

**UNIVERSITY OF GHANA**

**UNIVERSITY OF GHANA BUSINESS SCHOOL**

**THE EFFECTS OF CORPORATE GOVERNANCE ON PERFORMANCE  
OF INSURANCE FIRMS IN GHANA**



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## **DECLARATION**

I declare that this work is a result of my own research produced under supervision and no other person has presented this or any other university.

I have acknowledged all references used in the study.

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### **CERTIFICATION**

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

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## **DEDICATION**

This work is dedicated to my mother – Mrs. Faustina Aboagyewah, my wife – Mrs. Joyce Tutu and my kids, Adom and Akua for their encouragement through my studies.

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AE	Allocative Efficiency
AEC	Allocative Efficiency Change
AGM	Annual General Meeting
ANOVA	Analysis of Variance
BDexp	Board Expertise
BDg	Board Gender Diversity
BDp	Board Presence
BIND	Board Independence
BOD	Board of Directors
BSIZE	Board Size
CAP	Capitalisation
CCR	Charnes, Cooper and Rhodes
CE	Cost Efficiency
CEO	Chief Executive Officers
CG	Corporate Governance
CIS	Cooperative Insurance Society
CM	Cost Malmquist
CMI	Cost Malmquist Index
CMPI	Cost Malmquist Productivity Index
CRS	Constant Return to Scale
CTC	Cost-Technical Change
DEA	Data Envelopment Analysis
DMU	Decision Making Units
EIC	Enterprise Insurance Company

FEAR	The Frontier Efficiency Analysis
GCIC	Gold Coast Insurance Company
GDP	Gross Domestic Product
GSE	Ghana Stock Exchange
GSS	Ghana Statistical Services
III	Institute of International Insurance
INF	Inflation
IOD	Institute of Directors
LP	Linear Programming
MI	Malmquist Index
MPI	Malmquist Productivity Index
NIC	National Insurance Commission
OECD	Overall Efficiency Change
OECD	Organisation for Economic Co-operation And Development
OLS	Ordinary Least Square
PE	Price Effect
PEF	Private Enterprises Foundation
PNDC	Provisional National Defence Council
PPS	Production Possibility Set
RTS	Return to Scale
SBM	Slacks-Based Measure
SEC	Security and Exchange Commission
SIC	State Insurance Company
SIZE	Firm Size

SZAL	Simar-Zelenyuk Adapted Li Test
TE	Technical Efficiency
UK	United Kingdom
US	United States
VRS	Variable Return to Scale

## ABSTRACT

The main aim of the study is to determine the effects of Corporate Governance on efficiency and productivity performance of insurance firms in Ghana. The study employed a panel data of fourteen (14) life insurers and fifteen (15) non-life insurers to assess the efficiency and productivity of insurers in Ghana between the years from 2005 to 2014. Apart from the static efficiency measure, the study assessed the dynamic productivity of the insurance firms by using the Cost Malmquist Index to incorporate the time effect resulting in efficiency changes overtime. The study equally compared the efficiency and productivity of life insurers and non-life insurers and also examined the effect of corporate governance mechanisms on insurers' efficiency and productivity. The study found that there has been an average a 3% cost productivity growth in the Ghanaian insurance industry. Productivity growth peaked between 2008 and 2009 at 43% cost productivity growth. This productivity growth in the industry was driven mainly by managerial efficiency rather than technological growth. The study also found that life insurers were more productive than the non-life insurers, which can be attributed to some form of economies of scale they were enjoying. The study found corporate governance to affect both insurance efficiency and cost productivity of insurance firms in Ghana. Whereas larger board size is found to improve both cost efficiency and cost productivity, a large proportion of directors with finance expertise negatively impact on the cost efficiency and productivity of the industry. Also, a highly independent board reduces cost efficiency, but not cost productivity. The study recommends for managers and policy makers of non-life insurers to adopt policies that will position them to benefit from technological spillovers, whereas the life insurers leverage the managerial expertise to improve the firm to drive productivity growth.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of Study

The insurance industry, like other financial institutions, play pivotal roles in economic growth and contributes to development of many countries (Arena, 2006, 2008; Chen, P. F., Lee, & Lee, 2012; Ćurak, Lončar, & Poposki, 2009; Haiss & Sümegi, 2008; Han, Li, Moshirian, & Tian, 2010; Kaldor, 1957; Kugler & Ofoghi, 2005; Smith, Newhouse, & Freeland, 2009; Soo, 1996; Ward & Zurbruegg, 2000). For example, in 2014, the insurance industry (excluding cross-border business) accounted for 6.2% of the world's Gross Domestic Product (GDP). Premiums accounted for 18.9% of GDP in Taiwan, 14.2% in Hong Kong, 14% in South Africa, 11.3 % in South Korea, 11% in Netherlands, 7.3% in the United States (III, 2016). However, in the case of developing countries like Ghana, although assets to GDP of 1.91% is quite low, the insurance industry serves as a major contributor to the general services industry (GSS, 2015).

Given its primordial importance to economic development, researchers, managers and policy makers have developed heightened interests in assessing insurance efficiency and productivity in the last two decades (Cummins & Dionne, 2008; Cummins, Rubio-Misas, & Zi, 2004; Cummins, J. D. & Weiss, M., 2013; Cummins, Weiss, Xie, & Zi, 2010; Gardner & Grace, 1993; Kao & Hwang, 2008; Leverty & Grace, 2010; Yuengert, 1993). To ensure that insurance companies play their primary role of intermediary services, risk transfer and indemnification, savings mobilization and monitoring, robust corporate governance (CG) mechanisms are required to reduce their principal-agent problems (Arun & Turner, 2002). The Asian financial crisis in 1997, fall of large US Corporations in 2000 and the global economic meltdown in 2007 were all attributed to CG failure (Demyanyk & Hasan, 2010; Lim, Brooks, & Kim, 2008).

CG has been defined by John and Senbet (1998) as “mechanisms by which stakeholders of a corporation exercise control over corporate insiders and management such that their interests are protected”. The CG failure heightened the interest of researchers, in assessing the possible effect of CG on firm performance (Aboagye & Otieku, 2010; Bhagat & Bolton, 2008; Black, B. S., Love, & Rachinsky, 2006; Forbes & Milliken, 1999; Gilham, 2004; Joh, 2003; Karpoff, Malatesta, & Walkling, 1996; Kesner & Dalton, 1986; Kiel & Nicholson, 2003; McGee, 2010; Mensah, Aboagye, Addo, & Buatsi, 2003; Sueyoshi, Goto, & Omi, 2010; Wen, Rwegasira, & Bilderbeek, 2002; Zelenyuk & Zheka, 2006). Viewing firms as a nexus of implicit and explicit contract, Garvey and Swan (1994) asserts that CG determines how the firm’s top decision makers administer such contracts. Despite its importance, few studies consider the potential impact of CG mechanisms on both efficiency and productivity of insurance industry and to the best of the researcher’s knowledge, no study in Ghana measure the impact of CG on insurance efficiency. The present study first estimates the cost efficiency and dynamic cost productivity change of insurance firms in Ghana using the cost Malmquist index. Second, it compares the cost performance of life and non-life insurance firms using the Simar-Zelenyuk adapted Li test. Finally, it investigates the effect of CG on cost efficiency and productivity of insurance firms in Ghana.

## **1.2 Problem Statement**

Despite the existing efficiency studies in the insurance industry globally (Cheung, Connelly, Jiang, & Limpaphayom, 2011; Hsu & Petchsakulwong, 2010b; Huang, L. Y., Lai, G. C., McNamara, M., & Wang, J., 2011; Makokha, 2014; Najjar, 2012; O’Sullivan, 1997; Shujie, Genfu, & Zhongwei, 2005; Wang, J. L., Jeng, & Peng, 2007a), this study identifies some gaps in the literature. First, though board size and board expertise has been proven as an effective CG mechanism for addressing the agency problem of firms, empirical evidence on the

performance-enhancing role of board characteristics to the insurance sub-sector are mixed (Barnhart & Rosenstein, 1998; Florackis, Chris, Kanas, & Kostakis, 2015; Girardone, Nankervis, & Velentza, 2009; Himmelberg, Hubbard, & Palia, 1999; Zheka, 2005), and a study is yet to investigate their impact on cost productivity.

Second, some empirical researchers have examined how CG impact insurance efficiency globally (Cheung et al., 2011; Hsu & Petchsakulwong, 2010b; Huang, L. Y. et al., 2011; Makokha, 2014; Najjar, 2012; O'Sullivan, 1997; Shujie et al., 2005; Wang, J. L. et al., 2007a). However, these studies associating CG with insurance efficiency focused on a static measure of efficiency rather than on the dynamic productivity measure, thus failing to capture trends and patterns across the years. In line with the going concern concept of accounting, it is imperative that the potential impact of time is incorporated into efficiency measure to enable management and regulators determine the going concern status of firms over time.

Third, although some studies as indicated above have examined how CG impact insurance efficiency globally, there is no such study in Ghana. Ansah-Adu, K., Andoh, C., and Abor, J. (2012a) and Owusu-Ansah, Dontwi, Seidu, Abudulai, and Sebil (2010) investigated the cost efficiency and technical efficiency respectively of insurers in Ghana, however, none considered the impact of corporate governance on the performance of insurers. Moreover, Ansah-Adu et al. (2012a) found the average cost efficiency of 30 sampled insurers between 2006 and 2008 to be 0.30 indicating more potential for growth within the industry, as no insurer was observed to be fully efficient during the study period. Furthermore, they found inconsistency in the average efficiency of insurers in Ghana. Another relevant study is Alhassan, Addisson, and Asamoah (2015), who also examined the impact of insurance profitability, market structure and efficiency of insurance companies in Ghana. Although their study provides more current views of the efficiency in the industry, it failed to consider cost dimension in estimating efficiency as well as ignoring changes over time. There is, therefore, more relevance for this

study since it assesses the cost efficiency of Ghanaian insurers over time using more recent data.

Lastly, studies that assessed the efficiency or productivity of DMUs in various industries employed the nonparametric tests such as Wilcoxon signed-rank test, Mann Whitney U-test, Kruskal-Wallis test, and Friedman test in determining potential differences among sub groups. These tests, however, focused on central point estimates of the data, require separation of dependent and independent samples and consider the efficiency estimates as observed which actually is not the case (Epure, Kerstens, & Prior, 2011; Kumar & Russell, 2002). Simar and Zelenyuk (2006) adapted the Li (1996) test which considers the entire distribution of efficiency scores rather than its average value and can be applied to both independent and dependent samples. Empirical application of the Simar-Zelenyuk adapted Li test (SZAL) remains few (Chowdhury, Zelenyuk, Laporte, & Wodchis, 2014; Epure et al., 2011; Hadad, Hall, Kenjegalieva, Santoso, & Simper, 2012; Kenjegalieva, Simper, Weyman-Jones, & Zelenyuk, 2009; Kerstens & Van de Woestyne, 2014; Kumar & Russell, 2002; Murillo-Melchor, Pastor, & Tortosa-Ausina, 2009; Simar & Zelenyuk, 2006, 2007).

### **1.3 Research Objectives**

The main objective of the study is to examine how corporate governance affects efficiency and productivity of insurance firms in Ghana. Specifically, the study seeks

- i. To assess the efficiency and cost productivity of insurance firms in Ghana.
- ii. To determine the drivers of cost productivity change of insurance firms in Ghana.
- iii. To compare the cost productivity change of life and non-life insurance firms in Ghana.
- iv. To determine the impact CG has on cost efficiency and cost productivity change of Insurance firms in Ghana.

#### **1.4 Research Questions**

To study seeks answers to the following questions:

- i. What is the cost efficiency and dynamic cost productivity change of insurers in Ghana?
- ii. What is/are the driver(s) of cost productivity change in Ghana's Insurance Industry?
- iii. Is there a significant difference in the cost efficiency and cost productivity change of Life and Non-Life Insurance firms in Ghana?
- iv. What effect does CG have on cost efficiency and cost productivity change of insurance firms in Ghana?

#### **1.5 Research Contributions**

The study purports to investigate how CG affects cost efficiency and cost productivity change of 29 insurers in Ghana from 2005 to 2014 and to explore the driving force of cost productivity change for these insurance firms. The outcomes of the research have direct implications for policy, practice and academic works. In terms of policy, by empirically assessing the cost efficiency and productivity change of the Ghanaian insurance industry, the insurance regulator, National Insurance Commission (NIC) is better informed about the drivers of cost and technical productivity changes in the insurance industry. Moreover, it informs the NIC regarding the potential impact of the trends and patterns on their policies. Also for the accounting practice, the going concern concept of insurance firms is comprehensively identified for appropriate measures to be taken at both the firm level and industrial level. The study uses the Malmquist index in estimating the cost productivity on insurers, which incorporate trends and patterns. This will give accounting practitioners a reasonable ground for determining the going concern status of firms in the industry. The analysis may provide insights for policy prescriptions and enhancement in the industry. For managerial practice, management of insurance firms should be able to ascertain which CG mechanisms to invest in to trigger performance and to improve

managerial decisions that enhance these mechanisms. The outcome will also provide management with important information concerning the economic status of the firm's activities as well, as how CG may affect cost efficiency.

The research contributions to academic literature are threefold. First, this is the first study to link CG with Insurance efficiency using the Cost Malmquist Index in the African context. Second, it is the first to examine the impact of CG on insurer's cost efficiency and cost productivity change in Ghana. Finally, the study is among the few to test the scale elasticity property using Simar and Wilson (2002) approach and is the first to apply the approach in the Ghanaian insurance industry.

### **1.6 Limitations of the Study**

All be it, this study contributes to academic research, practice and policy, it has some drawbacks regarding data and time. It would have been appropriate to augment the sample period than the 10-year period. However, the study is limited due to data unavailability.

### **1.7 The structure of the thesis**

The study is organised into six chapters. The first chapter of the study introduces the study and includes the background of the study, the research problem, the gaps in existing studies, the objective of the study and the research questions. In addition, the chapter includes the contribution of the study and organization of the study. Chapter two of the study presents a comprehensive review of related theories that form the basis of the study. In addition, this chapter also discusses empirical literature covering productivity assessment of the insurance industry, productivity studies in Ghana, board size in insurance efficiency, board diversity and expertise and corporate government in the Ghanaian context. This chapter concludes with the concept of the study formulated into a model to guide the research work. The third chapter on

the contextual framework of the study provides information on the context of the study and an overview of the insurance industry. The fourth chapter explains the research plan and method and give detail description of the models used to achieve the research objectives. This chapter further explains the variables used in both the first and the second stage analysis. The fifth chapter presents the result of the data analysis for the first and second stages of the study, the findings and discussion. Finally, chapter six summarizes the findings and concludes the study whilst giving recommendations for improving insurance productivity and for further research.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter reviews the theoretical and empirical literature in relation to corporate governance, cost efficiency, dynamic productivity change and other literature that throws more light on the environmental factors that may affect cost efficiency and productivity change in the insurance industry.

#### **2.1 Theoretical Review**

This section reviews the fundamental theories that underpin the study. Two corporate governance theories will be reviewed, the theory of agency and Resource dependence theory.

##### **2.1.1 Agency Theory**

This theory emanated from theory of economics proposed by Alchian and Demsetz (1972) in their study on production, information cost and economic organisation. Jensen and Meckling (1976) later extended the theory by consolidating components from a theory of property right and theory of finance to show the relationship between separation of firm ownership and control. Jensen and Meckling (1976) identified managerial behaviour, cost of agency contract and ownership structure as the main pillars of the agency theory. The theory explains why returns to the principals (shareholders) fall below what they would have been if the shareholders themselves were to manage their organisation's activities (Jensen & Meckling, 1976). Agency theory argues that in contemporary organisations where shares of the organisation are held by diversified portfolio, managers take action the suit their personal interest rather than to maximise shareholders interest (Abdullah & Valentine, 2009). It is expected that agents (managers) channel their activities toward to enhance the interest of their

principals in agency contract. However, managers seek to gratify themselves first before making room for shareholders' interest of wealth maximisation. Shareholders appoint competent managers to manage their funds in order to generate for them the profit they desire (Davis, Schoorman, & Donaldson, 1997). The effect of this is the incurrence of agency costs. Agency cost is incurred when managers use shareholders' resources to satisfy their self-interests (Peterson, 2006). The primary focus of the agency theory is to mitigate agency cost by instituting internal controls to curtail agents from advancing their self-seeking behaviour. (Jensen & Meckling, 1976).

According to Donaldson and Davis (1991), managers will fail to act in a manner that maximises the wealth of owners of firms, unless suitable CG mechanisms are instituted to secure the wealth of the owners. Accordingly, the theory of agency postulates that the main aim of CG is to reduce the opportunity available for managers to act in conflict with the shareholders' interests, to the barest minimum. Therefore, various mechanisms of CG are included into the agency contracts to align owner – manager interests.

The board of directors (BOD) are viewed as the most important mechanism of control in the internal governance structure of any firm (Fama & Jensen, 1983). In addressing the effectiveness of governance structures, the agency theory advocates for separation of management from the control of decision making process in order to reduce agency conflict. The BODs perform a basic function of mediating owners and manager's activities to ensure they are aligned. However, for the BODs to act as an effective mechanism of monitoring, the characteristics of the board plays a pivotal role. These characteristics of the board which include board size (Canyon & Peck, 1998; Eisenberg, Sundgren, & Wells, 1998; Huther, 1997), board composition or independence (Agoraki, M. E., Delis, & Staikouras, 2009; Kang, Cheng,

& Gray, 2007; Tanna, Pasiouras, & Nnadi, 2011), roles separation for board chair and managers (Elsayed, 2007; Krause, Semadeni, & Cannella, 2014; Lam & Lee, 2008), board diversity (Adams, Renée B. & Ferreira, 2009; Carter, D'Souza, Simkins, & Simpson, 2010; Kang et al., 2007) and the structures of key committees of the board (Black, B. & Kim, 2012; Callen, Klein, & Tinkelman, 2003; Klein, 1998) are central to the effective functioning of mechanisms of CG. Previous studies conclude that the performance of firms results from their fundamental link to the mechanisms of corporate governance; thus making the use of the agency theory relevant to the topic of study. For instance, Tanna et al. (2011), applied the agency theory in determining the potential impact of mechanisms of CG on the efficiency of insurance firms.

### **2.1.2 Resource dependence theory**

The resource dependence theory explains the functions of the BOD with respect to the dependence of an organization on resources of the directors. According to Pfeffer and Salancik (1978), the board of directors has the potential to help the acquisition and sustenance of essential resources that an organization needs to survive with. It is explained that, the networks of board members in both personal and professional circles are advantageous to the survival of an organisation because the board members offer to an organization access to information and help minimize the uncertainty in the organization. The resource dependency theory emphasizes the diverging-interest mediating responsibilities of board of directors. Boards of insurance firms, for example, provide an adequate response to requirements stemming from the regulatory environment, the resource environment or funding environment. The theory indicates that board of directors of insurance is needed to help the firms in learning of, responding to and adapting to constraints available in the operating environment (Pugliese, Minichilli, & Zattoni, 2014).

The resource dependence theory seeks to improve the coordination among different organizations, enable an organization's access to funds particularly among insurance firms and other financial institutions and improve the reputation of firms through networking. The theory posits that the goal for board structures is to make use of the knowledge base of members of the board for improving the process of governance, enhance the flow of needed resources into the organization, and becomes a tool that drives increased performance. The focus of the resource dependence theory has been on examining how the size and diversity of the BODs indicate their capability to make critical resources available to the organization. Therefore, the resource dependence theory helps in explaining how board size and diversity helps to link a firm to critical resources in its operational environment and to produce important information to management with the evaluation of the organization by influential others.

In many respects, when a board is made up of members of influences from the external environment of an organization, the board undertakes a boundary-spanning function that "minimizes uncertainty of business operations, decreases operational dependencies, leads to information exchanges, represents the organization to external stakeholders, and enhances overall performance" (Provan, 1980). The theory provides insights to explaining board behaviour with respect to the external environment of firms by emphasizing the ability of the board of directors towards uniting a firm with critical resources its environment.

## **2.2 Empirical review**

### **2.2.1 Productivity and Insurance Industry**

Several studies have applied productivity indices in the insurance industry worldwide. Recent literature has shown flourish us of DEA in assessing an insurer's productivity (Cummins, J. D. & Weiss, M., 2013; Cummins & Weiss, 2002; Cummins & Zi, 1998; Xie, 2010). The

Malmquist Productivity Index (MPI) has become a well-liked approach for assessing productivity change.

For instance, Barros, Nektarios, and Assaf (2010) using DEA to study the efficiency of insurers in Greek, decomposed the Malmquist index (MI) into Technical Efficiency Change and technological change and found that, the life insurance sector experienced higher average productivity growth than the non-life sector. Interestingly they also observed that insurers who undertake both life and non-life activities had the lowest levels of productivity growth. Most of these studies estimating insurance efficiency with the MI focus on Europe. For instance, Fenn, Vencappa, Diacon, Klumpes, and O'Brien (2008) examined the productivity of the European insurance industry and concluded that, the productivity of the sector is driven by technical efficiency. Similarly, Nektarios and Barros (2009) analysed the efficiency of insurers in Greek and discovered that, the life insurance sector is most productive with average annual growth of 16% and non-life sectors showed a productivity growth of 6.5%. The results of these studies can be biased since they failed to consider prices of inputs or allocative efficiency, which is crucial in determining total factor productivity change. In such view, the conclusion of productivity does not reflect the full picture of the European insurance industry. There is ample avenue for research on non-European countries especially on developing ones like Ghana.

Another important consideration in the insurance industry literature is the differences in the efficiency and productivity of life and non-life insurers. This is a topical issue of concern in the insurance literature. There are quite a number of studies on cost efficiency in life and non-life insurance industry mostly in Europe, America and Asia and only one study have been done on the Ghanaian insurance industry (Ansah-Adu et al., 2012b).

### **2.2.1 Drivers of insurance cost productivity**

Empirical studies of drivers of productivity change in insurance sectors have also received some attention in recent literature. For instance, Grifell-Tatjé and Lovell (1997) using the Spain insurance industry for a period between 1986 to 1992 examine the sector's productivity and concluded that, the main source of productivity growth was attributable to technological change. In addition, Casu, Barbara, Girardone, and Molyneux (2004) examine productivity in a cross section of five year period; 1994 to 2000 and found that productivity improvement is driven by technological change. Similarly, Chang, Hu, Chou, and Sun (2012) found that the productivity growth of China's financial sector from 2002 to 2009 was driven by technological change. On the contrary, Wheelock and Wilson (1999) found that the productivity change of the US insurance sector from 1984 to 1993 was attributed to efficiency change. Despite the evidence provided by these studies, their measure of productivity did not consider the cost of inputs in estimating productivity. The present study adds to the literature by including input cost to derive the source of productivity of insurance firms in Ghana.

### **2.2.2 Efficiency in the Insurance Industry in Ghana**

Globally, a decent number of research has employed frontier efficiency techniques to examine the efficiency and productivity change in the insurance industry. However, same cannot be observed for the Ghanaian context. From the literature review, there have been only three studies that used frontier efficiency assessment techniques in examining the efficiency of the Ghanaian insurance industry. These are studies by Alhassan et al. (2015); Ansah-Adu et al. (2012b); Owusu-Ansah et al. (2010).

Owusu-Ansah et al. (2010) examined the technical efficiency of Ghana insurance industry from 2002 to 2007. Using a sample of ten (10) insurance companies which collectively contributed to over 90% of the market share by gross premiums for the period of study,

observed that Ghanaian insurance industry collectively (both life and non-life) operate at an average overall efficiency of 68%, pure technical efficiency of 87% and scale efficiency of 78%. The study further tested and observed that Ghanaian general insurers with larger sizes and market shares tend to have higher efficiencies; implying that general insurers could increase their efficiencies by trying to increase among other things their size and market shares. Owusu-Ansah et al. (2010) failed to look at cost dimension of efficiency and also ignored change over time.

Ansah-Adu et al. (2012b), in their evaluation of the insurance industry in Ghana, applied a DEA approach for 30 insurance firms over a three (3) year period between 2006 to 2008. The authors estimated the cost efficiency of thirty (30) insurance firms in Ghana. They also examine the determinants of cost efficiency in the industry. Their study concluded that, the efficiency score for the life insurers is higher than that of the non-life sectors. In the second stage, they observed that market share, firm size and return on asset are the determinants of insurance efficiency in Ghana. However, this study failed to consider the cost efficiency over time since the study used static DEA models. Additionally, the study period examined (2006 – 2008) brings up issues with contemporary relevance of the research findings since there have been quite a number of regulatory changes in the insurance industry since then.

Finally, Alhassan and Biekpe (2015) also examined the impact of insurance profitability, market structure and efficiency of insurance companies in Ghana. They analysed data from 36 insurers for a five (5) period from 2007 to 2011, and applying the DEA technique, they concluded that life insurers have higher levels of efficiency compared to the non-life insurers. Although this study provides more current views of the efficiency in the industry, it failed to consider cost dimension in estimating efficiency as well as ignoring changes over time. There

is, therefore, more relevance for this study since it assesses the cost efficiency of Ghanaian insurers over time using more recent data.

### **2.2.3 Board size, efficiency and cost productivity**

The BOD of any corporation serves as the highest governance and decision-making body. According to Jensen (1993), the BOD has the highest form of power regarding governance system of a company and exercise the utmost duty required for an efficient and effective functioning of the company. Pugliese et al. (2014) indicated that BODs perform key structural roles such as monitoring owner-manager performance, organisational growth and providing access to diverse resources. The duties of the BOD are classified into five main groupings to include oversight, fiduciary, legal, strategic direction, and self-appraisal and renewal (Afanador, Bernal, & Oneto, 2017). The BOD is charged with the responsibility of overseeing the overall corporate strategies. They review and make constructive inputs into organisations decisions and also monitor firm's performance. Most capital intensive decisions are approved by the BOD. This decision includes top manager's remuneration, auditor fees and other capital expenditures. In playing the conflict-mitigation roles, the BODs bridges the gap between the conflicting interest of managers and shareholders. They monitor manager's decision to ensure that, their self-desire interest aimed at undermining shareholders' wealth is curbed while ensuring that managers interest is also upheld. The BOD also exists to ensure that potential conflicts of interests among managers, members of the BOD and shareholders are monitored and managed by the use of key remuneration schemes. Also, the BOD is responsible for ensuring the attainment of high integrity of the organization's reporting systems, and its disclosure and communications processes (OECD, 2004).

Considering the responsibilities placed on BOD, it becomes imperative that it's properly constituted. The Board's constitution determines the effectiveness of organisations governance structure and also ensures that the required skill is available to the organisation.

Hence, board size is indicated to play significant role in CG quality and represents an important determinant of corporate performance. This has instigated several researchers to define an appropriate size of the board of directors required for effective functioning of an organization. For instance, Florackis, C and Ozkan (2004) and Fama and Jensen (1983) suggest that larger board size impedes coordination, communication and decision-making, hence may be ineffective. It is also suggested that large size of the board is determined by CEOs for their dominating purposes. This is because large board size disperses decision-making power during board meetings, which impede coordination by other directors. It can, therefore, be concluded that to these researchers, large board affect firm performance negatively. They assert that smaller size of the board encourages board participation, monitoring and strategic decision making to enhance performance. (Huther, 1997). However, the resource dependency theory explains that larger board size enables a firm to derive the necessary resources for effective operations, and therefore, the larger the size of the board, the better the performance of a firm (Kiel & Nicholson, 2003).

This indicates that the results from the empirical studies of the board size relationship to corporate performance (Black, B. & Kim, 2012; Dahya, Dimitrov, & McConnell, 2008; Eisenberg et al., 1998; Huther, 1997; Mak & Kusnadi, 2005; Yermack, 1996) are still inconclusive. For example, studies suggest that there exists an ideal size of the BOD, beyond which performance decreases (Andres & Vallelado, 2008). Also, Coles, Daniel, and Naveen (2008) concluded that determining the relationship between board size and firm performance

is a complex one. Firm performance is positively affected when board is constituted of the required number and negative when board size is too small or large size.

The studies that found a positive relationship between board size and firm performance rely on the resource dependency theory to explain that larger board size enables a firm to derive the necessary resources for effective operations. Other studies found a negative impact of board size on firm performance (Canyon & Peck, 1998; Guest, 2009; Mashayekhi & Bazaz, 2008; Yermack, 1996). These researchers argue that a large size of the BOD become more difficult to coordinate and less interconnected, and becomes subject to easier control of the CEO leading to worsened performance (Yermack, 1996). The call for smaller board sizes is also explained by the fact that reducing the size of the board helps to reduce monitoring, communication and coordination problems, with their associated costs (Hermalin & Weisbach, 1991). Equally, there are studies that could not establish any relationship between board size and corporate performance (Belkhir, 2009).

With efficiency as a specific performance measure, Bokpin, Godfred A (2013), Huang, L.-Y., Lai, G. C., McNamara, M., and Wang, J. (2011), Hsu and Petchsakulwong (2010b) and Yeh, Wang, and Chai (2010) indicate that board size positively impacts firms technical and cost efficiency. Whereas Tian and Twite (2011) found a positive link between board size and total factor productivity of firms, Chiang and Lin (2007) indicated a negative relationship in the manufacturing sector. Despite the usefulness of these findings, none have considered the effect of board size on cost productivity.

#### **2.2.4 Board independence efficiency and cost productivity**

The BODs in any corporate organization is composed of executive directors and non-executive directors. The executive directors refer to professional management personnel of a company who also double as directors of the company. On the other hand, non-executive directors refer

to individuals who have no management affiliation or working contract with a company except for their role as directors (Clifford & Evans, 1997). In corporate settings, the functional and transactional powers of the board are delegated to management to ensure implementation of strategies and performance of responsibilities. Because of this delegation of powers to transact, management is made to account for their stewardship and performance to the board. Moreover, because of the distinction of the directors that compose the board, the agency theory identifies executive directors' interests to diverge greatly from those of the non-executive directors. Executive directors have the interest of being paid as employees of the company apart from being directors of the company. The non-executive directors are recognised as efficient element of enhancing efficiency and quality of the board. Their responsibilities are geared toward monitoring the executive directors and so their composition is relevant for firm performance. Subsequently, board independence or composition is measured as the proportion of the number of non-executive directors on the board to the total number of directors on the board.

Board independence is recognised in recent literature to play a vital role in monitoring managers action and help reduce corporate agency cost (Choe & Lee, 2003). The internally interested management possesses the requisites skill required for the day-to-day administration of the organisation because of their appreciable levels of expertise, specialized skills and valuable knowledge of the company's functional activities. However, it is imperative that their activities are balanced with the functions of the non-executive director. The non-executive directors contribute objective ideas and experience from other field of interest to the overall corporate decision making (Weir, Laing, & McKnight, 2002). Therefore, the corporate governance codes and the agency theory advocate for boards to be composed more of non-executive directors who can monitor and control self-interested behaviour of managers (Kiel & Nicholson, 2003).

### **2.2.5 Board diversity efficiency and cost productivity**

Existing literature indicates that the diversity of group membership in any field of endeavour increases the exchange of ideas and discussion, and group performance (Van Knippenberg, De Dreu, & Homan, 2004). For example, Andringa and Engstrom (1997) indicate that a diversified and inclusive board are important to building quality boards in recent times, as affirmed by Walt and Ingley (2003) who contends that diversity is mostly considered because of its direct value-based contribution to an organization, merit-based and organizational-enhancing values, rather than based on meeting affirmative action quotas or stakeholder representation. From the perspective of the agency theory, a more diversified board creates a balance of board membership to ensure effective coordination in decision-making process. With the resource dependence theory, the presence of diversities of the board is in the interest of any organization because more diversified boards provide the required expertise and generate strategic input to the organization (Bilimoria & Wheeler, 2000; Fondas & Salsalos, 2000).

Most prior literature concentrates on the gender perspective of diversity, which has resulted in highlighting the importance of having more women on the board (Reddy, Locke, & Fauzi, 2013). Gender is seen to be much-contested diversity terrain not only with regard to BODs but also in areas of politics and in other social disciplines (Kang et al., 2007). There have therefore been numerous advocacy and emphasis on the need for a more gender-diversified membership of the board. For example, Bear, Rahman, and Post (2010) argue that “the gender composition of the board can affect the quality of the monitoring role that is played by the board”. They suggest that women have critical symbolic values, both within and outside the company, indicating their high performance. It is worth knowing that the directorship of women is equally based on similar level of competence as required of male directors because women want to be

known as directors (for their competence on board issues) first rather than as having a feminist agenda.

Studies suggest that earnings of companies were significantly higher for organizations with senior female executives (Kang et al., 2007). Therefore, involving women on boards and in top management lead to greater earnings and shareholder wealth (Lincoln & Adedoyin, 2012). By the propositions of the resource dependency theory, corporate organizations can achieve greater transparency by including more women on the board, and this may subsequently translate into the firm's competitive advantage (Bernardi, Bean, & Weippert, 2002). It has been suggested that female directors contribute to an organization's competitive advantage firstly because they do not partake in the "old boys network" makes them more independent and secondly because they tend to have a better understanding the behaviour of consumer, their needs, and opportunities for organizations in meeting those consumer needs.

Previous studies justified a more gender-diversified board by finding board diversity directly influence firm performance. (Kang et al., 2007; Lincoln & Adedoyin, 2012; Wachudi & Mboya, 2012). However, Adams, Renée B and Ferreira (2004) observed a complete relationship between gender diversity and firm performance, they concluded that strictly enforce gender diversity can hinder productivity. They indicate that the enforcement of gender quota in the boardroom could rather reduce performance for firms with strong governance system. The findings in literature on the impact of board gender diversity are inconclusive, and this study further explores its link with cost productivity of insurance firms.

### **2.3 Corporate governance in Ghana**

Unlike the developed economies like the US and the UK where corporate governance is comprehensive and embracing of facets of discipline, same cannot be said of Ghana. Ghana does not have a single comprehensive corporate governance framework. Rather, as with the

laws that govern financial reporting in Ghana, the rules that govern the relationship among a business's stakeholders can be found in bits and pieces in different regulatory instruments. There is no single set of principles for corporate governance set out in Ghana's Company's Act, Act 179.

Companies Code contains some corporate governance provision that all companies are required to comply with. For instance, the company Act makes provisions on the number, appointment, duties, remuneration and removal of directors; shareholder meetings; rights of shareholders; and the appointment, duties, powers, remuneration and removal of auditors. Other corporate governance rules such as the mix of executive and non-executive directors and the existence of board committees are not covered by the Act. Provisions on these other corporate governance best practices can, however, be found in other laws. For example, the Securities and Stock Exchange Rules in addition to the Companies Code, require listed companies to comply with corporate governance principles set out in the Securities Industry Law (1993), the Securities Industries (Amendment) Act 2000, the SEC Regulations (2003) and the GSE Listing Regulations. A principal element of this provision is the existence and composition of an audit committee for every listed firms. Within this framework, a listed firm is required to have an audit committee whose chairman should be a non-executive director. Equally, financial expertise criteria for members of the audit committee are outlined in the regulation.

The National Insurance Commission (NIC) equally outlines some corporate governance mechanisms for insurance firms in Ghana. There are provisions on criteria of competence for appointment to directorship, the tenure of directors, provision of opportunities for inducting and training directors, institution of effective internal control, internal audit and compliance system.

Besides, voluntary corporate governance codes exist in Ghana, which include the Ghana Manual on Corporate Governance issued by the Private Enterprises Foundation (PEF) and the Institute of Directors (IOD); and the SEC Guidelines on Best Corporate Governance Practices. The SEC guidelines are principally based on OECD principles. These voluntary codes, however, have little recognition in Ghana and are mostly not adhered to. The lack of adherence to these voluntary corporate governance codes is hardly surprising given that even statutory laws in Ghana generally suffer from weaknesses in compliance (World Bank, 2005).

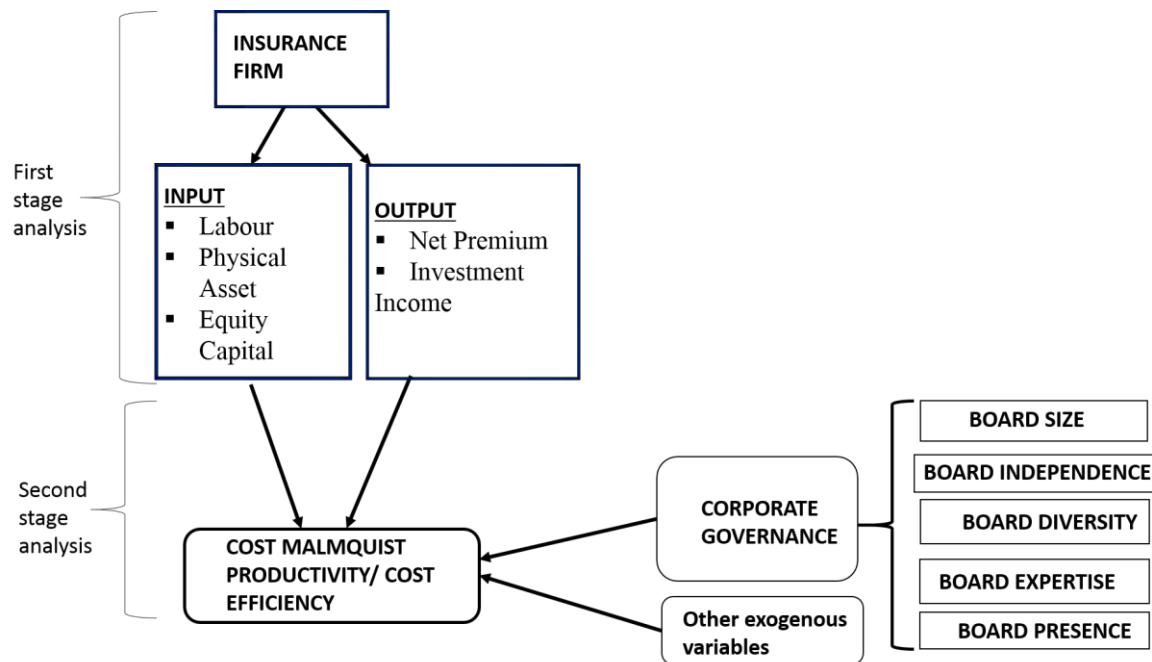
As noted by the World Bank (2005), several key aspects of good corporate governance practices are observable in Ghana – protection of basic shareholder rights, basic AGM rules, equitable treatment of shareholders in the law, and timely disclosures in the annual reports. There is, however, a lack of a coherent and comprehensive regulatory framework for corporate governance practices. This has resulted in the following significant weaknesses in corporate governance practices in Ghana – no rules on board independence, poor enforcement, lack of certain key disclosures, inconsistencies in the provisions relating to mergers in the Companies Code and the SEC regulations, single tier boards and limited audit committee effectiveness and expertise (World Bank, 2005). Consequently, as with the regulatory framework for financial reporting, there is a need for comprehensive corporate governance rules in Ghana for to address the weak level of corporate governance. The ability of the regulators to enforce compliance must also be enhanced to ensure a more effective adherence to the existing provisions of corporate governance.

#### **2.4. Conceptual Framework**

The study assesses the cost efficiency and productivity of insurers in Ghana. First the productivity of insurers is estimated using the Malmquist index (MPI) and the Simar-Zelenyuk

adapted Li test is used to test the productivity difference between life and non-life insurers. This study is quite different from previous studies since it considers cost productivity of insurers over a ten-year period of time to know the trends and patterns of the insurance industry in Ghana. A conceptual framework of the work is presented in Figure 2.1.

**Figure 2. 1: Conceptual Framework**



**Source: Author's Construct (2017)**

First, the study estimates the cost Malmquist productivity change which proxies as the dynamic cost productivity. Second, the SZAL test is used to assess the productivity differences in the distribution of scores between the Non-Life and Life insurers. Third, after obtaining the cost productivity scores in the first stage, the study then adopt the innovative bootstrapped truncated regression by Simar and Wilson (2007) to assess the impact of corporate governance proxies (board size, board independence, board diversity, board expertise, board presence) on the cost productivity estimates to assess the impact.

## **CHAPTER THREE**

### **OVERVIEW OF THE INSURANCE INDUSTRY**

#### **3.0 Introduction**

This chapter discusses the scope of the insurance industry in the global economy. The discussion is then narrowed to developing economies precisely to the Ghanaian context. The study also provides the setting of the Ghanaian insurance industry considering the major participants in the industry as well as discussion on how the sector is regulated in Ghana.

#### **3.1 The scope of Insurance**

Insurance companies like other financial institutions play a vital role in the economic growth and stability of both developed and developing economies, through financial intermediation. The role of the industry in the economy not only complements the role of the banking industry but also other sectors of the economy (Tornyeva & Wereko, 2012). The main object of insurance in any economy is risk management and protection. The industry provides an exclusive product in the form of insurance protection which cannot be provided by any other sector (Ansah-Adu, K., Andoh, C., & Abor, J. , 2012a; Outreville, 1990). However, some of these insurers engage in investment activities. As such, the role of insurance companies is not limited to risk management (risk allocation, absorption, and transfer) but also mobilization of funds from surplus units for use by the financial markets to stimulate economic growth.

Despite the benefits accrued to the economy from insurance, the level of penetration among developing countries particularly in Africa is low compared to that of developed economies (Alhassan & Biekpe, 2016; Alhassan & Fiador, 2014). Hence, the emerging markets are unable to benefit fully from capital accumulation. This finding underlines the increasing significance

of growing the insurance industry globally and more importantly in developing countries like Ghana.

In developing countries particularly Sub-Saharan Africa, the demand for insurance is affected by certain critical factors. These factors include extended family support which prevents the desire for financial cushioning, low information about the scheme or insurance products, and also lack of knowledge about insurance concept (Ackah & Owusu, 2012). Amoako-Adu and Menyah (1987) argues that aside from the above-stated factors that affect demand for insurance; some economic factors may be a result. These include high rate of inflation, substantial devaluations and generally a poor economic performance of some developing economies specifically in Africa.

### **3.2 The Ghanaian insurance industry**

Insurance business in Ghana is dated back to 1924 when the Royal Guardian Enterprise Insurance (now Enterprise Insurance Company Limited) was established to pioneer the industry. Subsequently, a merger between Gold Coast Insurance Company (GCIC) and Cooperative Insurance Society (CIS) established in 1955 and 1958 respectively led to the birth of the State Insurance Company (SIC) in 1962. Another insurance firm that existed during the times was General Insurance Company, which was established in 1957. Prior to the formation of GCIC, CIS and General Insurance Company which were local insurers, the industry was biased to foreigners who were mainly Europeans. As part of a divestiture programme by the Government of Ghana, in 1995, SIC was changed to a public limited liability company. SIC then become known as State Insurance Company of Ghana limited with the sole shareholder being the Government of Ghana. Subsequently, in 2007 the name was changed again to State Insurance company limited (SIC insurance,2008).

Deregulation of the Ghanaian insurance sector removed government's monopoly and saw the entrance of foreign companies. However, the foreign participants were allowed ownership of up to 60% in both life and non-life insurance.

The industry which was first regulated under the Insurance Law 1989 (PNDC Law 227) and currently under the Insurance Act, 2006 (Act 724) is regulated by the National Insurance Commission (NIC). The industry is mainly grouped into Life and Non-Life insurance business, based on the policies sold by these companies. 23 Life insurers and 26 Non-Life insurers operated as at 2015.

### **3.3 Key participants in the Ghanaian insurance industry**

The major participants in the industry include the regulator (NIC), insurers and the insured. The National Insurance Commission (NIC) is responsible for standards setting, licensing, and also approving premiums and commission rates. Companies that sell insurance policies are termed as insurers. The insured can be a company or individual who purchases the insurance policy (policies) sold by insurers. The responsibility of an insurer is mainly to develop policies to cover either the life or property or both life and properties of the insured. The insured is charged a periodic premium which as a consideration validates the contract entered with insurer. Upon occurrence of the event insured against, the insured can make claim on the contract.

As indicated, the main policies are life and non-life based on which a company is either a Life insurance company or Non-Life Insurance company. Some classes of businesses operated under the life policy are whole life, endowment, funeral, universal life, and group life. For the non-life policies, they include motor, engineering, accident, fire, marine, theft, and medical and general liability.

Over the last decade, the Ghanaian insurance industry has seen a rise in the number of insurers which will definitely reduce industry concentration whilst increasing competition. However, an increased competition has the potential to stimulate new entrants or even existing firms tap untapped markets which will be beneficial to the industry and economy at large. Below in Table 1 is a presentation of the number of insurers in the Ghanaian insurance industry.

**Table 3. 1: Number of Insurers in Ghana from 2005 to 2014**

Year	Number of Insurers	Life	Non-Life	Composite
2005	20	-	-	20
2006	29	-	-	29
2007	34	16	18	0
2008	38	17	21	0
2009	40	17	23	0
2010	40	17	23	0
2011	42	18	24	0
2012	43	18	25	0
2013	45	19	26	0
2014	47	21	26	0

**Source: 2005-2014 annual reports of NIC**

### **3.4 Regulation of the Ghanaian insurance industry**

Similar to other countries, the insurance industry in Ghana is regulated by a commission known as the National Insurance Commission (NIC). Its prime responsibility is licensing, standards setting for the industry and approving insurance premiums and commission rates. In addition, it also liaises with other key regulators like the Bank of Ghana in the financial system. The sector has under gone a number of significant reforms. The sector which was formerly

regulated under the PNDC Law 227 is now regulated under the Insurance Act 2006. The specific alterations in the act include separation of insurance business, change in capital requirement and removal of SIC monopoly (deregulation of the sector). Separation of insurance business and change in capital requirement is discussed in detail.

First, prior to the separation of insurance business, under the PNDC Law 227 section 17, insurers were allowed to transact life, non-life or composite insurance without any restrictions. This is clearly outlined in Table 3.1, where composite insurance was operated as at 2006. During the composite insurance era, management of insurance companies could use funds from one class of business to settle liabilities in another business area. Hence, it was stated in Act 724 section 26 (1) that the NIC shall not issue a license after the commencement of this Act that authorises the insurer to operate a composite insurance business. From Table 3.1, it is seen that after 2006, insurers were either Life or Non-Life but not both since the composite column is represented by Zero from 2007 till present. A company licensed to operate in one specialty shall duly operate such a business. Consequently, existing composite insurance companies were to separate their business into long-term and short-term companies. The Act was operationalized by the companies in 2008 after the law was passed in 2006. This separation of insurance businesses may reduce the net premiums generated by insurers leading to a reduction in their investment income and a possible drop in their efficiency levels.

Second, the minimum paid-up capital requirement for an insurance company (both life and non-life) was 60 million cedis. This capital was inadequate for the smooth operations of insurance businesses. Hence, it was mandated (under Act 724) for all direct insurers (life or non-life insurers) to maintain a minimum capital of one million dollars in its cedi equivalent. This increase in minimum capital may put insurers in a better financial position which can also

impact on their efficiencies since capital is considered as a major factor of production in most industries including the insurance sector. Moreover, all insurers have been directed by NIC to deposit a minimum of 10% of the required capital in an escrow account with Bank of Ghana, with the aim of ensuring sufficient resources to absorb liquidity shocks.

In 2013, various stakeholders in the industry reviewed the draft insurance bill to address limitations of the Act 724 (2006). The purpose was to look at prioritising licensing for specialized insurer's dealings in micro-insurance and agriculture insurance and also to support product development for other critical sectors of the economy.

## **CHAPTER FOUR**

### **METHODOLOGY**

#### **4.1 Introduction**

This chapter presents the research philosophy subscribed to and the research design employed in the pursuit of achieving the research objectives. This chapter also present the various data sources, identifies the variables for the study and explain how the overall research objective can be achieved.

#### **4.2 Research design**

The research design encompasses the set of research philosophy, approach and strategy adopted to execute the research.

##### **4.2.1 Research philosophy**

A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analyzed and used (Mark, Philip, & Adrian, 2009). The term epistemology (what is known to be true) encompasses the various philosophies of research approaches (Zikmund, Babin, Carr, & Griffin, 2012). According to Saunders, M. N., Saunders, Lewis, and Thornhill (2011), there are two main acceptable research philosophies which describe how knowledge is developed and judged, namely positivism and interpretivism. This study adopts the positivist research paradigm because knowledge of corporate governance and cost efficiency and productivity of insurance firms is not subjective, but rather requires objectivity from the researcher.

#### **4.2.2 Research approach**

The research approach ties a particular philosophy appropriately to the research methods which links philosophical notions to practical and applicable research strategies (Byrne, 2001). The inductive approach is associated with interpretivism while the deductive approach is usually attached to positivism. The deductive approach is adopted for this study because it leads to testing of the hypotheses with specific data. In connection with the positivism philosophy, data for the research (normally sourced secondary data) remain objective to enable comparisons to be made.

#### **4.2.3 Research strategy**

The general plan that specifies the way to answer the research question is the research strategy (Saunders, M. L. & Lewis, 2009). Two distinct types of research strategy have been identified by Saunders, M. N. et al. (2011) namely qualitative and quantitative research. Words (rather than quantification) in the collection and analysis of data are stressed by the former while the latter give emphasis to quantification in the collection and analysis of data (Bryman, 2012). Based on this basic distinction and arguments expounded in the literature review, it is obvious that this research follows the quantitative strategy. The quantitative strategy obtained an unbalanced panel data on insurance firms in Ghana over a ten-year period. A balanced data is used (rather than unbalanced panel) because of unavailability of some observations of the same unit in every time period (year), though it can lead to noise being introduced by unit heterogeneity (Baltagi & Griffin, 1983).

#### **4.3 Sampling and source of data**

All insurance companies in Ghana from the period 2005 to 2014 constitute the population for the study. The population consists of 47 insurance companies (21 life and 26 non-life) as at 31

December, 2015. Of this number, 29 insurance firms were sampled. Throughout the study period, 29 insurance companies had their cost efficiency and productivity estimated. The first stage analysis requires the use of panel data which necessitated the dropping of some insurers from the sample. The basic reason for using the balanced panel data is that data is obtained throughout the study period on the insurance firms. Subsequently, only 29 insurance firms qualify to form the sample frame. The study used secondary data covering various inputs and outputs, and corporate governance variables of insurance companies in Ghana, which was extracted from their respective annual reports and with the financial data cross-validated by similar figures from the National Insurance Commission.

#### **4.4 Frontier efficiency and productivity analysis**

The Data Envelopment analysis has its root from a study by Farrell (1957) on the estimation of relative technical efficiency of Decision Making Units (DMUs). The model was formalised by Charnes, Cooper, and Rhodes (1978) with extension of the concept by Banker, Rajiv D, Charnes, and Cooper (1984). “The Data Envelopment Analysis is a non-parametric linear programming (LP) optimization-based technique to assess the relative efficiency of homogeneous DMUs that produce multiple outputs from multiple inputs” (Cook & Seiford, 2009; Fried, Lovell, & Schmidt, 2008). The choice of DMUs depends on the industry of concern and can be airlines, oil firms, insurance firms, football clubs, universities, hospitals and banks. This technique uses observed units of various DMUs in creating a piece-wise frontier to which the all other DMUs in the possibility set are compared to determine their efficiency levels. A DMUs are deemed efficient when they lie on the frontier dominated by any other firm. Then, the efficiency or inefficiency ratings generated from those units enveloped by the “best practice” frontier or on the frontier are estimated in relation to the constructed frontier’s boundary.

The DEA technique is credited for being a good optimization model to enable management to make out the “best-practice” units without bias and the aspects of a firm’s multi-faceted operating circumstances that ought to be improved. To peruse a detailed discussion of the developments, evolution and the concept of frontier methods and DEA, kindly refer to Cooper, Seiford, and Zhu (2011), Daraio and Simar (2007), Coelli, Timothy J, Rao, O'Donnell, and Battese (2005). For DEA applications in the insurance industry, see Ackah and Owusu (2012); Basturk (2012); Breyer, Bundorf, and Pauly (2011); Consiglio, Cocco, and Zenios (2008); Cummins and Weiss (2000); Cummins, J. D. and Weiss, M. A. (2013); David Cummins and Sommer (1996); Dionne and Harrington (2014).

There are many reasons why the Data Envelopment is employed to estimate the efficiency score of insurers. First, this DEA technique is able to handle multiple inputs and multiple outputs of homogenous DMUs in computing its score (Charnes et al., 1978). Insurance firms use various inputs such as property plant and equipment, (PPE), employee cost and benefit, labour, deposits etc., in producing various outputs, including investments and reinsurance, loans and advances and securities. An insurance firm’s multifaceted business operation, multiple inputs, and multiple outputs warrant the use of DEA. Using DEA, one is also able to identify sources of inefficiency by disintegrating the efficiency scores into various components, including profit, revenue, cost, technical, pure technical, scale, allocative and mix efficiencies. Again, in DEA estimations the spelling out of restrictive functional forms for the technology (i.e. either production or cost or profit) or the distributional assumptions that underlie the observations is of no importance, unlike in some parametric approaches such as Stochastic Frontier Analysis (Cook & Seiford, 2009; Fried et al., 2008). In other words, the DEA technique uses the original data form without imposition strict assumption and structure on the data. This avoid errors related to data specification (Cummins et al., 2010). Further, DEA is unit invariant (Lovell & Pastor, 1995) meaning that the inputs and outputs usable for the DEA

need not be in the same metric units necessarily. For instance, although man-hours measures labour, space (square meters) measures size and currency unit measures operating expenses, an analysis under consideration can use them as inputs. DEA is imperative for managerial policy making because of its strength of identifying reference sets or peers for each inefficient unit. Notwithstanding its merits, the DEA technique is not a universal remedy for the problems and weaknesses in using other performance assessment tools. First, the technique is not an absolute measure efficiency but rather a relative efficiency assessment tool. In relative efficiency estimation, the exclusion and/ inclusion of various DMUs have the possibility of affecting the efficiency scores from the analysis because the best point (firm) in the sample and not the ideal point (firm) determines the farthest point of expectation to be reached in order to be efficient (Avkiran, 1999). Also, the outcome of a DEA analysis is based on the choice of inputs, outputs and other relevant proxies making it a deterministic method which makes it prone to identification problems. This emanates from the fact that every digression from the efficient boundary is attributed to inefficiency devoid of considering statistical noise. These problems have however been addressed in DEA and second-stage efficiency analysis through the emergence of bootstrapping which aids in solving sampling variation and autocorrelation problems. Again, DEA is subtle to outliers and random noise from missing explanatory variables or measurement errors that are able to vary the efficiency rankings (Ohene-Asare, K. & Asmild, 2011). Ultimately, some inputs or outputs, are treated like homogeneous ones albeit their heterogeneous nature which is a cause of biases in the efficiency estimates (Coelli, Timothy J et al., 2005). A case in point is where in an input oriented analysis, no distinction is made between skilled and unskilled labour. In such cases, both are lumped up for the purpose of the analysis as labour whereas in reality, for the efficiency of the DMUs, each has its distinct impact.

For a mathematical formalization of this DEA method, supposing there are  $n$  observed DMUs under study, that utilizes various amounts of  $m$  inputs for generating various amounts of  $s$  outputs, a specific DMU $j$  thus end up consuming  $x_{ij}$  amount of input  $i$  for the production of  $y_{rj}$  amount of output  $r$ . The definition of the technology set,  $T$ , is given as:

$$T = \left\{ (x, y) : x \text{ can produce } y \right\} \quad (1)$$

The input-oriented efficiency of a target DMU $o$  is defined as maximum of the ratio of weighted sum of outputs to weighted sum of inputs subject to the condition that similar ratios representing the efficiency measures for each DMU be equal or less than unity (ie. one). Mathematically, the formalization of the Charnes, Cooper and Rhodes (CCR) fractional programming model (2) can be given as:

$$\begin{aligned} \max h_o(u, v) &= \frac{\sum_{r=1}^s u_r y_{ro}}{\sum_{i=1}^m v_i x_{io}} \\ \text{s.t.} & \\ & \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1, \quad j = 1, \dots, n \\ & u_r, v_i \geq 0; \forall r, r = 1, \dots, s; \forall i, i = 1, \dots, m \end{aligned} \quad (2)$$

It should be noted that  $y_{rj}, x_{ij} \geq 0$  are the observed outputs and inputs, respectively, of DMU  $j$  whereas  $u_r, v_i \geq 0$  are the weights allocated to the outputs and inputs respectively, and are to be determined by solving the optimization problem. In estimating the relative values of the various firms, the shadow prices are used and it make firms as efficient as possible. This depends on the idea that the resulting value system is feasible for all other firms and that none achieves an efficiency score below one (Ohene-Asare, Kwaku, 2011). The CCR fractional programming model (2) can be transformed into a corresponding linear model (3) using the Charnes-Cooper

transformation (Charnes & Cooper, 1962), under the assumptions of free disposability and convexity:

$$\begin{aligned}
 \theta^* &= \text{Min } \theta \\
 &\quad \lambda_{j^0} \\
 \text{s.t.} \\
 \sum_{j=1}^n \lambda_j x_{ij} &\leq \theta x_{io}; \quad i = 1, \dots, m \\
 \sum_{j=1}^n \lambda_j y_{rj} &\geq y_{ro}; \quad r = 1, \dots, s \\
 \sum_{j=1}^n \lambda_j &= 1 \quad (\text{vrs}) \\
 \lambda_j &\geq 0; j = 1, \dots, n; \quad \theta \text{ free}
 \end{aligned} \tag{3}$$

In model (3),  $\theta^*$  denotes the radial input-oriented efficiency score of the DMU under evaluation which falls between 0 and 1;  $\lambda_j$  is the optimal weight of the referenced sets for DMU  $j$ ;  $x_{ij}$  and  $y_{rj}$  are the amounts of  $i$ th input and  $r$ th output generated by the  $j$ th DMU.

The technique differentiates variable returns to scale (VRS) model from the constant returns to scale (CRS) model under the convexity constraint,  $\sum_{j=1}^n \lambda_j = 1$ . The introduction of this constraint changes the reference set from a conical hull, as is in the case of CRS model, to convex hull for the VRS model (Luo, 2003). By solving this linear programming problem, the efficiency estimates of each DMU can be obtained, inefficient units are identified, targets identified, and policy guidelines provided. Based on the assumptions of free disposability and convexity as well as the technology set,  $T$ , other measures of efficiency can be estimated.

## 4.5 Formalizing the cost efficiency and productivity estimation model

### 4.5.1 The Classical Malmquist

The Malmquist index was developed for measuring dynamic performance of firms over a two-time period comparison of technical efficiency in terms of input-output levels. The productivity measurement is an index first proposed by Malmquist (1953) in the context of consumer theory and was adapted by Caves, Christensen, and Diewert (1982)

To formalize the Malmquist index, let us assume that in time period  $t$ , producers are using inputs  $x^t \in R_+^n$ , to produce outputs  $y^t \in R_+^m$  and the technology of production can be captured in terms of input distance function (Shepard, 1953) as:

$$D_i^t(y^t, x^t) = \text{Sup}_\theta \left\{ \theta : \frac{x^t}{\theta} \in L^t(y^t), \theta > 0 \right\}, \quad (4)$$

Where the subscript  $i$  denotes inputs orientation and  $L^t(y^t)$  is the set of input vectors  $x^t$  which can secure the output vector  $y^t$ . Assumed two-time period  $t$  and  $t+1$  respectively and define in each one of them technology and production.

$$MI = \left[ \frac{D^t(y^{t+1}, x^{t+1})}{D^t(y^t, x^t)} \frac{D^{t+1}(y^{t+1}, x^{t+1})}{D^{t+1}(y^t, x^t)} \right]^{1/2} \quad (5)$$

$$D_o^t(X_o^t, Y_o^t) = \min \theta \quad (6)$$

Subject to

$$\sum_{j=1}^n \lambda_j x_{ij}^t \leq \theta x_{io}^t \quad i = 1, \dots, m,$$

$$\sum_{j=1}^n \lambda_j y_{rj}^t \geq y_{ro}^t \quad r = 1, \dots, s,$$

$$\lambda_j \geq 0 \quad j = 1, \dots, n.$$

$$D_o^t(X_o^{t+1}, Y_o^{t+1}) = \min \theta \quad (7)$$

Subject to

$$\sum_{j=1}^n \lambda_j x_{ij}^{t+1} \leq \theta x_{io}^{t+1} \quad i = 1, \dots, m,$$

$$\sum_{j=1}^n \lambda_j y_{rj}^t \geq y_{ro}^{t+1} \quad r = 1, \dots, s,$$

$$\lambda_j \geq 0 \quad j = 1, \dots, n.$$

The index of the Malmquist Index (MI) is interpreted based on three distinct conditions. There is a situation when a firm may experience a progress or a regress in productivity or have a constant productivity. The three conditions are explained as:  $MI < 1$ , observed progress,  $MI > 1$ , observed regress, finally, an  $MI = 1$ , means the firm did not observe any change in productivity. However, for a simpler interpretation, a reciprocal of the index could be used. That way an  $IM < 1$ , implies regress,  $IM > 1$  means the firm or the industry had experience growth and an  $IM=1$ , means stagnation over the period.

#### 4.5.2 Cost Efficiency

Despite the classical Malmquist ability to account for time variability, it is biased towards cost. The standard cost efficiency assumes that prices are known and this was developed by Farrell (1957) to account for cost of inputs. This is to evaluate the ability of DMUs to produce the current level of output at a minimal cost given input prices. From the standard technical efficiency equation  $Min \theta = \sum_{r=1}^s u_r y_{ro}$ , when input prices,  $w^t \in R_+^m$ , are available, the cost efficiency technology may be defined in terms of the cost function, which is:

$$C^t(y^t, w^t) = \min_{x^t} \{w^t x^t : x^t \in L^t(y^t)\} \quad (8)$$

Where  $w^t x^t = \sum_{n=1}^m w_n^t x_n^t$  the subscript  $n$  denoting the  $n$ th input.  $C^t(y^t, w^t)$  defines the minimum cost of producing a given output vector  $y^t$  given the input  $w^t$  and the technology of period  $t$ . The set of input  $x^t$  which correspond to the scalar  $C^t(y^t, w^t)$  lie on the isocost which defines a cost boundary which is the locus of the input vectors that, given the technology and inputs prices, are capable of securing  $y^t$  at the cost of  $C^t(y^t, w^t)$ .

Cost efficiency refers to the combination of technical efficiency (TE) and allocative efficiency (AE). The ability to produce current outputs at the minimal cost is evaluated by cost efficiency (CE) analysis. Crucial to the success of the use of CE is the assumption that prices of inputs are known and are fixed, even though it is an impossibility to have fixed price between DMUs. The least price of producing the current output can be obtained by solving the linear problem as formulated by Färe, Rolf, Grosskopf, and Lovell (1985).

The minimal cost model is:

$$\min \sum_{i=1}^m w_{io} x_i \quad (9)$$

*Subject to*

$$\sum_{j=1}^n \lambda_j x_{ij} \leq x_{io}, \quad i = 1, \dots, m,$$

$$\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro}, \quad r = 1, \dots, s;$$

$$\lambda_j \geq 0, \quad x_i^o \geq 0, \quad j = 1, \dots, n,$$

In the model labelled (9),  $w_{io}$  is the price of inputs  $i$  for the DMU<sub>0</sub>, under assessment. Amount of input  $i$  to be used by DMU<sub>0</sub> at the optimal solution in order to produce the current output at minimal cost is denoted by the variable  $w_i x_i^o$ .

Considering the price of the inputs, the model assumes the input price at each DMU ( $w_{io}$ ,  $i=1, \dots, m$ ) are fixed and known, although prices can differ between DMUs.

#### 4.5.3 Cost Malmquist Productivity Index

Literature advance arguments as to the importance of prices of inputs in efficiency, especially allocative efficiency (Maniadakis & Thanassoulis, 2004). The allocative efficiency has to do

with how a technically efficient firm can further reduce aggregate cost of securing its outputs by selecting an optimal mix of inputs given their associated costs. Since allocative efficiency can significantly affect performance (Thanassoulis, Shiraz, & Maniadakis, 2015), it should be factored into cost efficiency over time.

Consider that in time period  $t$ , producers are using inputs  $x^t \in R_+^n$ , to produce outputs  $y^t \in R_+^m$ . Defining the production technology of period  $t$  in terms of the inputs requirement set, which is:

$$L^t(y^t) = \{x^t: x^t \text{ can produce } y^t\} \quad (10)$$

Note that  $L^t(y^t)$  comprises of all input vectors that are able to generate output  $y^t$  is non-empty, closed, and convex, bounded and satisfies strong disposability of inputs and outputs. The input isoquant bounds  $L^t(y^t)$  from below which is:

$$IsoqL^t(y^t) = \{x^t : x^t \in L^t(y^t), \lambda x^t \notin L^t(y^t) \text{ for } \lambda < 1\} \quad (11)$$

$IsoqL^t(y^t)$  defines a boundary (frontier) to the input requirement set in the sense that any radial contraction of input vectors that lie on the frontier is not possible within  $L^t(y^t)$ . Alternatively, with reference to the input set, defines the technology of production in terms of input distance function as:

$$D_i^t(x^t, y^t) = \sup_{\theta} \left\{ \theta: \frac{x^t}{\theta} \in L^t(y^t), \theta > 0 \right\} \quad (12)$$

Where, the subscript  $i$  denote input orientation.  $D_i^t(x^t, y^t)$  is the largest factor by which the input level in  $x^t$  can be divided while  $x^t$  remains in  $L^t(y^t)$ .  $D_i^t(x^t, y^t)$  Characterises the technology of production completely in the sense that  $D_i^t(x^t, y^t) \geq 1$  is sufficient for  $x^t \in$

When input prices,  $w^t \in R^m$ , are available, the cost function is defined:

$$C^t(y^t, w^t) = \min_{x^t} \{w^t x^t : x^t \in L^t(y^t)\} \quad (13)$$

Where,  $w^t x^t = \sum_{n=1}^m w_n^t x_n^t$ , the subscript  $n$  denoting the  $n$ th input. The minimum cost of producing output vector  $y^t$  given the input vector  $x^t$  and input prices  $w^t$  and the technology at  $t$  is  $C^t(y^t, p^t)$ . The set of input vectors  $x^t$  which is equal to the scalar  $C^t(y^t, p^t)$  lie on an isocost line which define cost boundary which is the locus of the input vectors that, given the technology and input prices, are capable of securing output  $y^t$  at the cost of  $C^t(y^t, p^t)$ .

$$IsoC^t(y^t, w^t) = \{x^t : w^t x^t = C^t(y^t, w^t)\} \quad (14)$$

Using allocative efficiency (AE) and technical efficiency (TE), input's price productivity changes are determined. Maniadakis and Thanassoulis (2004) defined the cost Malmquist (CM) productivity index of period  $t, t+1$  and their geometric mean as follows:

$$CM^t = \left[ \frac{w^t x^{t+1} / C^t(y^{t+1}, w^t)}{w^t x^t / C^t(y^t, w^t)} \right]$$

$$CM^{t+1} = \left[ \frac{w^{t+1} x^{t+1} / C^{t+1}(y^{t+1}, w^{t+1})}{w^t x^t / C^t(y^t, w^{t+1})} \right]$$

$$CM = \left[ \frac{w^t x^{t+1} / C^t(y^{t+1}, w^t)}{w^t x^t / C^t(y^t, w^t)} \times \frac{w^{t+1} x^{t+1} / C^{t+1}(y^{t+1}, w^{t+1})}{w^t x^t / C^t(y^t, w^{t+1})} \right]^{1/2} \quad (15)$$

Where,  $w^t x^t = \sum_{n=1}^N w_n^t x_n^t$ ,  $n$  denotes the  $n$ -th input and  $C^t(y^t, w^t)$  defines the minimum cost of producing a given output vector  $y^t$  given the prices  $w^t$  and the technology of period  $t$  with reference to constant returns to scale (CRS) technology. The cost  $w^t x^t / C^t(y^t, w^t)$  measures the extent to which the aggregate production cost in period  $t$  can be reduced while still securing the output  $y^t$  under the input price  $w^t$ . This ratio measures the distance between the observed cost  $w^t x^t$  and the cost boundary  $C^t(y^t, w^t)$ . Minimum value of this distance will be one (1), (when the two cost coincide). This (cost) distance is the reciprocal of the input oriented measure of overall efficiency. A CM index value less than 1 implies productivity progress, a value greater than 1 implies a regress and a value of 1 indicates constant productivity.

Computation of input distance function and the cost distance function can be done using a widely used approach for efficiency measurement known as the nonparametric, mathematical programming based method of DEA. The principle behind the DEA is to estimate the production possibility set (PPS) by laying a convex hull around the empirically available input-output combinations of the different DMUs in a sample. The decisive components of the various indices are the input distance functions  $D_i^t(y^t, x^t)$  and the cost function  $C^t(y^t, w^t)$ . These measures are crucially dependent on a definition of the PPS and the correspondent isoquants. Using DEA to compute the CMI as follows: Suppose that in each time ( $t$ ) period production units  $j = 1, 2, \dots, n$ . In period  $t$ ,  $j_0$  unit employs inputs amount,  $x_{ij_0}^t$  ( $i = 1, 2, \dots, m$ ) available at prices  $w_{ij_0}^t$  ( $i = 1, 2, \dots, m$ ). For any unit  $j_0$ , the cost of securing its inputs in time period  $t$  is denoted by  $w^t x^t \equiv \sum_{i=1}^m w_{ij_0}^t x_{ij_0}^t$ . Similarly, in relation to cost in time period  $t+1$ , and the intertemporal periods are denoted by  $w^{t+1} x^{t+1}$ ,  $w^{t+1} x^t$  and  $w^t x^{t+1}$  respectively as  $\sum_{i=1}^m w_{ij_0}^{t+1} x_{ij_0}^{t+1}$ ,  $\sum_{i=1}^m w_{ij_0}^{t+1} x_{ij_0}^t$ , and  $\sum_{i=1}^m w_{ij_0}^t x_{ij_0}^{t+1}$ . For unit,  $j_0$ , the term  $C^t(y^t, p^t)$  can be computed using the models such as:

$$C^t(y^t, w^t) = \min_{\lambda_j, x_i} \sum_{i=1}^m w_{ij_0}^t x_i, \quad (16)$$

Subject to:

$$\sum_{j=1}^n \lambda_j x_{ij}^t \leq x_i, \quad i = 1, \dots, m,$$

$$\sum_{j=1}^n \lambda_j y_{rj}^t \geq y_{rj_0}^t, \quad r = 1, \dots, s,$$

$$\lambda_j \geq 0, \quad x_n \geq 0, \quad j = 1, \dots, n; i = 1, \dots, m$$

In the model (15),  $w_{ij_0}^t$  is the price of input  $i$  for DMU  $j_0$  at period  $t$ .  $X_i, i = 1, 2, \dots, m$  as well  $\lambda_j, j = 1, 2, \dots, n$  are variables of the model. The cross-period cost  $C^t(y^{t+1}, w^t)$  is computed using the model in (15) after changing  $t$  to  $t+1$  in  $y_{rj_0}^t$ , (this means using period  $t+1$  output

levels for unit  $j_0$ ) while the constraints and prices remain as they in period  $t$ . The model uses CRS technologies based index measure, which implies that the firms are able to scale their inputs and outputs linearly without increasing or decreasing efficiency. The motivation for the CRS measure is the reliability or accuracy of the productivity regardless of the true form of the technology (CRS) (Färe, R, Grifell-Tatjé, Grosskopf, & Lovell, 1995; Färe, Rolf, Grifell-Tatjé, Grosskopf, & Lovell, 1997).

The term  $C^t(y^{t+1}, w^t)$  can be computed using a model as:

$$C^t(y^{t+1}, w^t) = \min_{\lambda_j, x_i} \sum_{i=1}^m w_{ij_0}^t x_i, \quad (17)$$

Subject to:

$$\begin{aligned} \sum_{j=1}^n \lambda_j x_{ij}^t &\leq x_i, & i = 1, \dots, m, \\ \sum_{j=1}^n \lambda_j y_{rj}^t &\geq y_{rj_0}^{t+1}, & r = 1, \dots, s, \\ \lambda_j &\geq 0, \quad x_n \geq 0, & j = 1, \dots, n; i = 1, \dots, m \end{aligned}$$

The term  $C^{t+1}(y^{t+1}, w^{t+1})$  and  $C^{t+1}(y^t, w^{t+1})$  can be computed using the two previous models, after the changes in time period  $t$  and  $t+1$ . Computing  $C^{t+1}(y^{t+1}, w^{t+1})$  is as follow:

$$C^{t+1}(y^{t+1}, w^{t+1}) = \min_{\lambda_j, x_i} \sum_{i=1}^n w_{ij_0}^{t+1} x_i, \quad (18)$$

Subject to:

$$\begin{aligned} \sum_{j=1}^n \lambda_j x_{ij}^{t+1} &\leq x_i, & i = 1, \dots, m, \\ \sum_{j=1}^n \lambda_j y_{rj}^{t+1} &\geq y_{rj_0}^{t+1}, & r = 1, \dots, s, \\ \lambda_j &\geq 0, \quad x_n \geq 0, & j = 1, \dots, n; i = 1, \dots, m \end{aligned}$$

The decomposition of the CMPI, compute the distance functions as shown Färe, Rolf et al. (1985). The own-period decomposition is as follows:

$$[D_i^t(y^t, w^t)]^{-1} = \min_{\lambda_j, \theta} \theta, \quad (19)$$

Subject to:

$$\sum_{j=1}^J \lambda_j x_{ij}^t \leq \theta x_{ij_0}^t, \quad i = 1, \dots, m,$$

$$\sum_{j=1}^J \lambda_j y_{rj}^t \geq y_{rj_0}^t, \quad r = 1, \dots, s$$

$$\theta \text{ free}; \lambda_j \geq 0, \quad j = 1, \dots, n.$$

The cross-period decomposition of the cost productivity is as follows:

$$[D_i^t(y^{t+1}, w^{t+1})]^{-1} = \min \theta, \quad (20)$$

Subject to:

$$\sum_{j=1}^J z_j y_{jm}^t \geq y_{km}^{t+1}$$

$$\sum_{j=1}^J z_j x_{jn}^t \leq \theta x_{kn}^{t+1}$$

$$z_j \geq 0,$$

The CMPI can be decomposed into other units to identify the sources of productivity change for effective managerial actions. Therefore, Maniadakis and Thanassoulis (2004) demonstrated that the first stage of CMPI decomposition into two components namely; Overall Efficiency Change (OEC) and Cost-Technical Change (CTC). The decomposition is as follows:

$$CM = \underbrace{\left[ \frac{w^{t+1}x^{t+1}/C^{t+1}(y^{t+1}, w^{t+1})}{w^t x^t / C^t(y^t, w^t)} \right]}_{\text{(OEC)}} \times \underbrace{\left[ \frac{w^t x^{t+1} / C^t(y^{t+1}, w^t)}{w^{t+1} x^{t+1} / C^{t+1}(y^{t+1}, w^{t+1})} \times \frac{w^t x^{t+1} / C^t(y^{t+1}, w^t)}{w^t x^t / C^t(y^t, w^t)} \right]^{\frac{1}{2}}}_{\text{(CTC)}} \quad (21)$$

The change between period  $t$  and  $t + 1$  is captured by OEC. This measure indicates if from period  $t$  and  $t + 1$  the production unit “catches up” the cost boundary. The CTC measures the shift of cost boundary estimated at the input mixes  $x^t$  and  $x^{t+1}$ . A CTC value of less than unity indicates a positive shift or technical progress, a value of CTC greater than unity indicates negative shift or technical regress and value of CTC equal to unity indicates no shift in cost frontier.

#### 4.6 Test of returns to scale

In estimating the cost oriented dynamic productivity of insurance firms, there is the need to choose an appropriate return to scale (RTS). Literature show that either VRS or CRS is employed by numerous researcher without empirically testing which one suffices (Battese, Rao, & O'Donnell, 2004; Bonin, Hasan, & Wachtel, 2005; Chen, C.-M., 2009; Chen, C., 2009; Chen, K.-H. & Yang, 2011; Juo, Lin, & Chen, 2015; Parteka & Wolszczak-Derlacz, 2013; Scotti & Volta, 2015). Though the test of return to scale had been applied in non-insurance industries (de Borger, Kerstens, & Staat, 2008; Gómez-Calvet, Conesa, Gómez-Calvet, & Tortosa-Ausina, 2014; Ippoliti, Melcarne, & Ramello, 2015; Mahlberg & Url, 2010; Moradi-Motlagh & Babacan, 2015; Simar & Wilson, 2015; Sueyoshi & Goto, 2012; Tortosa-Ausina, Armero, Conesa, & Grifell-Tatjé, 2010), this study provide empirical test of returns to scale in the insurance sector of Ghana.

The present study applies the nonparametric test of returns to scale (RTS) of Simar and Wilson (2002) to test the technology under which insurance firms in Ghana operate. The fundamental

concept is to test the null hypothesis that the technology exhibits globally constant returns to scale (CRS) against the alternative hypothesis that the technology exhibits globally variable returns to scale (VRS) (Badunenko, 2010). Whereas under the CRS, it is assumed that the size of firms do not have any effect on their efficiency and productivity performance, the VRS assumes that firms' size have an impact on their performance (Falavigna, Ippoliti, Manello, & Ramello, 2015). According to Simar and Wilson (2002), the nonparametric test of RTS can be performed to test the hypothesis that:

$H_0$ : the production technology exhibits CRS globally.

$H_A$ : the production technology is VRS.

The test statistic is computed based on the mean of ratios or ratio of means of efficiency of all firms. The mean of ratios is computed as follows:

$$\hat{S}_1 = n^{-1} \sum_{i=1}^n \left[ \frac{D_n^{CRS}(x, y)}{D_n^{VRS}(x, y)} \right] \quad (22)$$

The ratio of means is computed as:

$$\hat{S}_2 = \frac{\sum_{i=1}^n D_n^{CRS}(x, y)}{\sum_{i=1}^n D_n^{VRS}(x, y)} \quad (23)$$

$H_0$  is rejected if  $\hat{S}$  is significantly less than unity. To statistically check these, the critical values and p-values must be used. Simar and Wilson (2002) apply bootstrapping to generate appropriate critical values. For the purpose of this study, the mean of ratios is used. The empirical test produced the following result:

**Table 4. 1: Empirical test of returns to scale of Ghana's Insurance sector**

Year	P-Value	Decision on H <sub>0</sub>	RTS
2007	0.294	Do not Reject	CRS
2008	0.023	Reject	VRS
2009	0.056	Do not Reject	CRS
2010	0.037	Reject	VRS
2011	0.029	Reject	VRS
2012	0.035	Reject	VRS
2013	0.152	Do not Reject	CRS
2014	0.301	Do not Reject	CRS
Pooled	0.036	Reject	VRS

The empirical test indicates that apart from years 2008, and 2010 to 2012, the remaining years indicate a CRS. However, the pooled data exhibited a VRS. Therefore, the variable returns to scale is applied in evaluating the cost oriented productivity of insurance firms in Ghana.

#### 4.7 The SZAL for cost efficiency and productivity analysis

A number of nonparametric statistical significance tests have been proposed to test the differences between efficiency distributions. These includes Friedman tests, Kolmogorov-Smirnov test, Kruskal-Wallis test, Mann-Whitney U test, Welch's mean test and Wilcoxon-Sign-Rank test (Banker, Rajiv D., 1993, 1996). These tests have their parametric equals such as ANOVA tests and t-tests. Nevertheless the study used a more comprehensive test of uniformity of efficiency distributions, the Simar-Zelenyuk adapted Li-test, a nonparametric test that applies kernel density estimations (Simar & Zelenyuk, 2006). Unlike other statistical tests such as the Mann Whitney test, Wilcoxon's signed ranks test and Li-test that neglects the

distribution of the entire dataset by assuming that the true efficiency estimates are observed when they are rather unknown. The Simar-Zelenyuk test is chosen because it addresses these issues associated with other statistical tests discussed above and its ability to compare the distribution of DEA efficiency scores between groups using bootstrap technique.

In conducting this comparison, Simar and Zelenyuk (2006) offered two algorithms. The first algorithm which is similar to the approach used in truncated regression, and is built on computation and bootstrapping of the Li test statistics applying DEA estimates ignoring samples with efficiency scores of unity and thus ignoring bogus estimates. The second algorithm uses a smoothing approach instead of ignoring an efficiency score of equal to unity. Even though results from the two algorithms were not seemingly dissimilar, the second algorithm is further suitable since it is more robust to an increase in dimension (Simar & Zelenyuk, 2006). This approach is most suitable and is used in this study to compare the distribution of DEA efficiency scores between groups.

Suppose the study apply this approach to compare the densities two random variables of efficiency scores  $\{\delta_{G,i} : i=1, \dots, n_G\}$  and  $\{\delta_{N,i} : i=1, \dots, n_N\}$  obtained from potentially different distributions characterised by a point  $\delta^0$  by density functions  $f_G(\delta^0)$  and  $f_N(\delta^0)$ , respectively. The objective is to test whether these two distributions are the same or not. The null and the alternative hypotheses can be expressed as:

$$H_0 : f_G(\delta^0) = f_N(\delta^0),$$

$$H_1 : f_G(\delta^0) \neq f_N(\delta^0)$$

The Li (1996) test is based on the statistics:

$$\frac{n_G h^{1/2} \hat{T}^0_{n_G n_N}}{\sqrt{\hat{\sigma}_{\lambda, h}^2}} \xrightarrow{d} N(0, 1) \quad (24)$$

where,

$$\hat{T}^0_{n_G n_N} = \frac{1}{n_G^2 h} \sum_{i=1}^{n_G} \sum_{\substack{k=1 \\ i \neq k}}^{n_G} K\left(\frac{\delta_{G,i} - \delta_{G,k}}{h}\right) + \frac{1}{n_N^2 h} \sum_{i=1}^{n_N} \sum_{\substack{k=1 \\ i \neq k}}^{n_N} K\left(\frac{\delta_{N,i} - \delta_{N,k}}{h}\right)$$

$$-\frac{1}{n_G n_N h} \sum_{\substack{i=1 \\ i \neq k}}^{n_G} \sum_{k=1}^{n_N} K\left(\frac{\delta_{G,i} - \delta_{N,k}}{h}\right) - \frac{1}{n_N n_G h} \sum_{\substack{i=1 \\ i \neq k}}^{n_N} \sum_{k=1}^{n_G} K\left(\frac{\delta_{N,i} - \delta_{G,k}}{h}\right) \quad (25)$$

and

$$\begin{aligned} \hat{\sigma}_{\lambda, h}^2 := & 2 \left\{ \frac{1}{n_G^2 h} \sum_{i=1}^{n_G} \sum_{k=1}^{n_G} K\left(\frac{\delta_{G,i} - \delta_{G,k}}{h}\right) + \frac{\lambda_n^2}{n_N^2 h} \sum_{i=1}^{n_N} \sum_{k=1}^{n_N} K\left(\frac{\delta_{N,i} - \delta_{N,k}}{h}\right) \right. \\ & \left. + \frac{\lambda_G}{n_G n_N h} \sum_{i=1}^{n_G} \sum_{k=1}^{n_N} K\left(\frac{\delta_{G,i} - \delta_{N,k}}{h}\right) + \frac{\lambda_N}{n_N n_G h} \sum_{i=1}^{n_N} \sum_{k=1}^{n_G} K\left(\frac{\delta_{N,i} - \delta_{G,k}}{h}\right) \right\} \\ & \times \int K^2(z) dz \end{aligned} \quad (26)$$

where  $\lambda_n = n_G / n_N$ ,  $n = n_G + n_N$ , and assuming  $\lim_{n \rightarrow \infty} \lambda_n = \lambda$ . The algorithm of the bootstrap for

Simar and Zelenyuk adapted Li-test used in comparing the distribution of efficiency scores estimated by the DEA approach and adapted to the notations in this paper is as follows:

1. For each DMU in the sample  $\Xi_n = \{(x^k, y^k) : k = 1, \dots, n\}$ , compute the cost efficiency,

$C\hat{E}(x, y)$  using the DEA approach, thus obtaining a sequence of estimated cost efficiency scores  $\{C\hat{E} : k = 1, \dots, n\}$ .

Smooth the original estimates of the efficiency scores using the smoothing rule:

$$C\hat{E}^*(x^k, y^k) = \begin{cases} C\hat{E}(x^k, y^k) + \varepsilon^k, & \text{if } C\hat{E}(x^k, y^k) = 1 \\ C\hat{E}^*(x^k, y^k) & \text{otherwise} \end{cases}$$

where  $\varepsilon^k = \text{uniform} \left( 0, \min \left\{ n^{-2/(M+N+1)}, a-1 \right\} \right)$  and  $a$  is the  $\alpha$ -quantile (e.g. 5%) of the empirical distribution of  $C\hat{E}^*(x^k, y^k) > 1$ .

Split the sample estimate into two sample estimates and into two subsample of DEA estimates, I and J thus obtaining:

$$\{C\hat{E}^{*I,k} : k = 1, \dots, s_I\} \quad (27a)$$

$$\{C\hat{E}^{*J,k} : k = 1, \dots, s_J\} \quad (27b)$$

Where  $s_l = n_l$  ( $l = 1, \dots, L$ ).

2. Next, estimate the Li (1996) test statistics (Equation 23) using the subsamples in (27a) and (27b) and bandwidth  $h^* = \min\{h_A^*, h_Z^*\}$ , where  $h_A^*$  and  $h_Z^*$  are obtained using some optimal rule applied to (27a) and (27b) respectively.
3. Resample from the largest subsample out of (27a) or (27b) in order to obtain the bootstrap analogues of (A1) and (A2) and call them:

$$\{\hat{C}E_b^{**I,k} : k = 1, \dots, n_A\} \quad (27c)$$

$$\{\hat{C}E_b^{**J,k} : k = 1, \dots, n_Z\} \quad (27d)$$

4. Estimate the bootstrapped Li-test statistics using (27c) and (27d) and  $h_b^{**} = \min\{h_{b,A}^{**}, h_{b,Z}^{**}\}$ , where  $h_{b,A}^{**}$  and  $h_{b,Z}^{**}$  are obtained using the same optimal rule applied to (27a) and (27b) in step 3 and to (27c) and (27d) respectively.
5. Repeat steps 4 and 5:  $b = 1, \dots, B$  times to obtain  $B$  bootstrap estimates of the Li statistics that will mimic the distribution of the original estimate of the Li statistics under the null hypothesis.

Although the original algorithm of the Simar and Zelenyuk adapted Li-test is based on efficiency scores, studies like Kerstens and Van de Woestyne (2014) have applied the test on productivity change scores and have provided consistent results.

#### 4.8 Definition of Input and output variables

Three inputs are used: labour and business services, equity capital and debt capital. The cost of **labour and business services** is calculated as the ratio of operating expense and total assets. The price of **equity capital** is given by total equity divided by total asset. The price of **debt capital** is calculated by dividing total liability by total assets. Also, two output are used: risk pooling and intermediation.

**Table 4. 2: Description of inputs, outputs, input prices**

<b>Variables</b>	<b>Definition</b>	<b>Description</b>
<b>Outputs</b>		
$Y_1$	Risk Pooling	Net Premium
$Y_2$	Intermediation	Investment Income
<b>Input Levels</b>		
$X_1$	Labour & Business services	Operating Expenditure
$X_2$	Equity Capital	Total Equity
$X_3$	Debt Capital	Total Liability
<b>Input Costs</b>		
$W_1$	Price of $X_1$	Operating Expense/Total Asset
$W_2$	Price of $X_2$	Total Equity/Total Asset
$W_3$	Price of $X_3$	Total Liability/Total Asset

#### 4.9 Second-stage regression analysis

The survey of Simar and Wilson (2007) indicate that they have problems with prior studies that applied Tobit regression models because of the DEA scores are truncated or censored (which are limited 1 as the highest score). Therefore, the studies were opposed as a result of their inability to explain the underlying DEA that allow uncontrollable covariates to influence a firm's efficiency. Simar and Wilson (2007) contended that the DEA efficiency scores from the first-stage scores are serially related with (depend on) the inputs and outputs of the stage-one computation in a complicated and obscure way (in a statistical sense). Equally, they argued that the dependency issue of the first-stage mean that the stochastic error term of the Tobit regression is equally associated with the environmental variables, which makes Tobit estimation biased. The outcome is that deductions from the second-stage parameters will be inconsistent and misleading. The use of maximum likelihood in the stage-two analysis implies

that this correlation vanishes asymptotically (resulting in reliable estimates. However, the rate at which the error term converges is slow and may still yield invalid deductions). Accordingly, Hirschberg and Lloyd (2002) and Xue and Harker (1999) proposed a single bootstrap algorithm to deal with the serial correlation issue, which was applied by Casu, B. and Molyneux (2003). Be that as it may, Simar and Wilson (2007) indicated their bootstrap method as being "naive" bootstrap approach for resampling without considering the unique distribution of the scores estimated through nonparametric DEA methodology. Simar and Wilson (2007) along these lines of argument proposed the use of a bias-corrected efficiency estimate during the stage-two regression so as to augment the robustness of the regression coefficients and enhance the level of their estimated confidence interval. Simar and Wilson (2007) proposed an intelligent, well-defined model where truncated regression give consistent estimates instead of OLS or Tobit estimated. Their two-fold bootstrap algorithm to deal with left-truncated bias-corrected DEA scores was given to permit valid deductions and enhance statistical consistency of the second-stage estimates.

Denoting  $\rho_k$  as the true unknown efficiency score of insurance firm  $k$  and  $Z_k$  as the (row) vector of observation-specific contextual variables for DMU  $k$  (that is expected to be related to the DMU's efficiency score), the second-stage truncated regression model can be specified as:

$$\rho_k = \alpha + Z_k \delta + \varepsilon_k, \quad k = 1, \dots, K \quad (28)$$

where  $\alpha$  is the intercept term,  $\delta$  is the vector of parameters to be estimated,  $\varepsilon_k$  is the statistical or idiosyncratic noise. Equation (28) can be understood as the first-order approximation of the unknown true relationship. Following the Algorithm of Simar and Wilson (2007) double bootstrap procedure, it is assumed that the distribution of  $\varepsilon_k$  is restricted by the condition  $\varepsilon_k \geq 1 - \alpha - Z_k \delta$ , given that both sides of (28) are bounded by one and the distribution of  $\varepsilon_k$  is assumed to be truncated normal with zero mean (before truncation), unknown variance, and

(left) truncation point determined by the very restriction on  $\varepsilon_k$ . Besides, the true but unobserved (unknown) efficiency score,  $\rho_k$ , in (28) is replaced by its bootstrapped-based, bias-corrected DEA estimate  $\tilde{\rho}_k$  obtained in the first stage. Since Simar and Wilson (2007) argued against Tobit estimation, the study follows the suggestion and used a truncated econometric regression model formally given by:

$$\tilde{\rho}_k \approx \alpha + Z_k \delta + \varepsilon_k, \quad k = 1, \dots, K \quad (29)$$

where

$$\varepsilon_k \sim N(0, \sigma_\varepsilon^2), \text{ such that } \varepsilon_k \geq 1 - \alpha - Z_k \delta, \quad k = 1, \dots, K \quad (30)$$

where given the obtained data set, the estimated factor  $\hat{\delta}$  is obtained through the maximization of the correspondent likelihood function, relative to  $(\delta, \sigma_\varepsilon^2)$ . The equation (30) above is the algorithm on parametric bootstrap regression of Simar and Wilson (2007) which is able to obtain the bootstrap confidence intervals for the scores of parameters  $\delta$  and  $\sigma_\varepsilon^2$  by the incorporation of information on both the parametric structure and the distributional assumptions. Their argument was based on a Monte Carlo simulation such that the procedure for the second-stage truncated regression ensures feasible, unbiased and consistent estimation. This study used a second-stage bootstrapped truncated regression to solve the problems encountered by using the Tobit and OLS regression as proposed by Simar and Wilson (2007). The bootstrapped truncated regression have been applied by previous studies that investigated the impact of exogenous variables of efficiency (Hsu & Petchsakulwong, 2010b; Wang, W.-K., Lu, & Lin, 2012). In this study, corporate governance variable is considered to be exogenous variables which have effects on productivity indicator. The empirical model is given by:

$$CE_{it} = \alpha + \beta_1 BSIZE_{it} + \beta_2 BIND_{it} + \beta_3 BDp_{it} + \beta_4 BDexp_{it} + \beta_5 BDg_{it} + \beta_6 SIZE_{it} + \beta_7 CAP_{it} + \beta_8 INF_{it} + \beta_9 GDP_{jt} + \beta_{10} LEV_{jt} + \varepsilon_{it} \quad (31)$$

$$CM_{it} = \alpha + \beta_1 BSIZE_{it} + \beta_2 BIND_{it} + \beta_3 BDp_{it} + \beta_4 BDexp_{it} + \beta_5 BDg_{it} + \beta_6 SIZE_{it} + \beta_7 CAP_{it} + \beta_8 INF_{it} + \beta_9 GDP_{jt} + \beta_{10} LEV_{jt} + \varepsilon_{it} \quad (32)$$

Where  $CE_{it}$  and  $CM_{it}$  are the cost efficiency and the cost Malmquist of firm  $i$  at time  $t$  respectively and the second stage variables are described in the table below:

**Table 4. 3: Description of second stage variables**

Variable	Definition	Measurement
<b>Corporate governance variables</b>		
BFSIZE	Board size	Number of board of directors
BIND	Board independence	Proportion of Non- Executive Directors on the Board
BDg	Board gender diversity	Proportion of female directors on the Board
BDexp	Board Expertise	Proportion of directors with finance-related qualification
BDp	Board Presence	Frequency of directors in board meetings
<b>Control variables</b>		
SIZE	Firm size	Natural log of total assets
CAP	Capitalization	Proportion of shareholders' equity to total assets
INF	Inflation	Change in the consumer prices index
GDP	Gross Domestic Product	GDP growth rate between two consecutive years

#### 4.10 Data analysis instruments

The analysis was performed using the non-parametric linear programming software MaxDEA Pro version 6.5 (Cheng & Qian, 2014), and FEAR (Wilson, 2008), Benchmarking (Bogetoft &

Otto, 2011) and truncReg (Croissant, Zeileis, & Croissant, 2009), in R. The MaxDEA software is preferred to the others because it is easier to enter data and run commands for the computation of the efficiency scores. It can also contain unlimited number of DMUs coupled with its capacity to handle both radial and non-radial (SBM) productivity scores, all the returns to scale and all the orientations (Cheng & Qian, 2014). The Frontier Efficiency Analysis in R (FEAR) is a library package in the R software which, according to Wilson (2008), can be used in making statistical inference and hypothesis testing with DEA and other nonparametric efficiency estimators. The other DEA software are inflexible, thereby limiting the user to models and procedures the authors have explicitly made available. FEAR, however, provides a high level of flexibility and allow the user to compute DEA estimates of efficiency and productivity, while assuming either variable, non-increasing, or constant returns to scale (Wilson, 2008). The truncReg package in R was used to undertake the second stage analysis.

## CHAPTER FIVE

### DATA ANALYSIS AND INTERPRETATION OF RESULTS

#### 5.0 Introduction

A discussion of the insurance inputs and outputs used for efficiency and productivity estimation is presented in this chapter. Also, variables used as the proxy for corporate governance is discussed. Consequently, the results are presented in a logical manner with the intent of achieving the objectives of this research. In addition, a discussion of the results is provided as a means of approving or disproving the various hypotheses and arguments raised.

#### 5.1 Summary Statistics of Input and Output Variables

The primary reason for this study is to investigate the effect of corporate governance on the cost efficiency and cost productivity of Ghanaian insurers. To achieve this purpose, data for this study was sourced from successive annual reports of insurers that have been compiled by the National Insurance Commission of Ghana for the years 2005 to 2014. For the purpose of this study, three inputs and two outputs were selected in accordance with literature. Whereas the inputs are Operating Capital (X1), Equity Capital (X2), Debt Capital (X3), the outputs comprised Net Premiums (Y1) and Investment Income (Y2). Price information for the three inputs has also been collected. A balanced data of insurers was used as it forms a prerequisite for using Cost Malmquist Index. Table 5.1 provides pooled descriptive statistics of the inputs and outputs adopted for the study for the period 2005 to 2014.

**Table 5.1: Pooled Summary Statistics of Input and Output Variables (2005 – 2014)**

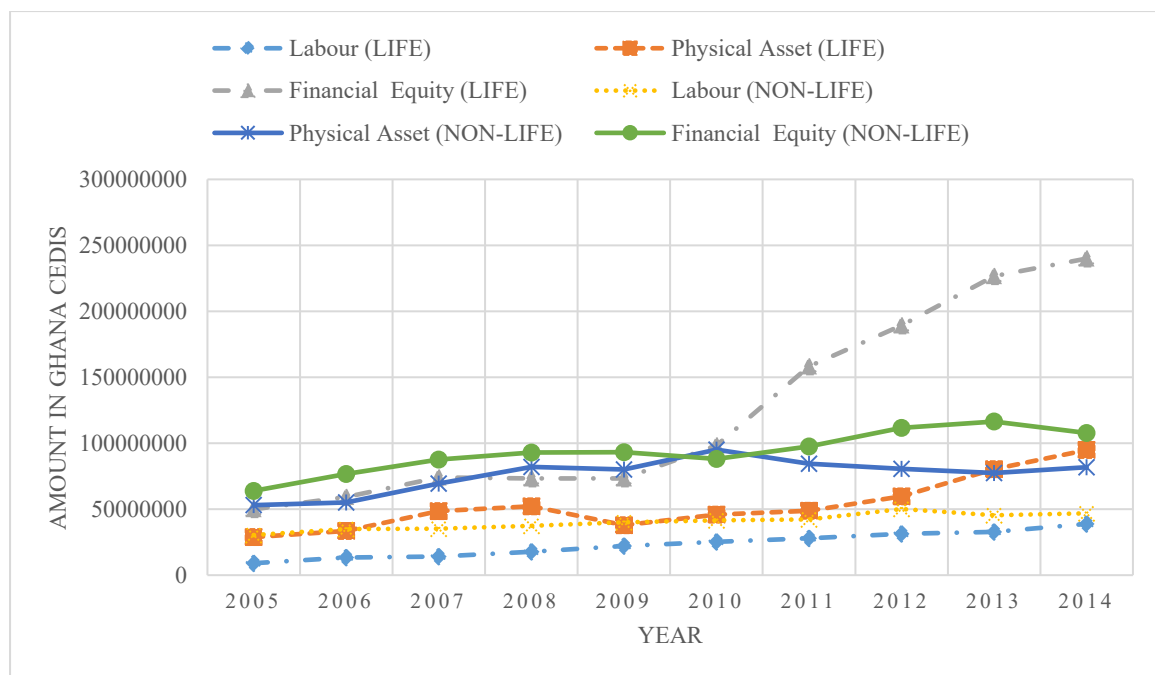
	Type	N	Descriptive statistics				Independent t-test		
			Mean	Std. Dev.	Min	Max	T	Sig.	
<b>Net Premium (Y1)</b>	Life	140	6,087,741	8,685,883	18,575	40,892,491	1.54	0.125	
	Non-Life	150	4,743,191	5,813,685	27,109	27,648,895			
<b>Investment Income (Y2)</b>	Life	140	1,234,563	2,234,489	16,551	17,771,451	2.21	0.028	*
	Non-Life	150	737,233	1,501,702	127	11,970,455			
<b>Operating Expense (X1)</b>	Life	140	1,663,472	1,605,758	9,322	7,535,698	-3.38	0.001	**
	Non-Life	150	2,698,932	3,359,936	19,138	16,331,285			
<b>Equity Capital (X2)</b>	Life	140	3,793,210	5,128,776	54,908	21,425,889	-1.63	0.104	
	Non-Life	150	5,059,176	7,740,958	25,814	42,265,197			
<b>Debt Capital (X3)</b>	Life	140	8,874,285	13,000,000	32,721	71,267,969	2.18	0.03	*
	Non-Life	150	6,239,584	6,673,301	63,040	34,310,238			

The significant level is given by; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

From Table 5.1, 140 observations for life insurers and 150 observations for non-life insurers making a total of 290 observations were used. The means, standard deviation (Std. Dev.), minimum (Min) and maximum (Max) values for the input and output variables are presented in Table 5.1. Higher premium levels are generated by life insurers ( $M = 6087741.3$ ,  $std. = 8685882.8$ ) as compared with non-life insurers ( $M = 4743190.9$ ,  $std. = 5813685.2$ ). However, the difference in their levels of net premiums is not statistically different between the two groups ( $t = 1.538$ ,  $p = 0.125$ ). Again, a significantly larger level of investment income is generated by the life insurers ( $M = 1234562.7$ ,  $std. = 2234489.1$ ) relative to the non-life insurers ( $M = 737233.11$ ,  $std. = 1501701.5$ ) since the t-value is 2.209 and p-value (0.028) is less than 0.05 alpha level. The operating expenditure of non-life insurers are higher on average ( $M = 2698931.9$ ,  $std. = 3359936$ ) compared to that of

life insurers ( $M= 1663471.7$ ,  $std. =1605757.9$ ). Moreover, non-life insurers hold higher equity capital ( $M = 5059176$ ,  $std. = 7740958.2$ ) as compared with life insurance companies who hold 3,793,210 ( $std. =5128775.5$ ) on average. The average of debt capital for insurers in Ghana suggests that the industry leverages on debt capital, with the average debt capital being higher than that of the equity capital. Considering the average per unit costs, on average non-life insurers seem to incur higher costs for every cedi of operating expenditure ( $M = 0.28$ ,  $std. = 0.16$ ) and equity capital ( $M = 0.42$ ,  $std. = 0.22$ ) than Life insurers. On the contrary, Life insurers seem to incur more cost per cedi of debt capital ( $M = 0.7$ ,  $std. = 0.27$ ) than Non-life insurers. Prices are not the same since the cost of various insurers is expected to be different. Further observations of the pooled statistics in Table 5.1 suggest that there is a huge disparity between the minimum and maximum scores signifying high levels of variations in the inputs and output levels of individual insurers. This is clearly observed from the level of deviation from the average inputs and outputs.

**Figure 5. 1: Trend Analysis of Input Variables**



Source: 2005-2014 annual reports of NIC

## 5.2 Test of Isotonicity

The test of isotonicity is a pre-estimation process that non-parametric DEA uses to assess the correlation between input and output variables selected for efficiency estimation (Dyson et al., 2001). The null hypothesis for the test is that there is a positive correlation between inputs and outputs; whilst the alternative hypothesis argues otherwise. The Isotonicity property assumes an increase in inputs should not be commensurate with a reducing outputs level, but rather increasing outputs.

**Table 5. 2 Correlation matrix of inputs and outputs**

	<b>Net Premium</b>	<b>Investment Income</b>	<b>Operating Expense</b>	<b>Equity Capital</b>	<b>Debt Capital</b>
Net Premium	1.00				
Investment Income	0.64***	1.00			
Operating Expense	0.8***	0.3***	1.00		
Equity Capital	0.76***	0.36***	0.87***	1.00	
Debt Capital	0.92***	0.67***	0.69***	0.64***	1.00

*The level of significant is given by: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$*

Table 5.2 shows a positive significant relationship between the inputs and outputs used.

Therefore, the isotonicity property in adopting DEA for efficiency analysis is satisfied.

The inputs and outputs can, therefore, be used for efficiency and productivity estimation.

### 5.3 Dynamic Cost Productivity in the Insurance Industry

To achieve objective 1 and 2 of this study, the necessary empirical results is provided. First, the dynamic cost productivity and drivers (decomposition) of productivity change are examined. Subsequently, the variations between the productivity of life and non-life insurers are examined. Consequently, results of the cost Malmquist indices of the various insurers are presented in Table 5.3. For each insurer, cost productivity scores between all adjacent time periods from 2005 to 2014 are reported together with an overall geometric average for the study period. For interpretation of the Malmquist indices and its components, a score greater than 1 (>1) signifies growth in cost productivity while scores less than 1 (<1) signifies a decline in cost productivity. However, a cost productivity score of 1 implies that the insurer has not changed in the level of productivity over the comparative periods.

**Table 5. 3: Cost Malmquist Productivity Indices**

NO.	DMU	INSURERS	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	Average
1	X1	CDH Life	1.19	0.18	1.82	0.93	0.72	1.44	1.38	0.9	0.95	<b>0.97</b>
2	X2	Donewell Life	0.94	1.06	1.05	0.97	1	0.9	0.94	1.05	1.13	<b>1</b>
3	X3	Enterprise Life	1.38	0.8	1	1.25	0.89	0.96	1	1.01	0.84	<b>1</b>
4	X4	Ghana Life	0.92	0.61	0.96	1.29	0.9	1.12	1.11	1.14	1	<b>0.99</b>
5	X5	Ghana Union Assur. Life	0.86	1.02	5.21	7.06	1.04	0.74	1.31	1.32	0.84	<b>1.49</b>
6	X6	Glico Life	0.4	0.57	0.7	1.63	0.75	1.3	0.76	1.21	0.92	<b>0.84</b>
7	X7	Met Life	1.61	0.62	1.47	1.51	0.74	1.05	1.09	1.14	1.09	<b>1.1</b>
8	X8	Phoenix Life	1.06	0.53	1.24	1.09	0.95	1.1	1.13	0.95	0.79	<b>0.96</b>
9	X9	Provident Life	0.66	0.45	3.35	1.1	1.23	0.35	1.69	1.2	0.75	<b>0.96</b>
10	X10	Quality Life	0.89	0.9	0.99	1.58	0.65	3.32	0.98	0.39	0.98	<b>1</b>
11	X11	SIC Life	0.93	1.12	1.2	2.62	1.26	0.29	0.99	0.96	0.98	<b>1.01</b>
12	X12	StarLife Assurance	1.2	1.14	0.94	1.27	0.98	0.99	0.98	0.85	0.97	<b>1.03</b>
13	X13	Unique Life	0.99	0.5	1.23	1.81	1.11	0.81	0.92	0.82	0.97	<b>0.96</b>

14	X14	Vanguard life	1.66	0.65	1.44	1	1.28	0.78	0.83	1.12	2	<b>1.13</b>
15	X15	CDH Insurance	0.83	1.56	0.87	10.0 1	1.11	0.91	1.03	0.89	1.02	<b>1.3</b>
16	X16	Donewell insurance	0.98	0.69	1.67	0.89	1.21	0.98	0.84	0.98	0.97	<b>0.99</b>
17	X17	EIC	0.7	0.81	0.83	1.25	0.87	10.6 5	0.21	1	1.25	<b>1.04</b>
18	X18	Ghana Union Assurance	1.12	1.12	0.94	0.78	1.16	0.82	1.31	0.7	1.43	<b>1.02</b>
19	X19	Glico General Insurance	0.74	1.26	0.79	1.28	0.58	1.6	0.93	1.14	0.79	<b>0.96</b>
20	X20	Global Alliance Insurance	0.98	0.55	0.74	3.08	0.82	0.91	1.56	0.96	0.72	<b>1</b>
21	X21	Metropolitan Insurance	1.28	0.95	1.24	1.4	0.86	0.91	1.12	1.04	0.8	<b>1.05</b>
22	X22	Phoenix Insurance	1.11	0.71	1.02	1.16	1.11	1.01	1.13	0.88	0.78	<b>0.98</b>
23	X23	Provident Insurance	0.94	0.82	1.52	1.06	1.15	1.13	0.65	0.83	1.22	<b>1.01</b>
24	X24	Quality insurance	0.89	1.14	0.98	0.76	0.95	1.43	1.02	1.04	1.07	<b>1.02</b>
25	X25	Regency Alliance Ins.	2.33	4.66	0.35	2.59	0.95	1.26	0.92	1.16	0.75	<b>1.28</b>
26	X26	SIC Insurance	1.03	1.01	0.89	0.96	0.97	1.2	1.27	0.83	0.97	<b>1</b>
27	X27	Star Assurance	1.07	0.9	1.18	1.15	1.08	1.04	1.05	1.06	0.82	<b>1.03</b>
28	X28	Unique Insurance	0.8	0.98	1.11	0.98	0.82	1.13	0.76	1.19	1.11	<b>0.98</b>
29	X29	Vanguard Assurance	0.88	1.51	0.73	0.94	1.18	0.99	0.78	1.08	1.12	<b>1</b>
<b>Geometric Mean</b>			<b>1</b>	<b>0.85</b>	<b>1.14</b>	<b>1.43</b>	<b>0.96</b>	<b>1.08</b>	<b>0.97</b>	<b>0.97</b>	<b>0.98</b>	<b>1.03</b>

The nature of cost performance of Ghanaian insurers over time is provided by estimating the cost productivity levels of each individual insurer as well as the industry. For example, CDH life insurance experienced about 19% cost productivity growth between 2005 and 2006, having a score of 1.19. CDH witnessed a massive productivity growth between 2007 and 2008 after a severe decline of 82% between 2006 and 2007. However, CDH life insurance

productivity growth seems to have declined significantly from the 2007-2008 period. From Table 5.3, the entire industry was characterized by volatility in productivity over the period. To obtain the sources of the decline and growth over the period of study, the drivers of cost productivity growth is presented in Table 5.4 and subsequently deliberated in detail. Considering the average productivity scores over the period, insurers like CDH Life, Ghana Life, Glico Life, Phoenix Life, Provident Life, Unique Life and all other firms with an average less than 1 experienced retrogression in their cost productivity over the study period. Ghana Union Assurance Life and Regency Alliance Insurance and other firms with an average score of more than 1 experienced a progression in their cost productivity growth level. However, insurers like Donewell Life, Enterprise Life, Quality Life, Global Alliance Insurance, SIC insurance and Vanguard insurance, with an average score of 1 over the study period experienced stagnation in their cost productivity.

The insurance industry experienced an overall average of 3% cost productivity growth over the 10-year period from 2005 to 2014. Whereas a stagnation was recorded for 2005/2006, the highest productivity growth was recorded in the 2008/2009 period. Subsequent years after 2009, however, did not come with similar levels of cost productivity growth. For example, from 2010 the cost productivity levels in the insurance industry have been lower than 1, which can be attributed to external economic factors and continuous power outages that forced firms to secure alternative means of energy for their operation. Industry specific regulatory changes can be factor accountable for the volatilities as its acceptance by firms and the general public can improve productivity whilst its rejection can lead to stagnation or decline in productivity.

#### **5.4 Decomposition of cost Malmquist indices**

To determine the drivers (sources) of productivity change in the Ghanaian insurance industry, the cost Malmquist (CM) indices of the various insurers are decomposed. The decomposition

of the CM reveals the Overall Efficiency Change (OEC) and Cost Technical Change (CTC) components. The OEC compares the minimum realistic cost to the observed cost whilst the CTC compares the minimum production cost of acquiring certain output in one period relative to the cost in another period. The OEC estimates firm-specific changes in cost efficiency related to input-mix and hence managerial activities, and CTC catches the combined effect of changes in input prices and technology (both of which are out of a firm's managerial control) (Baležentis, 2012).

Subsequently, Technical Efficiency Change (TEC) and the Allocative Efficiency Change (AEC) are obtained from decomposing the OEC. The TEC component is the ability of management to mix input quantities to generate outputs irrespective of the cost. The AEC considers the management's ability to produce at the least cost by evaluating management's ability to choose the combination of inputs that can produce a specified quantity of output at the minimum production cost (Coelli, Tim J. & Rao, 2005).

Lastly, Technical Change (TC) and Price Effect (PE) are also obtained from decomposing the CTC. PE basically measures how changes in general price levels affect firm productivity over time. Thus, it measures variations in the inputs required to produce certain output attributed to changes in relative input prices. The TC component is the traditional technology change component that looks at how the firm is keeping up or taking advantage of the changes in the industry's production technology irrespective of price information. Also, the traditional Malmquist scores represented by IM shows productivity change irrespective of price information. Just like the CM values, scores greater than 1 signify progress, scores lower than 1 show regress while value equal to 1 shows stagnation in the particular component.

**Table 5. 4: Drivers of Cost Productivity in the industry (Pooled data of all years)**

NO	DMU	CM	OEC	CTC	IM	TEC	TC	AEC	PE
1	X1	1.3004	1.0997	1.1825	1.3947	1.0845	1.286	1.014	0.9195
2	X2	0.9652	0.9885	0.9764	0.8536	0.9341	0.9138	1.0582	1.0685
3	X3	0.9936	1.0432	0.9525	0.9744	1.0318	0.9443	1.011	1.0087
4	X4	1.0017	0.9532	1.0509	1.1528	1.0837	1.0638	0.8796	0.9879
5	X5	1.0416	1.0166	1.0245	1.0028	1.0513	0.9538	0.967	1.0741
6	X6	1.0009	1.0222	0.9791	0.9638	1	0.9638	1.0222	1.016
7	X7	0.9871	0.9505	1.0385	0.9573	0.9526	1.0049	0.9978	1.0334
8	X8	1.0155	0.9565	1.0617	1.0161	1.0021	1.014	0.9546	1.047
9	X9	1.4895	1.3429	1.1092	1.1722	1.0163	1.1533	1.3213	0.9617
10	X10	0.9639	0.9976	0.9662	0.8959	0.9143	0.9799	1.0911	0.9861
11	X11	0.8421	0.9314	0.9041	0.999	0.9851	1.0141	0.9455	0.8916
12	X12	0.9992	1.2522	0.798	0.9678	1.1047	0.8761	1.1336	0.9108
13	X13	1.0974	1.0756	1.0202	1.06	1.0465	1.0128	1.0278	1.0073
14	X14	1.0488	1.1056	0.9486	1.006	0.9852	1.0211	1.1221	0.9291
15	X15	0.9777	1.0617	0.9209	0.9743	0.9711	1.0033	1.0932	0.9179
16	X16	0.9579	0.9578	1.0002	0.9753	0.9689	1.0065	0.9885	0.9937
17	X17	1.0062	1.0332	0.9738	0.8232	0.9145	0.9002	1.1299	1.0818
18	X18	0.9619	0.8938	1.0762	0.8307	0.9003	0.9227	0.9928	1.1663
19	X19	1.0175	1.034	0.9841	1.0188	1.0163	1.0024	1.0173	0.9817
20	X20	1.0012	0.9348	1.071	0.9214	0.9498	0.9701	0.9842	1.104
21	X21	1.2832	1.3402	0.9575	1.2655	1.1074	1.1428	1.2103	0.8378
22	X22	1.005	1.0261	0.9794	0.9685	1.0539	0.9189	0.9736	1.0658
23	X23	1.0132	0.9784	1.0355	1.0122	1.0248	0.9877	0.9547	1.0484
24	X24	1.033	1.0967	0.9419	1.0033	1.0547	0.9512	1.0398	0.9902
25	X25	1.0291	1.0366	0.9928	1.0121	1.0314	0.9813	1.005	1.0117
26	X26	0.9753	0.9752	1.0001	0.9843	0.9866	0.9977	0.9885	1.0024
27	X27	0.9637	0.8588	1.1221	1.2027	1	1.2027	0.8588	0.933
28	X28	1.0008	1.0703	0.935	1.0347	1.0403	0.9946	1.0288	0.9402
29	X29	1.1257	1.1055	1.0183	1.0685	1.0618	1.0063	1.0412	1.0119
<b>Geo. Mean</b>		<b>1.0316</b>	<b>1.0336</b>	<b>0.998</b>	<b>1.0109</b>	<b>1.0079</b>	<b>1.0029</b>	<b>1.0255</b>	<b>0.9951</b>

The analysis is done from the industry point of view considering that there are 29 sampled insurers and analysing them individually will be inexhaustible. From Table 5.4, as already indicated, the industry over the study period observed 3% cost productivity growth and this is mainly driven by the progress in overall efficiency (OEC). There was a 3.36% OEC growth that neutralized the 0.2% and 0.5% decline in CTC and PE respectively. This suggests that even though management of the various insurance firms are not adequately taking advantages of the technological spill overs, improvement in the allocation and mix of inputs to generate outputs is quite considerable. Similar findings were obtained by Vencappa, Fenn, and Diacon (2013) when they examined the total productivity change in the insurance industry in Europe. Moreover, they observed that productivity is volatile and mainly driven by managerial acumen. The growth in OEC is observed to be due to both growths in TEC (0.79%) and AEC (2.55%). On the other hand, the decline in CTC is mainly due to decline in PE (0.49%) rather than TC. Another important observation that can be made at the industry level is that the recorded growth in cost productivity (CM) is greater than the recorded growth in the IM and this growth in CM over IM means in general, the industry profited from better managerial proficiency and took advantage of technological changes in the industry though the growth margin was insignificant.

### **5.5 Performance difference between Life and Non-Life insurers**

To achieve the third objective of this study, the productivity score between life and non-life insurers is examined to ascertain if there exist any differences in their performance. Undertaking this assessment is critical not just for academic purpose but also to aid policy makers to roll out vital policies that can help any wing of the insurance industry that may be lagging in growth.

**Table 5. 5: Summary Statistics of the Performance of Life and Non-life Insurers**

	Life		Nonlife	
	Mean	Std.	Mean	Std.
<b>CM</b>	1.031	0.148	1.044	0.103
<b>OEC</b>	1.002	0.119	1.074	0.102
<b>CTC</b>	1.028	0.057	0.975	0.081
<b>IM</b>	1.013	0.111	1.022	0.138
<b>TEC</b>	0.997	0.052	1.021	0.060
<b>TC</b>	1.015	0.080	0.999	0.101
<b>AEC</b>	1.006	0.107	1.052	0.075
<b>PE</b>	1.017	0.069	0.980	0.070

From figure 5.5, indicate a slight upper hand of non-life insurers over life insurers in terms of cost productivities. This finding supports the findings of Kasman and Turgutlu (2011) which saw a higher performance of non-life insurers over life insurers. On the contrary, Barros et al. (2010) studying the Greek insurance industry report that life insurers experienced higher average productivity growth than the non-life insurers. In the Ghanaian context, Ansah-Adu et al. (2012b) observed life insurers to outperform non-life insurers.

Despite the difference between Life and non-life insurers, the mean scores, which are marginally different, suggest that the management approach for the two groups are similar. However, the statistical significance of the difference is not clear. Consequently, the scores of the groups are subjected to nonparametric tests of differences. Since DEA estimates are nonparametric, the Mann Whitney's U test is used to compare the ranks of the groups. Preferably, the Simar-Zelenyuk adapted Lit test which is a nonparametric test of the

distribution of scores is also employed on the results of the two groups to ascertain the statistical significance. Table 5.6 shows the results from the test statistics.

**Table 5. 6: Test statistics of difference between Life insurers and Non-Life insurers**

	L-test		U-test	
	L	Sig.	U	Sig.
CM	-0.014	0.506	81	0.295
OEC	1.506	0.066	53.00*	0.023
CTC	2.532**	0.006	49.00*	0.015
IM	0.039	0.484	104	0.965
TEC	-0.395	0.653	74.5	0.183
TC	-0.528	0.701	82	0.315
AEC	-0.056	0.522	66.5	0.093
PE	-0.017	0.507	72	0.15

From Table 5.6, the two statistical tests employed show no significant differences in the drivers of cost productivity Malmquist for both groups of insurers at a significant level of 5%.

However, both tests confirm a significant difference in the scores of the CTC between life and non-life insurers (significant at 5%). A contrasting result is obtained for the tests under OEC.

Whilst the SZAL test reported no significant difference, the Mann Whitney test observes significant difference at 5%. The remaining drivers of cost productivity showed no significant differences. The results imply that in as much as Life insurers are better able to take advantage of technological changes; Non-life insurers are more managerially competent in the allocation of production resources.

## 5.5 Summary Statistics

The descriptive statistics on the key variables used are presented in Table 5.7 below;

**Table 5. 7: Summary Statistics of Key Variables**

<b>Variables</b>	<b>Observation</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Efficiency</b>					
CE	290	0.58	0.28	0.05	1
CPM	286	1.21	1.22	0.08	12.86
<b>CG Variables</b>					
Bsize	249	8.85	1.99	4	15
BIND	252	0.71	0.13	0.25	0.9
BgDIV	255	0.13	0.11	0	0.5
BEXP	112	0.57	0.22	0	1
BDp	208	0.12	0.1	0	0.43
<b>Control Variables</b>					
SIZE	289	19.92	1.3	16.08	22.61
Inflation	260	13.52	4.08	8.73	32.91
GDP	260	7.06	2.98	3.92	14.05
LEV	284	0.8	0.58	-0.65	9.58
Cap	290	0.41	0.42	-4.71	1

**Table 5. 8: Correlation matrix**

	CE	CM	BSIZE	BIND	BgDIV	BEXP	BDp	SIZE	INF	GDP	LEV	Cap
<b>CE</b>	1											
<b>CM</b>	0	1										
<b>BSIZE</b>	-0.02	0.14*	1									
<b>BIND</b>	-0.13*	-0.02	0	1								
<b>BgDIV</b>	0.01	-0.09	0.05	-0.15*	1							
<b>BEXP</b>	0.02	-0.13	0.17	0.03	-0.12	1						
<b>BDp</b>	-0.09	0.11	0.17*	0.04	-0.02	0.23*	1					
<b>SIZE</b>	-0.06	-0.07	0.12	-0.15*	0.48***	0.11	-0.02	1				
<b>INF</b>	-0.34***	-0.09	0.01	-0.04	-0.04	0.01	-0.12	-0.12	1			
<b>GDP</b>	0.33***	0.09	-0.07	-0.06	0	0	0	-0.02	-0.58***	1		
<b>LEV</b>	-0.05	0.01	-0.07	-0.07	0.06	-0.17	0.01	0.03	-0.08	0.16*	1	
<b>Cap</b>	0.06	-0.03	-0.01	0	0.04	0.22*	0	0	0.07	-0.1	-0.02	1

*Correlation results are significant at ‘\*\*\*’0.001 and ‘\*’ 0.05*

The average board size of the Ghanaian insurance industry is 8.85, with an average of 71 percent of the board being non-executives. An average of 13 percent of the board of directors of insurance companies constitutes females. Moreover, the proportion of the board with finance qualification averages 0.57. The correlation matrix in Table 5.8 shows a low relationship between the independent variables, hence the issue of multicollinearity in the regressors are avoided. The analysis on board independence (BIND) and inflation (INF) shows a significant negative correlation with cost efficiency with correlation coefficients of -0.13 and -0.34 respectively. Only GDP have a significant positive association with cost efficiency (0.33). Regarding the relationship with cost productivity change (Malmquist), only board size shows a

significant correlation. The proceeding Tables (5.9) shows the results from the bootstrapped truncated regression.

**Table 5. 9: Regression Results: Cost efficiency and cost productivity Malmquist and CG**

Variables	Cost Efficiency		Cost Productivity Malmquist	
	Estimates	Std. error	Estimates	Std. error
(Intercept)	0.938	0.666.	1.430	2.128
Bsize	0.084	0.019***	0.097	0.056.
BIND	-0.159	0.228	-1.052	0.935
BDg	-0.411	0.371	-0.424	0.959
BDexp	-0.366	0.133**	-0.747	0.383.
BDp	-0.206	0.302	0.126	0.701
SIZE	-0.024	0.032	0.004	0.080
INF	-0.029	0.009***	-0.008	0.039
GDP	0.036	0.011***	0.018	0.049
LEV	0.026	0.102	-0.154	0.200
Cap	-0.080	0.111	-0.088	0.291
Sigma	0.188	0.014***	0.491	0.130***

*The level of significance is denoted by 0.1 ‘.’, 0.05 ‘\*’, 0.01 ‘\*\*\*’, and 0.001 ‘\*\*\*\*’*

### 5.5.1 Board size

A significantly positive impact is obtained between board size and cost efficiency. Although a significantly positive relationship was found between board size and cost productivity. The implication is that the more people insurance companies put on their board, the more cost efficient and cost productive they are expected to be. The coefficient implies that ceteris paribus, an additional member to the board of directors of insurers lead to 8.4 percent and 9.7 percent increase in cost efficiency and cost productivity respectively. The findings support the

proposition of the resource dependency theory (which suggest that larger board size enables a firm to derive the essential resources for effective and efficient operations). A likely reason for the findings is that larger board size draws more resources, expertise and may also provide better decisions geared at improving cost. The findings are consistent with Huang, L. Y. et al. (2011), who found a positive impact of board size on cost efficiency of US insurers. Golden and Zajac (2001) also found a positive relationship between board size and firm performance. Some studies in the banking industry also found a significant positive impact of board size on financial performance include (Tanna et al. (2011), Kiel and Nicholson (2003)). However, the results contrast the proposition of agency (which indicate that smaller board size increase efficiency whiles a larger board size does not). Previous studies such as reported board size to impact significantly but negatively on cost efficiency of Taiwan insurers. The findings of Wang, J. L., Jeng, and Peng (2007b) on board size could be because as the number of board directors increases the cost incurred from conflicts and interactions increases correspondingly. Some studies also found no significant impact of board size of corporate financial performance (Yeh et al., 2010).

### **5.5.2 Board Independence**

Although agency theory proposes a relatively higher proportion of non-executive directors, the study found a negative insignificant impact on cost efficiency and cost productivity. This also contradicts the proposition by resource dependency theory (which suggest that higher proportion of non-executive directors who are well connected to vital resources of the firm can improve financial performance. The result of the study is consistent with several empirical studies that assessed the impact of board independence on corporate financial performance (CFP) (Haan & Vlahu, 2016). Minton, Taillard, and Williamson (2010) concluded that although a negative impact is obtained between board independence and financial performance,

the relationship is not always significant. Some studies in the banking sector also found a negative insignificant relationship (Agoraki, M.-E. K., Delis, & Staikouras, 2010; Bokpin, Godfred A., 2013), though other such as Tanna et al. (2011) reported a positive impact. Hardwick, Adams, and Zou (2011) studying the UK insurance industry from 1994-2004 found a significant positive relationship with efficiency. However, they posit that the relationship is dependent on whether there is CEO duality and also whether there exist an audit committee. The coefficient further indicates that all else being equal, an increase in the proportion of non-executive directors results in a 15 percent and 100% percent decrease in cost efficiency and cost productivity respectively. The result implies that oversized non-executive directors would essentially result to ungainly, indecisive board due to high variability which eventually affects corporate financial performance.

### **5.5.3 Board Expertise**

Board expertise is found to have a negative significant impact on cost efficiency and cost productivity. Thus, the coefficients indicate that all things being equal, when the proportion of the board with finance related expertise increase, cost efficiency and cost productivity will have to decrease by 36 percent and 74 percent respectively. The relationship is in contrast to the propositions of resource dependency theory (which suggest that when directors have skills related to the industry it improve the performance of the firm). The implication of the findings in this study suggests that when more of the directors have skills or qualification that are finance related, they assume higher operational risk which in effect increases the cost of operation and eventually cost efficiency and productivity (Minton et al., 2010). The empirical results of board expertise are mixed.

#### **5.5.4 Board Diversity and Board Presence**

The study reports a negative but insignificant impact of board diversity on both cost efficiency and cost productivity. Thus, all else being equal an increase in the proportion of board diversity (female directors on the board) reduce the efficiency of insurers in Ghana. The conclusion is contrary to the proposition from resource dependency theory that a diversified board makes available essential resources for corporate performance. Although female presence is promoted in several countries, the empirical result indicates otherwise in practice. Nielsen and Huse (2010) proposed that the impact of female on the board is dependent on the nature of the industry and task to be performed.

The study shows a negative relationship between board presence and cost efficiency but a positive impact on cost productivity, although all the relations are insignificant. Although board presence is supported by the agency theory and backed by legislation (Companies Act), the nexus between board diversity and cost efficiency says otherwise. However, the impact of board presence on cost productivity is consistent with agency theory, because as directors are present for board meeting it improves their monitoring role.

## **CHAPTER SIX**

### **SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

#### **6.0 Introduction**

Three subsections are found in this chapter. The first subsection provides a summary of the study with the research objectives being the focus. The second subsection presents the conclusion of the study based on which recommendations for policy, practice and future research are provided.

#### **6.1 Summary of findings**

The purpose of this study was to assess the impact of corporate governance on both static cost efficiency and dynamic cost productivity of insurers in Ghana from 2005 to 2014. The static measure of cost efficiency has dominated prior studies with little or no study using dynamic efficiency measure. The dynamic measure of efficiency (cost productivity Malmquist) is preferable for analysis because unlike the static measure which considers efficiency within a certain year, it assesses cost efficiency over a period of time in order to investigate trends within the industry in Ghana. After estimation of the cost Malmquist productivity indices of the various insurers, it was decomposed into overall efficiency change (OEC) and cost technical change (CTC). OEC was further decomposed into technical efficiency change (TEC) and allocative efficiency change (AEC), whilst CTC was decomposed into technical change (TC) and price effect (PE) respectively. Subsequently, the difference in productivity between life and non-life insurers in Ghana was also investigated. This was done using the Simar-Zelenyuk adapted Li test, a nonparametric test which relies on kernel density to test the distribution of the scores.

A balanced panel data of 14 life and 15 non-life insurers was obtained from the National insurance commission and also the annual reports of the respective insurers. The total number of observation after data cleaning was 290 over a study period of 10 years. In order to estimate the cost efficiency and cost Malmquist productivity indices of selected insurers, the variables used included total assets, equity capital, debt capital, investment income, net premiums and operating expenses. The variables used in the estimation process is however consistent with the literature.

In addition, the impact of corporate governance variables was assessed on the cost efficiency and cost Malmquist productivity scores of the insurers. Some of the major findings identified in this study include:

First, the Ghanaian insurance industry over the 10-year study period (2005-2014) have experienced on average 3 percent cost productivity growth. The higher of the growth was experienced between 2008 and 2009 where the cost productivity growth was 43 percent.

Second, the cost productivity growth observed was mainly from progress in overall efficiency (OEC) of about 3.36%, which reduced the effect of a 0.2% decline in CTC. The growth in OEC was as a result of growth in both TEC and AEC (0.79% and 2.55% respectively). Also, the reduction in CTC is as a result of a decline in PE (0.49%).

Third, the study also showed that at the firm level, insurance companies like Regency alliance, Ghana Union Assurance Life, CDH insurance experienced growth in cost productivity, whilst insurers like Glico Life, Unique insurance and provident Life experienced a slight regression over the study period of 10 years. However, firms like Donewell Life, Enterprise Life and SIC insurance experienced a stagnated growth in cost productivity.

Fourth, considering the differences in cost productivity of life and non-life insurers in Ghana, the study observed that non-life insurers, in general, were slightly ahead of life insurers. Also

with a slightly better average in terms of overall efficiency change (OEC) than life insurers suggest that they are relatively better in managerial competence than life insurers. However, the study shows that life insurers also take advantage of technological changes better than non-life insurers, by showing a higher CTC over the period.

Lastly, on the issue of corporate governance and the efficiency measures (cost efficiency and cost productivity), it is observed that board size have a positive significant impact on both cost efficiency and cost productivity. Board expertise is also found to have a significant but negative impact on both cost efficiency and cost productivity. Furthermore, board independence is found to have a significant negative impact on cost productivity of insurers in Ghana but not significant impact on their cost efficiency.

## **6.2 Conclusions of the study**

The results of this study have provided some essential issues that are worth considering in the Ghanaian insurance industry in order to improve its contribution to the economy. Some conclusions from the study include:

The overall cost productivity growth of the insurance industry in Ghana between 2005 and 2014 was observed to be 3 % on average. The growth is seen to have increased more between 2008 and 2009 with 43% cost productivity growth. This peak period was a period of structural changes in the industry where composite insurers were required to separate their operation between life and non-life. This structural development was the consequence of the amendment of the insurance regulation (Act) in 2006, which was operationalized in 2008. The change appeared to have had an immediate impact on the cost of operating insurance business in Ghana and also the cost productivity of insurers.

The growth of 3% in cost productivity which is observed to be mainly driven by overall efficiency change (OEC) rather than cost technical change (CTC) which was on a decline. The findings imply that managerial expertise is what mainly improves the cost productivity growth of the insurance industry rather than the changes in the production technology or general prices of goods and services. Thus, an improvement in managerial acumen has a relatively higher impact on cost productivity compared to the impact resulting from changes in the rules and regulations in the Ghanaian insurance industry.

Comparing the performance of life and non-life insurers, the study found that even though non-life appears to have a slightly higher performance (CM and OEC) than life insurers, there is no significant differences in their performance. Whilst non-life insurers were better in terms of their managerial competencies, life insurers were also better in taking advantage of the changes in the production technology (how the industry is operated). Thus, life insurers are positioned to take advantage of general price levels as well as changes in industry regulations. Likewise, non-life insurers are dominant when it comes to combining its inputs and outputs for their work.

On issues of corporate governance and cost efficiency and productivity, a larger board size is found to improve both cost efficiency and cost productivity. Moreover, a relatively small proportion of directors with finance expertise improve the cost efficiency and productivity of the insurance industry. However, a larger proportion of board independence reduces both the cost efficiency and cost productivity, though the impact on cost efficiency was not significant. The result of board independence suggests that in as much as a higher proportion of independent directors is recommended by the Agency theory, a higher proportion could negatively affect the cost efficiency of insurers and subsequently cost productivity.

On the impact of macroeconomic factors, the study shows that inflation negatively impacts the cost efficiency of the insurance industry as the general prices level of operational inputs

increases. In addition, growth in GDP is seen to impact positively on the cost efficiency of firms as the whole economy improves.

### **6.3 Recommendations of study**

Ensuing from the summary and conclusions of the study, implications for policy, recommendations for policy and practice, as well as future research are outlined succinctly.

#### **6.3.1 Recommendation for Policy and Practice;**

First, the 3% average cost productivity growth of the insurance industry in Ghana has been encouraging, thus policy makers and insurers should adopt better practices to improve their cost productivity, as in the case of the insurance law 2006 which was observed to have impacted significantly on the industry performance.

Second, because non-life insurers showed better managerial competencies rather than taking advantage of technological changes, operational managers of non-life insurers, as well as policy makers, should as a result, adopt policies that will position them to benefit from technological spillovers. On the side of life insurers, the study showed that they take advantage of technological spillovers than managers using their expertise to improve the firm. As such, operational managers of life insurers and policymakers should target policies that will improve managerial competencies.

Third, though life insurers are required to focus on improving managerial competencies and non-life positioning their efforts to take advantage of technological changes, operational managers should endeavour to maintain and improve their overall efficiency (OEC) or competencies whilst also taking advantage of technological spillovers. When this is done the industry will observe a significant boost in overall productivity.

Fourth, on issues of corporate governance, because board size is observed to improve cost productivity, the number of directors can be pegged at the average size of about nine (9). However, depending on the size of the insurance firm and its operational needs, the number can be less. In addition, the proportion of directors with expertise in finance should be proportional to those without. As directors with finance background assume a higher risk and eventually increase operational cost. However, non-finance directors are considered to assume reasonable risk. Also, the proportion of independent directors should at least not be more than the average of 71 percent, since the increase in board independence is observed to reduce the cost efficiency of insurance companies in Ghana.

Finally, based on the limitation of the study which is mainly due to data unavailability, to improve and ease future research in the insurance industry of Ghana, the National insurance commission (NIC) should mandate that insurers operating within the Ghanaian jurisdiction regularly and properly publish their annual reports. This disclosure requirement which is a requisite in corporate governance can also reduce agency issues and to some extent build the confidence of some stakeholder in the economy.

### **6.3.2 Recommendation for future research**

Like other efficiency techniques, cost Malmquist productivity index is also a radial efficiency estimation technique. Future studies should consider a non-radial approach to estimate productivity.

Further studies can also consider looking critically and extensively at the drivers of cost Malmquist productivity in order to enhance policy development and implementation.

Also, the study can be extended to other sub-Saharan countries, and a cross country studies can be conducted aimed at improving performance in various countries where insurers may be lacking.

If data can be readily assessed, then future study can consider other governance variables in order to fully obtain the impact of CG on the performance of insurance firms in Ghana.

## REFERENCES

- Abdullah, H., & Valentine, B. (2009). Fundamental and ethics theories of corporate governance. *Middle Eastern Finance and Economics*, 4(4), 88-96.
- Aboagye, A. Q., & Otioku, J. (2010). Are Ghanaian MFIs' performance associated with corporate governance? *Corporate Governance: The international journal of business in society*, 10(3), 307-320.
- Ackah, C., & Owusu, A. (2012). *Assessing the knowledge of and attitude towards insurance in Ghana*. Paper presented at the Research Conference on Micro-Insurance.
- Adams, R. B., & Ferreira, D. (2004). Gender diversity in the boardroom. *European Corporate Governance Institute, Finance Working paper*, 57, 30.
- Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, 94(2), 291-309. doi: <http://dx.doi.org/10.1016/j.jfineco.2008.10.007>
- Afanador, S., Bernal, A., & Oneto, A. (2017). N° 26: Effectiveness and Structure of Boards of Directors at State-owned Enterprises in Latin America and the Caribbean: CAF.
- Agoraki, M.-E. K., Delis, M. D., & Staikouras, P. K. (2010). The effect of board size and composition on bank efficiency. *International Journal of Banking, Accounting and Finance*, 2(4), 357-386.
- Agoraki, M. E., Delis, M. D., & Staikouras, P. (2009). The effect of board size and composition on banking efficiency. *International Journal of Banking, Accounting and Finance*, II(4), 357-386.
- Alchian, A. A., & Demsetz, H. (1972). Production, information costs, and economic organization. *The American Economic Review*, 777-795.
- 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.
- Alhassan, A. L., & Biekpe, N. (2015). Efficiency, Productivity and Returns to Scale Economies in the Non-Life Insurance Market in South Africa. [Original Article]. *Geneva Pap R I-Iss P*. doi: 10.1057/gpp.2014.37

- Alhassan, A. L., & Biekpe, N. (2016). Insurance market development and economic growth: Exploring causality in 8 selected African countries. *International Journal of Social Economics*, 43(3), 321-339.
- Alhassan, A. L., & Fiador, V. (2014). Insurance-growth nexus in Ghana: An autoregressive distributed lag bounds cointegration approach. *Review of Development Finance*, 4(2), 83-96.
- Amoako-Adu, B., & Menyah, K. (1987). INFLATION, DEVALUATION AND THE INSURANCE INDUSTRY IN A LESS DEVELOPED ECONOMY: THE CASE OF GHANA/INFLATION, DÉVALUATION ET LE SECTEUR DES ASSURANCES DANS UN PAYS EN VOIE DE DÉVELOPPEMENT: L'EXPÉRIENCE DU GHANA. *Savings and Development*, 275-289.
- Andres, P. d., & Vallelado, E. (2008). Corporate governance in banking: The role of the board of directors. *Journal of Banking & Finance*, 32(12), 2570-2580. doi: <http://dx.doi.org/10.1016/j.jbankfin.2008.05.008>
- Andringa, R. C., & Engstrom, T. W. (1997). Nonprofit Board Answer Book: Practical Guidelines for Board Members and Chief Executives. *Washington, DC: National Center for Nonprofit Boards*.
- Ansah-Adu, K., Andoh, C., & Abor, J. (2012a). Evaluating the cost efficiency of insurance companies in Ghana. *Journal Risk Finance*, 13(1), 61-76.
- Ansah-Adu, K., Andoh, C., & Abor, J. (2012b). Evaluating the cost efficiency of insurance companies in Ghana. *Journal Risk Finance*, 13(1), 61–76.
- Arena, M. (2006). Does insurance market activity promote economic growth? Country study for industrial and developing countries. *Country Study for Industrial and Developing Countries (December 1, 2006)*. *World Bank Policy Research Working Paper(4098)*.
- Arena, M. (2008). Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. *Journal of Risk and Insurance*, 75(4), 921-946.
- Arun, T. G., & Turner, J. D. (2002). Financial Sector Reforms in Developing Countries: The Indian Experience. *World Economy*, 25(3), 429-445. doi: 10.1111/1467-9701.00440
- Avkiran, N. K. (1999). The evidence on efficiency gains: The role of mergers and the benefits to the public. *Journal of Banking and Finance*, 23, 991-1013.

- Badunenko, O. (2010). Downsizing in the German chemical manufacturing industry during the 1990s. Why is small beautiful? *Small Business Economics*, 34(4), 413-431.
- Baležentis, T. (2012). The Cost Malmquist Index decomposition for analysis of the total factor productivity change in Lithuanian family farms. *Žemės Ūkio Mokslai*, 19(3), 168–179.
- Baltagi, B. H., & Griffin, J. M. (1983). Gasoline demand in the OECD: An application of pooling and testing procedures. *European Economic Review*, 22(2), 117-137. doi: [http://dx.doi.org/10.1016/0014-2921\(83\)90077-6](http://dx.doi.org/10.1016/0014-2921(83)90077-6)
- Banker, R. D. (1993). Maximum Likelihood, Consistency and Data Envelopment Analysis: A Statistical Foundation. *Management Science*, 39(10), 1265-1273. doi: 10.1287/mnsc.39.10.1265
- Banker, R. D. (1996). Hypothesis tests using data envelopment analysis. [10.1007/BF00157038]. *Journal of Productivity Analysis*, 7(2), 139-159.
- Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management science*, 30(9), 1078-1092.
- Barnhart, S. W., & Rosenstein, S. (1998). Board composition, managerial ownership, and firm performance: An empirical analysis. *Financial Review*, November.
- Barros, C. P., Nektarios, M., & Assaf, A. (2010). Efficiency in the Greek insurance industry. *European Journal of Operational Research*, 205(2), 431-436. doi: <http://dx.doi.org/10.1016/j.ejor.2010.01.011>
- Basturk, F. H. (2012). Characteristics and competition structure of Turkish insurance industry. *Procedia - Social and Behavioral Sciences*, 62(0), 1084-1088. doi: <http://dx.doi.org/10.1016/j.sbspro.2012.09.185>
- Battese, G. E., Rao, D. S. P., & O'Donnell, C. J. (2004). A Metafrontier Production Function for Estimation of Technical Efficiencies and Technology Gaps for Firms Operating Under Different Technologies. *Journal of Productivity Analysis*, 21(1), 91-103. doi: 10.1023/b:prod.0000012454.06094.29
- Bear, S., Rahman, N., & Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. *Journal of Business Ethics*, 97(2), 207-221.

- Belkhir, M. (2009). Board structure, ownership structure and firm performance: evidence from banking. *Applied Financial Economics*, 19(19), 1581-1593.
- Bernardi, R. A., Bean, D. F., & Weippert, K. M. (2002). Signaling gender diversity through annual report pictures: A research note on image management. *Accounting, Auditing & Accountability Journal*, 15(4), 609-616.
- Bhagat, S., & Bolton, B. (2008). Corporate governance and firm performance. *Journal of Corporate Finance*, 14(3), 257-273.
- Bilimoria, D., & Wheeler, J. V. (2000). Women corporate directors: Current research and future directions. *Women in management: Current research issues*, 2(10), 138-163.
- Black, B., & Kim, W. (2012). The effect of board structure on firm value: A multiple identification strategies approach using Korean data. *Journal of Financial Economics*, 104(1), 203-226. doi: <http://dx.doi.org/10.1016/j.jfineco.2011.08.001>
- Black, B. S., Love, I., & Rachinsky, A. (2006). Corporate governance indices and firms' market values: Time series evidence from Russia. *Emerging Markets Review*, 7(4), 361-379.
- Bogetoft, P., & Otto, L. (2011). *Benchmarking with DEA, SFA, and R* (Vol. 157). New York Dordrecht Heidelberg London: Springer.
- Bokpin, G. A. (2013). Ownership structure, corporate governance and bank efficiency: an empirical analysis of panel data from the banking industry in Ghana. *Corporate Governance*, 13(3), 274-287.
- Bokpin, G. A. (2013). Ownership structure, corporate governance and bank efficiency: an empirical analysis of panel data from the banking industry in Ghana. *Corporate Governance: The international journal of business in society*, 13(3), 274-287.
- Bonin, J. P., Hasan, I., & Wachtel, P. (2005). Bank performance, efficiency and ownership in transition countries. *Journal of Banking & Finance*, 29(1), 31-53. doi: <http://dx.doi.org/10.1016/j.jbankfin.2004.06.015>
- Breyer, F., Bundorf, M. K., & Pauly, M. V. (2011). Chapter Eleven - Health Care Spending Risk, Health Insurance, and Payment to Health Plans. In T. G. M. Mark V. Pauly & P. B. Pedro (Eds.), *Handbook of Health Economics* (Vol. Volume 2, pp. 691-762): Elsevier.

- Bryman, A. (2012). *Social research methods*. London: Oxford University Press.
- Byrne, M. M. (2001). Evaluating the findings of qualitative research. *AORN Journal*, 73(3), 703-706.
- Callen, J. L., Klein, A., & Tinkelman, D. (2003). Board composition, committees, and organizational efficiency: The case of non-profits. *Non-Profit and Voluntary Sector Quarterly*, 32(4), 493-520. doi: <http://dx.doi.org/10.1177/0899764003257462>
- Carter, D. A., D'Souza, F., Simkins, B. J., & Simpson, W. G. (2010). The gender and ethnic diversity of US Boards and Board committees and firm financial performance. *Corporate Governance: An International Review*, 18(5), 396-414. doi: <http://dx.doi.org/10.1111/j.1467-8683.2010.00809.x>
- Casu, B., Girardone, C., & Molyneux, P. (2004). Productivity change in European banking: A comparison of parametric and non-parametric approaches. *Journal of Banking & Finance*, 28(10), 2521-2540. doi: <http://dx.doi.org/10.1016/j.jbankfin.2003.10.014>
- Casu, B., & Molyneux, P. (2003). A comparative study of efficiency in European banking. *Applied Economics*, 35, 1865-1876. doi: 10.1080/0003684032000158109
- Caves, D. W., Christensen, L. R., & Diewert, W. E. (1982). The economic theory of index numbers and the measurement of input, output and productivity. [10.2307/1913388]. *Econometrica*, 50, 1393-1414.
- Chang, T.-P., Hu, J.-L., Chou, R. Y., & Sun, L. (2012). The sources of bank productivity growth in China during 2002–2009: A disaggregation view. *Journal of Banking & Finance*, 36(7), 1997-2006. doi: <http://dx.doi.org/10.1016/j.jbankfin.2012.03.003>
- Charnes, A., & Cooper, W. W. (1962). Programming with linear fractional functionals. *Naval Research Logistics (NRL)*, 9(3-4), 181-186.
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European journal of operational research*, 2(6), 429-444.
- Chen, C.-M. (2009). A network-DEA model with new efficiency measures to incorporate the dynamic effect in production networks. *European Journal of Operational Research*, 194(3), 687-699. doi: <http://dx.doi.org/10.1016/j.ejor.2007.12.025>

- Chen, C. (2009). Bank Efficiency in Sub-Saharan African Middle-Income Countries. *IMF Working Paper*, 09/14.
- Chen, K.-H., & Yang, H.-Y. (2011). A cross-country comparison of productivity growth using the generalised metafrontier Malmquist productivity index: with application to banking industries in Taiwan and China. *Journal of Productivity Analysis*, 35(3), 197-212. doi: 10.1007/s11123-010-0198-7
- Chen, P. F., Lee, C. C., & Lee, C. F. (2012). How does the development of the life insurance market affect economic growth? Some international evidence. *Journal of International Development*, 24(7), 865-893.
- Cheng, G., & Qian, Z. (2014). MaxDEA linear programming (Version Version 6.5). Beijing, China: Peking University.
- Cheung, Y. L., Connelly, J. T., Jiang, P., & Limpaphayom, P. (2011). Does corporate governance predict future performance? Evidence from Hong Kong. *Financial Management*, 40(1), 159-197.
- Chiang, M.-H., & Lin, J.-H. (2007). The relationship between corporate governance and firm productivity: Evidence from Taiwan's manufacturing firms. *Corporate Governance: An International Review*, 15(5), 768-779. doi: <http://dx.doi.org/10.1111/j.1467-8683.2007.00605.x>
- Choe, H., & Lee, B.-S. (2003). Korean bank governance reform after the Asian financial crisis. *Pacific-Basin Finance Journal*, 11(4), 483-508.
- Chowdhury, H., Zelenyuk, V., Laporte, A., & Wodchis, W. P. (2014). Analysis of productivity, efficiency and technological changes in hospital services in Ontario: How does case-mix matter? *International Journal of Production Economics*, 150(0), 74-82. doi: <http://dx.doi.org/10.1016/j.ijpe.2013.12.003>
- Clifford, P., & Evans, R. (1997). Non-Executive Directors: A Question of Independence. *Corporate Governance: An International Review*, 5(4), 224-231.

- Coelli, T. J., & Rao, D. S. P. (2005). Total factor productivity growth in agriculture: a Malmquist index analysis of 93 countries, 1980–2000. *Agricultural Economics*, 32, 115-134. doi: 10.1111/j.0169-5150.2004.00018.x
- Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*: Springer Science & Business Media.
- Coles, J. L., Daniel, N. D., & Naveen, L. (2008). Boards: Does one size fit all? *Journal of Financial Economics*, 87(2), 329-356. doi: <http://dx.doi.org/10.1016/j.jfineco.2006.08.008>
- Consiglio, A., Cocco, F., & Zenios, S. A. (2008). Chapter 15 - The prometeia model for managing insurance policies with guarantees. In S. A. Z. T. Ziemba (Ed.), *Handbook of Asset and Liability Management* (pp. 663-705). San Diego: North-Holland.
- Conyon, M. J., & Peck, S. I. (1998). Board size and corporate performance: evidence from European countries. *The European Journal of Finance*, 4(3), 291-304. doi: <http://dx.doi.org/10.1080/135184798337317>
- Cook, W. D., & Seiford, L. M. (2009). Data envelopment analysis (DEA) – Thirty years on. *European Journal of Operational Research*, 192(1), 1-17. doi: <http://dx.doi.org/10.1016/j.ejor.2008.01.032>
- Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). *Handbook on data envelopment analysis* (Vol. 164): Springer Science & Business Media.
- Croissant, Y., Zeileis, A., & Croissant, M. Y. (2009). Package ‘truncreg’.
- Cummins, J. D., & Dionne, G. (2008). Dynamics of insurance markets: Structure, conduct, and performance in the 21st century. *Journal of Banking & Finance*, 32(1), 1-3. doi: <http://dx.doi.org/10.1016/j.jbankfin.2007.09.001>
- Cummins, J. D., Rubio-Misas, M., & Zi, H. (2004). The effect of organizational structure on efficiency: Evidence from the Spanish insurance industry. *Journal of Banking & Finance*, 28(12), 3113-3150. doi: <http://dx.doi.org/10.1016/j.jbankfin.2004.05.004>
- Cummins, J. D., & Weiss, M. (2000). Analyzing Firm Performance in the Insurance Industry Using Frontier Efficiency and Productivity Methods. In G. Dionne (Ed.), *Handbook of Insurance* (Vol. 22, pp. 767-829): Springer Netherlands.

- Cummins, J. D., & Weiss, M. (2013). Analyzing Firm Performance in the Insurance Industry Using Frontier Efficiency and Productivity Methods. In G. Dionne (Ed.), *Handbook of Insurance* (pp. 795-861): Springer New York.
- Cummins, J. D., & Weiss, M. A. (2002). Analyzing Firm Performance in the Insurance Industry, using Frontier Efficiency Methods.
- Cummins, J. D., & Weiss, M. A. (2013). Analyzing firm performance in the insurance industry using frontier efficiency and productivity methods *Handbook of insurance* (pp. 795-861). New York.: Springer
- 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. doi: <http://dx.doi.org/10.1016/j.jbankfin.2010.02.025>
- Cummins, J. D., & Zi, H. (1998). Comparison of frontier efficient methods: An application to the US life insurance industry. [10.1023/A:1026402922367]. *Journal of Productivity Analysis*, 10, 131-152.
- Ćurak, M., Lončar, S., & Poposki, K. (2009). Insurance sector development and economic growth in transition countries. *International Research Journal of Finance and Economics*, 34(3), 29-41.
- Dahya, J., Dimitrov, O., & McConnell, J. J. (2008). Dominant shareholders, corporate boards, and corporate value: A cross-country analysis. *Journal of Financial Economics*, 87(1), 73-100. doi: <http://dx.doi.org/10.1016/j.jfineco.2006.10.005>
- Daraio, C., & Simar, L. (2007). Conditional nonparametric frontier models for convex and nonconvex technologies: a unifying approach. [10.1007/s11123-007-0049-3]. *Journal of Productivity Analysis*, 28(1), 13-32.
- David Cummins, J., & Sommer, D. W. (1996). Capital and risk in property-liability insurance markets. *Journal of Banking & Finance*, 20(6), 1069-1092. doi: [http://dx.doi.org/10.1016/0378-4266\(95\)00044-5](http://dx.doi.org/10.1016/0378-4266(95)00044-5)
- Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of management review*, 22(1), 20-47.

- de Borger, B., Kerstens, K., & Staat, M. (2008). Transit costs and cost efficiency: Bootstrapping non-parametric frontiers. *Research in Transportation Economics*, 23(1), 53-64. doi: <http://dx.doi.org/10.1016/j.retrec.2008.10.008>
- Demyanyk, Y., & Hasan, I. (2010). Financial crises and bank failures: A review of prediction methods. *Omega*, 38(5), 315-324. doi: DOI: 10.1016/j.omega.2009.09.007
- Dionne, G., & Harrington, S. E. (2014). Chapter 5 - Insurance and Insurance Markets. In M. Mark & V. Kip (Eds.), *Handbook of the Economics of Risk and Uncertainty* (Vol. Volume 1, pp. 203-261): North-Holland.
- Donaldson, L., & Davis, J. H. (1991). Stewardship theory or agency theory: CEO governance and shareholder returns. *Australian Journal of management*, 16(1), 49-64.
- Eisenberg, T., Sundgren, S., & Wells, M. T. (1998). Larger board size and decreasing firm value in small firms<sup>1</sup>. *Journal of Financial Economics*, 48(1), 35-54. doi: [http://dx.doi.org/10.1016/S0304-405X\(98\)00003-8](http://dx.doi.org/10.1016/S0304-405X(98)00003-8)
- Elsayed, K. (2007). Does CEO duality really affect corporate performance? *Corporate Governance: An International Review*, 15(6), 1203-1214.
- Epure, M., Kerstens, K., & Prior, D. (2011). Bank productivity and performance groups: A decomposition approach based upon the Luenberger productivity indicator. *European Journal of Operational Research*, 211(3), 630-641. doi: 10.1016/j.ejor.2011.01.041
- Falavigna, G., Ippoliti, R., Manello, A., & Ramello, G. B. (2015). Judicial productivity, delay and efficiency: A Directional Distance Function (DDF) approach. *European Journal of Operational Research*, 240(2), 592-601. doi: <http://dx.doi.org/10.1016/j.ejor.2014.07.014>
- Fama, E. F., & Jensen, M. C. (1983). Agency problems and residual claims. *Journal of law and economics*, 327-349.
- Färe, R., Grifell-Tatjé, E., Grosskopf, S., & Lovell, C. (1995). Biased Technical Change and the Malmquist Productivity Index. *document de travail*, Department of Economics of Southern Illinois University, IL, USA.
- Färe, R., Grifell-Tatjé, E., Grosskopf, S., & Lovell, C. A. K. (1997). Biased Technical Change and the Malmquist Productivity Index. *The Scandinavian Journal of Economics*, 99(1), 119-127.

- Färe, R., & Grosskopf, S. (1994). Measuring Productivity - a Comment. *International Journal of Operations & Production Management*, 14(9), 83-88.
- Färe, R., Grosskopf, S., & Lovell, C. A. K. (1985). *The measurement of efficiency of production*. Boston Hingham, MA, U.S.A.: Kluwer Academic Publishers.
- Farrell, M. J. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society. Series A (General)*, 120(3), 253-290.
- 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. [10.1016/j.jbankfin.2007.09.005]. *Journal of Banking and Finance*, 32, 86-100.
- Florackis, C., Kanas, A., & Kostakis, A. (2015). Dividend policy, managerial ownership and debt financing: A non-parametric perspective. *European Journal of Operational Research*, 241(3), 783-795. doi: <http://dx.doi.org/10.1016/j.ejor.2014.08.031>
- Florackis, C., & Ozkan, A. (2004). Agency costs and corporate governance mechanisms: Evidence for UK firms, viewed 16 May 2008.
- Fondas, N., & Salsalos, S. (2000). A different voice in the boardroom: How the presence of women directors affects board influence over management. *Global focus*, 12(2), 13-22.
- Forbes, D. P., & Milliken, F. J. (1999). Cognition and corporate governance: Understanding boards of directors as strategic decision-making groups. *Academy of management review*, 24(3), 489-505.
- Fried, H. O., Lovell, C. K., & Schmidt, S. S. (2008). *The measurement of productive efficiency and productivity growth*: Oxford University Press.
- Gardner, L. A., & Grace, M. F. (1993). X-efficiency in the US life insurance industry. *Journal of Banking and Finance*, 17.
- Garvey, G. T., & Swan, P. L. (1994). The economics of corporate governance: Beyond the Marshallian firm. *Journal of Corporate Finance*, 1(2), 139-174.
- Gilham, A. (2004). Corporate Governance in Ghana. *Corporate Governance Challenges in a Disparate World*.

- Girardone, C., Nankervis, J. C., & Velentza, E.-F. (2009). Efficiency, ownership and financial structure in European banking: A cross-country comparison. [DOI: 10.1108/03074350910931753]. *Managerial Finance*, 35(3), 227-245.
- Golden, B. R., & Zajac, E. J. (2001). When will boards influence strategy? Inclination $\times$  power= strategic change. *Strategic Management Journal*, 22(12), 1087-1111.
- Gómez-Calvet, R., Conesa, D., Gómez-Calvet, A. R., & Tortosa-Ausina, E. (2014). Energy efficiency in the European Union: What can be learned from the joint application of directional distance functions and slacks-based measures? *Applied Energy*, 132(0), 137-154. doi: <http://dx.doi.org/10.1016/j.apenergy.2014.06.053>
- Grifell-Tatjé, E., & Lovell, C. A. K. (1997). The sources of productivity change in Spanish banking. *European Journal of Operational Research*, 98(2), 364-380. doi: [http://dx.doi.org/10.1016/S0377-2217\(96\)00353-0](http://dx.doi.org/10.1016/S0377-2217(96)00353-0)
- GSS. (2015). Ghana Statistical Services, Economic, 2017
- Guest, P. M. (2009). The impact of board size on firm performance: evidence from the UK. *The European Journal of Finance*, 15(4), 385-404. doi: <http://dx.doi.org/10.1080/13518470802466121>
- Haan, J., & Vlahu, R. (2016). Corporate governance of banks: A survey. *Journal of Economic Surveys*, 30(2), 228-277.
- Hadad, M. D., Hall, M. J. B., Kenjegalieva, K. A., Santoso, W., & Simper, R. (2012). A new approach to dealing with negative numbers in efficiency analysis: An application to the Indonesian banking sector. *Expert Systems with Applications*, 39(9), 8212-8219. doi: <http://dx.doi.org/10.1016/j.eswa.2012.01.145>
- Haiss, P., & Sümegi, K. (2008). The relationship between insurance and economic growth in Europe: a theoretical and empirical analysis. *Empirica*, 35(4), 405-431.
- Han, L., Li, D., Moshirian, F., & Tian, Y. (2010). Insurance development and economic growth. *The Geneva Papers on Risk and Insurance Issues and Practice*, 35(2), 183-199.

- Hardwick, P., Adams, M., & Zou, H. (2011). Board characteristics and profit efficiency in the United Kingdom life insurance industry. *Journal of Business Finance & Accounting*, 38(7-8), 987-1015.
- Hermalin, B. E., & Weisbach, M. S. (1991). The effects of board composition and direct incentives on firm performance. *Financial Management*, 20(4), 101-112.
- Himmelberg, C. P., Hubbard, R. G., & Palia, D. (1999). Understanding the determinants of managerial ownership and the link between ownership and performance. *Journal of Financial Economics*, 53(3), 353-384.
- Hirschberg, J. G., & Lloyd, P. J. (2002). Does the technology of foreign-invested enterprises spill over to other enterprises in China? An application of post-DEA bootstrap regression analysis. In P. J. Lloyd & X. G. Zang (Eds.), *Modelling the Chinese Economy*. London: Edward Elgar Press.
- Hsu, W.-Y., & Petchsakulwong, P. (2010a). The impact of corporate governance on the efficiency performance of the Thai non-life insurance industry. *The Geneva Papers on Risk and Insurance Issues and Practice*, 35(1), S28-S49.
- Hsu, W.-Y., & Petchsakulwong, P. (2010b). The impact of corporate governance on the efficiency performance of the Thai non-life insurance industry. *Geneva Pap R I-Iss P*, 35(S1), S28-S49. doi: <http://dx.doi.org/10.1057/gpp.2010.30>
- Huang, L.-Y., Lai, G. C., McNamara, M., & Wang, J. (2011). Corporate governance and efficiency: Evidence from U.S. property–liability insurance industry. *Journal of Risk and Insurance*, 78(3), 519-550. doi: <http://dx.doi.org/10.1111/j.1539-6975.2011.01410.x>
- Huang, L. Y., Lai, G. C., McNamara, M., & Wang, J. (2011). Corporate governance and efficiency: evidence from US property–liability insurance industry. *Journal of risk and insurance*, 78(3), 519-550.
- Huther, J. (1997). An empirical test of the effect of board size on firm efficiency. *Economics Letters*, 54(3), 259-264.
- III. (2016). Insurance Fact Book 2016.

- Ippoliti, R., Melcarne, A., & Ramello, G. B. (2015). The Impact of Judicial Efficiency on Entrepreneurial Action: A European Perspective. *Economic Notes by Banca Monte dei Paschi di Siena SpA*, *vol. 44(1)*, 57–74.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3(4)*, 305-360. doi: [http://dx.doi.org/10.1016/0304-405X\(76\)90026-X](http://dx.doi.org/10.1016/0304-405X(76)90026-X)
- Joh, S. W. (2003). Corporate governance and firm profitability: evidence from Korea before the economic crisis. *Journal of Financial Economics*, *68(2)*, 287-322. doi: [http://dx.doi.org/10.1016/S0304-405X\(03\)00068-0](http://dx.doi.org/10.1016/S0304-405X(03)00068-0)
- John, K., & Senbet, L. W. (1998). Corporate governance and board effectiveness. *Journal of Banking & Finance*, *22(4)*, 371-403.
- Juo, J.-C., Lin, Y.-H., & Chen, T.-C. (2015). Productivity change of Taiwanese farmers' credit unions: a nonparametric metafrontier Malmquist–Luenberger productivity indicator. *Central European Journal of Operations Research*, *23(1)*, 125-147. doi: 10.1007/s10100-013-0307-6
- Kaldor, N. (1957). A model of economic growth. *The economic journal*, *67(268)*, 591-624.
- Kang, H., Cheng, M., & Gray, S. J. (2007). Corporate governance and board composition: diversity and independence of Australian boards. *Corporate Governance: An International Review*, *15(2)*, 194-207. doi: <http://dx.doi.org/10.1111/j.1467-8683.2007.00554.x>
- Kao, C., & Hwang, S.-N. (2008). Efficiency decomposition in two-stage data envelopment analysis: An application to non-life insurance companies in Taiwan. *European Journal of Operational Research*, *185(1)*, 418-429. doi: <http://dx.doi.org/10.1016/j.ejor.2006.11.041>
- Karpoff, J. M., Malatesta, P. H., & Walkling, R. A. (1996). Corporate governance and shareholder initiatives: Empirical evidence. *Journal of Financial Economics*, *42(3)*, 365-395. doi: [http://dx.doi.org/10.1016/0304-405X\(96\)00883-5](http://dx.doi.org/10.1016/0304-405X(96)00883-5)

- Kasman, A., & Turgutlu, E. (2011). Performance of European insurance firms in the single insurance market. *International Review of Applied Economics*, 25(3), 363-378. doi: 10.1080/02692171.2010.483470
- Kenjegalieva, K., Simper, R., Weyman-Jones, T., & Zelenyuk, V. (2009). Comparative analysis of banking production frameworks in eastern european financial markets. *European Journal of Operational Research*, 198(1), 326-340. doi: DOI: 10.1016/j.ejor.2008.09.002
- Kerstens, K., & Van de Woestyne, I. (2014). Comparing Malmquist and Hicks–Moorsteen productivity indices: Exploring the impact of unbalanced vs. balanced panel data. *European Journal of Operational Research*, 233(3), 749-758. doi: <http://dx.doi.org/10.1016/j.ejor.2013.09.009>
- Kesner, I. F., & Dalton, D. R. (1986). Boards of directors and the checks and (im) balances of corporate governance. *Business Horizons*, 29(5), 17-23.
- Kiel, G. C., & Nicholson, G. J. (2003). Board composition and corporate performance: How the Australian experience informs contrasting theories of corporate governance. *Corporate Governance: An International Review*, 11(3), 189-205. doi: <http://dx.doi.org/10.1111/1467-8683.00318>
- Klein, A. (1998). Firm performance and board committee structure. *Journal of Law and Economics*, 41(1), 275-304. doi: <http://dx.doi.org/10.1086/467391>
- Krause, R., Semadeni, M., & Cannella, A. A. (2014). CEO duality: A review and research agenda. *Journal of Management*, 40(1), 256-286. doi: <http://dx.doi.org/10.1177/0149206313503013>
- Kugler, M., & Ofoghi, R. (2005). *Does insurance promote economic growth? Evidence from the UK*. Paper presented at the Money Macro and Finance (MMF) Research Group Conference.
- Kumar, S., & Russell, R. R. (2002). Technological Change, Technological Catch-up, and Capital Deepening: Relative Contributions to Growth and Convergence. *The American Economic Review*, 92(3), 527-548.
- Lam, T. Y., & Lee, S. K. (2008). CEO duality and firm performance: evidence from Hong Kong. *Corporate Governance: The International Journal of Business in Society*, 8(3), 299-316. doi: <http://dx.doi.org/10.1108/14720700810879187>

- Leverly, J. T., & Grace, M. F. (2010). The robustness of output measures in property-liability insurance efficiency studies. *Journal of Banking & Finance*, 34(7), 1510-1524. doi: <http://dx.doi.org/10.1016/j.jbankfin.2009.08.015>
- Li, Q. (1996). Nonparametric testing of closeness between two unknown distribution functions. *Econometric Reviews*, 15(3), 261-274.
- Lim, K.-P., Brooks, R. D., & Kim, J. H. (2008). Financial crisis and stock market efficiency: Empirical evidence from Asian countries. *International Review of Financial Analysis*, 17(3), 571-591. doi: <http://dx.doi.org/10.1016/j.irfa.2007.03.001>
- Lincoln, A., & Adedoyin, O. (2012). Corporate governance and gender diversity in Nigerian boardrooms. *governance*, 1(4), 5.
- Lovell, C. A. K., & Pastor, J. T. (1995). *Operations Research Letters*, 18(3), 147.
- Mahlberg, B., & Url, T. (2010). Single Market effects on productivity in the German insurance industry. *Journal of Banking & Finance*, 34(7), 1540-1548. doi: <http://dx.doi.org/10.1016/j.jbankfin.2009.09.005>
- Mak, Y. T., & Kusnadi, Y. (2005). Size really matters: Further evidence on the negative relationship between board size and firm value. *Pacific-Basin Finance Journal*, 13(3), 301-318. doi: <http://dx.doi.org/10.1016/j.pacfin.2004.09.002>
- Makokha, A. W. (2014). *The effect of corporate governance on financial performance of insurance companies in Kenya*. University Of Nairobi.
- Malmquist, S. (1953). Index numbers and indifference surfaces. *Trabajos de Estadística y de Investigación Operativa*, 4(2), 209-242.
- Maniadakis, N., & Thanassoulis, E. (2004). A cost Malmquist productivity index. *European Journal of Operational Research*, 154(2), 396-409. doi: [http://dx.doi.org/10.1016/S0377-2217\(03\)00177-2](http://dx.doi.org/10.1016/S0377-2217(03)00177-2)
- Mark, S., Philip, L., & Adrian, T. (2009). Research methods for business students. *Harlow: Prentice Hall*.

- Mashayekhi, B., & Bazaz, M. S. (2008). Corporate governance and firm performance in Iran. *Journal of Contemporary Accounting & Economics*, 4(2), 156-172. doi: [http://dx.doi.org/10.1016/S1815-5669\(10\)70033-3](http://dx.doi.org/10.1016/S1815-5669(10)70033-3)
- McGee, R. W. (2010). Corporate Governance in Transition and Developing Economies: A Case Study of Ghana. Available at SSRN 1665083.
- Mensah, S., Aboagye, K., Addo, E., & Buatsi, S. (2003). *Corporate governance and corruption in Ghana: Empirical findings and policy implications*. Paper presented at the African Capital Markets Forum, Johannesburg.
- Minton, B., Taillard, J., & Williamson, R. (2010). Board composition, risk taking and value: Evidence from financial firms. *SSRN Electronic Journal*.
- Moradi-Motlagh, A., & Babacan, A. (2015). The impact of the global financial crisis on the efficiency of Australian banks. *Economic Modelling*, 46, 397-406.
- Murillo-Melchor, C., Pastor, J. M., & Tortosa-Ausina, E. (2009). A bootstrap approach to analyse productivity growth in European banking. *J Oper Res Soc*.
- Najjar, N. J. (2012). The impact of corporate governance on the insurance firm's performance in Bahrain. *International Journal of Learning and Development*, 2(2), 1-17.
- Nektarios, M., & Barros, C. P. (2009). Deregulation and productivity of the Greek life insurance market. [Aufsatz in Zeitschriften, Article in journal]. *International review of applied economic research*, 4(1/2, (1/12)), 53-68.
- Nielsen, S., & Huse, M. (2010). The contribution of women on boards of directors: Going beyond the surface. *Corporate Governance: An International Review*, 18(2), 136-148.
- O'Sullivan, N. (1997). Insuring the agents: The role of directors' and officers' insurance in corporate governance. *Journal of Risk and Insurance*, 545-556.
- Ohene-Asare, K. (2011). *Nonparametric efficiency and productivity change measurement of banks with corporate social responsibilities: the case for Ghana*. University of Warwick.
- Ohene-Asare, K., & Asmild, M. (2011). Banking efficiency under corporate social responsibilities: a nonparametric approach. *International Journal of Banking, Accounting and Finance* 4(2), 146–171.

- Outreville, J. F. (1990). The economic significance of insurance markets in developing countries. *Journal of Risk and Insurance*, 487-498.
- Owusu-Ansah, E., Dontwi, I. K., Seidu, B., Abudulai, G., & Sebil, C. (2010). Technical efficiencies of Ghanaian general insurers. *American Journal of Social and Management Sciences*, 1, 75-87.
- Parteka, A., & Wolszczak-Derlacz, J. (2013). Dynamics of productivity in higher education: cross-european evidence based on bootstrapped Malmquist indices. *Journal of Productivity Analysis*, 40(1), 67-82. doi: 10.1007/s11123-012-0320-0
- Peterson, C. L. (2006). Preemption, agency cost theory, and predatory lending by banking agents: are federal regulators biting off more than they can chew. *Am. UL Rev.*, 56, 515.
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York: Harper and Row.
- Provan, K. G. (1980). Board power and organizational effectiveness among human service agencies. *Academy of Management journal*, 23(2), 221-236.
- Pugliese, A., Minichilli, A., & Zattoni, A. (2014). Integrating agency and resource dependence theory: Firm profitability, industry regulation, and board task performance. *Journal of Business Research*, 67(6), 1189-1200. doi: <http://dx.doi.org/10.1016/j.jbusres.2013.05.003>
- Reddy, K., Locke, S., & Fauzi, F. (2013). Relevance of corporate governance practices in charitable organisations: A case study of registered charities in New Zealand. *International Journal of Managerial Finance*, 9(2), 110-132.
- Saunders, M. L., & Lewis, P. (2009). P. and Thornhill, A.(2009). *Research methods for business students*, 4.
- Saunders, M. N., Saunders, M., Lewis, P., & Thornhill, A. (2011). *Research methods for business students* (5 ed.). India: Pearson Education.
- Scotti, D., & Volta, N. (2015). An empirical assessment of the CO<sub>2</sub>-sensitive productivity of European airlines from 2000 to 2010. *Transportation Research Part D: Transport and Environment*, 37, 137-149.

- Shepard, D. D., & Twombly, B. (1996). Simultaneous dynamic mechanical analysis and dielectric analysis of polymers. *Thermochimica Acta*, 272(0), 125-129. doi: [http://dx.doi.org/10.1016/0040-6031\(95\)02622-3](http://dx.doi.org/10.1016/0040-6031(95)02622-3)
- Shujie, Y., Genfu, F., & Zhongwei, H. (2005). The Empirical Analysis of Efficiency of China's Insurance Industry [J]. *Economic Research Journal*, 7, 005.
- Simar, L., & Wilson, P. W. (2002). Non-parametric tests of returns to scale. *European Journal of Operational Research*, 139(1), 115-132. doi: Doi: 10.1016/s0377-2217(01)00167-9
- Simar, L., & Wilson, P. W. (2007). Estimation and inference in two-stage, semi-parametric models of production processes. *Journal of Econometrics*, 136(1), 31-64. doi: DOI: 10.1016/j.jeconom.2005.07.009
- Simar, L., & Wilson, P. W. (2015). Statistical Approaches for Non-parametric Frontier Models: A Guided Tour. *International Statistical Review*, 83(1), 77–110. doi: 10.1111/insr.12056
- Simar, L., & Zelenyuk, V. (2006). On testing equality of distributions of technical efficiency scores. *Econometric Reviews*, 25(4), 497-522.
- Simar, L., & Zelenyuk, V. (2007). Statistical inference for aggregates of Farrell type efficiencies. *Journal of Applied Econometrics*, 22(7), 1367-1394.
- Smith, S., Newhouse, J. P., & Freeland, M. S. (2009). Income, insurance, and technology: why does health spending outpace economic growth? *Health Affairs*, 28(5), 1276-1284.
- Soo, H. H. (1996). Life insurance and economic growth: Theoretical and empirical investigation.
- Sueyoshi, T., & Goto, M. (2012). Returns to scale and damages to scale under natural and managerial disposability: Strategy, efficiency and competitiveness of petroleum firms. *Energy Economics*, 34(3), 645-662.
- Sueyoshi, T., Goto, M., & Omi, Y. (2010). Corporate governance and firm performance: Evidence from Japanese manufacturing industries after the lost decade. *European Journal of Operational Research*, 203(3), 724-736. doi: DOI: 10.1016/j.ejor.2009.09.021
- Tanna, S., Pasiouras, F., & Nnadi, M. (2011). The effect of board size and composition on the efficiency of UK banks. *International Journal of the Economics of Business*, 18(3), 441-462.

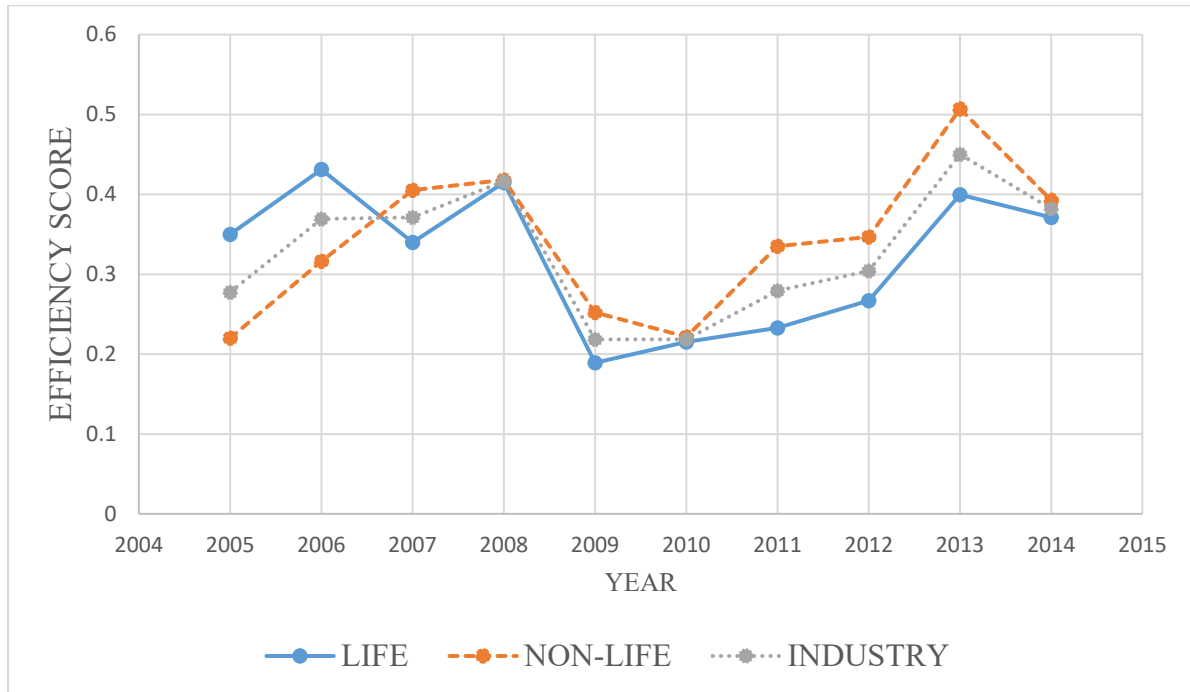
- Thanassoulis, E., Shiraz, R. K., & Maniatakis, N. (2015). A cost Malmquist productivity index capturing group performance. *European Journal of Operational Research*, 241(3), 796-805. doi: <http://dx.doi.org/10.1016/j.ejor.2014.09.002>
- Tian, G. Y., & Twite, G. (2011). Corporate governance, external market discipline and firm productivity. *Journal of Corporate Finance*, 17(3), 403-417. doi: <http://dx.doi.org/10.1016/j.jcorpfin.2010.12.004>
- Tornyeva, K., & Wereko, T. (2012). Corporate governance and firm performance: Evidence from the insurance sector of Ghana. *European Journal of Business and Management*, 4(13), 95-112.
- Tortosa-Ausina, E., Armero, C., Conesa, D., & Grifell-Tatjé, E. (2010). Bootstrapping profit change: An application to Spanish banks. *Computers & Operations Research*, In Press, Corrected Proof. doi: DOI: 10.1016/j.cor.2010.04.017
- Van Knippenberg, D., De Dreu, C. K., & Homan, A. C. (2004). Work group diversity and group performance: an integrative model and research agenda. *Journal of applied psychology*, 89(6), 1008.
- Vencappa, D., Fenn, P., & Diacon, S. (2013). Productivity Growth in the European Insurance Industry: Evidence from Life and Non-Life Companies. *International Journal of the Economics of Business*, 20(2), 281-305. doi: 10.1080/13571516.2013.782979
- Wachudi, E. J., & Mboya, J. (2012). Effect of board gender diversity on the performance of commercial banks in Kenya. *European Scientific Journal*, 8(7).
- Walt, N., & Ingley, C. (2003). Board dynamics and the influence of professional background, gender and ethnic diversity of directors. *Corporate Governance: An International Review*, 11(3), 218-234.
- Wang, J. L., Jeng, V., & Peng, J. L. (2007a). The impact of corporate governance structure on the efficiency performance of insurance companies in Taiwan. *The Geneva Papers on Risk and Insurance-Issues and Practice*, 32(2), 264-282.
- Wang, J. L., Jeng, V., & Peng, J. L. (2007b). The impact of corporate governance structure on the efficiency performance of insurance companies in Taiwan. *The Geneva Papers on Risk and Insurance Issues and Practice*, 32(2), 264-282.

- Wang, W.-K., Lu, W.-M., & Lin, Y.-L. (2012). Does corporate governance play an important role in BHC performance? Evidence from the U.S. *Economic Modelling*, 29(3), 751-760. doi: <http://dx.doi.org/10.1016/j.econmod.2012.01.021>
- Ward, D., & Zurbrugg, R. (2000). Does insurance promote economic growth? Evidence from OECD countries. *Journal of Risk and Insurance*, 489-506.
- Weir, C., Laing, D., & McKnight, P. J. (2002). Internal and external governance mechanisms: their impact on the performance of large UK public companies. *Journal of Business Finance & Accounting*, 29(5-6), 579-611.
- Wen, Y., Rwegasira, K., & Bilderbeek, J. (2002). Corporate governance and capital structure decisions of the Chinese listed firms. *Corporate Governance: An International Review*, 10, 75-83.
- Wheelock, D. C., & Wilson, P. W. (1999). Technical Progress, Inefficiency, and Productivity Change in U.S. Banking, 1984-1993. *Journal of Money, Credit and Banking*, 31(2), 212-234.
- Wilson, P. W. (2008). FEAR: A software package for frontier efficiency analysis with R. *Socio-Economic Planning Sciences*, 42(4), 247-254. doi: <http://dx.doi.org/10.1016/j.seps.2007.02.001>
- Xie, X. (2010). Are publicly held firms less efficient? Evidence from the US property-liability insurance industry. *Journal of Banking & Finance*, 34(7), 1549-1563. doi: <http://dx.doi.org/10.1016/j.jbankfin.2010.01.007>
- Xue, M., & Harker, P. T. (1999). *Overcoming the inherent dependency of DEA efficiency scores: a bootstrap approach*, Unpublished Working Paper. Wharton Financial Institutions Center, University of Pennsylvania.
- Yeh, C.-P., Wang, K.-M., & Chai, K.-C. (2010). Measuring the efficiency of securities companies by corporate governance in a financial holding and non-financial holding system. *Expert Systems with Applications*, 37(6), 4671-4679. doi: <http://dx.doi.org/10.1016/j.eswa.2009.12.041>
- Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, 40(2), 185-211.

- Yuengert, A. M. (1993). The measurement of efficiency in life insurance: Estimates of a mixed normal-gamma error model. *Journal of Banking & Finance*, 17(2-3), 483-496. doi: [http://dx.doi.org/10.1016/0378-4266\(93\)90047-H](http://dx.doi.org/10.1016/0378-4266(93)90047-H)
- Zelenyuk, V., & Zheka, V. (2006). Corporate governance and firm's efficiency: the case of a transitional country, Ukraine. *Journal of Productivity Analysis*, 25(1-2), 143-157.
- Zheka, V. (2005). Corporate governance, ownership structure and corporate efficiency: the case of Ukraine. *Managerial and Decision Economics*, 26(7), 451-460. doi: 10.1002/mde.1258
- Zikmund, W., Babin, B., Carr, J., & Griffin, M. (2012). *Business research methods*: Cengage Learning.

## APPENDICES

### Appendix A: Graphical Presentation of CE Scores for Life insurers, Non-Life insurers and Overall Ghanaian Insurance Industry.



### Appendix B: Average Cost Efficiency Score of Insurers in Ghana from 2005 to 2014

Insurers	Average CE scores (2005-2014)
CDH Life	0.2792
Donewell Life	0.155052
Enterprise Life	0.49483
Ghana Life	0.404293
Ghana Union Assurance Life	0.198642
Glico Life	0.31332
Met Life	0.197698
Phoenix Life	0.432941

Provident Life	0.191438
Quality Life	0.470118
SIC Life	0.439304
StarLife Assurance	0.275513
Unique Life	0.357191
Vanguard life	0.407869
CDH Insurance	0.768333
Donewell insurance	0.28623
EIC	0.429621
Ghana Union Assurance	0.195766
Glico General Insurance	0.390754
Global Alliance Insurance	0.108571
Metropolitan Insurance	0.352581
Phoenix Insurance	0.348923
Provident Insurance	0.240428
Quality insurance	0.471947
Regency Alliance	0.339082
SIC Insurance	0.36385
Star Assurance	0.296343
Unique Insurance	0.382152
Vanguard Assurance	0.388177

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**Appendix C: Graphical Presentation of Average Cost Efficiency Scores**

