UNIVERSITY OF CAPE COAST

COMPETITION AND EFFICIENCY: THE CASE OF INSURANCE COMPANIES IN GHANA

ROSEMOND SAM- QUARM

2021

UNIVERSITY OF CAPE COAST

COMPETITION AND EFFICIENCY: THE CASE OF INSURANCE COMPANIES IN GHANA

BY

ROSEMOND SAM-QUARM

Dissertation submitted to the Department of Finance of the School of Business, College of Humanities and Legal Studies, University of Cape Coast in partial fulfilment of the requirements for the award of Master of Business Administration degree in Finance.

OCTOBER 2021

DECLARATION

Candidate's Declaration

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

Candidate's Signature…… Date……

Name: …….

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the

University of Cape Coast.

Supervisor's Signature……Date …….

Name ……..……..

ABSTRACT

In recent years, researchers have put a lot of focus on the study of how efficiency in an industry is affected by competition in that same industry. Most of these studies have been on the financial sectors with stronger preference for the banking industry. The insurance industry unlike the banking industry has seen less of these studies and even less of this area of study has been for the Ghanaian insurance industry Alhassan *et al*., (2015). This study focuses on determining the level of technical efficiency in the Ghanaian insurance industry and further investigates the level of competition in the same industry. The study then finally analyses the impact competition has on the overall efficiency of the industry. In the determination of the level of technical efficiency of the industry, the Stochastic Frontier Analysis (SFA) was used as a tool for efficiency estimation whereas the Panzer Rosse model was used in investigating the nature of competition in the insurance industry. The results obtained from the study revealed that, there is a positive and significant linkage between competition and technical efficiency of insurance business. In view of these results, it is recommended that, efforts are made by appropriate industry regulators in creating a more liberal environment for the industry to promote competition. This move will encourage the introduction of new products and services by insurance companies creating a more competitive and innovative industry.

KEY WORDS

Competiton

Efficiency

Efficiency Structure Hypothesis

Structure Conduct Hypothesis

ACKNOWLEDGEMENTS

My utmost gratitude goes to Almighty God for the successful completion of my programme.

My sincere gratitude to my supervisor. Dr. Zangina Isshaq of the Department of Finance, School of Business, University of Cape Coast, for his time, patience and corrections throughout my entire work and to Benjamin Nii Tetteh Annan of the Youngstown State University in the USA for his immense support during my entire work.

DEDICATION

To my family

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Within the past two decades, the insurance industry of Ghana has experienced a huge increase in the number of companies within it. The increase has been dramatic, since entering the early 2000's. This relative increase may or may not have a negative influence on business efficiency in this industry. The knowledge of the number of insurance companies and their ultimate impact on the efficiency of the industry is very important, so as to assist the regulators of the industry in setting policies regarding the entry into the industry as well as, the setting of minimum requirements needed by insurance companies, to continue to stay in the industry (Hauner, 2005).

As a regulator of the insurance industry of Ghana, the National Insurance Commission, occasionally increases the required minimum capital requirements of the country's insurance companies Addisson and Asamoah (2015). This action if taken arbitrarily without considering the competition's impact on the efficiency of the businesses in the industry, can lead to serious inefficiencies in the market.

Several studies on the competition and efficiency in different industries including that of the insurance market have been conducted. However, in Ghana, the majority of these researches have been centered on the banking sector. Few studies such as Alhassan, Addisson and Asamoah (2015) focused on the insurance industry of Ghana, however their study did not focus on the "effect, the level of competition has on the efficiency of these companies in the industry." This study therefore, establishes that effect and how it can guide the regulator in making its policies.

Background to the Study

The study of the impact of competition on efficiency in various industry is not novel, especially for the financial industry. However, much of the focus on this study has been placed on the banking industry relative to the other financial sectors such as the insurance industry (Biener, Eling & Wirfs, 2016). The contribution made by insurance to the economies of a country and in fact the economy of the world as a whole is enormous. This is one major motivating factor encouraging studies in this field (Kulger & Ofoghi, 2005) explained in their work that insurance companies' supports the economy of each country, through the provision of long-term funds for infrastructural development in the country. Generally, insurance companies' serve as an avenue for which the government as well as the private sector obtain funding for their capital-intensive projects.

Insurance firms in Ghana have made considerable contributions to the economy in recent years, according to the National Insurance Commission of Ghana's 2018 report, the insurance industry employed approximately 12,000 people in 2018 while paying the government GHC36 million in corporate tax.

According Alhassan, et al. (2015) in their work market structure, efficiency and profitability of insurance companies in Ghana explained that insurance in itself encourages people to cultivate the art of saving as a monthly or weekly contribution deducted by these companies are a form of savings against future uncertainties for these insurees. By so doing, there is a sense of security that these insurees obtain. Regardless of these numerous benefits insurance services seems to provide to the economy and individuals, in Ghana, the majority of people live without any insurance policy. This is because, there

are several inefficiencies relating to the provision of services by these insurance companies to their customers. Amongst these are, the undue delay in the settling of claims by the companies to customers, the blatant refusal in paying pre agreed claims as well as the delay in even settling claims of insurees where they become redeemable. As a result of these and several other challenges, many new insurance companies have surfaced in the country, with the hope of correcting some of these inefficiencies to encourage patronage by the citizens. These new entries, are likely to affect the competition within the insurance sector, thus this likely effect is examined in this study. Additionally, this study also examines the impact of industry competition on the productivity of businesses.

The importance of competition in any given industry can never be overemphasized as, it has the ability to strongly encourage innovation and the invention of improved goods and services as well as new way of doing businesses (Kulger & Ofoghi, 2005). Competition in the insurance sector will ensure that, insurers provide improved insurance packages for their insurees as well as pay claims whenever insurees become entitled without unnecessary delays. Furthermore, when regulatory bodies are in the know on competition's impact on effectiveness, it guides them in policy making decisions concerning entries by new companies into the market.

If regulatory bodies undertake exercises such as the increasing of minimum capital requirements of companies, with the aim of pushing seeming non performing companies out of the market, without assessing how such a move can affect the level of competition and the successive impact these alterations in market structure have on the efficiency of companies in the

industry, it can lead to situations where there are a lot of inefficiencies in the market (Alhassan, et al., 2015). Therefore, it is crucial, they know and understand the organization of the sector before any entry requirements are instituted by them. New entrants can also benefit from understanding competition in the industry as it would inform them on the best strategy to use in doing business. Finally, even customers may also benefit from understanding competition in the industry as it may help them form the basis on which they do business with, by sidelining companies who collude with other businesses in price settings of their goods and services (Apergis & Polemis, 2016).

The National Insurance Commission (NIC) regulates Ghana's insurance business, and according to their 2018 annual report, there are 24 life and 29 non-life insurers operating in the country. According to the commission's 2018 financial report, four of the industry's 24 life insurers control 75 percent of total gross premiums, while five of the industry's 29 non-life life insurers-controlled 75 percent of gross premiums from 2012 to 2018 (National Insurance Commission's Report, 2019).

In the non-life market, however, there is less concentration, since four of the insurers controls less than half of total premiums as of the year ended 2018. As the regulator of the insurance companies in Ghana, the NIC sets minimum capital requirements for insurers in the country as and when it deems necessary. The commission has made a move to increase the "stated capital of insurance companies from GHC15 million to GHC50million by the end of June 30, 2021." "The Insurance Act 2006, ACT 724 also reviewed the then minimum capital" to the cedi equivalent of US$1million for an insurance

company. In 2012, the amount was then raised to GHC5 million ($1.4 million) and the cedi equivalent of $5 million for insurers covering risk in the oil and gas industry (National Insurance Commission's Report, 2016). The minimum capital requirement was raised again by the end of 2013 to GHC10million ($2.8million). Due to this, it can be inferred that, the NIC is of the view that the regulation of the minimum capital requirement of insurers in the industry provides some benefits to the industry. This study would therefore assess whether this form of regulation is necessary as well as if it is imperative for the commission to formulate such restrictions, by examining their influence on the level of rivalry in the marketplace.

The goal of the research is to look into the technical efficiency of the decision units in the industry deriving it theoretical grounds from the production theory, the "efficient structure hypothesis and the relative market power hypothesis." In addition, competition in the industry is investigated considering the industrial nature of the market. The study then finally assesses the impact of the structure of the insurance market on the technical efficiency of the decision units.

Statement of the Problem

To be able to assess the impact of competition on efficiency, there is the need to determine the level of efficiency in the industry and subsequently investigate the nature of the competition in that industry. Numerous studies on industrial rivalry and efficiency have produced contradictory conclusions. Whereas some studies (Arrawatia & Dawar, 2015) found clear effects of competition on efficiency, Apergis and Polemis (2016) revealed no effect of competition on efficiency. Casu and Giradone (2002) studies on "bank

competition, concentration and efficiency" on the other hand forms part of the few studies which could not assert a straight forward relationship amid competition and efficiency

Studies on the effect of competition on efficiency in specific markets, usually test two main theories, the "structure conduct performance (SCP) of Bain (1951)" and Baumol (1982) and "the efficient structure (ES) hypothesis" (Demesetz, 1973).

The SCP hypothesizes that the structure of a market determines the behavior of businesses in that sector, particularly in product pricing, as well as their economic performance. The ES hypothesis however asserts that efficient firms in a market conduct themselves in such an efficient manner, so much so that, they are able control Significant market shares result in market concentration. As such firms have large market shares due to the efficient manner, they conduct themselves and not due to unsanctioned tactics such as price collusion in product pricing.

Several studies on competition and efficiency have tested these major theories, recent amongst them is the Jaloudi and Bakir (2018) which "found results in support of the SCP hypothesis whiles rejecting the ES hypothesis." Such a result gives an indication that the huge profits of large firms in the insurance industry in Jordan, is not as a result of their efficiency in production, but as a result of their collusion with each other to set high prices. Similar studies on "competition and efficiency in the" European Property liability insurance industry by Berry-Stölzle, Weiss and Wende (2011) however rejected the SCP hypothesis whiles supporting the ES hypothesis, which is an indication that, "in the European Property liability insurance industry", large

firms are large and profitable, due to their efficiency in production and not due to any price collusion with other firms to set high prices for high profits.

In Ghana, studies on the effect of "competition and efficiency in the" financial sector have put more focus on the banking industry rather than the insurance industry. Alhassan et al., (2015) is part of the few studies and their results was not "in support of the SCP hypothesis for the Life insurance market. In the case of the non-Life" markets, conflicting results were obtained. Their findings for both studies however supported the ES hypothesis. It revealed that there was no collusion amongst the life insurance companies in Ghana to set high prices for services they offer. But instead, their high profits are as a result of how efficient their production is. This efficiency in production ultimately leads to increase in economies of scale.

The studies of Alhassan et al. (2015) looked at efficiency and competition in the workplace. They also "tested the SCP and the ES hypothesis on their studies" but there was no indication of how he efficiency of businesses in the industry is influenced by competition. This revelation, is necessary in order to assist regulators of the industry in making policy decisions which can potentially affect the industrial structure of the market. It can also be argued that, most studies on the linkage amid "efficiency and competition" focuses on banking sector with very few, in the area of insurance which in the recent years is gaining much relevance in the financial industry, thus the need for this study.

Purpose of the Study

The main purpose of the study is to investigate the impact of the insurance industry's level of competition sector of Ghana on its efficiency.

Thus, how competition affects the technical efficiency of insurance businesses in Ghana.

Research Objectives

To achieve the study's purpose, three objectives were set. These includes;

(a) To assess the technological effectiveness of Ghanaian insurance businesses.

(b) To investigate the nature of competition in the insurance industry of Ghana.

(c) Examine the influence of competition on insurance companies' technological efficiency in Ghana.

Research Questions

The aforementioned sub objectives were achieved by answering three research questions, which were;

(a) What is the level of efficiency in the insurance companies in Ghana?

(b) What is the level of competition among the insurance companies in Ghana?

(c) What is the impact of competition in the insurance industry in Ghana on the efficiency in the insurance companies in Ghana?

Significance of the Study

There has not been much focus on the study of the "impact of competition on efficiency in the insurance industry in Ghana." This study expands the literature in this area.

Additionally, this study looks at the insurance industry's structure in Ghana, and how it can be affected by policies made by their regulator, especially with regards to minimum capital requirements which has the potential of changing the structure of the market. Most Ghanaians do not usually patronize insurance services due to their general view of efficiency

and lack of competition in the insurance industry. As a result of the aforementioned perception, this study will help insurance patrons to embrace themselves with the happenings of the insurance industry.

Economic agents, policy makers as well as stakeholders from the insurance industry like the insurance companies, the National Insurance Commission as well as people who patronizes insurance products can also use findings from this research to make inform decisions at both the individual or the corporate level. It shall be of great relevance to commercial banks in Ghana.

Delimitations

The focus of this study is on Ghana's insurance industry in general. The study determines the efficiency level of the insurance companies as well as examines the nature of competition in the industry.

Limitations

The major limitation of this study is the limitation, related to the data set used in the study. The homogeneity of the insurance companies used in this study stemming from the differences in locations of these companies as well as differences in sizes, in relation to their revenues and expenditure implies that they are not comparable. In order to have had a more comparable data, the data set should have been a larger panel data.

Organization of the Study

This section summarizes the chapters in the study and how they are organized. The study is divided into five main chapters, the first of which has previously been introduced, outlining the study's background, problem, and

significance. The second chapter inspects the empirical literature on market competition and efficiency in industries, with a particular focus on studies of the insurance business. The "research methodology to be used in evaluating the data for the study" is discussed in Chapter three. Chapter four provides the results of technical efficiency of the insurance companies and the level of competition within the industry using the Panzer-Ross model. It also includes the findings of investigations into the relationship amid the level of competition and the insurance industry's technical efficiency. The study's conclusions are then summarized in the last chapter, along with policy recommendations based on the findings.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter introduces Ghana's insurance industry. It brings to light the competition and efficiency in the insurance industry. It also presents an overview of theoretical and empirical literature on competition and efficiency in the insurance industry. It is further divided into three main sections; the first section explores the insurance industry. The second section explores the theoretical foundation upon which the current study is premised. This is followed by a review of empirical literature on efficiency and competition measurement as well as review of "literature on the linkage between efficiency and competition.

Theoretical Review

This section discusses the various theories and hypothesis based on which the study was conducted. These include the production theory which underpins the derivation of the efficiency scores on the study units, efficient structure hypothesis, market conduct hypothesis and then relative market hypothesis which are the underlying hypotheses to explain the linkage amid market efficiency and market structure

Production Theory

The basis of measuring efficiency in a firm, is derived from the fundamentals of the production theory. This is because, efficiency determination relies on a company's capacity to use the minimum possible contributions to create the highest level of yields possible for a given level of

output, or to ensure the maximization of outputs produced (Berry-Stölzle, Weiss & Wende, 2011).

According to Berry-Stölzle, et al. (2011), Every output a firm produces, is made up of a given combination of inputs which are considered as factors of production. Thus, factors of production are resources used to facilitate production. The production function explains how much of each "factor of production is used to produce a given output" (Kasman, & Turgutlu, 2009). The relationship between various inputs or factors of production and the outputs produced is measured by the production function. There are three basic inputs used by firms in their production, which is land, labour and capital. Mostly the conventional production function however, measures output focusing on labour and capital.

Labour refers to any human addition in the process of production. Therefore, all human efforts which are involved in a firm's production is considered to be labour. It includes factory workers to administrative workers and the marketers of outputs produced. In the insurance industry, labour is mostly considered as commissions and salaries paid to workers in the insurance company. Capital as a factor of production was traditionally explained as man made goods like machinery, equipment and factories which are used in production. Money was not initially considered as a factor of production, as it was not involved in the direct production of output. This stance is currently weak however, since neoclassical economist now considers money as a form of capital. Studies on efficiency in the insurance industry (Cummins, Weiss, Xie, & Zi, 2010; Biener et al., 2016) mostly considers

financial capital as capital, in the production function, which otherwise was not previously considered as capital.

In determining efficiency levels of firms, there has to be an understanding of what factors of production should be considered in the production function as well as what is considered as an optimum level of output. This study considered two basic factors of production as basis of input for the insurance industry which are labour and financial capital as seen in many studies on the financial sectors such as, (Nitoi & Spulbar, 2015; Adjei-Frimpong, Gan & Hu, 2014; Moyo, 2018)

Efficient Structure Hypothesis

"Technical efficiency and allocative efficiency" are the two major ways to measure efficiency. This was first proposed by (Farell, 1957). The ability of firms to produce maximum output with the least amount of waste describes technical efficiency, whiles, allocative efficiency explains the capacity of firms to combine optimum quantities of inputs and outputs corresponding to their current prices (García-Herrero, Gavilá & Santabárbara, 2009). Farell (1957) mentioned that, technical efficiency precedes economic efficiency, that is, in order for a firm to be economically efficient, they must necessarily be technically efficient.

Efficient Structure hypothesis simply explains that, large firms experience high sales and more profits due to their efficiency in production and not due to collusion with other firms to set high prices in order to make abnormal profits. And that, the more firms are efficient in their production, the higher the likelihood of high market concentration. According to the ES hypothesis, efficient firms will mostly conduct their activities in a manner

such as the continuous development of their products and services to suit the constant changing needs of consumers, increasing production scale and maintaining healthy competition amongst rivals which ultimately leads to high profits for these firms and market concentration in the industry.

Structure Conduct Hypothesis

The benefit of understanding an industry's structure cannot be overstated, as several studies have shown that the market's structure influences a firm's behavior and success in the market. This knowledge stems from the well-known Structure Conduct hypothesis developed by Bain (1951) and Baumol (1982) explaining that, a market's structure affects firms' behaviour such as product pricing, differentiation and collusion with other firms. The SCP hypothesis describes the possibility that, the structure of an industry can affects firm pricing and other conducts of firms which ultimately affects their performance.

When few large firms in an industry collude in price setting in order to achieve abnormal profits, the market is described as a highly concentrated market. It can therefore be inferred that, in a highly competitive market, one single firm cannot influence the market price as the firm rather takes the price from the market.

Pricing, product differentiation, and collusion have real-world consequences for a company's profitability, efficiency and productivity. According to the SCP, companies in higher competition face a lot of constraints in terms of their conduct. Firms in lower-competition industries, such as monopolies, have more options when their conduct in the industry. As a result, in oligopolistic markets, big companies collude to fix prices for their

goods in order to make massive profits. For instance, monopolies are notorious for setting rates as high as they want before the government intervenes to control them, and even then, they have the option of leaving the market. It is important to however note that, regardless of how much control each type of market peruses, this control reduces as the barriers to entry into the market also reduces. The moment there ceases to be barriers to entry, the control over these markets also ceases. Nothing can stop firms from entering a market with no or low barriers to entry.

Relative Market Power Hypothesis

The ability of firms to raise the prices of goods above what would be generated by the ordinary interplay of the demand and supply forces in a competitive market describes the Relative Market Hypothesis (RMP). The RMP hypothesis explains that, the larger a firm is in terms of its market share relative to the total market share, the higher its influence in the market. Additionally, there is a greater chance for firms with well differentiated products to exert a greater degree of dominance in the market (Guillen & Ozsoz, 2014). Generally, it is known that, firms with larger market shares as well as differentiated products will have higher profitability in any market structure more than that of their competitors Ahiabor (2013). Thus basically, the RMP hypothesis is one of the basic underlying factors of price setting in a market. Monopolies, by virtue of being the only supplier of goods and services in a particular market are at liberty to freely make their pricing decisions and therefore mostly end up setting high prices leading to high profitability. Whereas competitive market is not so much at liberty to increase their prices as this can lead to a considerably dramatic drop in their sales.

Conceptual Review

This section reviews the various concepts that have been applied in measuring efficiency and market structure in an organized markets such as that of an insurance industry. It further reviews studies that have been undertaking that have applied the methods. The primary objective of this section is to provide a conceptual foundation of the study.

Concept of Efficiency

Efficiency simply means, the ability to optimize the use of resources in order to achieve stated objectives (Adjei-Frimpong, et al., 2014). The ability to use minimum quantities of scarce resources to achieve desired goals whiles producing at the optimal production level explains efficiency. Studies on efficiency measurement may differ from one another in different dimensions such as the conceptualization of efficiency assumed and the measurement method applied in the study. As such, the efficiency scores may vary across studies. Thus, this section discusses efficiency in detail and also looks at the various methods applied in measuring efficiency, especially, in the insurance environment.

In embarking on efficiency study, a primary decision to make at the onset of the study is to determine the type of efficiency to measure, as it is unlikely that a firm may be efficient in all respect. For instance, a firm may not be able to allocate its resources efficiently but may be technically efficient, i.e., maximum output may be achieved from the minimum feasible input combination (technically efficient) but may fail to allocate their inputs in a manner which minimizes cost which may in tend leads to cost inefficiency. Additionally, some firms may even be allocatively or cost efficient, but may

not be profit efficient. This highlights three of the most frequent efficiency principles that have been thoroughly researched in empirical literature; "technical efficiency, allocative efficiency and X – efficiency (cost efficiency and profit efficiency)." Each type of efficiency measure provides valuable information and insight into the firm's efficiency paradigm.

Technical Efficiency

Technical efficiency measures how effective a firm is, in deploying its resources in its production process in order to achieve an optimum output. The ability of a company to generate as much as possible in a given production level, given a set of input describes how technically efficient a firm is. In measuring technical efficiency using the production function, a firm "is said to be technically efficient", if the distance between the firms' production function and that of the industry's optimal production function is short. This distance is usually shortened by the ability of a firm to use modern and improved technologies in production in order to cut costs and increase production. In a technically efficient production, input resources are not wasted in the production process.

Measuring Efficiency

The extent to which the total production cost of a whole industry can be considerably reduced is fairly dependent on the ability of individual firms of the same sizes and average mix of outputs, produce at lowest possible production cost. As a result, if each firm uses its inputs effectively, an industry generates the most effective level and combinations of goods. X-efficiency accounts for both cost and profit efficiency. Modern research into financial

institution performance is increasingly using X-efficiency as a measure of their efficiency. This is because, the earlier measure of efficiency; popularly known as the traditional measures, were accounting ratios which came with a lot of shortcomings and inefficiencies with their use. This placed a limitation on the accuracy of results obtained using these measures. Amongst the shortcomings which came along with the use of the traditional accounting ratios is its subjectivity. Since there are a lot of these ratios measuring the same efficiency level, one could use the method which favors his objective the most. Thus, the ratios have become a less reliable way of measuring efficiency due to the subjectivity that comes with its use. The X-efficiency measures which are also known as the econometric measures of efficiency are; the ordinary least square regression, conditional accounting ratio regression and quantile regression are the three main econometric approaches used in the measure of efficiency.

In using the X-efficiency method to measure firms' performance, a predetermined production curve that represent optimum practice in the industry is compared with current production. X-efficiency simply compares a firm's output to that of the best production function in the same industry given that market conditions are the same (Jarraya, 2014).

In assessing X-efficiency, two main methods are used in the efficiency measurement; the parametric approach popularly known as the econometric approach, uses the Tick Frontier Approach (TFA) or the "Distribution Free Approach (DFA)" or the commonly used Stochastic "Frontier Approach (SFA). And the non- parametric approach uses the Data Envelope Analysis (DEA) or the Free Disposal Hull (FDH)" as its two main measurements.

Both approaches aim to define a production function that is shared by all companies in the sample who have similar production methods. Each individual performance is then compared to the predetermined optimum production function (Jarraya & Bouri, 2014). In order to be called "fully efficient, firms in the sample must be operating on or near the best" frontier, creating the highest output from the collection of inputs. Studies frequently apply either the non-parametric technique, which predominantly involves competition does this by considering the number of identical production units compared with each other and selecting a production frontier curve which captures all observations. Thus, production units that stays on the frontier are efficient in the usage of their production inputs in producing their outputs, whilst production units which fail to lie on the curve are taken to be inefficient.

In the measure of efficiency with the DEA, the idea is to measure the efficiency of the productive unit against a specific efficiency frontier. This is done by considering the proximity of the production units' curve to that of the efficiency curve. Aigner et al., (1977) and Meeusen and Van den Breock (1977) were the first to introduce the stochastic frontier analysis. It estimates production or cost functions and considers inefficiencies in the firm in its estimation of the functions. Its origins can be traced back to the traditional production function technique. Output is assessed as production or actual value added against traditional inputs of production such as labor and capital in a typical production function method, with an error term factored in. This production function relates all deviations from the production curve to random shocks otherwise known as the error term and does not attribute any of the

deviations to inefficiencies as it assumes all firms in the data are totally and completely efficient and producing along the production possibility curve.

This is however "the point where the stochastic frontier" research comes in, demonstrating that such variations can be caused not only by spontaneous shocks, but also by inefficiencies caused in the production process. The SFA, introduces a random error structure in this traditional production function in the frontier analysis to measure firm's efficiency. The approach also has the ability to detect when firms produce below optimum levels.

The main limitation of the DEA relative to the SFA is that, the SFA is able to provide a clear difference between inefficiency and noise or statistical errors. Whereas the DEA puts the two, inefficiency and error as one making the DEA mostly over calculate inefficiency. DEA has been used in several studies such as Alhassan et al., (2015) as well as (Ahiabor 2014).

Alhassan and Beikpe, (2016) used the SFA in measuring efficiency in their studies. They explained that, they used the SFA instead of the DEA because, the DEA fails to give a clear distinction between errors and statistical noise in its measurement, but he SFA provides this clear distinction.

With all the major advantage for the SFA, it still has its limitations as Bezat (2009) revealed in his study that, the use of SFA requires the use of a proxy in determining a particular functional form of a stochastic frontier and if a wrong choice of proxy is used then it may have an adverse effect on the results obtained.

Competition

The level of competition in an industry is largely determined by its market structure, which is affected by the number of suppliers and their relative market shares (Apergis & Polemis, 2016). According to neoclassical firm theory, there are four types of market structures for any particular industry, with the most notable distinction being how many suppliers there is in the particular market.

Alhassan and Biekpe (2018) asserts that amongst the four types of markets, perfect competition and monopolies are on each extreme end. Perfect competition is characterized by perfect rivalry, as this is demonstrated by the fact that this type of market has a free market with no entry or exit barriers, the selling of identical products or services, and most significantly, a large enough number of suppliers that no single supplier could control pricing decisions in the market.

A monopoly, on the other hand, is characterized by only one firm being the sole supplier of a product or service in the market and thus having exclusive control over pricing decisions in the market as a result, demand has no impact on how much it sells its products (Alhassan & Biekpe, 2018). The monopolistic and oligopolistic competitions exist in the space between these two extremes. They are all categorized according to their market influence, which is primarily based on the quantity of competing businesses in the market.

As previously indicated, a range of elements decide whether a firm is "classified as a perfectly competitive market or a monopoly, the most significant of which is the number of competing firms in the market."

Measuring Competition

In measuring competition in a market, it is important to understand what concentration means as some of the measures of competition invariably measures concentration and use that as a basis for determining the level of competition. Concentration simply refers to the proportion of a market's overall output that is accounted for by a limited number of firms. This can be explained as, when a relatively smaller number of suppliers' total market shares forms a greater percentage of the total market share then, the market is said to be concentrated. Basically, when a market is dominated by very few suppliers in terms of total market share, then the market is said to be concentrated. For example, amongst the different types of market, oligopolistic markets are usually concentrated markets, as they are characterized very small number of large firms dominating the total market.

Measuring market concentration can provide insight into the level of competition in that certain market. Competition is vital in any market, because without it, businesses will simply price their goods at any level, leaving consumers with no option but to pay more for products that do not provide them with the maximum utility.

Four firms' concentration ratio is one of the methods used in measuring the level of competition in a given market. This method essentially calculates the percentage of overall revenue accounted for by the industry's four largest companies. Using the insurance industry of Ghana as an example, we compute the overall gross premiums of all the insurance companies and determine what "percentage of that belongs to the four largest firms in the industry." The lower the competition, the higher the ratio and the higher the

competition, the lower the ratio. This simple and easy calculation can give an indication of how concentrated a particular market is and to a large extent give an indication of competition level in an industry.

It must however be noted that, high concentration isn't always an indication of low competition. For instance, there could be fierce and strong competition among the four largest firm. But this measure fails to consider such a fact. Additionally, what if their high sales are as a result of their highly diversified products in addition to their main product. How does this ratio account for such a phenomenon?

When the "Herfindahl-Hirschman Index", commonly abbreviated as HHI, is used to calculate competition, these flaws and insufficiencies in the four firm concentration ratios are reduced. The HHI essentially adds up all of the companies' percentage market shares in a given industry. Any HHI computation resulting in a figure of less done 1000 is considered as representing a highly competitive industry where as an HHI of 1800 and above is considered as representing an industry with very low competition.

Though the HHI measure comes with several of its own advantages and additionally correcting many of the disadvantages associated with the use of the four firm concentration ratios, it fails to address issues such as product diversification and industry barriers to entry, since low barriers to entry, can easily alter competition in the market.

The "Boone indicator" is also another popular measure of competition. It compares the elasticity of profits of a firm to its marginal costs. This method also agrees with ES hypothesis which says, efficient firms are likely to achieve higher profits. More and more studies have used the Herfindahl-Hirschman

Index in practice to measure competition. "Alhassan *et al*., (2015) used the HHI as well as the concentration ratio in measuring competition." However other studies have also used the Boone indicator. Studies like Abel *et al.* used the Boone indicator, (2017) in their research, as well as (Moyo 2018).

However, the Panzar Rosse index is used in this study to determine the level of competition in Ghana's insurance industry. This index measures competition by building a "competition indicator called the H-statistic and provides a quantitative evaluation of the competition level of the market." The use of the Panzar Rosse model instead of the Concentration ratio and the HHI is because, these two are more geared towards the measuring of concentration and not necessarily competition. It is also difficult to obtain data needed to successfully compute the level of competition using the Boone indicator hence the Panzar Rosse was the preferred choice.

Empirical Review

At a glance, is possible to look at a firm's performance and be able to link its performance measured by profits to the market's concentration, however it is the direction of the causality which is uncertain (Peltzman, 1977). This relationship between a firm's profitability and the concentration in a market is explained by the "Relative Market Hypothesis (RMP)" hypothesis. The RMP relates higher firm performance to a firm's ability to charge prices above its marginal cost of production. This hypothesis is corroborated "by the Structure Conduct hypothesis", which explains that, large firms in a concentrated market collude to set high prices in order to gain high profits.

The efficiency structure hypothesis however has a divergent view on this. The ES hypothesis disagrees with the two earlier hypotheses; the RMP

and the SCP by explaining that, due to the efficiency in the production activities of large firms, they are able to sell their goods and services at relatively low prices which inadvertently lead to high sales and abnormal profits. Thus, their high revenues and profits are not as a direct result of collusion with other firms in the industry. It therefore links efficiency in production to high market power (Dudu & Kilicaslan, 2009). It is evident that these three hypotheses try to explain the same relationship between efficiency in firms and their profitability but due to major fundamental differences in their hypothesis, policy recommendation for the theories are always different especially for the two key sides since they define the relationship between firm's performance and market power in different ways.

Several studies in developed economies have found a correlation between firm's efficiency and competition. Majority of these studies on both variables placed emphasis "more on the banking industry rather than the insurance industry." Arif and Awwaliyah (2019) measured the impact of "concentration in the Islamic banking industry" on the efficiency of the industry and discovered no apparent effect. The result of their studies discovered that, there is no evidence to support firms' collusion to set high prices in the industry. Thus, their study refuted the SCP hypothesis. Their findings were also consistent with that of Amalia and Nasution (2007)

Bhatti and Hussain (2010) have dismissed the SCP hypothesis and argued that market share and profitability have a negative relationship. Gullen et al. (2014) investigated relative market power and productivity as a major factor of Latin American bank profitability. Their conclusion was that, the Latin American Banks have their profits affected by their various sizes as well

as the market power they wield. Their study therefor supported both the ES and the RMP hypothesis.

Gullen et al. (2014) used the DEA approach in measuring efficiency in their study, as against the use of the SFA method in this study. Their research also focused on measuring the impact of competition and efficiency on the "profitability of the European banking industry, whiles this study on the other hand looks at the impact of competition on efficiency" in the Ghanaian insurance industry. Arrawatia and Dawar (2015) also measured competition in their study, however the "Lerner index was used as a measure of competition", whiles the DEA was used in calculating efficiency.

There are many similarities between Arrawatia and Dawar's (2015) and Gullen et al. (2014) research and the subject of this study; however, the methods used to determine their efficiency are not the same as the methods used in this study. Since the SFA is used to calculate efficiency in this analysis. Furthermore, while "their study focused on the banking industry, this study focuses on expanding the literature in the insurance industry."

Marius and Căpraru (2012) study were in the EU 27 banking systems. While the "focus of this study is to check the impact of competition on efficiency", their study looked at the impact of efficiency on competition instead. As a result, their conclusion was that an improvement in bank efficiency fosters competition, and therefore policymakers should not depend on fostering competition to improve bank efficiency, but rather establish an environment conducive to improving bank efficiency in order to increase competition. The Lerner index was used to measure competition, and the SFA was used to measure cost efficiencies. Marius and Căpraru (2012) used

methods similar to this research, but their objective was different from that of this study.

As indicated earlier, more focus has been placed on the banking industry when it comes to efficiency and competition determination in an industry. Some studies, however, continue to focus on the insurance industry. Jaloudi and Bakir (2019) conducted research on the "Jordan Insurance Market's market structure, quality, and performance." According to the conclusions of their study, the market is highly concentrated, with a few businesses owning a sizable market share of insurees, meaning that the Jordanian insurance market is an oligopoly. As a result, they accepted the SCP hypothesis but not the ES hypothesis.

Other current studies on these two main variables, competition and efficiency in developing economies is that of Moyo (2018). Their findings revealed that the effect of competition on efficiency differed depending on which method is used in the measure of competition. When the Lerner index was used, rivalry had a negative impact on performance, while the theoretically robust Boone indicator had the opposite effect. Although his research focused on the banking industry, this study extends the literature in the insurance industry.

The Ghanaian industry as a whole have seen quite a few studies on competition and efficiency. But mostly these studies have mostly been on the Ghanaian banking industry. "Thierry Buchs and John Mathisen (2005) measured the degree of bank competitiveness and efficiency in terms of banks' financial intermediation" in Ghana. Other studies such as Latif Alhassan and Nicholas Biekpe (2017) have focused on other African countries, in their case

the South African insurance industry. Using the SFA, they assessed the impact of competition on cost and profit efficiency for 75 non-life insurers. Their findings revealed that "profit efficiency and competition have a positive" relationship. And because "competition improves profit efficiency, the market power" argument is debunked. They also discovered that, contrary to the ES hypothesis, small insurers are more effective at managing costs and optimizing profit than large insurers. However, unlike their research, which focused on the effect of competition and cost efficiency, this research is focused on technological efficiency instead of cost efficiency.

On the Ghanaian insurance market, Latif Alhassan et al. (2015) tested the SCP and ES hypotheses on the country's insurance firms to see "how the structure of both life and non-life insurance markets" has influenced company behavior in terms of pricing decisions. "Life insurers are more competitive than non-life insurers", according to their findings. In these markets, they employed the DEA to measure competitiveness. In the non-life industry, they found ambiguous evidence in support of the SCP theory, but favorable evidence in favour of the ES hypothesis. In the life markets, there was also clear evidence to support the ES hypothesis, ignoring the SCP theory. Despite the fact that their research is similar to "this study's, their focus was on the impact of market structure and efficiency on firm profitability, whereas this study examines the impact of industry competition on efficiency." Furthermore, they used the DEA to analyze efficiency, whereas our study used the SFA approach.

Chapter Summary

This chapter has expounded on the synopsis between technical efficiency and allocative efficiency as the two major ways to measure efficiency as proposed by (Farell, 1957). The ability of firms to produce maximum output with the least amount of waste describes technical efficiency, whiles, allocative efficiency explains the capacity of firms to combine optimum quantities of inputs and outputs corresponding to their current prices (García-Herrero, et al., 2009). Again, two main measures of efficiency were also presented in the chapter. The use of X-efficiency and "Data Envelope Analysis (DEA), or the parametric approach's" Stochastic Frontier Analysis.

The X-efficiency method compares a firm's output to that of the best production function in the same industry given that market conditions are the same (Jarraya, 2014). This econometric approach, uses the Tick Frontier Approach (TFA) or the "Distribution Free Approach (DFA)" or the commonly used Stochastic "Frontier Approach (SFA). However, Data Envelope Analysis (DEA) also referred to as the Frontier analysis is used as a performance measure in production units of firms as well as also measuring operational efficiency (Charnes et al., 1978). According to Allen *et al*., (2013), DEA creates its own measures of operational efficiency.

CHAPTER THREE

RESEARCH METHODS

Introduction

The research technique and research design, as well as the models, data source, sampling procedure, and variables employed in the study, are all described in this chapter. The following is how the chapter is organized: the first section of the chapter explains the study's research approach and design. This is followed by the description of the data and procedure adopted in selecting the insurance companies for the study. The model employed in estimating the technical efficiency of the insurance companies is then described together with the estimation technique. The model used in assessing competition in the Ghanaian insurance sector across the research period is next described, followed by a discussion of the estimation approach used in order to calculate the connection amid insurance firms' technical efficiency and the level of competition in the market.

Research Paradigm

As explained by Kuhn (2012), research paradigm is a conceptual framework shared by a group of researchers which provide them with a convenient model for analyzing problems and finding a solution in a study. Simply put, it is a research culture of a group of researchers with the similar beliefs, values and assumptions regarding the nature and conduct of a study (Thomas, 2010; Kuhn, 2012). There are two major recognized methods under

the research paradigm which includes interpretivism and positivism. This research is based on the positivism paradigm since it has a quantitative and objective nature. Positivists assume that the reality is objectively given and is measurable using properties which are independent of the researcher and his or her instruments, that is knowledge is objective and quantifiable (Thomas, 2010). Most researches in finance usually deploy the positivism due to its quantifiable and objective nature.

Research Approach

In research the approaches mainly adopted are quantitative and qualitative and, in some cases, the mixed method is applied. Quantitative methods relate to objective and numeric analysis as well as generalization of findings (Amaral et al., 2013a). Hittleman and Simon (1997) stated that quantitative research makes use of revised and tabulated data which allows for the data to be characterized by the use of statistical analysis. Thus, quantitative research is the kind of research that uses deductive reasoning to create meaning, establish, confirm, or validate the relationships between variables to provide generalizations that contribute to a theory. Qualitative research on the other hand, has to do with studies that concentrate on events that occur naturally and in natural settings. Myers (2009) argued that, qualitative approach helps researchers understand people, the social and cultural context they find themselves living within. The mixed method is a combination of the quantitative and qualitative research methods (Amaral et al., 2013a).

This study adopted a quantitative approach using a mathematical model to ensure objective analysis. The implementation of quantitative method would provide results that support statistical comparison between

entities; results are precise, definitive and standardize (Sukamolson, 2005). The quantitative approach was used in this study because it allows for analysis of collected data using statistical procedures and hypothesis testing (Creswell, 2011). Generally, the quantitative research approach requires the determination of relationships between variables of a study using statistical techniques and hence the use of quantitative research approach in the study.

Research Design

According to Neustadtl and Babbie (1989), a research design is a plan or blueprint of how the researcher intends to conduct the research. This study employed the explanatory research design. The explanatory research is also used since the study looks at how one variable predicts the other. Explanatory research design is deployed in this study because it sought to explore competition and efficiency; the case of insurance companies in Ghana.

Data Area, Sampling Procedure and Collection Procedures

The study employed imbalanced micro-panel data derived from the annual reports of selected insurance businesses registered with the Ghanaian National Insurance Commission and functioning under the Insurance Act 2006 (Act 724). The life insurance market and the non-life insurance market were considered in "accordance with the provisions of the Insurance Act of 2006 (Act 724)." The study, however, excludes the reinsurance market, insurance breakage market, the reinsurance brokerage market and the loss adjustment market due to their level of concentration and nature of their businesses which create less room for competitive activities. The study also made use of the database from the National Insurance Commission as it plays a repository, supervisory and regulatory role in the insurance industry since 2006. The

study covers eight-year period spanning from 2012 to 2019. The choice of this period was motivated by the many strides in development the industry has seen over this period. This includes the introduction of the new corporate governance and risk management framework in the year 2015. There was also a paper issued on the rules and conduct by insurance companies regarding premium collection, management guidelines on claims to be received by insurers, a review on the insurance Act and an introduction of new minimum capital requirements. These improvements, goes a long way to affect` the competition and efficiency level of the industry. The insurance industry in Ghana had "24 life insurance companies and 29 non-life insurance companies" operating as of 31 December 2019 (the study's end date). The study included 21 "life insurance companies and 24 non-life insurance companies." The companies that were left out of the study were as a result of data scarcity. Even though the sample does not contain the entire population, is a representation of 82% and 88% of the total assets "in the life insurance market and non-life insurance market" respectively. The data collected from the sampled companies resulted in 158 data points for life insurance market and 198 data points for the non-life insurance market. Table 1 shows the number of firms in each year of the study, as well as the number chosen for the study. The study's Appendix 1 provides information on the companies that were chosen for the study.

Table 1: Number of Insurers Selected for the Study Classified by Market

	Companies in the population		Companies selected for the study	
Year	Life	Non-life	Life	Non-life
2012	18	25	18	24
2013	18	25	18	24
2014	20	25	18	24
2015	24	27	20	24
2016	24	27	20	25
2017	24	28	21	25
2018	24	29	21	26
2019	24	29	21	26

Source: National insurance commission annual report (2012 – 2019)

Data Processing and Analysis

Model specification and estimation procedure for estimation of technical efficiency

The estimation of technical efficiency scores, as well as the input and output variables used in the estimation, are discussed in this section. It also goes over the theoretical and empirical specifications of the model used to

estimate the insurance industry's technical efficiency. Again, the estimation strategy employed in estimating the parameters of the empirical model.

Choice of input and output variables for computing efficiency scores

In modelling insurance industry's efficiency, one of the most challenging tasks is the selection of the relevant inputs and outputs variables. Though several approaches have been proposed to assist in the selection of inputs and outputs for efficiency computation, there is no consensus in the literature as to what constitutes an insurer's inputs and outputs (Casu and Girardone, 2002; Sathye, 2003). The production (or value added) method, operating approach, and intermediation (or asset) method are the most prevalent methodologies used in efficiency modeling, according to Sealey & Lindley (977). One feature that all of these approaches have in common is that they all apply traditional firm microeconomic theory to insurance. They do, however, differ from insurers in terms of their specifications.

The production approach in the insurance industry, was explained by Benston (1965) as a production process which uses the traditional production input factors such as land, labour and capital to produce variety of services to customers. The input variables in the production process were explained the constitutes variables required by the insurer to produce the products or services to their customers and these includes physical asset, labour, material, space, information systems, operating cost, etc. Output was therefore the resultant services rendered to insurers such as claims provided and any other services provided to the insurer. Where information on transaction flows is not available, insurance products sold to customers and financial investments made by the insurance companies are used as a proxy to represent the output.

The operating approach on the other hand considers efficiency in insurance from the perspective of premium and cost reduction management. The inputs for this type of approach forms all relevant costs involved in rendering basic insurance services whereas revenues to the insurance companies are considered to be their outputs. Some of the inputs for this approach are management expenses, salaries, capital intensive projects, and commission expenses. Premium income and commission received are considered to be the output for this process.

The intermediation approach seems to be mostly applied in empirical research in the area of insurance and hence, it is the approach applied in this study. "The approach was proposed by Sealey and Lindley (1977)" in which insurance is treated as financial intermediary whose prime object is to channel funds between surplus and deficit units through the process of pulling risk. That is, an insurer is considered as a unit that accepts risk from clients and in return receive premium and invest or transfer them to deficit units who have been affected by the risk, using labour and capital in a form of investments or claim payment respectively.

According to Berger and Humphrey (1997), none of these techniques is flawless since none of them captures the dual role of insurance companies as transaction processing service providers completely. Nevertheless, they are of the view that the intermediation approach is relatively preferred in examining financial institutions level of efficiency as most of the decisions that affect the insurance efficiency are taken at the firm level rather than the agency level. Again, in practice, data used by the production and operating approach is usually not directly obtained from the published accounts of these

companies except from the management accounts which due to information asymmetry, management usually are not willing to release such information. Thus, the most widely used approach is the intermediation "approach rather than the production" or the operating approach in the selection of variables for both input and output processes in the computation of the various efficiency values of the companies. On this basis, the study adopts the intermediate approach in the selection of inputs and outputs for the study. Thus, selected output variable for the study is the net claim paid by the insurers to their clients. Labor (measured as the number of full-time employees at the end of the year), equity capital to total asset ratio (defined by the shareholders fund divided by total asset), and total debt to total asset ratio (defined as the total long-term liability standardized by total asset) are the variables used to compute the efficiency ratings of the selected insurers. In this case, the efficiency scores reflect the ability of the insurer to generate adequate funds to pay claims as demanded by their clients using the inputs; labour, equity capital and debt capital.

Table 2: Study Variables

Variable	Description
Net claim incurred ($Nclaim_{it}$)	Surrender values, withdrawals and claims paid claims to their policyholders hence subtracting reinsurance claims.
Labour (lab_{it})	Total compensation due to employees at the end of the year
Equity capital (equ_{it})	shareholders fund reported at the year end
Debt capital ($debt_{it}$)	Long term liabilities reported at the year end
Price of labour (w_1)	Ratio of total compensation to total asset
Price of equity (w_2)	Ratio of total dividend to market capitalisation
Price of debt (w_3)	Ratio of cost of claim to net technical reserves

Size ($size_{it}$)	Logarithm of total asset
Market share	Total premium income as a % of the industry premium
Reinsurance	Ratio of the amount reinsured to total premium
Ownership	1 – foreign majority ownership 0 – local majority ownership

Source: Field data (2021)

The output variable adopted for the study is the net incurred benefits paid to customers in the case of life insurance companies and net claims incurred in the case of non-life insurance companies. The output variables were adopted to represent risk bearing and intermediary functions of the insurance business (Alhassan and Biekpe, 2016). The life firms pay surrender values, withdrawals and claims while non-life firms pay claims to their policyholders hence subtracting reinsurance claims from these expenditures represent net incurred benefits (life) and net claims (non-life). The description of both the input and output variables applied in this study is described in Table 2.

Empirical Model Specification

In specifying the technological variables to generate efficiency score, a model based on the intermediate approach as "proposed by Sealey and Lindley (1977)" and applied in several efficiency studies such as Hermes et al, (2011) was used. Because it best shows the characteristics of the decision-making unit in question, the intermediate approach is regarded preferable to other ways for evaluating frontier efficiency. The model for the production frontier was empirically stated as follows, assuming that technical change is represented by a time-trend;

$$\ln Nclaim = \beta_0 + \beta_1 \ln lab_{it} + \beta_2 \ln equ_{it} + \beta_3 \ln debt_{it} + \beta_4 time + \frac{1}{2}\left(\beta_5 \ln lab_{it}^2 + \beta_6 \ln equ_{it}^2 + \beta_7 \ln debt_{it}^2 + \beta_8 time_{it}^2\right) + \beta_9(\ln lab_{it} \times \ln equ_{it}) + \beta_{10}(\ln lab_{it} \times \ln equ_{it}) + \beta_{11}(\ln lab_{it} \times Time_{it}) + \beta_{12}(\ln equ_{it} \times \ln debt_{it}) + \beta_{13}(\ln equ_{it} \times Time_{it}) + \beta_{14}(\ln debt_{it} \times Time_{it}) + v_{it} - u_{it} \quad (9)$$

where v_{it} is the statistical noise associated with "decision making unit i at time t, u_{it} is the" error due to inefficiency associated with "decision making unit i at time t, and betas represent coefficients or factor shares of the production function." The variables in the model are defined in Table

A log likelihood ratio test was then carried out to confirm or not that the Translog specification does not reduce to the Cobb-Douglas production function specification. The result (as shown in the appendix) of the log likelihood ratio test indicated that, at 1% level of significance, the translog function does not reduce to the Cobb-Douglas functional form and hence the Translog functional form was selected for the analysis. Of course, one could argue that, the Translog functional form had the Cobb-Douglas specifications nested in it but it is necessary to state that, the "Translog models presented more information on interactive effects" among the input variables which is useful for policy decisions and performance monitoring.

Model Specification and Estimation Procedure for Estimation of Competition

The Panzar-Rosse (P-R) model, established by Panzar and Rosse, is used to estimate the level of competition in Ghana's insurance industry (1987). The P-R model analyzes changes in input prices and how they affect a company's bottom line to determine the intensity of competition. Through this, the model is able to classify market into "perfect competition, monopolistic competition and monopoly" market. In this sense, the model yields a statistic known as the "H-statistic, which is defined as the sum of the elasticities of firm total revenue with respect to input prices, based on the assumption that firms could adjust their strategies" to enhance revenue in response to input

price fluctuations. The H-statistic is a "derivation of a reduced form revenue equation obtained at the firm level in a market to determine the degree of industry competition."

Despite the fact that other tools could be used to estimate competition in the Ghanaian "insurance industry, Panzar-Rosse" was chosen over competing models "such as Lerner index and Boone indicator because both Lerner Index and Boone indicator" fail to provide a reliable measure of competition in long-term equilibrium as the Panzar Rosse model does. As a result, the Lerner Index and the Boone Indicator are mostly useful for shorter periods of observations. The model specification and estimation procedure for applying the Panzar-Rosse methodology to the Ghanaian insurance industry are as follows;

The E-statistic, defined as the sum of input price elasticities from a particular profit equation, is used to assess the basic assumption behind the P-R model, which involves testing for long-run market (dis)equilibrium. Due to persistent effect of profit, a dynamic profit equation is specified in Equation (10) as follows;

$$ln\ (1 + ROA_{it}) = \propto' + \beta_0' \ln(1 + ROA_{it-1}) + \sum_{j=1}^{3} \beta_j' \ln w_{it} + \sum_{j=1}^{2} \gamma_j' \ln Z_{jt} + \varepsilon_{it} \quad (10)$$

Where the subscript i denotes insurance company i, the subscript t denotes year t. ROA denotes returns on asset defined in Table 2. The dependent variable is defined as $ln(1 + ROA)$ due to some insurance companies having negative returns on asset at some point following the procedure adopted by Utrero-Gonzalez (2004. w_1 denotes price of labour proxied by the ratio of

compensation cost to total asset following the Murat et al. (2002) and Alhassan & Biekpe (2017). w_2 denotes the price of equity capital represented by the ratio of operating cost excluding compensation to total asset, $w_3$is the price of debt input price proxied by the ratio of cost of claims to net technical reserves. Three variables which are very specific to the insurance industry are introduced in the model to serve as control variables to check differences arising from risk, size and market positioning which may affect the revenues of the insurance companies. These include the ratio of equity to total assets (Z_1) which takes into account the leverage effect and solvency risk. More equity implies more earning should be retained, which will imply less revenue. Thus, the expected sign of its coefficient is negative even though Gunalp and Celik (2006) has "pointed out the unclear relationship between capital adequacy and the income generation ability of insurance" companies. The second control variable is the log of total asset (Z_2) which is used to control for changes in company sizes and to analyze industry economies of scale. Because more assets are required to provide more income, and thus greater returns, the predicted sign of this variable is positive. Market share dummies (Z_3) have been generated "to control for possible macroeconomic and market structure changes within each year." "The size dummy takes the value of one when the insurance firm has a market share above the average for the net earned premium of year t, and 0 otherwise." ε denotes an error term. The dynamic profit Equation (10) provides the input to compute the E-statistic defined as;

$$E = \sum_{j=1}^{3} \beta_j \quad (11)$$

If E = 0, it provides an indication of long-run market equilibrium, otherwise, the state of the market can be said to be at disequilibrium. "The equilibrium test in the long run is calculated using the Wald coefficient constraint test that tests whether E = 0 or not."

The next step, after identifying the state of the market, is to compute the long-run H- statistic by estimating a reduced form of the log-normal dynamic function of insurance revenue specified in Equation (12) following the work of Kumar & Gulati (2018) as follows;

$$ln\ R_{it} = \propto'' + \beta_0'' \ln R_{it-1} + \sum_{j=1}^{3} \beta_j'' \ln w_{it} + \sum_{j=1}^{3} \gamma_j'' \ln Z_{jt} + \varepsilon_{it} \quad (12)$$

Where R denotes "is the sum of net retained earned premium and investment income" defined in Table 2. "Because insurance firms make revenue from both commissions received from investments in other insurers and premiums paid by customers after risk reserves have been adjusted, the sum of net retained earned premium and investment income has been chosen as the dependent variable." The parameter β_0'' is persistence coefficients; and all other variables are as denote as explained above and defined in Table 2.

The estimating technique used by Goddard and Wilson (2009) and Daley and Matthews (2012) is used because of the endogeneity problem. As a result, in order to ensure an efficient estimator and reduce the possible "biases and inaccuracies associated with the traditional panel and first-difference GMM estimators" currently used by several authors in the literature, the current study used the two-step system GMM approach with the lag of the explanatory variables as instruments (Blundell and Bond 1998; Roodman 2009). "The overall validity of the instruments is tested by using the

Difference-in-Hansen test of exogeneity of instruments." The long-run H statistic then computed as;

$$H = \sum_{i=1}^{3} \beta_j'' \quad (13)$$

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

To estimate the annual H statistic for the insurance industry over the study period, we interact the time dummies variable, d_t, with the input prices so as to obtain β_{it}, over time. In this case, Equation (13) is restated as follows;

$$ln\, R_{it} = \propto''' + \beta_0''' \ln R_{it-1} + \sum_{j=1}^{3} \sum_{t=2012}^{2019} \beta_{jt}'' \, d_t * \ln w_{it} + \sum_{j=1}^{3} \sum_{t=2012}^{2019} \gamma_{jt}'' \, d_t * \ln Z_{it} + \varepsilon_{it} \quad (14)$$

Consequently, the annual H statistic is then computed as;

$$H_t = \sum_{i=1}^{3} \beta_{jt}'' \quad (15)$$

Model Specification for determining the effect of competition on efficiency

The study uses the technique employed by Trujillo-Ponce (2013) and Sarpong-Kumankoma et al. to assess the influence of market competition on insurance company efficiency (2018). Consequently, a dynamic linear regression model is specified as follows;

$$Eff_{it} = \propto_0 + \beta Eff_{it-1} + \delta_k Comp_k + \sum_{n=1}^{5} \phi_n Speci_n + \sum_{q=1}^{3} \psi_q Macro_q + \eta_i + \varepsilon_{it} \quad (16)$$

Where the subscripts *i*, and *t* represent firm *i* at year *t*. Eff_{it}denote a measure of technical efficiency of the insurance companies. Eff_{it-1} is the technical efficiency measure on the same insurance company in the previous

year. $Comp_k$ measures competition level of the insurance industry captured in the P-R competition score. $Speci_n$ and $Macro_q$ are vectors representing insurance industry specific and macroeconomic control variables. η_i captures firm specific effect and ε_{it} captures the random error where $\varepsilon_{it} \sim iid(0, \sigma_u^2)$. Table 2 gives the composition of each of the variables included in the model.

In estimating insurance efficiency-structure linkage model, Berger *et al*. (2000) suggests that, efficiency of insurance companies persist over time and it is affected by constraints to market competition, poor information flow, and sensitivity to macroeconomic shocks. Besides, Garcia-Herrero *et al*. (2009) pointed out that, potential endogeneity is highly possible when assessing financial institutions' efficiency drivers. As a result, empirical studies on the efficiency-structure relationship may be plagued with discrepancies from a variety of causes, including high persistence performance, omitted factors, and endogeneity bias. Poghosyan and Hesse (2009). As a result, standard fixed effects and random effects estimators would be ambiguous, because the individual firm effects are associated with the lagged dependent variable by construction.

To account for these issues, a dynamic panel model is used to investigate the efficiency-structure relationship, with the first lag of the dependent variable introduced as an explanatory variable in the model and estimated using Arellano and Bond's system Generalized Methods of Moments (GMM) estimator. This estimation method allows the control for possible persistency and endogeneity; hence, estimation yields consistent estimates. The assumption that the error terms are not autocorrelated and that the instruments utilized are valid are important to the system GMM's

reliability. “The presence of first-order autocorrelation in the differenced residuals does not imply that the estimates are inconsistent, but the presence of second-order autocorrelation does” (Baum et al. 2010). As a result, we test the hypothesis that the error term has no autocorrelation. The Hansen test of over identifying restrictions, which is asymptotically distributed as χ^2 in the number of restrictions, is also used to assess the instrument's validity. If the null hypothesis of instruments being orthogonal to errors is rejected, it means the estimates are inconsistent (Baum *et al*. 2010; Liu et al., 2013).

A correlation matrix of the explanatory factors is obtained and provided in Chapter 5 of the panel regression analysis to satisfy the assumption of no multicollinearity among the explanatory variables. The matrix reveals that the correlation between the explanatory variables is weak in general (the maximum absolute correlation efficient is 0.58), implying that multicollinearity problems are not strong. Multicollinearity is a concern, according to Kennedy (2008), when the correlation coefficient between explanatory variables is greater than 0.80, which is not the case here. As a result, in the following chapter, we will estimate the model parameters.

Chapter Summary

The research design, study area, population, and sampling procedure were all covered in this chapter. It also explained how the data for this study was collected, as well as how the data was processed and analyzed. The chapter explained the model employed in estimating the technical efficiency of the insurance companies together with the estimation technique. The model used in estimating competition in the Ghanaian insurance industry over the study period was then described, followed by a description of the estimation

technique used to estimate the relationship between the technical efficiency of insurance companies and the level of competition in the insurance industry.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter explains the findings of this study in relation to the research objectives. The section presents the result of the efficiency analysis in the quest to achieve the first objective of the study. The second section presents the findings on the nature of competition in the insurance industry of Ghana in an attempt to achieve the second objective. The final section presents the findings on the linkage between efficiency of the insurance firms and the level of competition in the insurance industry. The analysis was carried out for the two insurance markets; the "non-life insurance market and the life insurance market." All values gotten from the financial statement of the insurance companies were stated at constant prices with 2015 as the base year.

Technical Efficiency of Insurance Companies in Ghana

The estimation approach used in the measuring the technical efficiency level of both life and non-life insurance firms in Ghana is Stochastic Frontier Analysis (SFA). Also, the study ranks insurance firms in both markets based on technical efficiency scores. This section is categorized as follows; the first section describes the data used in the estimation of the efficiency estimation. This is followed by result from employing the SFA.

Description of the Input and Output Variables

The research was conducted using an annual panel dataset derived from the financial statements of the selected insurance firms. The data was collected over an eight-year period, from 2012 to 2019. Table 2 shows a

summary of the descriptive statistics for the variables used in the efficiency estimation for both insurance firms.

Table 3: Descriptive Statistics of Raw Figures for Input and Output Variables

	Insurance firms	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Labour cost	Non-life	1,715,600	38,165,900	9,112,375	7,700,555	2.021	4.806
	life	618,500	41,125,600	8,052,273	7,486,037	1.808	3.872
Equity	Non-life	41,288,700	72,5162,400	1,835,543,15	1,347,883,11	2.101	5.852
capital	life	9,815,600	658,246,300	168,050,036	137,309,136	1.210	1.445
Debt	Non-life	15,482,00	312,856,00	95,144,30	8,149,604	1.170	0.285
capital	life	4,185,11	516,328,00	60,215,86	8,138,895	3.345	13.417
Net claim	Non-life	6,018,500	172,460,500	33,337,587	28,448,926	2.606	9.250
incurred	life	1,524,800	135,244,000	30,420,662	26,430,505	1.595	2.883

Source: Field data (2021)

Labour cost is an input variable in the efficiency analysis. From the sample of 24 non-life insurance firms and 21 life insurance firms, labour cost ranges from GHS0.62million to GHS41.13 million with the non-life insurance firms having the lowest labour cost and the life insurance firms having the highest. This implies that, all other things being equal, the labour size of the life insurance firms seems to be greater than that of the non-life insurance firms. However, comparing this observation with the average labour cost, the non-life insurance firms seem to have a higher average labour cost (GHS9.11 million) as compared with GHS8.05 million in life insurance firms which is an indication of a better salary conditions for the employees in the non-life insurance firms than in the life insurance firms which in a long way affects the efficiency level of the firms.

The variation in the labour cost appears to be higher among the life insurance firms (91% of the mean) than that of the non-life insurance firms (86% of the mean) with the variation in the entire data around 90% of the mean. This supports the claim that, there exist some form of inequalities in terms of remuneration of staff among the life insurance firms as compared to the non-life insurance firms. The distribution of the labour cost data of the firms in general is positively skewed with the level of skewness being pronounced in the case of the non-life insurance firms. This also gives an indication of some extreme values in the labour cost data of the non-life insurance firms but following the Balanda and MacGillivray (1988) test of differences in skewness, at 5% level of significance, we can reject the null hypothesis and conclude that there is no difference between the skewness in the labour cost data for the life insurance firms and that of the non-life

insurance firms. Also, the distribution of the labour cost among all the insurance firms shows a leptokurtic share (implying the tail of the distribution is longer and flatter than the normal curve) with that of the non-life insurance firms being more pronounced. These statistics gives an indication of a possible disturbance of extreme values hence, to ensure normality, the labour cost of the all the firms were logged for further analysis.

Another input variable used in the study is equity capital, which was defined to include all shareholders fund reported at the end of each reporting year over the study period. Over the study period, equity capital for the firms considered ranged from GHS9.82 million to GHS72.52 million with the lowest equity composition attributed to life insurance firms and the highest equity capital obtained from a non-life insurance firm. Thus, the average equity capital of GHS18.3 million for non-life insurance firms exceeded that of the life insurance firms (of GHS16.8 million) with variation in the non-life insurance firms being 73.4% of the mean for non-life insurance firms as against 81.7% from life insurance firms. The data for equity capital of the firms considered is positively skewed with the skewness being pronounced in the case of non-life insurance firms. Also, the share of the entire data and that of the life insurance firms can be described as platykurtic as they exhibit shorter and thinner tail as compare to the normal distribution. The distribution of the non-life insurance firm's data however showed leptokurtic shape. This result is an indication that, the data contains extreme value hence needs to be normalized for the purpose of efficiency estimation.

Debt capital of the firms were also used as an input variable. Debt capital was defined to include non-current liabilities reported at the year end.

The value of debt capital among the selected firms over the study period ranges from GHS0.42 million to GHS51.63 million which are all attributable to life insurance firms with a degree of variation of 135% of their average debt value. The data on debt of the non-life insurance firms showed a variation of 85.6% of the average value of debt of the non-life insurance firms which is an indication of less variability in the non-life insurance firms data relative to the life insurance firms data. The data for both non-life insurance firms and life insurance firms are positively skewed with the skewness more pronounced in the life insurance firms data. Also, the non-current asset data of the non-life insurance firms showed a platykurtic shape whereas that of the life insurance firms showed a leptokurtic shape. This result is an indication of existence of extreme values in the data and to deal with this, the data on debt capital were logged before being used for the efficiency analysis.

The output variable used in the study is the net claim processed by the insurance firms and is surrender values, withdrawals and claims paid claims to their policyholders after subtracting reinsurance claims. The claims of the insurance firms considered over the study period ranges from GHS1.52 million to GHS172.4 million with the lowest claim attributed to the life insurance firms and the highest claim attributable to a non-life insurance firm. Data for both insurance firms showed a variation of 85.3% and 86.9% of the mean income for "non-life insurance firms and life insurance firms" respectively. The data on net claims for both insurance firms showed positive skewness with that of the non-life insurance firms highly skewed relative to that of the life insurance firms. The non-life insurance firm's data depicted a leptokurtic shape whereas the data of the life insurance firms depicted

platykurtic shape which is an indication of existence of extreme value. To deal with this situation, the data values for this variable was transformed by taking the natural logarithm of the raw data. This in effect helps in even out and minimize the degree of asymmetry in the distribution of the variable.

Estimation of Stochastic Frontier Analysis (SFA) parameters

The probabilistic Stochastic Frontier Analysis (SFA), as defined in Equation 9, was used to estimate the insurance providers' efficiency ratings. Only time-varying specifications based on Greene's true random effect and true fixed effect models were taken into account. The Huasman test (see Appendix A) resulted in the random effect model being rejected in favor of the true fixed effect model. The Cobb-Douglas and Translog functional forms were also shown. The Maximum Likelihood (ML) approach was used to estimate the models. The xtfrontier and sfpanel commands in Stata were used to estimate the parameters of the parameters (Belotti et al., 2013). Table 3 shows the estimates for the non-life and life insurance markets using both functional forms.

Table 4: Result of SFA Estimation for Insurance Firms in Ghana from 2012 to 2019

Model		Non-Life		Life	
		Cobb-Douglas	Translog	Cobb-Douglas	Translog
		$b/_{(se)}$	$b/_{(se)}$	$b/_{(se)}$	$b/_{(se)}$
$\ln lab_{it}$	β_1	0.708***	0.718***	0.716***	0.786***
		(0.0602)	(0.0474)	(0.1795)	(0.2754)
$\ln equ_{it}$	β_2	0.115**	0.211***	0.140**	0.118**
		(0.0524)	(0.0745)	(0.0659)	(0.0592)
$\ln debt_{it}$	β_3	0.093	0.014	0.099	0.069
		(0.3563)	(0.1538)	(0.1298)	(0.1120)
$Time$	β_4	-0.081	-0.042**	-0.240	-0.252
		(0.0674)	(0.020)	(0.1578)	(0.2907)
$\ln lab_{it}^2$	β_5		-0.232*		-0.125**
			(0.1317)		(0.0542)
$\ln equ_{it}^2$	β_6		-0.640***		-0.268*
			(0.2183)		(0.1521)
$\ln debt_{it}^2$	β_7		-0.285		-0.941*
			(0.2633)		(0.5213)
$time_{it}^2$	β_8		-0.117		-0.213**
			(0.8178)		(0.0879)
$\ln lab_{it} \times \ln equ_{it}$	β_9		-0.043		-0.504
			(0.0587)		(3.8473)
$\ln lab_{it} \times \ln equ_{it}$	β_{10}		0.015***		0.022***
			(0.0037)		(0.0031)
$\ln lab_{it} \times Time_{it}$	β_{11}		0.306**		0.122**
			(0.1383)		(0.5627)
$\ln equ_{it}$	β_{12}		0.680**		0.855*
			(0.2887)		(0.4912)
$\ln equ_{it} \times Time_{it}$	β_{13}		-0.357		-0.312
			(0.3186)		(0.3521)
$\ln debt_{it} \times Time_{it}$	β_{14}		0.026		0.109
			(0.1338)		(0.0766)
Constant	β_0	0.453	0.522	0.772	0.813
		(0.7134)	(0.7196)	(0.5791)	(0.6582)
Parameter					
σ_u		0.466	0.321	0.049	0.075
σ_v		0.101	0.098	0.014	0.021
γ		0.956***	0.915***	0.928***	0.927***
eta		0.132***	0.763***	0.158***	0.826***
		(0.0214)	(0.0431	(0.0257)	(0.0535)

Source: Field data (2021)

Model		Non-Life		Life	
		Cobb- Douglas	Translog	CobbDougla	Translo
Model selection					
Log likelihood	LL	43.814	46.147	59.193	62.133
Information Criteria	AI	−69.6280	−76.113	−80.3861	−93.174
	BIC	40.8914	36.901	19.7200	16.326

Log likelihood ratio test

Assumption: Cobb-Douglas Functional form is nested in Translog Functional Form

Likelihood-ratio test

LR chi2(10) = 30.76*** Prob > chi2 = 0.0006

****p<0.01*; ***p<0.05*; **p<0.1*.

Source: Field data (2021)

The "estimates of variance parameters, sigma-squared (u), sigma_squared (v), and Gamma (γ) are statistically significant for both models, suggesting evidence of technical inefficiency in the data as expected (Wadud and White, 2000)." Technical inefficiency, rather than random error, accounts for almost 90% of the overall error fluctuations in the data, according to the estimates for gamma across the models. The parameter Gamma (γ) is significant at 1% in both models which indicates that, the null hypothesis of no existence of technical inefficiency effect in the data is rejected and "can be concluded that, significant amount of variation in the composite error term (*v-u*) is due to technical inefficiency component." This provides fascinating proof that, the assessment of production's suitability to use as a border. for the data. Also, the estimate for *eta* across the time varying models is statistically significant, suggesting that, models that change throughout time may be more

suitable. for the data. This is expected as efficiency in an industry such as insurance is expected to change over time.

Despite the fact that each functional form suggests data inefficiency, it is vital to select the form that is best suited for further analysis, as employing various functional forms with different assumptions underlying them may result in different rankings of estimated efficiency scores (Jung and Pyo, 2009). As a result, the Likelihood Ratio Test was performed on both functional forms, with the null hypothesis being that the Translog specification does not reduce to the Cobb-Douglas production function specification. The result of the likelihood ratio test is shown in Table 4. From the result of the log likelihood ratio test indicated that, at 1% level of significance, the translog function does not reduce to the Cobb-Douglas functional form and hence the Translog functional form was selected for further analysis. Also, "judging from the minimized AIC and BIC information criterion, the Translog function is selected for the subsequent prediction of technical efficiency" scores on the insurance firms.

Technical Efficiency Score of Life and Non-Life Insurance Firms in Ghana

Using the Translog functional form, the summary of the efficiency score of all the insurance firms analyzed into non-life insurance firm and life insurance firms is shown in Table 5. Using the truncated-normal distribution option, the Stochastic Production Frontier technical efficiency scores were estimates and was observed that, among the non-life insurance firm insurance firms, the average overall efficiency score is 0.834 (83.4%), as against 0.853 (85.3%) among the life insurance firms. Thus, it could be stated that,

relatively, non-life insurance firm insurance firms could achieve a full efficiency level with no impact on productivity should input be cut by 16.6% as compared to 14.7% among the life insurance firms. The standard deviation of both insurance firm's category indicates that, their efficiency score over the eight-year period is all around the average score, even though is much skewed to the right.

Table 5: Average Technical Efficiency Scores for insurance firms in Ghana from 2012 to 2019 based on SFA

	Mean Score	Std dev	Skewness	Minimum	Maximum
Non-life	0.834	0.135	0.647	0.585	1.000
Life	0.853	0.159	0.546	0.519	1.000

Source: Field data (2021)

Annual Technical Efficiency scores of the Insurance Industry in Ghana

A close review of the trend of overall technical efficiency scores across the research period reveals that overall firm efficiency has been generally consistent, with the exception of 2018 and 2019, when the industry's overall efficiency fell sharply. The year-by-year average efficiency scores for non-life insurance firms and the life insurance firms is shown in Table 6 and the graph of the trend of the average efficiency scores is shown in Figure 1. The efficiency score of the life insurance firms however fluctuates significantly over the period, hence showing a variation of 13.3% of the average score. This may be attributable to the strict requirements the regulator put in place to regulate the activities of these insurance firms. With the non-life insurance firms however, there was a sharp fall in efficiency in 2012 (whereas in the same period the life Insurance firms experienced their highest efficiency)

followed by a rising and relatively stable efficiency over the period. Both the life and the non-life insurance firms exhibited a fall in efficiency level during the latter part of the study period. This may be attributable to the pressure on these insurance firms to meet the regulators minimum capital requirement, hence shifting the focus of the insurance firms from efficiency in productivity to financing.

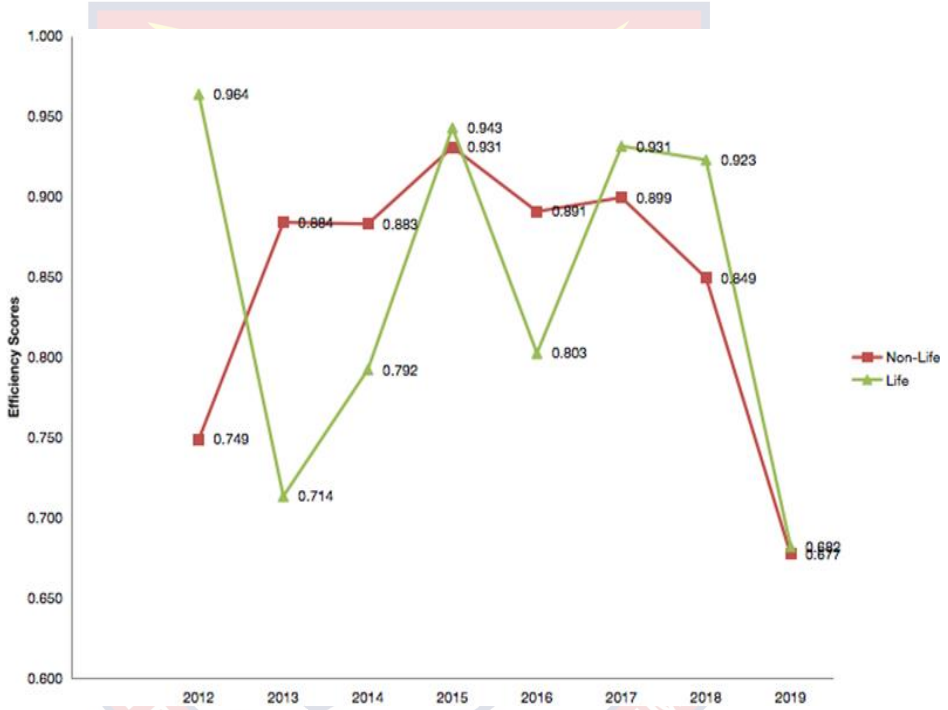

Figure 1: Annual Technical Efficiency Score of Insurance firms in Ghana from 2012 to 2019

Source: Field data (2021)

Table 6: The Year-on-Year Average Efficiency Scores Insurance Firms in Ghana from 2012 to 2018

Year	Non-life	Life
2012	0.749	0.964
2013	0.884	0.714
2014	0.883	0.792
2015	0.931	0.943
2016	0.891	0.803
2017	0.899	0.931
2018	0.849	0.923
2019	0.677	0.682
Summary		
Mean	0.854	0.830
Std dev	0.0854	0.1110
Skewness	-1.4741	-0.0685
Minimum	0.677	0.682
Maximum	0.931	0.964

Source: Field data (2021)

Estimation of Competition Level in the Ghanaian Insurance Industry

This section presents the estimation results of dynamic profit function based on Equation (10) and dynamic revenue function based on Equation (12) necessary for determining market equilibrium and level of competition in the market respectively using Panzer Rosse model.

State of Equilibrium of the Ghanaian Insurance Industry

The Panzer Rosse approach developed by Panzar & Rosse (1987) operates on the assumption that, the market for which its competition is to be determined should be in a state of long run equilibrium. If not, the dynamic version of the model is applied in estimating competition level in the industry. The state of equilibrium in the industry is determined by first estimating Equation (10) and secondly, obtain the E-statistic as defined in Equation (11). The estimation result of Equation (10) for both markets (life and non-life) and the associated E-statistic is presented in Table 6. The Wald test was performed under the null hypothesis, $E = 0$: the market is under long run equilibrium, to ascertain whether the E-statistic obtained is significantly different from zero.

Table 7 reports a negative and a value which is statistically different from zero for both markets, suggesting that the hypothesis of long-run equilibrium is rejected for the Ghanaian insurance market for this study period. The phenomenon of the seeming disequilibrium in the market is expected as there have been considerable structural changes in relation to financial, technological, legal and regulatory developments in the industry. This has led to a series of merger and acquisitions over the study period. As a result of findings, the use of dynamic specification of the P-R model is more appropriate which accommodates persistence role of the dependent variable in competition determination, hence, the dynamic P-R model is applied.

Table 7: Equilibrium and Competitive Test in the Insurance Industry of Ghana from 2012 to 2019

		Model 1			Model 2	
Part A: Model coefficients		**Non-life**	**Life**		**Non-life**	**life**
Con_	$\propto'$	-8.178***	-6.182	$\propto''$	4.113***	3.298***
		(2.619)	(1.133)		(0.571)	(0.318)
$\ln R_{t-1}$		-	-	β_0''	0.613**	0.517
		-	-		(0.298)	(0.261)
$\ln ROA_{t-1}$	β_0'	-0.322*	-0.518**		-	-
		(0.187)	(0.372)		-	-
$\ln w_1$	β_1'	-0.819***	- 0.821***	β_1''	0.502***	0.610**
		(0.277)	(0.2170		(0.132)	(0.231)
$\ln w_2$	β_2'	-0.221	-0.312	β_2''	0.281***	0.118***
		(0.225)	(0.309)		(0.092)	(0.071)
$\ln w_3$	β_3'	0.203**	0.172**	β_3''	-0.122*	-0.213*
		(0.092)	(0.088)		(0.054)	(0.071)
$\ln Z_1$	γ_1'	0.932**	0.994**	γ_1''	0.629*	0.813
		(0.459)	(0.422)		(0.294)	(0.762)
$\ln Z_2$	γ_2'	-3.155**	-4.102**	γ_2''	0.013	0.037
		(1.586)	(1.627)		(0.012)	(0.031)
$\ln Z_3$	γ_3'	-0.115**	-0.218**	γ_3''	-0.024*	-0.041*
		(0.053)	(0.041)		(0.015)	(0.021)
Part B: Model statistics						
No. of observations		198	158		198	158
No. of firms		24	21		24	21
1st stage F statistic		25.268***	22.176**		34.159***	21.928***
E-statistic		-0.838	-0.961		-	-
H-statistic		-			0.661	0.515
Part C: Long run equilibrium test						
$H_o: E = 0$						
Wald Chi^2		4.113***	3.211**			
State of market		Disequilibrium	Disequilibrium			
Part D: Test for competitiveness						
$H_o: H = 0$						
Wald Chi^2 *(p-value)*					8.137***(0.002)	7.318***(0.001)
$H_o: H = 1$						
Wald Chi^2 *(p-value)*					3.173**(0.041)	3.272**(0.03)
Market condition					**Monopolistic competition**	**Monopolistic competition**

Source: Field data (2021)

In each of the regression, dependent variable is the log of ROA following Equation (10) for model 1 and Revenue for Model 2 following Equation (12). All the regressions are estimated using two stage system GMM with IV estimation. Robust standard errors are reported in parentheses in Part A and level of significant in Part C. $^{***}p<0.01$; $^{**}p<0.05$; $^{*}p<0.1$.

Competition in the Ghanaian Insurance Industry

We proceed to estimate the revenue equation as described in Equation (12) using the two-step system GMM methodology to compute the values of H-statistic for the entire study period after establishing the presence of market disequilibrium. Unscaled values of the "dependent variable, the sum of net retained earned premium and investment income", are utilized to solve the issue of misspecification Bikker et al. (2012). The result of estimation of Equation (12) is presented in Table 6 under Model 2 for both non-life and life insurance markets. From Part A of Model 2 in Table 6, it can be noticed that the input prices of labour (w1) and equity (w2) are positively and significantly related insurance revenue whiles the input price of debt is negatively and significantly related to insurance revenue with the price of labour being the largest contributor to the value of H-statistic. With respect to the control variables, the ratio of equity to total asset is positively and significantly related total revenue. This indicate that, well capitalized insurance firms are a panacea to higher revenue generating ability. In both markets, the size of insurance firms is positively and significantly associated to revenue, demonstrating that size plays a key role in generating income for insurance companies. The H-statistic has an estimated value of 0.661 for non-life firms and 0.515 for life companies for the study period. The higher magnitude of the H-statistic

indicates that there is more competition in both the life and non-life insurers. The outcomes of "the Wald test indicate that the hypotheses of H = 0 (insurance market is monopoly) and H = 1 (insurance market is perfect competition) are rejected" at 1% and 5% level of significant. The hypothesis of $0 < H < 1$ (the insurance market is monopolistic competition) is validated for the Ghanaian insurance industry.

Observing development in competition over time, Equation (14) was estimated and H statistic for each year was computed based on Equation (15). The result of the H-statistic and the Wald test of the null hypotheses of H = 0 (insurance market is monopoly) and H = 1 (insurance market is perfect competition) is presented for both insurance markets in Table 7.

Table 8: Development of Competition over Time Using P-R Model

	Non-Life insurance market				Life insurance market			
2012	0.521	0.031	0.000	MP	0.751	0.021	0.001	MP
2013	0.235	0.006	0.000	MP	0.375	0.206	0.006	CO
2014	0.215	0.333	0.001	CO	0.315	0.333	0.002	CO
2015	-0.023	0.572	0.003	CO	0.203	0.012	0.002	CO
2016	-0.035	0.113	0.021	CO	0.115	0.013	0.113	PC
2017	0.211	0.021	0.000	MP	0.031	0.021	0.121	PC
2018	0.211	0.001	0.000	MP	-0.111	0.001	0.000	CO
2019	0.315	0.004	0.000	MP	0.215	0.000	0.004	MP

Year	H-statistic	Wald test *(p value)*	Market condition	H-statistic	Wald test *(p value)*	Market condition
	$\boldsymbol{H_0: H = 0}$	$\boldsymbol{H_0: H = 1}$		$\boldsymbol{H_0: H = 0}$	$\boldsymbol{H_0: H = 1}$	

Source: Field data (2021)

H -statistic was estimated based on Equation (14) and Equation (15). Note that, MP – Monopolistic competition; CO – Collusive oligopoly; PC – Perfect Competition.

Almost all the observed years have a positive H statistic, except in 2015 and 2016 where the H statistic assumed negative values in the case of non-life firms and 2018 in the case of the life insurance firms. The Wald test showed that, the null hypothesis H statistic = 0 cannot be rejected as the H statistic is not significant. It can therefore be concluded that the nature of competition in the non-life insurance market during 2015 and 2016 were of oligopolistic nature. In the case of the life market, H-statistic assumed negative in 2018 but both H = 0 (insurance market is monopoly) and H = 1 (insurance market is perfect competition) were rejected and concluded that, the market was collusive oligopoly. Similar observation can be made in 2014 where, even though H-statistic is positive, the acceptance of the null hypothesis (H=0) suggests that, the market structure of the industry in 2014 is of oligopolistic type.

Effect of Competition on Technical Efficiency of the Insurance Industry

This section discusses the impact of changes in the insurance industry's level of competition on technical efficiency. As previously indicated, estimation of the relationship between technical efficiency and market structure was performed using the GMM method. Table 9 shows the estimation's results. Observation of the result obtained warrant some general comments as follows; Firstly, the coefficients of the main variables of interest remains stable across the regressions models in the two markets in terms of direction and magnitude. Secondly, the highly significant and positive lagged

technical efficiency variable's coefficient across the model in both markets suggest that, efficiency of Ghanaian insurance industry in the current year is significantly and positively affected by its previous year's efficiency. This supports the use of dynamic panel data model estimate by confirming the dynamic character of the model specification. Finally, the F-test results suggest that the model fits the data fairly well. Additionally, the Hansen test statistics for over identifying restrictions indicate that, at a 5% level of significance, the instruments used are sufficiently orthogonal to the error terms for both regression models estimated. Furthermore, the Arrelano–Bond AR (2) test reveals that no second order serial correlation can be identified at the 5% significance level.

Table 9: Panel GMM Result of Technical Efficiency on Competition of the Insurance Industry.

	Non-life	Life
Part A: Model coefficients		
con_	5.154*	3.154*
	(3.035)	(1.867)
Lag dep. var	0.079***	0.064***
	(0.021)	(0.004)
Competition (P-R)	0.024***	0.044**
	(0.007)	(0.021)
Small firms	-0.082	-0.077
	(0.157)	(0.142)
Medium firms	0.036**	0.011***
	(0.013)	(0.002)
Large firms	0.017***	0.018**
	(0.005)	(0.011)
Market share	0.067***	0.168**
	(0.007)	(0.082)
Re-insurance	0.065**	0.149***
	(0.025)	(0.058)
Ownership	0.205***	0.189**
	(0.058)	(0.071)
Capitalisation	0.087	0.088**
	(0.066)	(0.045)
Economic dev't	0.194***	0.064***
	(0.050)	(0.023)
Fin. Sec dev't	-0.262***	-0.180*
	(0.092)	(0.127)
Macro. Risk	0.021***	0.169
	(0.006)	(0.111)
Part B: Model statistics		
F-test	28.714***	22.571***
AR (1) p-value	0.092	0.086
AR (2) p-value	0.216	0.216
Hansen p-value	0.265	0.265

$^{***}p<0.01$; $^{**}p<0.05$; $^{*}p<0.1$.

Source: Field data (2021)

Robust standard error in parenthesis. Dependent variable is technical efficiency scores

estimated based on equation (9)

Competition and Technical Efficiency

In analysing the connection amid competition and technical efficiency, competition was measured based on the Panzer-Ross (P-R) model whereas technical efficiency was estimated based on the parametric stochastic frontier analysis. In both markets, the coefficient of competition was revealed to have a positive and significant connection with technical efficiency in regression models. This suggests that, higher P-R values are associated higher the value of technical efficiency scores. As high P-R value is an indication of high level of competition all other things being equal, thus, the regression outcome proposes that, increased competition in the insurance market is associated with higher technical efficiency of the firm. The observed relation between competition and technical efficiency tends to confirm the assertion of Berger, *et al*. (2008) and Boyd and De Nicolo (2005) who are of the view that, as competition in the financial sector heightens, firms are able to adopt strategies to make them relevant in the industry, resulting in firms being motivated to improve productivity and thereby becoming efficient.

Control Variables

In addition to the main variables of interest, the study controlled for other variables that seek to explain the variability in insurance company's technical efficiency. Five insurance specific (firm size, market share, re-

insurance, ownership and capitalisation) variables and three macro variables (economic development, financial development and macro-economic risk) were controlled for. Table 8 shows the effect of these control variables on technical efficiency.

Firm size is a very important variable in the insurance industry as it has a lot of connotations with economies of scale and scope which can lead to reduction in cost of production and improvement in production efficiency. It is measured as the log of total asset of firms but for clarity of the effects on technical efficiency the study analysed the firm's size into small, medium and large. Following the classification by Rai (1996), small represented firms with size below the second quartile, medium represented firms "with size below the third quartile and large represented firms with size above the third quartile" in the sample. Most of than not, the size of an insurer offers some sort of security for insurees and thus attract more policy holders to a large firm. However, the ability of a firm to perfectly manage this increase in growth determines whether the overall costs which comes with this increase will be minimized. This challenge is why Fama and Jensen (1983) stated that, complexities arising from expansion in businesses can make it more difficult in monitoring managerial behavior in relatively large firms than in smaller firms. Insurance literature on size firm reveals a positive connection with technical efficiency in cross-country studies (Eling and Luhnen, 2010; Rai, 1996) and in individual country studies (Ansah-Adu et al., 2012 and Cummins and Weiss, 1998).

From the Table 9, large firms had a positive and significant connection with technical efficiency. Small firms on the other hand recorded a negative and insignificant relationship with technical efficiency at 5% significance

level. This means that small firms are comparatively not technically efficient as compare to larger firms. According to Hauner (2005), there are two possible theories for why scale has a favorable impact on the technological efficiency of insurance firms. First, it is assumed that, size is associated with market power and as such, through the enjoyment of economies of scale, large insurance firms should pay less for their inputs which directly translate into improvement in their level of efficiency. Secondly, as firm expands, it might enjoy increasing returns to scale as results of spreading fixed costs over a large number of services or from productive gains from using a highly skilled workforce. This observation confirms the findings of Ansah-Adu et al. (2012) who observed a positive relationship in the Ghanaian insurance industry.

The portion of industry premiums controlled by a firm represents market share in the insurance literature and thus similar definition was adopted for this study. This variable serves as an indicator of the structure of the firm usually expressed in concentration ratios, Herfindahl Hirschman Index. However, market share in this study was defined as the proportion of the industry premium controlled by the insurance firm. According to Baah-Nuakoh (2003) there exist a negative relationship between market share and technical efficiency, that is when a firm controls greater percentage of the market share, it becomes technically inefficient in the usage of its inputs in producing its output as the absence of competition bleeds inefficiencies. This observation which has a strong presence in economic theory was confirmed differently in the insurance literature as Weiss and Chou (2008) argued that despite the likelihood that insurers in competitive and loosely regulated markets profit from market power through charging higher prices, they are on

average more cost-effective and charge lower prices. As a result, market share might have a positive or negative association with technical efficiency in such markets. This can be seen in the findings of Fenn et al. (2008), who found a negative link between market share and efficiency among European Union countries in the same market, and Barros et al. (2010), who found a positive association.

Table 9 reports a positive and significant relationship between market share and technical efficiency, suggesting that firms benefited from controlling higher portions of the premiums in the industry. This finding confirms the study of Ansah-Adu et al. (2012), Fenn et al. (2008) and Kasman and Turgutlu (2009) but contradicts the argument of Baah-Nuakoh (2003) who supports a negative association amid market share and technical efficiency.

The concept of risk diversification is practiced in insurance through reinsurance as firms share their uncertain risks with other insurers or reinsurers by ceding part of received premiums to these partners. These practices allow an insurer to benefit from large numbers as the burden of carrying all the risk of those policies are lifted by the reinsurance partner. Contrary to the benefits it can also reduce the available funds for investments as well as become a cost burden on the insurer hence the relationship of the reinsurance and efficiency depends on the benefits and cost attached to the activity. Insurers undertake reinsurance in order to be able to diversify their risks and therefore underwrite more insurance businesses. At 1% significance levels, this study finds a positive association amid diversifying risks (reinsurance) and technical efficiencies, i.e., firms that undertook reinsurance profited by improving their technical efficiencies over the period. Insurers'

security allows them to execute good production management methods, which lowers their operating costs. As they discussed technical efficiency and reinsurance, Alhassan and Biekpe (2015) made the same observation.

In assessing the effect of ownership on technical efficiency, the study used a dummy of one (1) to represent domestic insurers and zero (0) for foreign to control for ownership type in the insurance of Ghana. The international experience of foreign firms has been observed to make them more efficient relative to domestic firms (Kasman & Turgutlu, 2009) but the long absence of foreign domination in the Ghanaian insurance industry makes this relationship unpredictable. The result as shown in Table 8 shows that foreign controlled firms tend to be technically efficient than locally controlled firms. This observation was made across both insurance markets.

Across the two markets, capital strength (measured as the ratio of equity capital to total asset) demonstrated a positive and substantial link with insurance firm technical efficiency, which is consistent with Goddard *et al*. (2004), and Kosmidou (2008) and argument in the literature which provides that well capitalized insurance firms face lower costs of going bankrupt, rather are able to fund huge insurance business. Furthermore, strong capital base is essential for insurance firms in developing economies necessary to provide a shock absorber in times of financial crises and also provide a reliable insurance package during unstable macroeconomic conditions (Sufian, 2009).

The results of the relationship between GDP and insurance firms' technical efficiency appears to provide evidence in support of the argument on the linkage between economic growth and financial sector's performance. The result suggests that, a high economic growth encourage insurance firms

operating in in Ghana to offer more product packages on the market, charge appropriate margins, and improve the quality of their assets. Although the level of financial development has little bearing on insurance firm efficiency, the negative coefficients clearly show that, during the study period, Ghana stock markets provide substitution prospects rather than complementing the products and services provided by insurance firms to investors. Similarly, the coefficient of the macroeconomic risk (proxied by inflation) seems to be negatively association with insurance firm's efficiency. Rising inflation reduces the real value investment of these firms and since most insurance firm contracts are not inflationary adjusted, it tends to be detrimental to insurance firms' technical efficiency.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The study's summary of findings, conclusions and recommendations are presented in this chapter. The session considers the study's objectives and links it to the summary and findings as well as the literature that was analyzed.

Summary of the Study

Most Ghanaians do not usually patronize insurance services due to their general view of efficiency and lack of competition in the insurance industry. An attempt to change this opinion of insurees by the insurers resulted into an attempt to improve competition to facilitate improvement in services provided in the industry by price cutting, and the likes. This move by insurers has rather actually led to a more increase in the complaints of insurees on repudiated claims, disputes over quantum of claims due the insurees, delay in settlement and payment of claims. It is therefore clear that, the interventions have rather aggravated the negative perceptions of Ghanaians about the insurance industry. Despite the essence of competition in the industry and the role it plays in the efficiency of these insurers, few studies have been geared towards studying these variables in this sector. In Ghana, studies on the effect of competition and efficiency in the financial sector have focused more on the banking industry rather than the insurance industry.

As a result of these factors, the current study looked into the effect of competition on the technical efficiency of insurance businesses in Ghana. The study made the following observations using data from 21 life insurance firms

and 24 non-life insurance firms during an eight-year period, from 2012 to 2019, and so reports the summary below.

i. Non-life insurance firm showed an average overall efficiency score is 0.834 (83.4%), as against 0.853 (85.3%) among the life insurance firms. It can therefore be deduced that, relatively, non-life insurance firm insurance firms could achieve a full efficiency level with no impact on productivity should input be cut by 16.6% as compared to 14.7% among the life insurance firms.

ii. The overall efficiency of the insurance firms is relatively stable over the period except in 2018 and 2019 where there was a sharp decline in the overall efficiency of the industry.

iii. Ghana's insurance industry is at the state of long-term disequilibrium and this observation was assess to be due to major financial, technological and regulatory developments which has led to a series of merger and acquisitions over the study period.

iv. The estimated value of H-statistic is 0.661 over the study period for non-life firms and 0.515 for life firms. The observed higher magnitude of H-statistic implies that the degree of competition is higher in both life and non-life insurances businesses.

v. The coefficient of competition measure in the regression models exhibit a positive and significant relationship with technical efficiency in both life and non-life insurance market.

vi. Large firms had a positive and significant relationship with technical efficiency. Small firms on the other hand recorded a negative and insignificant relationship with technical efficiency at 5% significance level.

vii. There is a positive and significant relationship between market share and technical efficiency, suggesting that firms benefited from controlling higher portions of the premiums in the industry.

viii. There is a positive relationship between risk diversification (reinsurance) and technical efficiencies, i.e., firms that engaged in reinsurance profited by improving their technical efficiencies over time at 1% significance levels.

ix. Foreign-controlled companies are more technically efficient than domestically managed companies. This observation was made in both life and non-life insurers.

x. In both markets, capital strength had a positive and significant relationship with insurance firm technical efficiency.

Conclusions

In Ghana, few research on the effect of competition and efficiency in the financial sector have been conducted, but this research concentrated on the banking industry rather than the insurance industry. The aim of this research was to look into the effects of competition and efficiency in the insurance business in Ghana. In total, data from 21 life insurance firms and 24 non-life insurance firms were included in the study, which spanned eight years from 2012 to 2019. The survey indicated that non-life insurance businesses had an overall efficiency score of 83.4 percent, whereas life insurance businesses had an efficiency score of 85.3 percent. This overall efficiency of the insurance firms was relatively stable but with exceptions in 2018 and 2019 where the industry experienced a sharp decline.

The H-statistic for non-life and life insurance companies was 0.661 and 0.515 respectively; which clearly indicated that the extent of competition

was higher in both life and non-life insurance firms. Furthermore, the regression model estimated in the study revealed the coefficient of competition had a significant positive relationship with technical efficiency in both life and non-life insurance firms. There was a positive significant relationship for large firms whereas the relationship for smaller firms was negative and insignificant. Also, there existed a positive significant relationship between market share and technical efficiency which infer that firms benefit from controlling higher portions in the industry.

Risk diversification shown to have a positive significant relationship with technical efficiency, and firms that engaged in reinsurance were able to benefit from increased technical efficiency. Capital strength also had a substantial positive relationship with technical efficiency, across the two markets.

In conclusion, the empirical findings of this study support the statement that there is a positive and significant relationship between insurance company rivalry and technical efficiency. In addition, the efficiency of the insurance business is determined by the industry's previous efficiency state.

Recommendations

The findings of this study fill the gap in the literature and also the results in this study can be generally applied to emerging economies whose have insurance industry similar to that of Ghana. More so, the empirical findings of this study have direct implications for structures responsible for making policy changes in the insurance industry. Outlined below are the policy implications for this study.

One major finding of this study is the falling of the level of efficiency especially during the latter part of the study period. This is a confirmation of the low performance perception of Ghanaians about the insurance industry. This perception was as a result of the bureaucracies during claims payments and the unclear processes in the industry. Overcoming such challenges lies in product innovations. The nature of some insurance products reduces the number of processes required before claims payments. For instance, the Kenyan insurance industry with the help of weather service stations and telecommunication companies innovated weather index insurance products which made claim payments via mobile phones without any written documentation (KPMG Africa, 2014). By this innovation, premium mobilization by the Kenyan insurance industry increased therefore making it one of the dominant markets in Africa. An introduction of such insurance products on the Ghanaian insurance market would help overcome the negative perception challenge that has befallen the industry. And this in effect would also go a long way to increase the efficiency of insurers in the insurance.

This study reports factors that are under the control of insurers which has the potential of deepening or lessening the perception of poor performance of Ghanaians on the industry. Hence the era of targeting other mediums or activities to increase technical inefficiencies must be relegated as the study identifies firm size, capitalization, reinsurance, market share as the determinants of technical efficiencies in the Ghanaian insurance industry. Insurance companies in Ghana enjoy the benefits of large numbers through risk diversification. Hence, streamlining reinsurance policies by both NIC and insurers to attractive more reinsurance contracts can increase cost efficiency among insurers in Ghana.

Observations from the study using the Panzar-Rosse model shows that, competition tends to increase at the latter part of the study period. It was also observed that, even though there appears to be evidence of oligopolistic competition in the middle of the study period (2014 and 2015), the market exhibited monopolistic competition towards the end of the study period. Accordingly, this is an indication that, there is much more room for competition in the Ghanaian insurance industry. There is a greater need for major and basic institutional changes within the insurance sector before industry players can fully enjoy the benefits which comes with increased competition. This conclusion can urge policy makers as well as regulators put more efforts in institutionalizing measures which will facilitate increase in competition. This is likely to come in the form of increased innovation by insurers as well as the provision of quality insurance services to insurees. The ability of insurers to provide different ranges of products and services for will greatly increase the level of competition in the industry as consumers will have a much more variety of quality services to choose from.

Suggestions for Further Research

The knowledge on efficiency analysis from developing countries had been very limited in the insurance literature, this study therefore provides additional information on technical efficiency from the perceptive of a developing economy. It also provides a roadmap which researchers can replicate on technical, allocative, profit, revenue, scale and scope efficiencies on different countries and industries.

REFERENCES

Adjei-Frimpong, K., Gan, C., & Hu, B. (2014). Cost efficiency of Ghana's banking industry: A panel data analysis. *The International Journal of Business and Finance Research*, *8*(2), 69-86.

Ahiabor, G. (2013) The impact of microfinance on the development of small-scale enterprises in the Ledzokuku-Krowor Municipality in the Greater Accra Region of Ghana. *European Journal of Business Management*, 5, 165-172.

Aigner, D., Lovell, C. K., & Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. *Journal of Econometrics*, *6*(1), 21-37.

Alhassan, A. L., & Biekpe, N. (2016). Competition and efficiency in the non-life insurance market in South Africa. *Journal of Economic Studies*, 4(1), 23-120.

Alhassan, A. L., & Biekpe, N. (2018). Competition and risk-taking behaviour in the non-life insurance market in South Africa. *The Geneva Papers on Risk and Insurance-Issues and Practice*, *43*(3), 492-519.

Alhassan, A.L., Addisson, G. K., & Asamoah, M.E. (2015). Market structure, efficiency and profitability of insurance companies in Ghana. *International Journal of Emerging Markets*, *10*(4), 648-669.

Amaral-Zettler, L. A., Mincer, T. J., & Zettler, E. R. (2013). Life in the "plastisphere": microbial communities on plastic marine debris. *Environmental Science & Technology*, 47(13), 7137-7146.

Apergis, N., & Polemis, M. L. (2016). Competition and efficiency in the MENA banking region: a non-structural DEA approach. *Applied Economics*, *48*(54), 5276-5291.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, *58*(2), 277-297.

Arrawatia, R., Misra, A., & Dawar, V. (2015). Bank competition and efficiency: empirical evidence from Indian market. *International Journal of Law and Management*.

Baah-Nuakoh, A. (2003). *The Industrial Sector* (Vol. 3). Woeli Pub Serv.

Bain, J. S. (1951). Relation of profit rate to industry concentration: American manufacturing, 1936–1940. *The Quarterly Journal of Economics*, *65*(3), 293-324.

Baumol, W. J. (1982). Applied fairness theory and rationing policy. *The American Economic Review*, *72*(4), 639-651.

Belotti, F., Daidone, S., Ilardi, G., & Atella, V. (2013). Stochastic frontier analysis using Stata. *The Stata Journal*, *13*(4), 719-758.

Benston, G. J. (1965). Branch banking and economies of scale. *The Journal of Finance*, *20*(2), 312-331.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, *98*(2), 175-212.

Berger, A. N., DeYoung, R., Genay, H., & Udell, G. F. (2000). Globalization of financial institutions: Evidence from cross-border banking performance. *Brookings-Wharton Papers on Financial Services*, *2000*

Berry-Stölzle, T. R., Weiss, M. A., & Wende, S. (2011). Market structure, efficiency, and performance in the European property-liability insurance industry. In *ARIA 2011 Meeting*.

Bezat, A. (2009). Comparison of the deterministic and stochastic approaches for estimating technical efficiency on the example of non-parametric DEA and parametric SFA methods. *Metody ilościowe w Badaniach Ekonomicznych*, *10*(1), 20-29.

Bhatti, G. A., & Hussain, H. (2010). Evidence on structure conduct performance hypothesis in Pakistani commercial banks. *International Journal of Business and Management*, *5*(9), 174.

Biener, C., Eling, M., & Wirfs, J. H. (2016). The determinants of efficiency and productivity in the Swiss insurance industry. *European Journal of Operational Research*, *248*(2), 703-714.

Bikker, J. A., & Van Leuvensteijn, M. (2008). Competition and efficiency in the Dutch life insurance industry. *Applied Economics*, *40*(16), 2063-2084.

Bikker, J. A., Shaffer, S., & Spierdijk, L. (2012). Assessing competition with the Panzar-Rosse model: The role of scale, costs, and equilibrium. *Review of Economics and Statistics*, *94*(4), 1025-1044.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115-143.

Boyd, J. H., & De Nicolo, G. (2005). The theory of bank risk taking and competition revisited. *The Journal of Finance*, *60*(3), 1329-1343.

Buchs, T. D., & Mathisen, J. (2005). Competition and efficiency in banking: Behavioral evidence from Ghana.

Casu, B., & Girardone, C. (2002). *Efficiency of large banks in the single European market*. Middlesex University Business School.

Casu, B., & Girardone, C. (2006). Bank competition, concentration and efficiency in the single European market. *The Manchester School*, *74*(4), 441-468.

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European Journal of Operational Research*, *2*(6), 429-444.

Charness, G., Gneezy, U., & Kuhn, M. A. (2012). Experimental methods: Between-subject and within-subject design. *Journal of Economic Behavior & Organization*, 81(1), 1-8.

Choi, B. P., & Weiss, M. A. (2005). An empirical investigation of market structure, efficiency, and performance in property-liability insurance. *Journal of Risk and Insurance*, *72*(4), 635-673.

Creswell, J. W. (2011). Controversies in mixed methods research. *The Sage handbook of qualitative research*, 4, 269-284.

Cummins, J. D., & Weiss, M. A. (1998). Analyzing firm performance in the insurance industry using frontier efficiency methods. *Center for Financial Institutions Working Papers*, (98-22).

Cummins, J. D., Weiss, M. A., Xie, X., & Zi, H. (2010). Economies of scope in financial services: A DEA efficiency analysis of the US insurance industry. *Journal of Banking & Finance*, *34*(7), 1525-1539.

Daley, J., & Matthews, K. (2012). Competitive conditions in the Jamaican banking market 1998–2009. *International Review of Financial Analysis*, *25*, 131-135.

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

Dudu, H., & Kilicaslan, Y. (2009). Concentration, profitability and (in) efficiency in large scale firms. In *Productivity, efficiency, and economic growth in the Asia-Pacific region* (pp. 39-58). Physica-Verlag HD.

Eling, M., & Luhnen, M. (2010). Efficiency in the international insurance industry: A cross-country comparison. *Journal of Banking & Finance*, *34*(7), 1497-1509.

Fama, E. F., & Jensen, M. C. (1983). Separation of ownership and control. *The Journal of Law and Economics*, *26*(2), 301-325.

Farell, P. (1957). DEA in production center: An input-output mode. *Journal of Econometrics*, *3*, 23-49.

Feeny, S., & Rogers, M. (1999). *Market share, concentration and diversification in firm profitability*. Melbourne: Melbourne Institute of Applied and Social Research.

Fenn, P., Vencappa, D., Diacon, S., Klumpes, P., & O'Brien, C. (2008). Market structure and the efficiency of European insurance companies: A stochastic frontier analysis. *Journal of Banking & Finance*, *32*(1), 86-100.

Fungáčová, Z., & Weill, L. (2012). Bank liquidity creation in Russia. *Eurasian Geography and Economics*, *53*(2), 285-299.

García-Herrero, A., Gavilá, S., & Santabárbara, D. (2009). What explains the low profitability of Chinese banks? *Journal of Banking & Finance*, *33*(11), 2080-2092.

Goddard, J., & Wilson, J. O. (2009). Competition in banking: A disequilibrium approach. *Journal of Banking & Finance*, *33*(12), 2282-2292.

Goddard, J., Molyneux, P., & Wilson, J. O. (2004). The profitability of European banks: a cross-sectional and dynamic panel analysis. *The Manchester School*, *72*(3), 363-381.

Guillén, J., Rengifo, E. W., & Ozsoz, E. (2014). Relative power and efficiency as a main determinant of banks' profitability in Latin America. *Borsa Istanbul Review*, *14*(2), 119-125.

Günalp, B., & Çelik, T. (2006). Competition in the Turkish banking industry. *Applied Economics*, *38*(11), 1335-1342.

Hauner, D. (2005). Explaining efficiency differences among large German and Austrian banks. *Applied Economics*, *37*(9), 969-980.

Hermes, N., Lensink, R., & Meesters, A. (2011). Outreach and efficiency of microfinance institutions. *World Development*, *39*(6), 938-948.

Hesse, H., & Poghosyan, T. (2009). Oil prices and bank profitability: evidence from major oil-exporting countries in the Middle East and North Africa.

Hittleman, D. R., & Simon, A. J. (1997). Interpreting educational research: *An introduction for consumers of research.* Prentice-Hall, Inc., One Lake St., Upper Saddle River, NJ 07458.

Jaloudi, M., & Bakir, A. (2019). Market structure, efficiency, and performance of Jordan insurance market. *International Journal of Business and Economic Research*, *8*(1), 6-13.

Jarraya, B. (2014). Parametric meta-technology frameworks to study technical efficiency and macro-economic effects in the European banking system. *Contemporary Economics*, *8*(1), 73-88.

Kasman, A., & Turgutlu, E. (2009). Cost efficiency and scale economies in the Turkish insurance industry. *Applied Economics*, *41*(24), 3151-3159.

Kennedy, P. (2008). *A guide to Econometrics*. John Wiley & Sons.

Kosmidou, K. (2008). The determinants of banks' profits in Greece during the period of EU financial integration. *Managerial Finance*.

Kugler, M., & Ofoghi, R. (2005, September). Does insurance promote economic growth? Evidence from the UK. In *Money Macro and Finance (MMF) Research Group Conference* (Vol. 8).

Lee, H. S., Cheng, F. F., Nassir, A. M., & Ab Razak, N. H. (2018). Does efficiency promote competitiveness of the insurance industry? *Journal of Business Economics and Management*, *19*(4), 566-591.

Leibenstein, H. (1966). Allocative efficiency vs." X-efficiency". *The American Economic Review*, *56*(3), 392-415.

Luhnen, M. (2009). Determinants of efficiency and productivity in German property-liability insurance: evidence for 1995–2006. *The Geneva Papers on Risk and Insurance-Issues and Practice*, *34*(3), 483-505.

MacGillivray, H. L., & Balanda, K. P. (1988). The relationships between skewness and kurtosis. *Australian Journal of Statistics*, *30*(3), 319-337.

Meeusen, W., & van Den Broeck, J. (1977). Efficiency estimation from Cobb-Douglas production functions with composed error. *International Economic Review*, 435-444.

Mensi, S., & Zouari, A. (2010). Efficient structure versus market power: Theories and empirical evidence. *International journal of Economics and Finance*, *2*(4), 151-166.

Moyo, B. (2018). An analysis of competition, efficiency and soundness in the South African banking sector. *South African Journal of Economic and Management Sciences*, *21*(1), 1-14.

Myers, P. C. (2009). Filamentary structure of star-forming complexes. *The Astrophysical Journal*, 700(2), 1609.

Niţoi, M., & Spulbar, C. (2015). An examination of banks' cost efficiency in Central and Eastern Europe. *Procedia Economics and Finance*, *22*, 544-551.

Olson, K. D., & Vu, L. (2007). *Economic efficiency and factors explaining differences between Minnesota Farm Households* (No. 381-2016-22244).

Panzar, J. C., & Rosse, J. N. (1987). Testing for" monopoly" equilibrium. *The Journal of Industrial Economics*, 443-456.

Pasiouras, F., & Kosmidou, K. (2007). Factors influencing the profitability of domestic and foreign commercial banks in the European Union. *Research in International Business and Finance*, *21*(2), 222-237.

Peltzman, S. (1977). The gains and losses from industrial concentration. *The Journal of Law and Economics*, *20*(2), 229-263.

Pruteanu-Podpiera, A., & Podpiera, J. (2008). The Czech transition banking sector instability: the role of operational cost management. *Economic Change and Restructuring*, *41*(3), 209-219.

Rai, A. (1996). Cost efficiency of international insurance firms. *Journal of Financial Services Research*, *10*(3), 213-233.

Sarpong-Kumankoma, E., Abor, J., Aboagye, A. Q. Q., & Amidu, M. (2018). Freedom, competition and bank profitability in Sub-Saharan Africa. *Journal of Financial Regulation and Compliance*, 443-456.

Sathye, M. (2003). Efficiency of banks in a developing economy: The case of India. *European Journal of Operational Research*, *148*(3), 662-671.

Sealey Jr, C. W., & Lindley, J. T. (1977). Inputs, outputs, and a theory of production and cost at depository financial institutions. *The Journal of Finance*, *32*(4), 1251-1266.

Sufian, F. (2009). Factors influencing bank profitability in a developing economy: Empirical evidence from Malaysia. *Global Business Review*, *10* (2), 225-241.

Sukamolson, S. (2005). *Pharmacognostic Specification of Cyclea Barbata Roots* (Doctoral dissertation, Chulalongkorn University).

Thomas, L., Buckland, S. T., Rexstad, E. A., Laake, J. L., Strindberg, S., Hedley, S. L., ... & Burnham, K. P. (2010). Distance software: design and analysis of distance sampling surveys for estimating population size. *Journal of Applied Ecology*, 47(1), 5-14.

Trujillo Ponce, A. (2013). What determines the profitability of banks? Evidence from Spain. *Accounting & Finance*, *53*(2), 561-586.

Utrero-Gonzalez, N. (2004, June). Banking competition in UK and Spain: Is there a Euro effect? In *FMA European Conference* (pp. 3-4). Zurich: University of Zurich.

Vesala, J. (1995). *Testing for competition in banking: Behavioral evidence from Finland*. Helsinki: Bank of Finland.

Wadud, A., & White, B. (2000). Farm household efficiency in Bangladesh: a comparison of stochastic frontier and DEA methods. *Applied Economics, 32*(13), 1665-1673.