0213		0.0213	
	(0.0239)		(0.0239)		(0.0239)	
TE	0.5399	***	0.5399	***	0.5399	***
	(0.0821)		(0.0821)		(0.0821)	
HHI	-1.9114		-1.9114		-1.7311	
	(1.2948)		(1.2948)		(1.0973)	
ECAP*HHI	1.2024		1.2024		1.2024	
	(5.3271)		(5.3271)		(5.3271)	
Sigma	0.1902	***	0.1902	***	0.1902	***

	(0.0079)	(0.0079)	(0.0079)
Log Likelihood	69.77	69.77	69.77

*HHI was measured using squared market shares of total Assets. '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1. Coefficients have been bootstrapped*

Further, unlike in previous CSFP studies in the banking industry, this study attempts to determine the impact of the interaction between competition and capital structure on profit efficiency. This is found to be positive, but insignificant as shown by ECAP*HHI. This suggests that, the effect of capital structure on profit efficiency increases as bank concentration increases. In other words, the negative effect of equity capital on profit efficiency increases as competition in Ghana's banking industry decreases. Thus, the benefits banks gain from using more leverage (deposits, borrowings, and accruals) in financing their activities become higher in periods when the banking industry is less competitive.

Using BI as a proxy for competition, the impact of the interaction between capital structure and competition on profit efficiency is negative and insignificant (see Table 17). This finding suggests that the effect of equity capital on profit efficiency increases as the level of competition in the banking industry reduces. But this effect is insignificant. Interestingly, the partial effect of competition on profit efficiency is negative and significant (see model 6) contrary to the positive link that seems more intuitive in most industries (Casu & Girardone, 2009). The results suggest that, higher levels of competition, reduce the profit efficiencies of banks in Ghana.

Ideally, it is expected that increases in competition would precipitate increases in profit efficiency. This is because with competition, managers are forced to exert more effort and allocate resources efficiently in order to reach market equilibrium. However, in this study, competition is negatively

related to profit efficiency. This is probably because, heightened competition is associated with shorter relationships between customers and banks (Boot & Schmeits, 2006; Petersen & Rajan, 1995) since the tendency for customers to switch to other banks upsurges in competitive environments.

Table 17: Regression Results : Capital Structure, Competition and Profit Efficiency

	Boone Indicator					
	Model 4		**Model 5**		**Model 6**	
(Intercept)	0.1623		0.1521		0.1623	
	(0.1829)		(0.1828)		(0.1829)	
ECAP	-0.7619	.	-0.2288		-0.7619	.
	(0.4065)		(0.1646)		(0.4065)	
$ECAP^2$	0.4502		0.4502		0.4502	
	(0.3464)		(0.3464)		(0.3464)	
BS	0.0231	*	0.0231	*	0.0231	*
	(0.0108)		(0.0108)		(0.0108)	
SG	0.0004	*	0.0004	*	0.0004	*
	(0.0002)		(0.0002)		(0.0002)	
REG	-0.0166	**	-0.0166	**	-0.0166	**
	(0.0054)		(0.0054)		(0.0054)	
OWN	0.0158		0.0158		0.0158	
	(0.0231)		(0.0231)		(0.0231)	
TE	0.5262	***	0.5262	***	0.5262	***
	(0.0815)		(0.0815)		(0.0815)	
BI	0.0026		0.0026		-0.0223	**
	(0.0164)		(0.0164)		(0.0082)	
ECAP*BI	-0.1658		-0.1658		-0.1658	
	(0.1312)		(0.1312)		(0.1312)	
Sigma	0.1886	***	0.1886	***	0.1886	***
	(0.0079)		(0.0079)		(0.0079)	
Log Likelihood	72.21		72.21		72.21	

*'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1*
Coefficients have been bootstrapped

The effect of this is that, information asymmetries between banks and customers increase, which causes an increase in the costs incurred by the banks in monitoring and screening borrowers. Further, given a higher unbanked population of over 70 % (Akosah, 2013) relative to the number

of banks in Ghana, to survive in the competitive financial landscape, banks incur greater expenses in maintaining and attracting customers through greater marketing efforts such as investments in Automated Teller Machines (ATMs) and advertisements. These may cause declines in their profit efficiencies.

5.6 Capital Structure, Conglomeration and Profit Efficiency.

The results for objective four (that is investigating the impact of the interaction between capital structure and conglomeration on profit efficiency) are presented in Table 18. Model 7 presents the original results of the bootstrapped truncated regression. Models 8 and 9 depicts the results of the partial effects of equity capital and conglomeration on profit efficiency respectively. Consistent with Chronopoulos et al (2011) conglomeration has a positive impact on profit efficiency. However, in this study the impact is insignificant (model 9). The relationship implies that in Ghana, banks with subsidiaries are more efficient in generating profits than their counterparts that are focused. This may be due to the economies of scale and scope benefits associated with diversification (Chronopoulos et al., 2011; Vander Vennet, 2002). The interaction between conglomeration and profit efficiency has a negative and insignificant impact on profit efficiency. This suggests that, the effect of equity capital on profit efficiency reduces if the bank is a conglomerate than if it is focused.

Table 18: Regression results: Capital Structure, Conglomeration and Profit Efficiency

	Model 7		Model 8		Model 9	
(Intercept)	0.2667		0.2635		0.2667	
	(0.1792)		(0.1798)		(0.1792)	
ECAP	-0.1961		-0.3967	*	-0.1961	
	(0.2702)		(0.1824)		(0.2702)	
$ECAP^2$	0.1417		0.1417		0.1417	
	(0.3569)		(0.3569)		(0.3569)	
BS	0.0149		0.0149		0.0149	
	(0.011)		(0.011)		(0.011)	
SG	0.0004	*	0.0004	*	0.0004	*
	(0.0002)		(0.0002)		(0.0002)	
REG	-0.0156	**	-0.0156	**	-0.0156	**
	(0.0053)		(0.0053)		(0.0053)	
OWN	0.0243		0.0243		0.0243	
	(0.0239)		(0.0239)		(0.0239)	
TE	0.5166	***	0.5166	***	0.5166	***
	(0.0823)		(0.0823)		(0.0823)	
CONG	0.1243	*	0.1243	*	0.0257	
	(0.0572)		(0.0572)		(0.0291)	
ECAP*CONG	-0.6569		-0.6569		-0.6569	
	(0.4298)		(0.4298)		(0.4298)	
Sigma	0.1892	***	0.1892	***	0.1892	***
	(0.0079)		(0.0079)		(0.0079)	
Log Likelihood	71.21		71.21		71.21	

Signif. Codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

5.7 Reverse Causation Between Profit Efficiency and Capital Structure.

To achieve objective five which is testing whether there is a reverse causation between profit efficiency and capital structure using two competing hypotheses, the two stage least squares (2SLS) technique is used. The technique is used to resolve the potential endogeneity problems likely to occur when a bi- causal relationship exists between a dependent and an independent variable. The technique requires the models in the simultaneous-equation to be either just identified or over identified. To test the identification of the models, the order condition by Ramanathan (1995, pp.666) is used. The order condition suggests that, the equation models

(equations 22 and 23) are econometrically identified since an appropriate number of the specified variables are excluded from each of the equations. Table 19 presents results for the predictions of the franchise value and efficiency-risk hypotheses of reverse causation from profit efficiency to capital structure.

Table 19: Results for reverse causation from profit efficiency to capital structure

	ECAP	
(Intercept)	0.3682	***
	(0.0986)	
ERC	-0.0475	
	(0.0787)	
BS	-0.02	***
	(0.0057)	
SG	0.0002	*
	(0.0001)	
REG	0.0136	***
	(0.003)	
AS	-0.3076	
	(0.2434)	

The results show a negative and statistically insignificant relationship between profit efficiency and equity capital, thereby providing support for the efficiency-risk hypothesis. This is similar to the finding of Margaritis and Psillaki (2010) on French manufacturing firms. This means that in Ghana, more profit efficient banks choose lesser equity capital than their counterparts that are less profit efficient. This may be because the higher profit efficiencies may translate into higher expected returns which substitute for equity capital to manage potential risks and costs (for example bankruptcy, financial distress) that the bank may be faced with.

5.8 Chapter Summary

This chapter presented the findings and the discussions of each research objective. First, it provided descriptive statistics on all the variables used in the estimation of each objective. The

first objective was achieved by estimating the profit efficiency of the banking industry relative to each yearly frontier. It was found that banks in Ghana over the fourteen year period were 79% profit efficient on average. The profit efficiency estimates were then compared with two profitability ratios, ROA and ROE to determine the extent to which they agreed on the performance of a bank. The findings revealed that the methods agreed weakly. The other objectives were achieved by regressing the estimated profit efficiencies on capital structure, the degree of competition in the industry, and a bank's ownership of a subsidiary. For the reverse causation, capital structure was regressed on profit efficiency and other control variables by using a two stage least squares (2SLS) method.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter is categorized into three sub-headings. The first sub-heading which is the summary clearly highlights what the study sought to achieve and presents the techniques employed in achieving the research objectives and the findings. Subsequently, conclusions on the study are provided, from which essential recommendations for practice, policy and further research are made.

6.2 Summary

The main objective of this study was to investigate the impact of capital structure decisions of banks in Ghana on their performance by employing a non-parametric profit efficiency technique as the indicator of bank performance. Additionally, reverse causation between capital structure and profit efficiency was tested in the Ghanaian banking industry, by using two competing hypotheses of Berger and Bonaccorsi di Patti (2006) - the efficiency-risk and the franchise value hypotheses. Previous studies that considered the CSFP nexus mostly used profitability ratios as proxies for performance and did not recognize the possible endogeneity problems that could occur as a result of the bi-causal relationship between capital structure and firm performance. This study is therefore the first to employ profit efficiency to measure performance in the Ghanaian banking industry. It is also the first to consider the possible bi-causal relationship between capital structure of banks and profit efficiency.

In this study, simultaneous equations modelling was used to assess the reverse causation between capital structure and profit efficiencies of banks in Ghana. This helped to understand the reasons for the mixed empirical results seen in earlier studies on the CSFP nexus. Interaction effects of capital structure and competition in the industry, as well as between capital structure and conglomeration were also further examined. This was to determine whether the level of competition and conglomeration of banks significantly affects the relationship between capital structure and bank profit efficiency, which is also the first to be investigated in the capital structure-efficiency studies in the banking industry.

The study used an unbalanced panel data of 26 banks from the year 2000 to 2013 to achieve the research objectives. Data was sourced from BOG and cross-validated with annual reports of universal banks in Ghana to ensure consistency and to handle missing data. *R*-based statistical packages- Frontier Efficiency Analysis with R (FEAR) by Wilson (2008) and Benchmarking by Bogetoft and Otto (2011) were the primary software used for the analysis. However, MaxDEA Pro version 6 was also used together with other default packages in the *R* software. The findings of the study included the following:

a. On average, about 79% of the profits that can be earned by a best practice bank under very similar conditions are earned by banks in Ghana. By implication, banks in Ghana are on average, 21% profit inefficient in their operations. The production of inappropriate output and input mix that maximizes cost while minimizing revenues may be the cause of these inefficiencies.
b. A comparison of the non-parametric profit efficiency with two predominantly used profitability ratios as measures of bank performance revealed that profit efficiency weakly agrees with the ROA and ROE of banks in Ghana. This is probably because whereas profit

efficiency mirrors overall or total-factor performance, profitability ratios only reflect factor-specific performance. In other words, a profitable bank may not necessarily be profit efficient.

c. In the assessment of the CSFP link, a significantly negative relationship was found between profit efficiency of banks and capital structure (equity capital). This is consistent with the views of the agency cost hypothesis of capital structure. However, when ROA and ROE were used as measures of bank performance, whereas a positive and significant relationship was found for ROA, a negative but insignificant relationship was found for ROE. This shows that, albeit both profitability ratios, they gave different and conflicting results, indicating that researchers need to be wary in their interpretations when using different accounting and financial ratios.

d. A negative and insignificant relationship was also found between bank concentration, measured by the HHI, and profit efficiency. A negative and significant relationship was, however, found between competition, measured by the BI and profit efficiency. This could mean that researchers need to be careful with the proxy measure used for competition as these could lead to different and misleading findings. This study endorses the BI as a better measure of competition.

e. For the results of the interaction between capital structure and competition, a positive relationship was found when HHI was used, whereas a negative relationship was identified when BI was adopted as measures of industry competition. It must be stressed, however, that in all two cases the interaction effects of competition and capital structure on profit efficiency was not statistically significant.

f. For the interactions between capital structure and conglomeration, its effect on profit efficiencies of banks in Ghana was found to be negative and insignificant. This implies that, having a subsidiary which engages in other activities besides those permissible as banking activities in Ghana does not necessarily influence the link between capital structure and profit efficiency.

g. Finally, the reverse causation between capital structure and profit efficiency, was found to support the efficiency-risk hypothesis. This was because a negative relationship was found between equity capital and profit efficiency. This means that, on average, in Ghana, profit efficient banks employ more debts than equity in their operations.

6.3 Conclusions of the Study

The findings of the study reveal that average profit efficiency levels in the banking industry are quite high, indicating an industry which is quite sound and economically profitable. More room, however, exists for improvement based on effective regulatory and policy controls. It should not be seen as the prerogative of only banks to improve profit efficiency. Regulators need careful consideration of the effects of policy directions on the level of profit efficiency in the industry. This is because a more profit efficient banking industry has implications for economic growth since banks will reduce waste in their intermediation roles.

The second major finding of the study was observed when the three profitability measures were compared. When ROA, ROE and DEA measures of performance were compared, these three measures provided slightly different conclusions. This is probably because whereas ROA and ROE are single-factor ratios which shows how much of a single output (income) can be generated from only one input (either assets or equity capital), DEA scores provide better and more holistic picture

of performance. ROA and ROE are more advantageous when simple profitability analyses are required. DEA, on the other hand, provides a comprehensive profitability assessment that takes into consideration the multiple inputs and multiple output dimensions of bank performance.

Furthermore, DEA computations, by their nature, not only provide information on bank profitability, but provides also, useful benchmarks or guidelines for policies towards achieving higher levels of profit efficiency. Coupled with this, DEA provides empirically and theoretically grounded models for both cross sectional and time series measurement of performance, whereas these profitability ratios mainly account for cross sectional performance which ignores any time dependencies. Consequently, DEA provides more holistic insights for policy-oriented decisions than ROA and ROE.

The mixed empirical results that were seen by Berger and Bonaccorsi di Patti (2006) when profitability ratios are employed, was also proved in this study. This is as a result of the divergent conclusions on the effects of capital structure on profitability when ROE and ROA were used as proxies for performance. Whereas the relationship between capital structure and ROA supports the pecking order theory, ROE supported the Modigliani and Miller irrelevance theory. The differences in the conclusions when the two financial ratios are used makes it difficult for effective policy formulation. However, because DEA is capable of encapsulating both the asset and equity dimensions of firm profitability, it provides a better and relatively more consistent conclusions to aid in effective policy formulation. Consequently, the relationship between profit efficiency and capital structure (equity capital) can be concluded to be negative. This follows the agency cost hypothesis and the trade-off theory of capital structure. Similar results were found by Berger and Bonaccorsi di Patti (2006) and Margaritis and Psillaki (2010) who employed Stochastic Frontier

Analysis (SFA) and DEA respectively in their study. The implication of the result is that banks in Ghana who use more debts/leverage are able to generate more loans and investments which generates more interest incomes and makes them more profit efficient.

Considering the reverse causation between profit efficiency and capital structure, the evidence from the study is that not only does more leverage result in higher profit efficiencies, but more profit efficient banks tend to also use more leverage. A clear empirical grounding has therefore been provided to believe leverage is critical in sustaining banks in Ghana. Therefore, policies that have the possibility of affecting the leverage decisions of banks in Ghana need careful rethink before they are enacted. This is because such policies have the possibility of affecting (reducing) profit efficiency in the industry, which may have a multiplier effect on economic growth in the country. Also evident in this study was the contradictory results between competition and profit efficiency when HHI and BI were employed. It is possible that the relationship between competition and profit efficiency is nonlinear. As seen, when the HHI was used, it is possible that competition will positively affect profit efficiency at some levels of competition, but at other levels of competition, a negative relationship may be manifested as seen by the BI. However, from current results, the direct linear impact of leverage decisions and policies of banks in Ghana has little to do with the level of competition in the industry. Therefore, banks' leverage decisions can provide consistent effects on profit efficiency irrespective of the level and nature of competition.

Finally, there is no empirical evidence in this study to conclude that the effects of capital structure decisions on profit efficiency in Ghana depends on the existence of subsidiary business operations. Therefore, owning a subsidiary firm is not a prerequisite for a larger impact of capital structure

decisions on the level of profit efficiency of banks in Ghana. This notwithstanding, it is possible that owning such conglomerates would directly lead to higher levels of profit efficiency.

6.4 Recommendations

Findings and conclusions of this study provide important policy implications and recommendations for practice, and further research. These are summarized as follows:

For Practice and Policy:

a. First, banks were seen to be 21% profit inefficient on average. It is necessary for policy makers and management to establish policies and procedures that will cut wastages in inputs whiles also strengthening their risk management practices. These may include better screening of borrowers and effective monitoring of loan performance to reduce and avoid adverse selection and moral hazards. These banks can also cut down expenses in operations by encouraging customers to use technologies like ATMs, mobile and internet banking in most of their bank transactions.
b. Also in the study were substantial disagreements in the results of the DEA and two profitability ratios as proxies for performance. Unlike these profitability ratios, the results of the DEA non-parametric profit efficiency incorporates the multiple inputs and multiple outputs employed by these banks in their operation. Consequently, banks are advised to use profitability ratios for mostly simple analysis, but for more inferential and holistic analysis, DEA provides a better assessment. These performance measures should be seen as complementary measures of profitability rather than alternatives when evaluating performance over time.

c. In the CSFP link, DEA and profitability ratios provided different conclusions. Even ROA and ROE which are both profitability ratios presented contradictory results on the nature of the relationship between capital structure and bank performance. To avoid complexities that can occur with the reliance on profitability ratios, it is recommended that management and policy makers routinely monitor decisions based on profitability ratios whiles also using more advanced performance measurement techniques like DEA.

d. Another key finding in this study is how essential leverage decisions are to bank profit efficiency in Ghana. Therefore, the regulator must be careful when formulating policies that can adversely affect the leverage decisions on banks. This is key because leverage is important in sustaining banks in Ghana.

e. On the negative nexus found between competition and profit efficiency, policy makers are advised to be careful in setting policies intended to increase competition in the banking industry. This is because information asymmetries and lower credit evaluations of borrowers may result from heightened competition that weakens the relationship between banks and customers. As a result, monitoring and screening costs may increase, which may lead to a decrease in profit efficiency of these banks. For example, in the US, increased competition resulted in banks lowering their lending stringency to subprime mortgage markets. This instigated the global financial crisis of 2007 to 2009.

For Further Research:

a. This study focused on estimating the profit efficiencies of the Ghanaian banking industry. A cross-country banking efficiency assessment of African countries can be undertaken to understand profit efficiencies in the banking industries of these countries. This way, a

bigger picture can be observed given that some of these countries are forming currency unions or political or economic blocks.

b. A decomposition of profit efficiency into technical and allocative efficiencies can also be considered to help determine the real source of performance so that managers can improve performance via those sources. One can decompose profit efficiency into revenue and cost efficiencies or better still, along the lines of Portela and Thanassoulis (2005), use the geometric distance function to estimate profit efficiency.

c. This study looked at static profit efficiency but further studies can be extended to profit productivity dynamics which can reveal patterns and trends of performance over time. For instance, a study can adopt the principles of Maniadakis and Thanassoulis (2004) cost productivity change to profit productivity change.

d. It is also recommended that further studies should clarify if the mixed results in the CSFP nexus is truly due to the employment of other profitability ratios as performance measures without the consideration of possible reverse causation as stated by Berger and Bonaccorsi di Patti (2006).

e. Further research should also consider other performance assessment techniques (e.g.Thick Frontier Approach, SFA, Bayesian Efficiency) besides profitability ratios in investigating the impact of capital structure on the performance of other industries in Africa.

f. Further empirical analyses may also be targeted at exploring the possible nonlinear relationship between competition and profit efficiency by applying nonlinear regression estimation. This is in light of the contradictory results when two different competition methods were applied.

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APPENDICES

APPENDIX A

Table I Definitions and summary statistics of inputs, outputs and prices (Amount in GH¢)

	Variables	Mean	Std. Dev	Min	Max
2000- N=16					
Inputs	*Deposits*	47525451.07	56487564.68	532192.1	169328300
	Labour	2013705.86	2559970.46	49094	9881200
	Fixed Assets	2228776.94	2634590.52	142846.3	9732800
Input Prices	*Deposits*	0.12	0.04	0.06	0.2
	Labour Cost	0.03	0.01	0.01	0.06
	Fixed Assets	1.45	0.68	0.68	2.89
Outputs	*Loans and Advances*	29086950.65	38677493.3	154708	128695800
	Investment	22064396.41	28981648.68	149307.8	100405200
Output Prices	*Loans and Advances*	0.25	0.11	0.11	0.52
	Investment	0.25	0.09	0.08	0.4
	Total Assets	76822341.07	92990986.31	884009	314956500
	Equity	8202300.99	8365797.32	278719	23232156.2
2001-N-17					
Inputs	*Deposits*	52962196.98	63943805.27	2172653.1	192441900
	Labour	2711770.34	3511081.52	71530	13744100
	Fixed Assets	2986023.28	4011719.67	124941.4	15981700
Input Prices	*Deposits*	0.13	0.05	0.06	0.26
	Labour Cost	0.04	0.01	0.02	0.07
	Fixed Assets	1.8	1.32	0.42	5.82
Outputs	*Loans and Advances*	31438771.87	47063933.86	646601.5	182619800
	Investment	23868658.24	30630042.82	729233.7	102411000
Outputs Prices	*Loans and Advances*	0.28	0.08	0.14	0.45
	Investment	0.28	0.05	0.16	0.34
	Total Assets	84915639.31	106957102	2712278.6	379428800
	Equity	10074851.61	11343803.6	274300	32919500
2002-N-17					
Inputs	*Deposits*	67998601.79	77989522.37	3584258.9	240860900
	Labour	3597164.92	4687376.34	122659.4	17773200
	Fixed Assets	3670531.5	4828090.32	181583.5	18417800
Input Prices	*Deposits*	0.08	0.03	0.04	0.13
	Labour Cost	0.03	0.01	0.01	0.05
	Fixed Assets	1.58	0.76	0.6	3.05

Outputs	*Loans and Advances*	33269547.19	35930226.14	1721614.6	102606200
	Investment	34823396.95	60658492.85	1010145.2	247857600
Output Prices	*Loans and Advances*	0.24	0.09	0.12	0.48
	Investment	0.19	0.05	0.06	0.25
	Total Assets	190212505.6	399255004.6	4921309.2	1667882000
	Equity	12571913.56	14522440.83	-1606000	42072100

Table II: Definitions and summary statistics of inputs, outputs and prices (Amount in GH¢)

	Variables	Mean	Std. Dev.	Min	Max
2003- N=18					
Inputs	*Deposits*	90286711.37	103379755.5	7355846.2	318383000
	Labour	4825164.49	7100041.48	287497.5	29715800
	Fixed Assets	3708830.12	4301705.9	232341.3	16696200
Input Prices	*Deposits*	0.11	0.09	0.03	0.4
	Labour Cost	0.03	0.01	0.01	0.06
	Fixed Assets	1.85	1.19	0.62	5.49
Outputs	*Loans and Advances*	49400346.86	56206249.21	3005457.4	175429700
	Investment	43462048.81	51488373.82	2374278.6	194454600
Output Prices	*Loans and Advances*	0.21	0.07	0.11	0.39
	Investment	0.2	0.05	0.11	0.32
	Total Assets	229315211.5	456337936.1	9624320.3	1971062000
	Equity	15715700.9	17051521.53	-1555775.4	47289000
2004-N-18					
Inputs	*Deposits*	118411804.1	131852493.5	11220601.8	426573300
	Labour	6079249.24	7844060.83	485331.7	32348200
	Fixed Assets	4915225.84	4274901.06	485032	14160300
Input Prices	*Deposits*	0.09	0.06	0.02	0.28
	Labour Cost	0.03	0.01	0.02	0.06
	Fixed Assets	1.66	0.73	0.47	2.91
Outputs	*Loans and Advances*	62331211.86	66475868.74	4361800	209506100
	Investment	64366725.94	67473125.24	5716200	231319000
Outputs Prices	*Loans and Advances*	0.2	0.05	0.12	0.3
	Investment	0.15	0.06	0.08	0.27
	Total Assets	285095149.7	551110556.5	16094300	2390684000
	Equity	20363230.9	19723247.95	1037000	57432400
2005-N-19					
Inputs	*Deposits*	127977020.7	131558904.7	13917800	472994000
	Labour	7779016.28	10185863.64	772009	43519700
	Fixed Assets	5740045.27	4522069.71	466300	16155300
Input Prices	*Deposits*	0.07	0.04	0.03	0.19
	Labour Cost	0.04	0.01	0.02	0.07
	Fixed Assets	1.31	0.53	0.62	2.52
Outputs	*Loans and Advances*	83595014.71	85063853.95	6371900	274552700

	Investment	51350746.41	50898858.24	3655700	184333000
Output Prices	*Loans and Advances*	0.18	0.05	0.08	0.3
	Investment	0.17	0.03	0.11	0.23
	Total Assets	179099375.2	166204596.6	17805900	586471300
	Equity	23295129.22	23022791.42	1401200	70094200

Table III: Definitions and summary statistics of inputs, outputs and prices (Armount in GH¢)

	Variables	Mean	Std. Dev	Min	Max
2006- N=23					
Inputs	*Deposits*	154009498.6	172081337.4	11860300	634572700
	Labour	8604648.37	10962427.66	837639	47425300
	Fixed Assets	7556785.03	6683872.26	982510	24066000
Input Prices	*Deposits*	0.06	0.04	0.02	0.18
	Labour Cost	0.03	0.01	0.02	0.07
	Fixed Assets	1.13	0.59	0.15	2.61
Outputs	*Loans and Advances*	109417439.2	125175115.5	3206220	430177000
	Investment	46392645.9	53429119.76	1791100	220616248
Output Prices	*Loans and Advances*	0.15	0.04	0.06	0.22
	Investment	0.16	0.07	0	0.35
	Total Assets	207051753.4	212586977.1	1351847.84	775992315
	Equity	26755148.76	26955216.69	6380163	89034865
2007-N-23					
Inputs	*Deposits*	228585933	217503326.6	20089129	839382600
	Labour	11617113.83	13715165.64	1466174	57884160
	Fixed Assets	10884911.04	10580454.85	1024386	42913000
Input Prices	*Deposits*	0.06	0.03	0.03	0.13
	Labour Cost	0.1	0.3	0.02	1.47
	Fixed Assets	1.22	0.65	0.38	3.18
Outputs	*Loans and Advances*	170080358.1	189978094.4	12689450	750663500
	Investment	61735108.57	72127676.32	5973484	255842000
Outputs Prices	*Loans and Advances*	0.15	0.04	0.07	0.22
	Investment	0.13	0.06	0	0.21
	Total Assets	321363495.1	314567924.2	29066347	1191015000
	Equity	36334821.96	41843549.75	5660191	173691300
2008-N-24					
Inputs	*Deposits*	302044219.8	273061382.6	5061311	1030106000
	Labour	16144511.98	18049327	650752	67714010
	Fixed Assets	14183716.96	13181039.41	731065	57412000
Input Prices	*Deposits*	0.07	0.04	0.02	0.21
	Labour Cost	0.03	0.01	0.01	0.06
	Fixed Assets	1.35	0.74	0.5	3.19

Outputs	*Loans and Advances*	237676639.4	245606506.6	2247845	1087119000
	Investment	68052465.75	66445808.06	4362458	258367000
Output Prices	*Loans and Advances*	0.16	0.06	0.02	0.23
	Investment	0.12	0.05	0	0.22
	Total Assets	429227927.8	388547628.4	13971170	1645797000
	Equity	45550179.92	47393686.81	7705363	203863700

Table IV: Definitions and summary statistics of inputs, outputs and prices (Amount in GH¢)

	Variables	Mean	Std. Dev	Min	Max
2009- N=27					
Inputs	*Deposits*	351596015.8	309866451.2	5214116	1259470000
	Labour	18472206.71	19440894.64	196280.79	84988700
	Fixed Assets	16313772.96	14038533.26	140573	51918000
Input Prices	*Deposits*	0.11	0.06	0.03	0.25
	Labour Cost	0.03	0.02	0.01	0.1
	Fixed Assets	1.41	0.86	0.57	4.41
Outputs	*Loans and Advances*	234653349.6	249774224.4	4315785	1265517000
	Investment	111662410.2	131655724.4	61000	505781000
Output Prices	*Loans and Advances*	0.23	0.07	0.12	0.49
	Investment	0.48	1.63	0	8.45
	Total Assets	498769276.2	449445580.7	15375874	1917083000
	Equity	68796622.78	59616981.85	702313	205413000
2010-N-26					
Inputs	*Deposits*	476856782	377994629.3	33464677	1584055000
	Labour	24540923.54	26176055.93	237590.13	107422800
	Fixed Assets	17991556.27	13586531.67	96133	54684000
Input Prices	*Deposits*	0.08	0.04	0.02	0.2
	Labour Cost	0.03	0.01	0	0.07
	Fixed Assets	2.44	2.46	0.48	11.53
Outputs	*Loans and Advances*	272253586.4	211694101	8127071	995356000
	Investment	182636135	182216614.3	10548232	741297000
Outputs Prices	*Loans and Advances*	0.2	0.08	0.07	0.47
	Investment	0.14	0.04	0.01	0.2
	Total Assets	635663123	478275851.4	64244649	2076361000
	Equity	88535757.73	62047303.93	3697802	242265000
2011-N-25					
Inputs	*Deposits*	614144882.3	518882741	20004683	2061390000
	Labour	28036940.71	30715489.1	294540.21	135912000
	Fixed Assets	20357687.88	16852588.41	59111	63339490
Input Prices	*Deposits*	0.05	0.03	0.02	0.1
	Labour Cost	0.03	0.01	0	0.06

	Fixed Assets	2.35	3.35	0.57	17.72
Outputs	*Loans and Advances*	315964551.1	225911827.2	6020889	848459000
	Investment	220231346.2	277584613.6	5158520	1215140000
Output Prices	*Loans and Advances*	0.16	0.05	0.06	0.27
	Investment	0.22	0.49	0.04	2.56
	Total Assets	783871666.2	613010614	91405281	2454564000
	Equity	114398916.2	77515784.55	40940000	316860000

Table V: Definitions and summary statistics of inputs, outputs and prices (Amount in GH¢)

	Variables	Mean	Std. Dev	Min	Max
2012- N=25					
Inputs	*Deposits*	790917500	634341682.2	36370986	2407615000
	Labour	37894000	36798060.86	473696.34	144435000
	Fixed Assets	24241680	19732991.59	176030	73404000
Input Prices	*Deposits*	0.06	0.03	0.01	0.13
	Labour Cost	0.03	0.01	0	0.07
	Fixed Assets	1.98	1.5	0.54	7.42
Outputs	*Loans and Advances*	472565000	328271555.1	16616224	1394967000
	Investment	272602800	340334319.7	5158520	1586813000
Output Prices	*Loans and Advances*	0.16	0.05	0.04	0.27
	Investment	0.29	0.63	0.07	3.28
	Total Assets	1045397000	797626631.9	115147396	3378843000
	Equity	158107500	103269543.1	61772515	456547000
2013-N-26					
Inputs	*Deposits*	902408000	766824500	60844336	3220777000
	Labour	46158110	42856690	585017.71	169996000
	Fixed Assets	31562130	25605750	129841	94756640
Input Prices	*Deposits*	0.08	0.04	0.02	0.16
	Labour Cost	0.03	0.01	0	0.07
	Fixed Assets	2.02	2.52	0.32	13.65
Outputs	*Loans and Advances*	597826400	470003600	13689042	2124530000
	Investment	415100000	445654700	5158520	1747087000
Outputs Prices	*Loans and Advances*	0.17	0.05	0.06	0.27
	Investment	0.41	0.89	0.06	4.34
	Total Assets	1398414000	1100222000	149042412	4624405000
	Equity	212729100	141366000	70351502	557106000

APPENDIX B

Table VI: Profit Efficiency Scores (in %) of banks from 2000- 2008

Bank	Profit Efficiency (%)								
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
GCB	100	100	100	100	100	100	100	100	100
BBG	100	100	100	100	100	100	100	100	64.80
SCB	100	100	100	100	50.01	100	100	100	100
NIB	72.21	29.34	60.90	84.64	91.24	63.92	64.91	74.46	72.29
UMB	55.31	100	63.53	100	100	100	100	100	100
ADB	68.58	71.41	62.44	100	69.52	100	100	94.02	84.80
AMAL/BOA	100	100	100	100	100	100	64.77	83.26	100
SG-SSB	100	100	71.93	74.26	73.63	100	92.65	100	100
UNIBANK		100	100	100	100	100	100	73.26	71.28
STANBIC	40.13	40.95	47.26	100	70.15	95.94	74.86	100	100
EBG	66.74	100	63.83	83.01	67.29	70.94	80.24	73.81	75.91
CAL	68.34	48.86	68.04	83.82	56.31	90.68	91.59	71.87	77.17
TTB	74.22	100	65.70	88.65	100	95.97	100	100	100
FABL	100	100	100	100	52.61	100	100	100	100
METRO/BPI	67.01	61.51	42.97	60.64	100	100	100	100	100
PBL	58.75	79.95	100	62.97	71.76	100	100	100	78.43
ICB	100	100	100	100	100	100	100	100	100
HFC				100	100	75.47	100	100	100
UBA						100	42.93	48.88	100
FBL							100	100	75.76
GTB							100	100	100

IBG	100	73.64	63.43
ZENITH	100	69.42	100
BSIC			100
BARODA			
ACCESS			
UT			
ENERGY			
ROYAL			

Table VII: Profit Efficiency Scores (in %) of banks from 2009- 2013

Bank	**Profit Efficiency (%)**				
	2009	**2010**	**2011**	**2012**	**2013**
GCB	100	100	100	100	100
BBG	73.53	100	100	100	100
SCB	100	100	100	100	100
NIB	72.99	50.25	100	71.16	44.11
UMB	94.66	100	27.80	30.56	26.41
ADB	64.39	68.51	47.64	58.42	71.36
AMAL/BOA	92.13	70.27	78.94	59.26	39.04
SG-SSB	100	100	100	54.94	47.55
UNIBANK	58.73	73.49	78.83	100	100
STANBIC	79.88	51.85	62.82	62.08	74.67
EBG	76.20	100	55.75	100	100
CAL	78.22	100	100	100	100
TTB	100	75.06			
FABL	100	63.94	45.90	38.59	42.70
METRO/BPI	100				
PBL	100	80.24	68.66	55.19	48.02
ICB	100	56.33	41.45	49.46	43.32
HFC	74.64	87.11	69.58	58.79	70.21
UBA	53.82	46.89	59.58	100	100

FBL	75.19	100	100	66.03	55.94
GTB	100	86.60	58.75	100	53.35
IBG	57.89	53.73			
ZENITH	78.11	78.88	60.47	60.74	100
BSIC	23.16	41.65	36.04	43.01	33.61
BARODA	100	100	100	100	100
ACCESS	100	100	100	69.56	64.96
UT	100	100	100	100	58.66
ENERGY			40.52	18.13	29.29
ROYAL					20.83

APPENDIX C

Table 20: Regression Results: Profit Efficiency and Capital Structure

	ERC		ROA		ROE	
(Intercept)	0.2039		-		-0.8353	
	(0.1761)		-		(0.6185)	
ECAP	-0.4474		0.1935		-2.0464	
	(0.243)	.	(0.0595)	**	(1.9872)	
$ECAP^2$	0.3917		-0.0719		3.3223	
	(0.337)		(0.045)		(2.088)	
BS	0.0192		0.0022		0.073	
	(0.0107)	.	(0.0068)		(0.0484)	
SG	0.0004		0.0001		0.0002	
	(0.0002)	*	(0)		(0.0003)	
REG	-0.015		-0.0027		-0.0437	
	(0.0054)	**	(0.0025)		(0.0281)	
OWN	0.0143		-		-0.025	
	(0.0234)		-		(0.0944)	
TE	0.5421		0.0493		0.6177	
	(0.0823)	***	(0.0215)	*	(0.2621)	*
Sigma	0.191		-		-	
	(0.008)	***	-		-	
Log Likelihood	68.46					
R squared				0.1603	0.0562	
F-statistic				8.1157***	2.3898*	

*Profit Efficiency estimates are truncated at zero. '***' 0.001 '**' 0.01 '*'0.05 '.' 0.1*
Standard errors are white robust to serial correlation and heteroscedasticity
Coefficients have been bootstrapped

Hausman Specification Test for ROA and ROE

Variable	Chi-square	p value

ROA=ECAP+$ECAP^2$+BS+SG+REG+OWN+TE	26.15	0.0002
ROE= ECAP+$ECAP^2$+BS+SG+REG+OWN+TE	5.6	0.47

APPENDIX D

Year	HHIA	HHID	HHIL	BI
2000	0.1484	0.1453	0.1661	-2.2603
2001	0.1467	0.1395	0.1829	-2.4558
2002	0.1361	0.1317	0.1234	-2.4716
2003	0.1162	0.1243	0.1235	-3.2549
2004	0.1092	0.1206	0.1152	0.0064
2005	0.0979	0.1053	0.1043	-4.0754
2006	0.0864	0.0954	0.1133	-0.2957
2007	0.0831	0.0811	0.0954	-7.3154
2008	0.0741	0.0743	0.0843	-2.281
2009	0.0670	0.0647	0.0774	-2.8148
2010	0.0607	0.0617	0.0608	-1.4571
2011	0.0644	0.0674	0.0596	-1.7947
2012	0.0630	0.0647	0.0585	-1.8489
2013	0.0614	0.0652	0.0613	-1.5464
Average	0.0939	0.0958	0.1019	-2.4190