X-EFFICIENCY OF INSURANCE COMPANIES IN KENYA

BY

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DECLARATION

I hereby declare that this project work is my original work and has not been submitted for any other academic degree at any University.

Signed..... Date.....

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This project has been presented for examination with my approval as the University supervisor.

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I am, however, wholly responsible for any error in this report

God bless you all.

DEDICATION

This project is dedicated to my parents Isaiah and Martha Kubai, who have been my backbone and who are responsible for nurturing me to who I am today.

ABSTRACT

This paper sought to determine the X-efficiency of insurance companies in Kenya and to establish whether the X-efficiency of these insurance companies is affected by market share, cost of debt and firm size. The data set consists of annual operation costs of insurance industry and commissions. Total capital and reserves, underwriting provisions and debt capital are the inputs, and claims incurred and bonuses are the outputs. The data was collected from 36 insurance companies for the period from 2005 to 2009.

To measure the X-efficiency level of insurance companies in Kenya, the study used the Stochastic Econometric Cost Frontier Approach which involves the estimation of the cost function and the derivation of the X-efficiency estimate based on the deviation from the efficient cost frontier respectively. The empirical results obtained showed that X-efficiency exists in the insurance companies in Kenya and that the X-efficiency of the insurance companies is affected by market share, cost of debt and size of the insurance company.

The level of mean X-efficiency of insurance companies in Kenya was found to be 100%. After controlling for scale differences, the average small insurance company was found to be relatively less inefficient than the average large insurance company. Large insurance companies were found to be generally more inefficient recording a mean X-efficiency of 139% compared to a mean X-efficiency of 57% recorded by the small insurance companies. The efficiency of insurance companies by organization type was also measured. Insurance companies specializing in either of life or non-life were found to be more efficient than the insurance companies operating both lines of business. Insurance companies handling both the life and non-life lines of business

were found to be more inefficient with a mean X-efficiency score of 139% compared to the companies specializing in either life or non-life that recorded mean X-efficiency scores of 89% and 72% respectively. These findings are consistent with the results found in other related studies in the such as those by Cummins et al.,(1996), Rai (1996) and Fenn et al.,(2006). These findings also support the existing regulation requiring the separation of life and non-life classes of business.

The variables of cost of debt, market share and organizational size were found to affect the cost efficiency insurance companies in Kenya. The study also considered the effect of increased regulation, inflation and fraudulent settlement of claims and these were found to increase the costs of insurance companies. Increased monitoring and adoption of the risk based supervision are expected to increase the efficiency of insurance companies in Kenya.

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ABBREVIATIONS

AKI	-	Association of Kenyan Insurers
BMI	-	Business Monitor International
CSFI	-	Centre for the Study of Financial Innovation
COMESA	-	Common Market for Eastern and Southern Africa
DEA	-	Data Envelope Analysis
FDI	-	Foreign Direct Investments
GDP	-	Gross Domestic Product
IAS	-	International Accounting Standards
IRA	-	Insurance Regulatory Authority
KARA	-	Kenya Auto Repair Association
PWC	-	Price Waterhouse Coopers
ROA	-	Return on Assets
ROE	-	Return on Equity
SECFA	-	Stochastic Econometric Cost Frontier Approach
TFP	-	Total Factor of Productivity
UK	-	United Kingdom
USA	-	United States of America
US	-	United States

CHAPTER ONE

INTRODUCTION

1.1. Background to the study

The efficient operation of financial intermediaries-banks, insurance and pension fund firms, government agencies is instrumental for the efficient functioning of the financial system and fuelling of the economies of the 21st century. The financial sector mobilizes savings and allocates credit across space and time. It enables firms and households cope with economic uncertainties by hedging, pooling, sharing and pricing risks thereby facilitating the flow of funds from the ultimate lenders to the ultimate borrowers, improving both the quantity and quality of real investments and thereby increasing income per capita and raising our standards of living. It is therefore well justified that the performance of the financial sector receives extensive scrutiny from scholars and industry thinkers (Harker and Zenois, 2000).

The insurance industry plays a critical role, providing individual and businesses with a broad spectrum of financial security products and playing a major role in financial intermediation, thus enhancing a nation's financial and economic development. Individuals and their families look to insurance companies to provide life insurance, retirement income, health insurance, and automobile and homeowners property and liability coverage. Businesses rely on insurers for similar coverage as well as workers compensation and more specialized products like marine insurance. The insurance industry will become an increasingly important sector as a country develops. Inefficient insurers cannot survive long in a competitive market (Karim and Jhantasana, 2005).

Production theory identifies several types of inefficiencies including allocative, technical, scale, scope and X-efficiency. Allocative inefficiency arises when companies use the costly combination of inputs in producing output. Technical inefficiency occurs when the company fails to produce on efficient production frontier. Scale inefficiencies arise when the firm cannot lower average costs by increasing or decreasing its output levels. Scope inefficiencies exist when the firm can lower average costs by changing its output mix. Harvey Leibenstein identified a fifth approach of examining efficiency, and called the term X-efficiency to describe the resulting difference between actual and minimum cost.

In economics, x-efficiency is the effectiveness with which a given set of inputs are used to produce outputs. If a firm is producing the maximum output it can, given the resources it employs, such as men and machinery, and the best technology available, it is said to be technical-efficient. X-inefficiency occurs when technical-efficiency is not achieved. The concept of x-efficiency was introduced by Harvey Leibenstein in 1966.

Leibenstein (1978) describes X-efficiency as follows: Suppose that certain inputs have been allocated to a firm. These inputs can be used with various degrees of effectiveness within the firm. The more effectively they are used the greater the output. When an input is not used effectively, the difference between the actual output and the maximum output attributable to that input is a measure of the degree of X-inefficiency. Effective use depends simultaneously on both the decisions that are made on how to use inputs and the actual performance based on these decisions. Thus, within the firm, the concept of X-inefficiency captures both the detailed decision making process which may determine the intent of how to use inputs and the actual performance aspect.

The focus in this article is on frontier efficiency, or how close financial institutions are to a best-practice frontier. Since engineering information on the technology of financial institutions is not available, studies of frontier efficiency rely on accounting measures of costs, outputs, inputs, revenues, profits, e.t.c. to impute efficiency relative to the best practice within the available sample (Berger and Humphrey, 1997).

In this study cost efficiency in the Kenyan insurance sector is modeled and measured using stochastic econometric cost frontier analysis (SECFA), and variations in efficiency in relation to firm size and market share explored. The functional form assumed in the estimation is the Flexible Fourier. This methodology is applied using the Insurance Regulatory Authority data set for the period 2005 to 2009, consisting of end of year technical, non-technical and balance sheet accounts from insurance businesses operating in Kenya. Efficiency scores are obtained and scale economies estimated.

The Insurance Act (2010) defines insurance as the business of undertaking liability by way of insurance, including reinsurance, in respect of any loss of life and personal injury and any loss or damage, including liability to pay damage or compensation, contingent upon the happening of a specified event.

The study is divided into five chapters. These chapters have been presented as follows: chapter one gives the introduction, chapter two presents the literature review, chapter three discusses the methodology behind estimation, chapter four describes the data and discusses the results and chapter five concludes the study and offers recommendations for further studies.

1.1.1. The Kenyan Insurance Industry

According to the 2010 AKI insurance report the insurance industry had 46 licensed companies at the end of 2010. 22 companies wrote non-life insurance business only 9 wrote life insurance business only and 14 insurance companies were composite(wrote non-life and life business). The penetration rate of insurance in Kenya is estimated to be 3%. Kenya's insurance industry leads within the East Africa Community (a trading block of Kenya, Uganda and Tanzania), and is a key player in the COMESA region (Rand, 2004).

The industry is represented by, AKI, which is a well, organized trade body and is regulated by a relatively new and empowered regulator, the Insurance Regulatory Authority (IRA) which was established under the Insurance (Amendment) Act of December 2006. The IRA, which has been in operation since 2007, formulates and enforces insurance standards, particularly in relation to compulsory lines such as compulsory third-party motor liability insurance. It also approves tariffs and rates of insurance, deals with complaints from the public, and monitors the viability of insurers. It monitors and enforces claims settlement, ownership of insurance companies limiting it to 25% for an individual shareholder and increasing the minimum capital requirements.

IRA has also effected the separation of life and general insurance business in an effort to rein in on malpractices where composite insurance companies are reportedly diverting life funds to settle claims from general insurance. In addition, the IRA has adopted the risk based supervision model, which is a shift away from the previous regulation model that gave financial health to an insurer based on the ability to meet the minimum share capital. The law presently requires the separation between life and non-life insurance. Currently the minimum capital requirements are One hundred and

fifty million for life insurers, three hundred million for general insurance business and four hundred and fifty million for composite insurance companies.

Embracing ICT, research and innovation expands the industry's capacity to exploit the existing untapped insurance market. This development coupled with improvement in regulatory environment and the review of the Insurance Act is expected to enhance the insurance penetration beyond the current level of 2.84% of the GDP. The East African Common Market that came into effect on 1st July 2010 is expected to herald a new dawn for the insurance industry. With an expanded market of 126 million people, the insurance industry is expected to benefit greatly both in terms of volume of business underwritten and capacity to undertake risks. These developments are meant to improve scale and scope efficiency of operations in the insurance industry.

The life and non-life business have low penetration rates in comparison with the developed world. Regulation plays a great role in the success of the insurance industry. The overall sector is very sensitive to changes in regulations that affect companies' ability to adapt products to their operating environment. There have been many new products launched, most of which are particularly tied in to the micro-insurance segment. The Kenyan insurance industry is not as vulnerable to changes in the political and economic conditions in the country and the sector is expected to grow. The industry is now keen on designing products accessible to as much of the Kenyan population as possible, particularly small and medium-sized businesses such as the shari'a-compliant insurance, Takaful (Business Monitor International, 2011).

Insurance companies are grouping themselves together in an effort to build economies of scale. A source of growth for life products had been by bundling together all the insurances relevant to a particular social group or industry. Kenya's life insurers have

been able to achieve growth by introducing innovative new products, exploiting one distribution channel or another or improving their rates. However, life insurance is not regarded by households as an important channel for long-term savings and/or provision against adverse events. The ability and opportunity to save over the long-term is extremely limited in the country. The local life insurance industry, accounts for about a third of total premiums (Business Monitor International 2011 insurance report).

According to the Business Monitor International 2011 insurance report, the industry struggles with two significant challenges. The first is the lack of knowledge about insurance. Companies in the marketplace have taken the strong economic growth as an opportunity to expand regionally, opening local offices to try to increase the level of insurance knowledge in the public. The second challenge is price. All the major players are involved, to varying degrees, in the development of micro-insurance products that aim to get people covered at a price they can afford to keep paying.

1.2. Statement of the problem

Recent changes in the Kenyan insurance industry that include changes in the regulatory environment, government intervention as well as increased innovation brought about by competitive pressures within the financial sector and increased consumer knowledge have intensified interest in the analysis of insurer efficiencies.

The efficient-structure hypothesis (Demsetz, 1973 as quoted in Fenn et al., 2006) predicts a reverse causality between competition and cost efficiency. The central argument for this hypothesis is that more efficient firms have lower costs which directly increase their profits. These firms are also able to capture larger market shares that may result in high levels of concentration. The greater efficiency may be in the

form of X-efficiency, in which some firms have superior management or production processes that allow them to operate at lower costs and subsequently reap higher profits. The resulting higher market shares may also lead to higher market concentration. Alternatively, the greater efficiency may be in the form of scale efficiency, in which some firms simply produce at output levels closer to the minimum average cost point-the scale efficiency hypothesis.

Firms operating at optimal economies of scale are expected to have the lowest costs and the resulting higher profits will lead to higher market concentrations. In the efficient-structure hypothesis, the positive relationship between efficiency and market structure is spurious because efficiency is the principal determinant of market structure. There is therefore reverse causality running from efficiency to competition as compared to the Structure-Conduct-Performance paradigm. Given that higher market concentration means lower competition, there should be an inverse relationship between competition and efficiency. Indeed, the existence of scale economies on a market means that an increase in the number of competitors results in higher average costs for each incumbent firm. Consequently, competition would decrease cost efficiency (Fenn et al., 2006).

In a recent contribution, Choi and Weiss (2005) have outlined a framework for testing hypotheses on the relationship between market structure and efficiency in insurance markets. Their formalization of the efficient structure hypothesis, distinguishing between the impact of scale efficiency and X-efficiency on performance is of particular relevance to this study. In their paper, they estimate equations for prices and profits in which cost and revenue efficiency scores as well as scale economies are used as independent variables.

This research uses a one-stage estimation approach to explore directly the relationship between market structure and cost efficiency and at the same time use the estimated frontiers to calculate scale economies.

This study will serve as an extension to other studies that have been done on the insurance industry in Kenya. The key contribution to existing literature will be on management decisions made on inputs used in insurance and whether decisions made on how these inputs are used has resulted into greater efficiency. This study aims to benefit all insurance stakeholders that include managers of insurance firms, the regulatory authority, policyholders, shareholders and government.

1.3. Objectives of the study

1. To determine the level of X-efficiency of insurance companies in Kenya in relation to cost efficiency.
2. To establish whether X-efficiency of insurance companies in Kenya is affected by the size of the firm, cost of debt and the market share of the firm.

1.4. Significance of the study

The importance of this study will be to determine efficiency of insurance firms and finding explanations of efficiency that may help inform government policy, identify the economic conditions that create inefficiency, and improve managerial performance.

The information obtained can be used to inform government policy by assessing the effects of deregulation, mergers, or market structure on efficiency; to address research issues by describing the efficiency of an industry, ranking its firms, and to improve managerial performance by identifying best practices and worst practices associated with high and low measured efficiency, respectively, and encouraging the former

practices while discouraging the latter. The study will be valuable in assessing and informing government policy as well as regulatory policies. The study will also be beneficial to scholars interested in researching on efficiency of insurance firms.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

There has been significant development in studies of efficiency over time. In the 1950s, the studies of efficiency just examined technical efficiency by comparing input to their corresponding output (Farrel, 1957). However, Leibenstein (1966) introduced the study of X-inefficiency whereby the element of cost in the study of efficiency was introduced (Lyaga, 2006). The concept of x-efficiency was introduced by Harvey Leibenstein in his paper “Allocative efficiency v. x-efficiency" in American Economic Review 1966. The X-efficiency hypothesis of Leibenstein (1966) is that organizations typically do not optimize as proposed by classical economic doctrine but rather may exhibit some degree of inefficiency.

Leibenstein (1978) defines X-efficiency as the degree of effectiveness in the use of inputs. The more effectively inputs are used, the greater the output. When an input is not used effectively, the difference between the actual output and the maximum output attributable to that input is a measure of the degree of X-inefficiency. Effective use depends simultaneously on both the decisions that are made on how to use inputs and the actual performance based on these decisions.

The X-efficiency theory by Leibenstein (1978) not only considers as one of its basic tenets the existence of principals and agents but also the likelihood of a clash of their interests. This is a deviation from traditional economic theory where all economic activity takes place between principals and, even if agents exist, their interests do no clash with the principal. Leibenstein (1978) found that in any type of complex society with multi-person firms, agents are likely to have opportunities to pursue their own

interests in such a way that they deviate to some degree from maximizing the interests of their principals.

Insurance management is a very particular field, with many specific characteristics which can create barriers to success for managers with no previous experience of the insurance industry. The managers may promote the elimination of those constraints encountered by companies which affect general efficiency. There are certain elements intrinsic to the management of companies that make some of them more efficient than others (Barros, Barroso and Borges, 2005).

The findings of the study by Karim and Jhantasana (2005) on the relationship between profitability and suggested the need for rationalization in the insurance industry. They found that the mean inefficiency is negatively correlated with size and advocated for the consolidation of the large number of smaller insurers as well as an increase in capital requirements.

In a dynamically changing environment, many insurers may be adopting new approaches to producing their outputs. This provides more opportunities for firms to make mistakes in the choice of technology, perhaps leading to excessive consumption of inputs even by best practice firms (Cummins, Turchetti and Weiss, 1996). The higher complexities and hence moral hazard for managers provides more opportunities for firms to make mistakes in using technology. Managers may make mistakes in their decisions on the approaches used to produce outputs.

Inputs of insurance companies used in this study include total capital and reserves, technical provisions, and debt capital. Input prices are defined as the rate of interest variable to reflect the cost of debt capital obtained from the long-term government bond rates. Outputs on the other hand include net incurred claims and bonuses.

Revenue is defined as net earned premiums plus investment income and other incomes as reported in life and non-life technical accounts at the end of the year. Costs are defined as total operational costs and expenses which include investment management expenses, commissions and other costs as reported in the technical and non-technical accounts at the year-end.

2.2. X-Efficiency of Insurance Companies

Cummins, Turchetti and Weiss (1996) conducted an analysis of technical efficiency and productivity growth in the Italian insurance industry. They examined the technical efficiency of insurance firms, changes in technical efficiency over time and technical change over time. The analysis found that activities requiring low management discretion resulted in greater efficiency lending credence to the argument that management decisions affect efficiency of insurance companies. The study revealed that firms with assets requiring more active management were associated with lower firm efficiency than those requiring less active management. Insurance companies with more standardized procedures and requiring less require less managerial expertise were found to be more efficient than the more complex types of business. This finding implies that more complex operations requiring more managerial skill and discretion are associated with lower technical efficiency.

Other factors such as claims ratios that were considered in the study revealed that insurance companies with higher loss ratios were more technically efficient than those with lower loss ratios because the longer settlement period presents higher complexities and hence moral hazard for managers and provides more opportunities for firms to make mistakes in using technology. The evidence suggests that management may make mistakes in their decisions on the approaches used to produce

outputs. The findings remained even after controlling for the effect of reinsurance on efficiency.

Organizational form was also found to have an effect on the technical efficiency of the firm. Cummins et al. (1996) found evidence that firms that conduct both life and non-life insurance business are significantly less efficient than those that specialize in either life or non-life insurance. This suggests that economies of scope may not be an important factor in this market, at least with respect to technical efficiency. Their study found no relationship between business mix and efficiency scores.

Cummins et al. (1996) found that there was a decline in productivity over the period of study and that insurers had become less efficient and experienced technical regress. Large declines were noted in periods affected by deregulation. Most of the deterioration was attributed to technical change. The sample period spanned the period of initial implementation of European economic unity, and was able to provide information on the effect of this deregulation on efficiency in the Italian insurance market. They also found that an increase in the complexity of insurance products and markets could lead to inefficiency.

Rai (1996) in his study on the cost efficiency of international insurance firms examined the cost efficiency of insurance firms located in 11 countries over a five-year period, 1988-1992. He derived two X-inefficiency measures, one from the stochastic cost frontier model and the other from the distribution-free model. The results show that x-inefficiencies not only vary by country but by size and specialization. The study found that on average, small firms are more cost efficient than large firms worldwide. The study also found that insurance that offer single or specialized services also operate more cost efficiently than those offering a

combination of life and nonlife services (combined firms). The results also indicated that the X-inefficiency estimates derived from the stochastic cost frontier model are more suitable for this sample of data than those derived from the distribution-free model.

Meador, Ryan and Schellhorn (1997) tested for a relationship between the firms' output choice and measures of X-Efficiency for the U.S life insurance companies. Using the study period from 1990 to 1995, the study tested two hypotheses regarding the effect of a firm's output choice on estimates of its X-efficiency: Diversification hypothesis in which X-efficiency increases when managers make resource allocation decisions for a broader range of distinct but related outputs, and Concentration hypothesis where managers focus on a particular area of expertise and a small number of product lines. The study found that diversification across multiple insurance and investment product lines resulted in greater X-efficiency than a more focused production strategy.

The findings suggest that in comparison to their counterparts in more narrowly focused firms, the managers of diversified firms appear better able to contain costs by reallocating inputs among independent product lines when adjusting to shifts in product demands and are able to generate cost savings by concentrating their financial and human resources in a single area of expertise. This relationship remained even after controlling for organizational structure and firm size. In addition, the study found a negative relationship between X-efficiency and regulation.

Hao (2004) carried out a study on the efficiency on Taiwan's life insurance industry using X-Efficiency approach. Using the study period from 1981 to 2003, he found that firms with larger market share are cost efficient supporting the need for

reorganization of financial markets through mergers and acquisition with a goal to increase efficiency. His findings also support the need for life insurance firms that want to increase their ordinary life insurance premium revenue to improve its investments ability and offered evidence that compels government to pay more attention to financial solvency for the life insurance.

Hao (2004) also found that the inefficient firms had smaller economies of scale compared to the more efficient firms. This result coincides with the current policy that encourages mergers and acquisitions. In addition he sought to provide some evidence on the relationship between the total assets, market share, and diversification products strategy. His study revealed that non-admitted assets impacted on firm's efficiency, and this suggested that these assets, excluded for solvency regulation, were potentially productive to the firm. Of the control variables employed in the efficiency regression, only size as measured by total assets was significantly related to efficiency. From this regression, the variable significantly related to profitability was market share (market power theory). The findings suggested that firms with larger market share were more profitable. He also found that the diversification products strategy did not help the firm to improve its operation efficiency. It is also important to note that the findings showed no significant change, because the Taiwan life insurance firms were observing the standardized policy regulation.

Karim and Jhantasana (2005) investigated cost efficiency of Thailand's life insurance industry and studied the relationship between profitability and cost efficiency. The purpose of their paper was to evaluate the cost efficiency and its relationship with profitability in Thailand's life insurance. They examined the association between profitability and inefficiency by examining the association between annual profitability and inefficiency. They found that the mean inefficiency was negatively

correlated to size and ROE and ROA ratios showing that efficient firms on average had higher returns on equity and on assets indicative of inefficiency effect on profitability of insurance companies.

Karim and Jhantasana (2005) also found that the mean inefficiency is negatively correlated with size suggesting the need for rationalization in the insurance industry in Thailand. These results imply that consolidating the large number of smaller insurers should be high on the government's agenda, and the capital requirements for life insurers need to be increased. The results also revealed that inefficiency is negatively correlated with ROE and ROA ratios. This shows that efficient firms, on average, have higher return on equity and on assets. This indicates that inefficiency has substantial effect on the profitability of life insurance companies. The study however found no significant relationship between inefficiency and age of the firm which is contrary to the argument that more experienced firms are more efficient than the less experienced ones because new firms are unaware of their abilities and need time to decide on their optimal size but because with time the less efficient firms exit the market, this leaves a population of more technically efficient firms.

Fenn, Vencappa, Diacon, Klumpes and O'Brien (2006) carried out a study on market structure and the efficiency of European Insurance companies: A stochastic Frontier analysis. They used the stochastic frontier analysis to estimate Flexible Fourier cost and profit functions for European insurance companies. Separate frontiers were estimated for life, nonlife and composites companies. They adopted a maximum likelihood approach to estimation in which the variances of both one-sided and two-sided error terms were modelled jointly with the frontiers. The study was done for the period between1995 and 2001 for 14 major European countries. They found that most European insurers were operating under conditions of decreasing costs, and that

company size and market share were significant factors determining X-inefficiency with respect to both costs and profits. They also found that larger firms, and those with high market shares, tend to have more cost inefficiency but less profit inefficiency.

2.3. X-efficiency of Insurance Companies in Kenya

The analysis of efficiency in the insurance industry is a theme that has attracted much research in the past in other markets but there are no documented studies on the efficiency of insurance companies in Kenya. While there has been some research on factors in the insurance industry in Kenya, notably the Application of dynamic financial analysis for solvency assessment for general insurance companies in Kenya, Osero (2008); Determinants of Profitability of insurance companies in Kenya, Karuiru (2005) and Critical success factors in the insurance industry in Kenya, Wamwati (2008), little has been written about the efficiency of insurance companies in Kenya and more generally, Africa.

Efficiency of the financial services industry particularly in the banking industry has been widely studied since the last decade. However, these studies focus mainly on developed countries as surveyed by Berger and Humphrey (1997), and Cummins and Weiss (2001). Cummins and Weiss (2001) recorded 20 studies of insurance efficiency across countries in which, most of them focus on the US. Moreover, in their survey, they do not report any study that deals with insurance industry in the developing countries. Leung and Young (2003) also found that when compared to the much literature on foreign direct investments (FDI) in banking sector, there have been rather less empirical studies on insurance services. The same findings are replicated by Fen et al. (2006) who found that of the very few studies available, most have been

undertaken for the banking sector. There are also no documented studies that have examined the technical efficiency of Kenyan insurance companies.

The technical efficiency of insurance companies has not been widely studied and there are no documented studies of research done in Kenya on the X-efficiency of insurance companies. Lyaga (2006) conducted a study on X-efficiency of Commercial banks in Kenya. The research investigated the X-efficiency of commercial banks in Kenya and sought to establish whether the x-efficiency of these banks was affected by economies of scale. There is a need to study x-efficiency of insurance companies in Kenya. In addition to determining the level of efficiency of insurance companies in Kenya, the study will offer a comparison of X-efficiency of Kenyan insurance companies to different countries like Taiwan, Italy, United States of America (USA) and Thailand.

There has been an increase in regulation as well as government legislation witnessed within the Kenyan Insurance sector in recent years. More comprehensive and broader regulation and legislation affecting the insurance industry is expected to lead to increased efficiency of the insurance companies. Research has advocated for the consolidation of the insurance companies through mergers and acquisitions to improve efficiency (Hao, 2004). The new legislation on ownership of insurance companies in Kenya and share capital requirements is expected to lead to increased mergers and acquisitions as is already being witnessed as companies merge their operations and other are acquired. The Kenyan insurance industry is embracing the separation of the two lines of business in compliance with the requirement by IRA to separate the General and Life lines of business and it is expected that this will lead to greater efficiency in the industry. Increased regulation has also been cited as one of

the factors leading to increased costs for the insurance industry (Centre for the study of financial innovation, 2011).

Growth in absolute premiums is strongly tied to the overall growth of the economy and any improvements in the business environment. Developments in the financial market are of great concern to insurers who are susceptible to risk from the rest of the financial sector. The exposure of insurers to the risks of economic fluctuations – where sensitivities include exchange rates, inflation and interest rates – is manifested in two ways: asset value and subsequent capital base and solvency levels, and commercial product and premium development. Insurers are major asset managers and as they are exposed to recession, they are naturally likely to benefit from recovery. (Business Monitor International, 2011).

The management of insurance companies on how to use the inputs available to produce desired levels of output is critical in analyzing the X-efficiency of insurance companies in Kenya. Jumba (2008) in her study on the management development strategies used by insurance companies in Kenya found that the general management skills in the insurance industry in terms of organization, management of quality, planning and controlling the business was rated as good in most organizations.

Karuiru (2005) in his study on the determinants of profitability of insurance companies in Kenya found that on the overall, managers of various businesses need to focus their attention on the identified classes of business due to their significance. He also found that the levels of the assets held in the books of insurance companies as well as the investments and the resultant investment income have significant influence on the insurance companies' profitability. His findings also revealed that apart from the normal earnings derived by a company with high level of assets and investments,

the confidence that the insuring public has on organizations which are stable and backed by a strong balance sheet may be an added advantage which has a direct contribution on the operations of the core business of the insurance companies, hence the level of profitability. He suggested further research on both internal and external factors affecting the profitability of the insurance companies in Kenya as well as further research to focus on both qualitative and quantitative measures of profitability and performance.

2.4. Estimation Techniques of Efficiency

The most commonly used methods to measure X-efficiency in insurance companies are Data Envelopment Analysis (DEA) and Stochastic Econometric Cost Frontier Approach (SECFA). Both methods have their advantages and drawbacks. (Constantin, Diogenes and Riviera, 2009). DEA is a non-parametric approach that does not require the specification of a cost function but rather computes an efficient best practice cost frontier based on convex combinations of firms in the industry. The alternative approach is to estimate an econometric cost frontier. Both DEA and the Stochastic Econometric Frontier Approach have been used extensively in the recent years and both have strong advocates (Cummins, Tennyson and Weiss, 1998).

2.4.1. Data Envelopment Analysis

Unlike the econometric stochastic frontier approach, Data Envelopment Analysis-DEA, permits the use of multiple inputs and outputs, but does not impose any functional form on the data; neither does it make distributional assumptions for the inefficiency term. By the application of non-parametric methods as Data Envelopment Analysis, the Malmquist index is calculated by distance functions obtained by mathematical programming and allows for the absence of price information, utilizing physical quantities of multiple inputs and products instead. The main two components

of the underlying index are technical change (innovation) and efficiency change (catching up effect towards the frontier). The principal limitation of the DEA approach is that it does not permit insurers to deviate from the frontier due to random error but measures all departures from the frontier as inefficiency (Cummins, Tennyson and Weiss, 1998).

2.4.2. Stochastic Econometric Cost Frontier Approach

SECFA has its origins in two papers: Aigner, Lovell and Schmidt (1977) and Meeusen e van den Broeck (1977), followed by the works by Battese and Corra (1977). These three original works represent, in the context of production frontier, the error term defined in a structurally composed manner. They were motivated by the idea that deviation from the production frontier might not be entirely under the control of the firm being studied. The main difference of stochastic frontier model from deterministic model is the composite error term.

The models of stochastic production frontier address technical efficiency and recognize the fact that random shocks beyond the control of producers may affect the production output. Therefore, in these models, the impact of random shocks (as labor or capital performance) on the product can be separated from the impact of technical efficiency variation. These models were simultaneously introduced by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977).

The Stochastic Econometric Cost Frontier Analysis – SECFA is an analytical approach that utilizes econometric, or parametric, techniques whose models of production recognize technical inefficiency and the fact that random shocks beyond producers' control may affect the product. Differently from non-parametric approaches that assume deterministic frontiers, SECFA allows for deviations from the

frontier, whose error can be decomposed for adequate distinction between technical efficiency and random shocks for example labor or capital performance variations.

In the presence of inefficiencies, the Stochastic Econometric Cost Frontier Analysis – SECFA-emerges as a theoretical and practical framework, whose objective is to contribute for the definition and estimation of production frontiers. SECFA has been developed from remote influences but the literature that directly influenced the development of SECFA has been the theoretical framework about production efficiency beginning in the decade of 1950 by Koopmans (1951).

An important advantage of the econometric frontier is that there are a number of well-developed statistical tests to investigate the validity of the model specification – tests of significance for the inclusion or exclusion of factors, or for the functional form. The accuracy of this hypothesis depends to some extent on the assumption of normality of errors which is not always fulfilled. A second advantage of the econometric frontier is that if a variable which is not relevant is included, it will have a low or even zero, weighting in the calculation of the efficiency scores, so its impact is likely to be negligible. This is an important difference from DEA, in which the weights for a variable are usually unconstrained. A third advantage of the econometric frontier is that it allows the decomposition of deviations from efficient levels between stochastic shocks (referred to as noise) and pure inefficiency, while the DEA classifies the whole deviation as inefficiency. (Kumbhakar and Lovell, 2000).

The principal limitation of the econometric approach is that it requires the specification of a cost function, and in most variants, a distribution form for the error term thus potentially confounding the efficiency estimates with specification error. (Cummins, Tennyson and Weiss, 1998). Cummins and Zi (1998) also provide

evidence that econometric methods and DEA produce efficiency estimates for US life insurers that are quite consistent and highly correlated. However, previous research has shown that the DEA scores are inferior in value to econometric scores, though the ranking is preserved (Bauer et al., 1998).

Berger and Humphrey (1997) also found that SECFA and DEA efficiency values were similar though the SECFA estimates were more informative than the DEA estimates. Unlike a non-parametric method such as DEA that assumes a deterministic frontier, the stochastic frontier allows for deviations from the frontier to represent both inefficiency and an inevitable statistic noise which intends to be a closer approach to reality given that observations normally involve a random walk.

Some of the studies in favour of the Stochastic Econometric Cost Frontier Analysis include Rai (1996) who derived two X-inefficiency measures, one from the stochastic cost frontier model and the other from the distribution-free model. The results indicated that the X-inefficiency estimates derived from the stochastic cost frontier model were more suitable than those derived from the distribution-free model. The advantages of SECFA outweigh its disadvantages, so it is a better approach to use in this study of Kenya's insurance companies X-efficiency.

2.5. Trends in the study of Efficiency

Farrell (1957) introduced the concept of an efficient frontier as an alternative to the usual least squares production function. The least squares production function tries to capture average performance while the efficient frontier is aimed at characterizing the best performance. He proposed specific measures of technical and allocative efficiency. Leibenstein (1966) introduced the concept of X-efficiency to explain the role of internal organization of the firm in resource allocation. Based on the concept

of technical and allocative efficiency, Leibenstein (1966) coined the term X-efficiency and noted that for a variety of reasons, people and organizations normally work neither as hard nor as effectively as they could.

A recent study by Cummins and Zi (1998) provides evidence that econometric methods and DEA produce efficiency estimates for US life insurers that are quite consistent and highly correlated. However, previous research has shown that the DEA scores are inferior in value to econometric scores, though the ranking is preserved (Bauer et al., 1998). Unlike a non-parametric method such as DEA that assumes a deterministic frontier, the stochastic frontier allows for deviations from the frontier to represent both inefficiency and an inevitable statistic noise which intends to be a closer approach to reality given that observations normally involve a random walk.

2.6. Summary

Several factors emerge from the studies on X-efficiency of insurance companies. Of importance is that insurance companies may achieve high levels of competitiveness by using vast amounts of resources and thus, perform inefficiently (Barros et al., 2005). These findings suggest that for insurance firms to be profitable, they have to increase their efficiency by reducing cost possibly through consolidation.

The regulatory agency is also found to have an important role to play in improving the efficiency of insurance companies. Policies should include publishing data on individual companies in order to introduce greater transparency into the market, resulting in increased competition and enforcing the regulations (technical provisions, reserve ratios) relating to the companies themselves. The implementation of internal auditing procedures will also result in better management and will facilitate the identification of sources of inefficiency. The insurance companies should carry out

benchmark analysis as a way to provide managerial indications for inefficient companies to catch up with the efficient frontier.

The study can also be used to offer comparison to other studies that have been carried out on X-efficiency of insurance companies in the more developed countries. The findings can also be used to analyze how insurance companies compare to the banking sector in terms of X-efficiency.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

The study used the Stochastic Econometric Cost Frontier Analysis to estimate Flexible Fourier cost function for Kenyan insurance companies. The maximum likelihood approach to estimation was adopted to calculate the variance of both one-sided and two-sided error terms was modeled jointly with the frontiers. This approach was used to simultaneously control for the impact of heteroskedasticity on the estimation of scale economies as well as estimate the effect of firm size and market structure on X-inefficiency.

This chapter presents the research methodology. Section 3.2 and 3.3 describe the population and data sample respectively. Section 3.3 discusses the sample design and section 3.4 has focused on the research methodology.

3.2. The Population

Currently Kenya has 46 insurance companies. All these constitute the population in the study.

3.3. Data Sample

The data set consists of secondary data of the audited financial statements of insurance companies included in the sample. The sample includes life insurance companies, non-life insurance companies and composite insurance companies (writing both life and non-life business). This provides technical and non-technical accounts at year-end for life, non-life and composite insurance businesses in Kenya. For each company and each year, consistent measures of revenue, profits and

operating costs were constructed from the accounting data available for the period from 2005 to 2009.

For each company (i) and each year (t) from 2005-2009, IRA data consistent measure of costs (C_{it}) was used. Outputs were measured in terms of net incurred claims. The incurred claims measured at the end of the year (X_{it}) were used as proxies for the latent expected present value of future claims on current policies.

IRA also provides measures of year end share capital and reserves (K_{it}) and technical provisions (T_{it}), each of which we assumed to be fixed inputs. Finally, corresponding to the assumed variable inputs such as labour and debt, a rate of interest variable (r_{it}) reflecting the cost of debt was used. Because of difficulty in estimating the wage variable, it was excluded for purposes of this analysis.

The study used consistent measures of costs, outputs, inputs and inputs prices with a few modifications to suit the context of our study, which is the Kenyan market, as well as availability of data. Costs were defined as total operational costs and expenses which included investment management expenses, commissions and claims management costs as reported in the technical and non-technical accounts at the end of the year.

Outputs were defined as the product provided by insurers to their policyholders and the insurer's estimation of incurred claims was used as a proxy for this because we were concerned in exploring the pricing behaviour of insurers. To approximate the output of insurers, this study followed Fenn et al., (2006) and used net incurred claims on life and nonlife policies respectively plus bonuses. They were calculated for each insurer from the life and nonlife technical accounts at the year-end.

Inputs were defined as measures of total paid up capital and reserves, technical (underwriting) provisions, and other debt capital. Total paid up capital and reserves figures given in the technical statements were used. The underwriting provisions given in the financial accounts were used as the technical provisions. Debt capital was defined as total borrowings from creditors (such as banks or reinsurers); as reported in the balance sheets at start of year.

The total of current and long term liabilities was used as a proxy for the debt capital. Debt capital was also assumed to be a variable input – capable of being changed in the short run. The study also followed Berger, Cummins and Weiss (1997) and Berger, Cummins, Weiss and Zi (2000) (as cited in Fen et al., 2006) by assuming that total capital and reserves, and technical provisions, are fixed inputs - stocks which have been built up over a long time and are difficult to adjust quickly. We therefore used an average of the total capital and reserves and technical reserves for the period of the study as a proxy for the total capital and reserves.

Input prices were defined as the rate of interest variable to reflect the cost of debt capital. The rate of interest variable was obtained from long-term government bond rates, which was calculated as an average of lending rate of the long term government bonds issued with a period of ten years and above obtained from the Central bank of Kenya statistical bulletin. Because of the difficulty in estimating the average wage of insurance workers in Kenya it was excluded for the purpose of this research.

The study tested the estimates for the impact of size of the firm, the organizational type and also the domestic market share which was measured by the ratio of the firm's net written premium to the industry aggregate net written premium income for

the relevant year as defined in Fen et al., (2006). The effect of the cost of debt on the level of X-efficiency was also explored.

There were 36 insurance companies in the sample. The effect of size on X-efficiency was analyzed in two ways: The full sample was divided into large and small insurance companies by using the median of the average asset size. The study also divided the insurance companies into deciles representing the size of the company and analyzed the effect on efficiency as companies increase in size. The rationale is that the small insurance companies have different scales of operation and through these subsamples the study sought to establish whether economies of scale affect X-efficiency. Mean scores of cost efficiency were calculated for the five year period and the results by using a time series to reveal the trend over the period were analyzed.

The study also analyzed the effect on efficiency by using the maximum likelihood estimates to establish the relationship between X-efficiency and market share, organization size and cost of debt. The X-efficiency estimates obtained were used to establish the impact of the different organization types of composite (operating both life and non-life business) and specialist insurance companies (operating either of life or non-life business) and how the X-efficiency measures vary among the various types of insurance companies.

3.4. Sample Design

The number of insurance firms studied in this paper constitutes 78% of insurance companies currently operating in Kenya. This comprises of 36 insurance companies that have been operating in Kenya in the period of study which is from the year 2005 to 2009. This sample size excluded insurance firms currently under statutory

management and those that have been closed down. These were selected through random sampling.

The sample was picked on the basis of the Central Limit Theorem in statistical theory which implies that any sample equal to or greater than 30 is representative enough irrespective of the population size. This sample was further divided into small and large insurance companies subsamples. The study followed Rai (1996) by classifying insurance companies with asset size greater than the median as large while those with assets less than the median for the industry were defined as small. The study also classified the size of the firms by grouping organizations into deciles shown in appendix VII by using the firm average assets.

The study further sought to distinguish the sample into organizational types by classifying insurance companies into composite (those carrying out life and non-life insurance business); life business only insurance companies; and those carrying out non-life business only.

3.5. Research Model

3.5.1. Conceptual Model

SECFA methodology was originally proposed independently by Aigner, Lovell and Schmidt (1977) and Meeusen and Van Den Broeck (1977). Explicit assumptions about the distribution of the measurement errors and the X-inefficiency terms allow the frontiers to be estimated and scale economies or diseconomies revealed. As they are assumed to capture the effect of measurement error, the v_{it} terms are typically assumed random errors independently distributed as N $(0, \sigma_v^2)$. These are therefore often referred to as the two-sided error terms as they are symmetrically distributed around the true frontier. By contrast the inefficiency terms u_{it} are assumed to have an

independent distribution which is truncated below by the frontier itself: For this reason these inefficiency terms are often referred to as the one-sided error terms. For example, it is sometimes assumed that $u_{it} \sim N+ (\theta, \sigma_u^2)$, where if $\theta = 0$ the assumed distribution is half-normal, and if $\theta \neq 0$ the assumed distribution is truncated normal (Fenn et al., 2006).

The impact of exogenous variables which have a significant influence on the X-inefficiency of the insurer is an issue that has not been frequently explored. Early empirical raised the issue of systematic determinants of the X-inefficiency of firms. The one-stage approach is used to model the inefficiency effects whereby the inefficiency effects are modeled jointly with the frontier (Yeungert, 1993 as cited in Fenn et al., 2006).

To avoid any systematic influence on X-efficiency that would potentially lead to heteroskedasticity in the one sided error term that can lead to significant estimation biases which can affect both the shape of the estimated frontier and the efficiency results the study adopted the procedure suggested by Khumbhakar and Lovell, 2000 (as cited in Fenn et al., 2006) and explicitly modeled the variances of both types of error when fitting the cost and profit functions. The error variances were modeled simultaneously with the frontier as $u_{it} \sim N+ (0, \sigma^2_{ui})$ and $v_{it} \sim N (0, \sigma^2_{vi})$ where:

$$\sigma^2_{ui} = g_u(s_i, \phi_{ui}) \quad (1)$$

$$\sigma^2_{vi} = g_v(s_i, \phi_{vi}) \quad (2)$$

s_i denotes a vector of systematic influences; ϕ_{ui} and ϕ_{vi} are coefficient estimates from the one-sided and two-sided heteroskedasticity models respectively. Khumbhakar and Lovell, 2000, (as cited in Fenn et al., 2006) point out that this approach offers the possibility of solving two problems at once – correcting for heteroskedasticity and

incorporating exogenous influences on X-inefficiency. Estimates obtained were tested for the impact on the error structure of firm size and domestic market share.

Maximum likelihood estimation techniques are required to simultaneously estimate the parameters of the stochastic frontier and of the heteroskedasticity models. The cost and profit efficiency scores were estimated using the formula:

$$E_i = \exp(\pm u_i) \quad (3)$$

where the sign depends on whether u_i is estimated from the cost or profit function.

3.5.2. Analytical Model: Cost Function

Given the difficulties surrounding the definition and measurement of outputs in the insurance sector, the direct estimation of production functions in order to explore supply equations can be problematic. It is therefore more common to use the dual approach and estimate the supply conditions directly from the cost function. This approach is based on the assumption of an objective function (cost minimization) (Fenn et al., 2006). A cost function is defined as the minimum cost (C) of producing a particular output vector (x) with given input prices (w):

$$C = C(x, w) \quad (4)$$

This function must satisfy a number of properties to ensure that it is consistent with the assumed objective behaviour. In particular, it should be continuous, twice differentiable, and symmetric, as well as being homogeneous of degree one in all prices. In addition it is also assumed in the above that the price and output vectors are exogenous. For the cost function, this implies that insurers choose input levels in order to minimize the costs involved in producing a given output.

Following Fen et al., (2006) these assumptions stated are modified in this paper; some of the inputs described there are unlikely to be significantly under the control of management in typical planning periods and are therefore held fixed in the cost function. The cost function to be estimated here is therefore written as:

$$C=C(x, w, z) \quad (5)$$

where the vector z represents the fixed inputs.

Second, given the objective in this paper of exploring the extent to which market power has evolved in the liberalized insurance market in Kenya it seems inappropriate to assume that the insurers are price takers in all markets. The function as presented above at (5) is deterministic and ignores the possibility of measurement error and they assume perfect cost minimization at the specified level of activity.

Because both measurement error and X-inefficiency are invariably present, the estimation process required to fit the cost frontiers has to find a way to separate these out, and, if necessary, estimate their structure. Stochastic Econometric Cost Frontier Analysis (SECFA) represents one approach to this problem (Fen et al., 2006).

3.5.3. Functional Form and Distributional Assumptions

While the translog function is generally considered a flexible functional form, the superiority of the Fourier functional form has appealed to many researchers in terms of its capacity to globally approximate the underlying function over the entire range of data. This functional form has been shown to provide a better fit of the data than translog (Fen et al., 2006).

In this study, for the cost function, we therefore use the Flexible Fourier (FF) specification, given as:

$$\ln Y=\alpha+\sum_{i=1}^{n}\beta_i \ln x_i+\sum_{k=1}^{m}\gamma k \ln p_i+0.5\sum_{i=1}^{n}\sum_{j=1}^{n}\beta_{ij}\ln x_i.\ln x_j+0.5\sum_{k=1}^{m}\sum_{l=1}^{m}\gamma_{kl}\ln p_k.\ln p_l+\sum_{i=1}^{n}\sum_{k=1}^{m}\delta_{ik}$$

$$+\ \ln x_i.\ln p_k+\sum_{j=1}^{m+n}[\phi_j \sin(z_j)+\varphi_s \cos(z_j)]+\sum_{j=1}^{m+n}\sum_{k=1}^{m+n}[\phi_{jk}\sin(z_j+z_k)+\varphi_{jk}\cos(z_j+z_k)]+$$

$$\sum_{j=1}^{m+n}\sum_{k=1}^{m+n}\sum_{l=1}^{m+n}[\phi_{jkl}\sin(z_j+z_k+z_l)+\varphi_{jkl}\cos(z_j+z_k+z_l)+\sum_{j=1}^{m+n}\sum_{k=1}^{m+n}\sum_{l=1}^{m+n}\sum_{m=1}^{m+n}[\phi_{jkl}\sin(z_j+z_k+z_l+z_m)$$

$$+\varphi_{jkl}\cos(z_j+z_k+z_l+z_m)]\ +v_i+u_i \qquad (6)$$

Where Y represents costs; the x variables are outputs and fixed inputs; the p variables are the prices of the variable inputs. The z variables inside the trigonometric terms are rescaled values of the original (logged) variables, such that each rescaled value is in the interval [0,2 π]. As in Fenn et al. (2006), to reduce approximation problems, 10 % is cut off each of the end of the [0, 2 π] interval, such that the rescaled value spans the interval [0.1×2π, 0.9×2 π]. This meant that the measurement error (v_i) and X-inefficiency term (u_i) were now included in this specification. Because the inefficiency term is expected to increase costs and decrease profits, the sign on u_i is positive or negative accordingly. Consistent maximum likelihood estimation of the above functions for the industry reveals the structure of the cost functions and therefore permits analysis of scale economies in the insurance sector, and the firm-specific X-inefficiency effects.

The cost function is specified as follows:

Cost: $C_{it} = \psi C(X_{it}, K_{it}, T_{it}, r_{it}, t, u_{it}, v_{it})$ (7)

Where $\psi C(X_{it}, K_{it}, T_{it}, r_{it}, t, u_{it}, v_{it})$ represents the flexible Fourier functional forms as specified above in equation (6). X_{it} represents the appropriate vector of net incurred claims and bonuses from the end of the year end for the insurer, K_{it} represents end of year share capital and reserves, T_{it} represents the technical provisions, r_{it} reflects the cost of debt, u_{it} represents the X-inefficiency term and v_{it} represents the measurement error. The inclusion of a time variable (t) ensures that changes over time in technology and the underwriting cycle can be captured.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1. Introduction

This chapter presents the data analysis, results of the data analysis and offers a discussion of the findings. Section 4.2 provides the summary statistics while section 4.3 provides the results of the data analysis. Section 4.4 discusses the findings of the study.

4.2. Summary Statistics

Table 1: Summary Statistics on Key Variables

(All figures are in Kshs. Billions)

	Mean	Median	Standard Deviation	Sample Variance	Kurtosis	Skewness	Min	Max
Claims and Bonuses	0.49	0.29	0.46	0.21	2.36	1.59	0.02	2.30
Total Capital and Reserves	3.37	1.76	3.81	14.50	4.86	2.18	0.54	18.31
Technical Provisions	2.33	0.95	3.07	9.44	5.25	2.32	0.17	14.17
Debt	0.28	0.21	0.25	0.06	6.67	2.12	0.03	1.52
Costs	0.18	0.11	0.18	0.03	4.71	2.01	0.01	1.02
Assets	4.35	2.11	5.12	26.18	3.66	2.01	0.61	22.78
Cost of Debt	12.31	12.67	0.83	0.69	(0.90)	(0.74)	10.88	13.17
Market Share	2.78	1.44	2.63	6.94	0.78	1.30	0.14	11.04

Source: Author's calculations based on data collected from IRA

Table 1 above shows the mean output for the full sample given by incurred claims and bonuses is at Kshs. 0.49 billion. The inputs are Kshs. 3.37 billion for capital and reserves, Kshs. 2.33 billion for technical provisions and Kshs. 0.28 billion for debt capital. The mean of the operating costs given by total operational costs including management expenses and commissions is Kshs. 0.18 billion while the mean for total assets is Kshs. 4.35 billion. The mean of the cost of debt is given by 12.31% while the

mean market share is given as 2.78%. We also calculated the median, standard deviation, sample variance, kurtosis, skewness, minimum and maximum amounts for each variable. The inputs of total capital and reserves; technical provisions and debt capital are used to produce the outputs of claims incurred and total bonuses and the operation cost is the total management costs, commissions and other expenses.

4.3. Results from the Analysis of Cost Efficiency

4.3.1. X- Efficiency in Relation to Cost Efficiency

The study applied Fourier functional form on the cost function using time series cross sectional data. Each regression fitted the data well when judged by the maximum likelihood ratio tests of overall model fit. The flexible Fourier parameter estimates are useful in producing a frontier with which to estimate company-specific cost efficiency scores.

Table 2 below shows the X-efficiency measures of mean and standard deviation for the full sample of data for the period from 2005 to 2009. The mean X-efficiency scores are increasing over the period and record constant efficiency for the periods after 2007. These results mean that insurance companies in Kenya have been operating further from the efficient cost frontier from the beginning of the period of study. From the years 2008 however there is a fall in the inefficiency measure indicating that insurance companies have become relatively more cost efficient.

The overall mean X-efficiency score for the period of study is 100% indicating that insurance companies are operating at double the costs that would make them efficient relative to the efficient cost frontier. The standard deviation shows the variation in the X-efficiency estimates. The deviation during the study period was at 89% for the full

sample of insurance companies. The highest variation in the cost efficiencies is recorded in 2007. The range of the standard deviation was 63% to 115%.

Table 2: X-Efficiency Measures based on Averages from 2005 to 2009 for the Full Sample of Insurance Companies

	2005	2006	2007	2008	2009	Average
Mean (%)	53	83	124	121	121	100
Standard deviation (%)	63	76	115	94	96	89

Source: Author's calculations based on data collected from IRA

4.3.2. Mean Efficiency Scores by Firm Size

Table 3 Panel A below shows the results of the mean X-efficiency scores for the full sample of insurance companies and the large and small companies. The two distinct size groupings were determined by using the median of the average of asset size recorded for companies over the period of study. The median was the preferred measure of central tendency to distinguish between the two sizes because it defines the middle value of the asset sizes arranged in order of size and therefore reflects the placement scenario of asset sizes. Companies that recorded a higher average asset size than the median were classified as large and those with an average asset size lower that the median score were classified as small.

The large insurance companies recorded high mean efficiency scores compared to the small insurance companies. This implies that the larger insurance companies are operating further from the efficient cost frontier that the small companies. The large insurance companies record a mean X-efficiency score of 138% compared to 57% for the small insurance companies. This means that the large insurance companies are operating at 138% more costs relative to the insurance companies at the efficient cost frontier while the small insurance companies are operating at 57% more costs relative to insurance companies at the efficient cost frontier.

Table 3 Panel B below shows the average efficiencies for all the companies as well as the large and small insurance companies by year. This table reveals increasing mean efficiency scores for each period with all insurance companies recording the highest cost inefficiency in 2007 then declining afterwards. After controlling for scale differences, the same trend remains.

Table 3 Panel C shows the cost efficiencies broken down by firm size into asset deciles. The table shows the mean scores for firms which fall into nine distinct size groupings within the full sample of the insurance sector. The size groupings were determined by dividing the distribution of total company assets within the insurance sector into deciles. Cost inefficiency is relatively low for smaller companies but then increases with size. This is similar to the findings by Fenn et al. (2006).

The companies falling in all the deciles register increasing cost inefficiency over the years with most companies falling in the 1^{st} to 8^{th} decile recording the highest cost inefficiency in 2007 and thereafter having a drop in cost inefficiency. The largest companies falling in the 9^{th} decile record an almost consistent increase in cost inefficiency over the period. The general time series trend is that cost inefficiency has been increasing over the years as depicted in figure 1(a). There's a marked slight decline from the year 2007.

The rise in costs in 2007 may be attributed to increased compliance costs arising from the new regulatory environment through the Insurance Regulatory Authority that came into effect in 2007. According to a survey conducted by the Centre for the Study of Financial Innovation (CSFI) in which Kenya took part, regulation was identified as a top risk for insurance companies in all geographical regions surveyed. The burden of regulation is being placed on the industry by a wave of regulatory reform at

international and local levels. The fear is that these initiatives load the industry with heavy costs, and distract management from the task of running profitable businesses. According to the survey the sheer volume and complexity of new regulations – now flowing at three levels, international, regional and local – imposes a heavy cost and distraction on insurance companies at a time when capital and management are already tightly stretched.

The increased supervision by the regulatory authority is expected to lead to the exit of inefficient firms operating in the industry. This is probably the reason the mean X-efficiency measure reduces in the years after 2007 for all insurance companies.

Table 3 Panel A and B: Cross Sectional X-Efficiency Estimates

Panel A: Average X-Efficiency Scores for the Period by Size			
Year	**All Insurance companies**	**Large Insurance companies**	**Small insurance companies**
2005-2009	100.34	138.92	57.22
Panel B: X-Efficiency Scores based on Averages for Each Year from 2005-2009			
Year	**All Insurance companies**	**Large Insurance companies**	**Small insurance companies**
2005	52.73	81.73	20.32
2006	83.11	119.82	42.08
2007	124.31	163.43	80.58
2008	120.63	164.96	71.07
2009	120.93	164.68	72.05

Source: Author's calculations based on data collected from IRA

Table 3 Panel C: X-Efficiency Scores based on Asset Deciles

	2005	**2006**	**2007**	**2008**	**2009**
Decile 1	33.18	55.54	113.94	95.68	106.06
Decile 2	19.80	40.62	73.09	71.14	70.14
Decile 3	25.77	45.14	75.49	64.80	62.30
Decile 4	13.88	35.45	71.14	62.35	64.38
Decile 5	26.97	59.46	96.37	90.78	82.26
Decile 6	98.52	135.08	223.21	168.47	135.53
Decile 7	109.43	148.79	165.46	162.91	150.07
Decile 8	79.96	112.92	243.61	179.37	193.79
Decile 9	100.23	146.69	115.69	236.39	287.80

Source: Author's calculations based on data collected from IRA

Figure 1(a) below depicts the cross-sectional mean of X-efficiency for each year between 2005 and 2009 for the full sample of insurance companies. It shows a sharp increase in the cost efficiency of insurance companies which peaks in 2007 and thereafter remains constant. The increased costs in 2007 can be attributed to a new regulatory environment and hence increased costs of compliance. The decrease in X-efficiency in the following years can be attributed to the positive effects of regulation arising from the exit of inefficient firms from the industry that is brought about by the risk based supervision by the insurance regulatory authority.

Figure 1: Time Series Properties of X-Efficiency for all Insurance Companies
Figure 1 (a): Mean of X-efficiency for the Full Sample of Insurance Companies

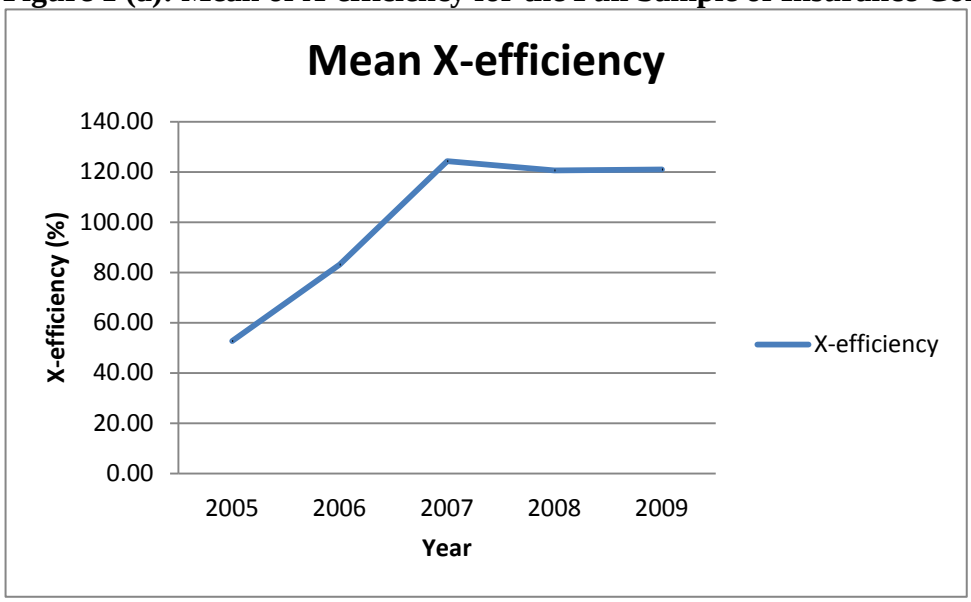


Figure 1(b) below shows the efficiency trends over the period of the study. The small companies were found to be more cost efficient compared to the large companies over the entire period of study. Small insurance companies are operating closer to the efficient cost frontier than the large insurance companies.

Figure 1(b): X- Efficiency Estimates by Size of Insurance Companies

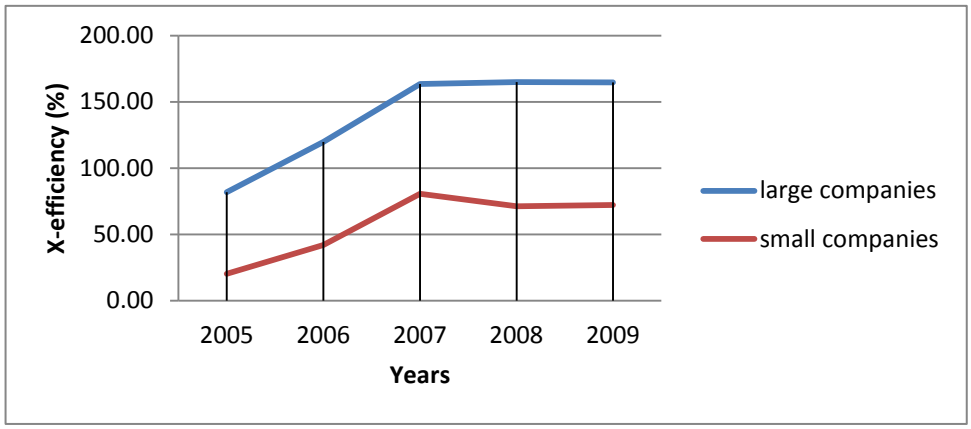
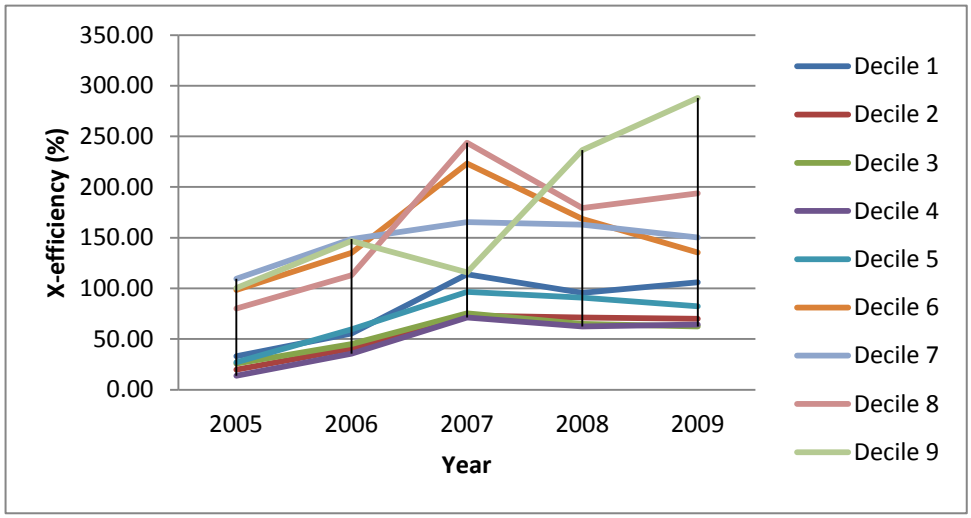


Figure 1(c) below depicts the cross-sectional mean of X-efficiency for each year for the various asset deciles. Insurance companies falling in the 6th and 8th decile record the highest cost inefficiency for the period. The companies falling in the 2nd, 3rd and 4th decile record the lowest cost inefficiency. This indicates that the smaller insurance companies are operating nearer the efficient cost frontier than the larger insurance companies and hence utilizing fewer inputs compared to the larger insurance companies in production of outputs. The largest insurance companies falling in the 9th decile exhibit increasing cost inefficiency over the period.

Figure 1(c): Mean X-Efficiency by Asset Deciles



4.3.3. Organizational Type Effect on X- Efficiency

Table 4 below shows the effect of organizational type of insurance companies on efficiency. Table 4 Panel A shows the averages for the whole sample of data for the period of study. The composite insurance companies recorded an X-efficiency measure of 130% compared to the specialist companies which recorded X-efficiency measures of 89% and 72% for the life and non-life insurance companies respectively.

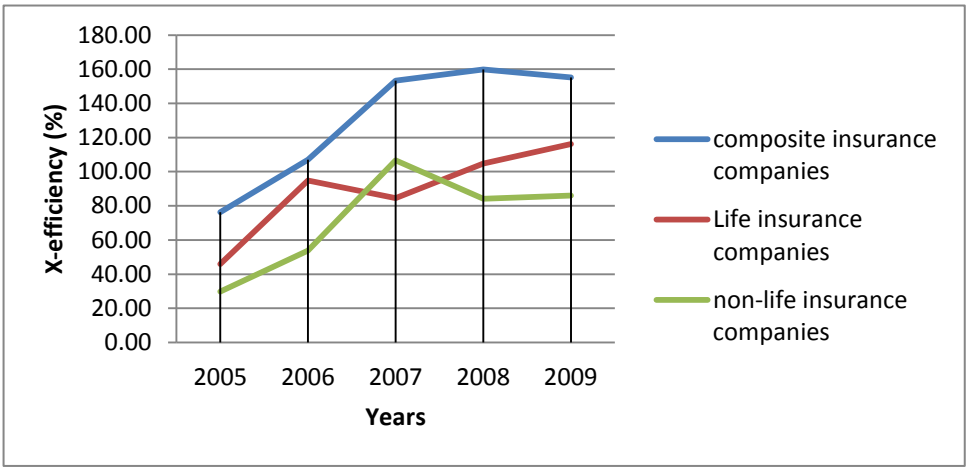
Table 4 Panel B and figure 2 below indicates that the composite companies are operating further from the efficient cost frontier as compared to the specialist companies. The life insurance companies exhibit the same trend as all the other companies as shown in table 3 above as shown in figure 2 though it is still operating nearer the efficient cost frontier than the composite insurance companies. As depicted in figure 2 the X-efficiency measure for the life insurance companies insurance companies is rising over the period from 2007 likely due to the pressure arising from inflation following the global economic downturn. Inflation has a potentially heavy impact on insurance portfolios, particularly on the life side according to the survey by the CSFI.

.**Table 4: Organizational Type Effect on X-Efficiency**

Year	Composite Insurance companies	Life insurance companies	Non-life insurance companies
Panel A: Based on averages for 2005 to 2009			
2005-2009	130.31	89.24	72.07
Panel B: Based on averages per year from 2005 to 2009			
2005	76.32	45.88	29.85
2006	106.96	94.90	53.74
2007	153.30	84.51	106.66
2008	159.87	104.74	84.06
2009	155.12	116.16	86.06

Source: Author's calculations based on data collected from IRA

Figure 2: Time Series X-Efficiency for Insurance Companies by Organization Type



4.3.4. The Relationship between X-Efficiency, Cost of Debt, Market Share and Organization Size

Table 5 below shows the coefficients maximum likelihood estimates on market share; cost of debt and organization size. The coefficient for market size is negative, indicating that an increasing organization size as measured by total assets in the Kenyan insurance industry tends to decrease X-efficiency; the correlation was however found to be insignificant at the 0.05 level. On the contrary there is a positive coefficient for market share and cost of debt indicating that an increasing market share as well as cost of debt tends to increase the X-efficiency of the Kenyan insurance companies. The relationship was found to be significant for both the market share and cost of debt.

Table 5: Relationship between Cost Efficiency and Determinants of Cost Efficiency

	coefficient	Std error	t-statistic	
Cost of Debt	18.10	4.56	3.97	Significant
Market Share	0.21	0.05	4.39	Significant
Firm Size	-0.06	0.03	-1.99	Insignificant

Correlation significant at 0.05 level (2-tailed)

Source: Author's calculations based on data collected from IRA

4.4. Discussion

This research identifies the relative dispersion of the efficiency scores among the companies analyzed. Companies operating further from the efficient cost frontier indicate a relatively low level of efficiency. The average X-efficiency of the full sample of insurance companies used in this study is Kenya is 100% indicating that companies are utilizing double the inputs given by the capital and reserves, technical provisions and debt capital to produce the outputs given by claims incurred and bonuses when compared to insurance companies on the efficient cost frontier. The results indicate that the Kenyan insurance companies are, on average, relatively inefficient and therefore there is room for their levels of efficiency to be upgraded, specifically in the case of those companies operating above the mean X-efficiency. As shown in Appendix VII, many of the insurance companies falling in the 6th to 9th decile are operating at costs above the mean X-efficiency of the industry which is 100%.

This study also found that the size of the insurance company contributes to X-efficiency, although it is not statistically significant as shown in table 5. These findings suggest that low costs of debt and a decreased market share is beneficial for efficiency and statistically significant at 5%. A possible interpretation for this finding is that an increased market share would require increased resources against an increase in premium that would be unable to cover the increase in costs. Accordingly, insurance companies may achieve high levels of competitiveness by using vast amounts of resources and thus, perform inefficiently (Barros, Barroso and Borges, 2005).

Because of the high levels of competition and low premium rates charged by the Kenyan insurance companies an increase in market share would not be adequate to

cover the increase in resources such as costs of opening additional offices, increased labour costs and commissions. The existence of scale economies on a market means that an increase in the number of competitors results in higher average costs for each incumbent firm. Consequently, competition would decrease cost efficiency (Fenn et al., 2006). Lower costs of debt would make it easier for insurance companies to obtain more debt capital and hence increase the level of inputs.

The estimates of mean X-efficiency over the period of the study offers insights into the effects on the operational environment for insurance companies. The increase in the mean X-efficiency implies that the insurance companies are operating further from the efficient cost frontier. A possible reason given for the increasing X-efficiency of insurance companies as shown in figure 1(a) is the increased competition from a high number of insurance companies operating in the insurance industry resulting in reduced business and increased costs of acquiring business in form of commissions paid to agents. The highest mean X-efficiency score is recorded in 2007. A possible explanation for the high X-efficiency score in 2007 is the coming into effect of the Insurance regulatory Authority, (IRA) and hence increased compliance costs.

Investment costs incurred by insurance companies to upgrade technology of production and to staff training costs are also an additional cost faced by the insurance industry. Large companies were found to be more cost inefficient than the small companies as shown in figure 1(b) and supports findings from other studies such as those by Rai (1996) and Cummins et al., (1996).

Too much expenditure on the cost factors adds to inefficiency, particularly when this expenditure is not converted into outputs. Of the control variables employed in the

analysis of X-efficiency, only cost of debt and market share were found to be significantly related to efficiency. These findings are similar to those of Hao (2004) who found a positive relationship between market share and cost inefficiency. Fenn et al., (2006) also found that insurance companies with high market shares tend to have more cost inefficiency.

Fraudulent claims is one of the major risks facing insurance firms in the region according to a recent PriceWaterhouseCoopers (PWC) survey on risk in East Africa's financial services sector has identified Insurance companies in Kenya estimate that they lose a total of Sh4 billion, paid every year to undeserving parties. Motor insurance is the worst hit industry segment and a bulk of the money paid lost in fraudulent claims by insurers is through rampant fraud in motor insurance. According to the AKI, fraudulent claims account for more than a third of the money paid by insurance firms.

The financial services sector witnessed a number of changes last year. Various legislative changes made during the year were aimed at improving regulation and governance in the insurance sector. Key among the changes were: Insurance companies were required to have paid up capital of at least Kshs. 300 million for general business, Kshs 150 million for life business and Kshs 450 million for composite insurance business respectively by 14th June, 2010. There was also regulation requiring financial statements of insurance companies to be prepared in accordance with International Financial Reporting standards. The new regulation also allowed insurance agents to transact business for more than three companies making the costs of acquiring business from agents higher because of competitive pressure.

Increased regulation will increase the industry's costs according to a survey conducted by the Centre for the study of financial innovation (CSFI) in conjunction with PWC in Kenya and other parts of the world. The burden of regulation that is being placed on the insurance industry by a wave of regulatory reform at international and local levels has raised concern that the industry will bear heavy costs, and distract management from the task of running profitable businesses.

The X-efficiency of insurance companies was also evaluated for the different organization types of insurance companies. The sample used in the study contains 16 insurance companies that transact life and non-life business, 5 insurance companies specializing in life business and 15 insurance companies specializing in non-life business. The findings of the study as depicted in figure 2 indicates that composite insurance companies transacting both lines of insurance business are more cost inefficient when compared to the specialist companies conducting either life or non-life business. The findings of this study on the effect of organization type on efficiency support other findings by Rai (1996) and Fenn et al., (2006) who found that composite companies record higher cost inefficiencies compared to specialist companies. The findings also validate the existing regulation effected in the year 2010 that requires the separation of the life and non-life lines of insurance business for insurance companies operating in Kenya.

The life business records a lower X-efficiency in 2007 when compared to the non-life business. A possible explanation for this is that the increased regulatory initiatives particularly in regard to pricing of insurance products could have lead to premium income that can adequately cover the costs arising from claims paid out.

These findings are similar to those of Meador et al., (1997) who found a negative relationship between regulation and X-efficiency of the United States life insurance companies. The X-efficiency of life insurance companies as depicted in figure 2 is however increasing for periods after 2007. A possible explanation is increased acquisition costs of life business from increased commissions paid to agents are high due to the low life insurance penetration in Kenya.

Life insurance business also faces increased costs arising from inflation as indicated in the survey by CSFI and PWC. Inflationary costs following the global economic downturn witnessed in 2008 could explain the increasing X-efficiency score of life insurance companies as depicted in figure 2. Generally accepted economic theory supports the conclusion that the rate of interest should move in the same direction as the expected rate of inflation (Mills, 1996) and hence a higher cost of debt for the life insurance companies.

The Kenyan insurance industry is a free market although the regulatory authority has imposed minimum premium rates for insurance companies to charge. The regulatory authority has an important role to play in improving the efficiency of insurance companies.

The Insurance Regulatory Authority has moved from assessing the strength of insurance companies based on whether a company is able to meet the share capital requirements to using risk based supervision. The increased transparency and enforcement of rules relating to technical provisions and solvency is envisaged in the next few years, with the introduction of the Solvency II rules and the application of the IAS (International Accounting Standards).

Barros, Barroso and Borges (2005) found that there are certain elements intrinsic to the management of companies that make some of them more efficient than others. Therefore, upgrading the quality of the management practices should be given major priority by insurance companies. Olende (2010) cites lack of skills in the Kenyan insurance workforce as one of the challenges facing the Kenyan insurance industry. Encouraging or insisting on continuous educational improvement through skills acquisition and upgrades among the workforce and management is an example of what can be done to improve efficiency in the Kenyan insurance industry. Finally, a benchmark analysis should be carried out by the insurance companies as a way to provide managerial indications for inefficient companies to catch up with the efficient frontier.

4.5. Summary

The Kenyan insurance companies have exhibited increasing X-efficiency during the period of study. The average industry X-efficiency is 100%. This means that the insurance companies have been utilizing 100% more inputs of the capital and reserves, debt capital and technical provisions relative to the insurance companies on the cost efficient frontier, to produce outputs of claims and bonuses.

The variables considered of cost of debt, market share and organization size were found to influence the measures of X-efficiency. The relationship between market share and cost of debt and X-efficiency were found to be significant. However there was an insignificant relationship between organization size and the measure of X-efficiency.

Large insurance companies were found to be more cost inefficient compared to the small insurance companies. This was attributed to the costs arising from the increased

operational costs resulting from the increased size of the organization. These findings are similar to those of other studies done by Rai (1996) and Cummins et al., (1996).

When analyzed by the existing organization types of composite insurers (those operating both life and non-life business) and those specializing in either life or non-life. The composite insurers were found to be more cost inefficient than those specializing in one line of business. This finding supports other findings such as Rai (1996) and Fenn et al., (2006). This finding also gives validation to the recently effected regulation requiring the separation of the two major lines of insurance business, the life business and non-life business.

Regulatory compliance costs, costs arising from settlement of fraudulent claims as well as inflation were attributed to the rising X-efficiency in Kenya. Other factors such as the global economic recession were also attributed to the increased X-efficiency. Regulation is however important in monitoring and supervising the management of insurance companies and as supervision increases the less efficient insurance companies will exit the market resulting in a fall in the X-efficiency measure as witnessed in the years after 2008. The rise in the X-efficiency measure of life insurance companies can be attributed to inflation which has been found to influence the costs of life insurance companies (Centre for the study of financial innovation, 2011). The risk based supervision by the Insurance Regulatory Authority is expected to influence management operations of insurance companies in Kenya and effectively lead to the catching up of inefficient companies with the efficient frontier.

CHAPTER FIVE

SUMMARY AND CONCLUSIONS

5.1. Introduction

This chapter presents the summary, conclusions from the results of the study and offers recommendations for further studies. Section 5.2 provides the summary of the findings while section 5.3 provides the conclusions of the data analysis. Section 5.4 provides the recommendations for further studies.

5.2. Summary of the Study

This study used a stochastic frontier methodology to model the efficiency of Kenyan insurance companies during the period under study. Flexible form frontiers were estimated for the three main business types observed in the Kenyan insurance market: life and nonlife specialist companies and composite companies which handle both life and non-life insurance. The study adopted a one-stage approach to estimation that simultaneously controlled for the effect of size and market share on X-efficiency, and also corrected for the potential estimation bias arising from heteroskedastic error terms. The estimated frontiers were then used to explore the scale economies under which the Kenyan insurance companies are operate, and to compare these with the estimated cost efficiency scores.

Company level data for the period from 2005 to 2009 was used. This study adopted a common efficient cost frontier for the Kenyan insurance industry and assumed that all the insurance companies operate on or below this common frontier. This study makes a presumption on the underlying technology of producing insurance being similar, and the accounting data consistent, across all insurance companies.

The findings revealed that larger companies have significantly higher levels of cost inefficiency. The domestic market share of insurers is positively associated with the mean X-efficiency. Moreover, firm size increases X-efficiency though the relationship was found to be insignificant.

After controlling for scale differences, the level of cost efficiency for the large companies was found to be relatively lower than that of the small companies. The results of the maximum likelihood estimates show that, although insignificant, there is a negative correlation between organization size and cost efficiency measures. Our findings support other studies such as that conducted by Rai (1996) and Fenn et al., (2006) which have shown that small firms are on average more cost efficient than large companies worldwide.

Insurance companies operating both life and non-life business were found to be more cost inefficient compared to the insurance companies specializing in either of the two lines of business of life or non-life. These findings support other findings by Rai (1996) and Fenn et al., (2006) who found that insurance companies operating both lines of business were more cost inefficient compared to insurance companies specializing in either life or non-life. Moreover this findings support new regulation requiring the separation of the two lines of business that was effected by the regulatory authority in 2010.

Non-life companies were found to be more cost efficient than life companies supporting findings by Fenn et al., (1996). The domestic market share of insurers is positively associated with the mean X-efficiency indicating that an increased market share for insurers will result in increased X-efficiency. This supports the findings by Fenn et al., (2006) who found that firms with a high market share recorded higher

measures of cost inefficiency. Moreover, firm size increases X-efficiency though the relationship was found to be insignificant.

5.3. Conclusion

This research paper analyzed the cost efficiency in a representative sample of the Kenyan insurance companies between 2005 and 2009, a period of intense volatility for the insurance industry due to an economic global recession and transition into increased supervision by the Insurance Regulatory Authority. The analysis is based on a stochastic cost frontier that allows for the incorporation of multiple inputs and outputs in determining the relative efficiencies.

The regulatory agency has an important role to play in improving the efficiency of insurance companies. Policies should include publishing data on individual companies in order to introduce greater transparency into the market, resulting in increased competition and enforcing the regulations such as technical provisions and reserve ratios relating to the companies themselves.

Legal backing by government agencies to deal with fraud that has caused insurance companies to incur increased costs arising from the settlement of fraudulent claims as well as increased monitoring is expected to yield increased efficiency for the insurance industry. The risk based supervision adopted by the Insurance Regulatory Authority is recognized as contributing positively to the efficiency scores captured by the trend.

The policy implication of this research is that increased regulation and fraud increases the costs of insurance companies. The increased monitoring however will result in the less efficient firms exiting the market as has been the case with insurance companies that are placed under statutory management. Increased capital share requirements

imposed through the regulatory authority will also result in mergers and acquisitions and hence increased inputs for the insurance companies.

The industry has taken measures to root out fraudulent elements that have resulted into high costs for insurers. The Kenya Auto Repair Association (KARA), a professional lobby for garage operators is already working with insurers, motor assessors and investigators to fight fraud. The Association of Kenya insurers(AKI) is moving towards getting a legal backing to enable them to take action on service providers in the motor industry such as garages operating outside the professional code of ethics as well as engage the Kenya Bureau of Standards to create standards for the industry. Insurers also expect the passing of the draft Insurance bill into law to help in fighting fraud as it will create a fraud investigative unit, which will be housed by the Insurance Regulatory Authority (IRA).

With regard to the new solvency system, it should be more risk-based. Insurance companies should be required to improve their risk analysis and risk mitigation techniques, in order to formulate their capital and earnings needs more precisely, which is highly significant in today's harder capital markets (Barros et al., 2005).
Increased monitoring by the regulatory authority through increasing the scrutiny of the accounts, the adequacy of reserves and the quality of management, and thus stimulating the less efficient companies to exit the market is required. The regulatory authority should also take measures to avoid excessive concentration and dominant firms, which might mitigate competition and decrease efficiency.

Policies that should be developed by the regulatory authority include publishing data on individual companies in order to introduce greater transparency into the market, resulting in increased competition and enforcing the regulations such as technical

provisions and reserve ratios relating to the companies themselves. These regulatory activities should be pursued without complacency by the regulatory agency because it is unfeasible to regulate a market with too many inefficient companies, displaying relatively low efficiency scores, particularly large companies with substantial market share (Barros et al., 2005)

5.4. Limitations of the Study

This paper has two main limitations: first, limitations related to the data set and second, limitations related to the method. The study uses accounting data which is prone to accuracy distortion arising from the use of different accounting basis, a limitation which the study was unable to overcome.

The limitations of the model are the following: the stochastic cost frontier model imposes a functional form on the data and relies on distributional assumptions for the inefficiency term. These limitations are precisely the most distinctive and appealing characteristics of the stochastic frontier model. This efficiency measurement assumes that the production function of the fully-efficient insurance company is known. In practice, this is not the case and the efficient isoquant must be estimated from the sample data. In these conditions, the frontier is relative to the sample considered in the analysis. Moreover, the proxies used to measure prices are debatable, but they are in line with the procedure used in this context (Barros et al., 2005).

5.5. Suggestions for Further Research

This study concentrated on the X-efficiency as measured by cost efficiency and analyzed this against the market share and size of the firm and organization type. A study on X-efficiency based on revenue and profitability of insurance companies in Kenya is suggested for future research. This is because large insurance companies by

asset size may not be an indicator of the institutions financial strength and efficiency and some companies which are large have been found to operate inefficiently and have been placed under statutory management.

The effect of regulation on the separate classes of life and non-life insurance business should be carried out to determine whether regulation affects the two lines of business differently. Future studies need to take into consideration comprehensive input and output measurements by allowing for factors that are not discretionary such as environmental, socio-economic and quality inputs and outputs hence eliminating the influence of insurance companies on the measures of X-efficiency.

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Appendix I: Aggregated Data

		Ksh. Billion	Ksh. Billion	Ksh. Billion
t	i	C	x	K
2005	AIG (K)	0.09	0.26	1.52
2005	AMACO	0.04	0.04	0.70
2005	APA	0.21	0.90	4.32
2005	APOLLO	0.02	0.04	1.39
2005	BLUE SHIELD	0.21	0.73	2.73
2005	BRITISH AMERICAN	0.31	0.46	9.53
2005	CANNON	0.06	0.14	1.93
2005	CFC LIFE	0.15	0.49	9.13
2005	CONCORD	0.14	0.27	0.60
2005	COOPERATIVE	0.16	0.59	2.37
2005	CORPORATE	0.03	0.11	0.74
2005	FIDELITY SHIELD	0.08	0.27	0.94
2005	FIRST ASSURANCE	0.09	0.24	1.37
2005	GATEWAY	0.03	0.17	1.10
2005	GEMINIA	0.06	0.17	0.97
2005	GENERAL ACCIDENT	0.04	0.19	1.65
2005	HERITAGE AII	0.19	0.53	4.48
2005	I.C.E.A.	0.21	0.50	18.14
2005	INTRA AFRICA	0.04	0.20	0.79
2005	JUBILEE	0.20	1.00	12.00
2005	KENINDIA	0.46	1.23	7.46
2005	KENYA ORIENT	0.02	0.06	2.30
2005	KENYAN ALLIANCE	0.11	0.19	2.19
2005	LION OF KENYA	0.15	0.47	3.43
2005	MADISON	0.17	0.63	3.02
2005	MERCANTILE	0.04	0.06	1.29
2005	OCCIDENTAL	0.06	0.21	0.79
2005	OLD MUTUAL	0.22	0.11	5.79
2005	PAN AFRICA LIFE	0.23	0.25	4.50
2005	PHOENIX OF E.A	0.05	0.11	1.76
2005	PIONEER	0.04	0.06	0.60
2005	REAL	0.09	0.23	1.02
2005	TAUSI	0.11	0.27	0.90
2005	THE MONARCH	0.02	0.03	0.56
2005	TRIDENT	0.04	0.18	1.56
2005	UAP PROVINCIAL	0.26	0.66	6.40
2006	AIG (K)	0.31	0.36	1.48
2006	AMACO	0.05	0.08	0.69
2006	APA	0.27	0.99	4.23
2006	APOLLO	0.05	0.06	1.39
2006	BLUE SHIELD	0.30	0.88	2.83
2006	BRITISH AMERICAN	0.39	0.51	9.92
2006	CANNON	0.08	0.15	2.03
2006	CFC LIFE	0.19	0.88	9.20
2006	CONCORD	0.12	0.27	0.61
2006	COOPERATIVE	0.13	0.80	2.29
2006	CORPORATE	0.04	0.13	0.79
2006	FIDELITY SHIELD	0.10	0.30	0.94
2006	FIRST ASSURANCE	0.11	0.29	1.41
2006	GATEWAY	0.02	0.17	1.10
2006	GEMINIA	0.06	0.18	1.04
2006	GENERAL ACCIDENT	0.05	0.34	1.64
2006	HERITAGE AII	0.20	0.55	4.48
2006	I.C.E.A.	0.29	1.27	17.93
2006	INTRA AFRICA	0.03	0.19	0.80
2006	JUBILEE	0.31	1.32	12.12
2006	KENINDIA	0.55	1.56	7.39
2006	KENYA ORIENT	0.03	0.09	2.31
2006	KENYAN ALLIANCE	0.08	0.29	2.20
2006	LION OF KENYA	0.16	0.53	3.42
2006	MADISON	0.17	0.57	2.89
2006	MERCANTILE	0.03	0.08	1.28
2006	OCCIDENTAL	0.07	0.24	0.79
2006	OLD MUTUAL	0.33	0.22	5.94
2006	PAN AFRICA LIFE	0.24	0.22	4.48
2006	PHOENIX OF E.A	0.07	0.10	1.74
2006	PIONEER	0.05	0.08	0.60
2006	REAL	0.11	0.28	1.01
2006	TAUSI	0.11	0.31	0.91
2006	THE MONARCH	0.02	0.02	0.62
2006	TRIDENT	0.05	0.21	0.96
2006	UAP PROVINCIAL	0.26	0.61	6.30

2007	AIG (K)	0.34	0.40	1.67
2007	AMACO	0.06	0.17	0.75
2007	APA	0.28	1.34	4.31
2007	APOLLO	0.02	0.07	1.41
2007	BLUE SHIELD	0.49	1.00	2.88
2007	BRITISH AMERICAN	0.58	0.66	9.67
2007	CANNON	0.12	0.20	2.11
2007	CFC LIFE	0.20	0.69	9.39
2007	CONCORD	0.12	0.24	0.64
2007	COOPERATIVE	0.18	1.12	2.45
2007	CORPORATE	0.06	0.16	0.69
2007	FIDELITY SHIELD	0.11	0.29	0.96
2007	FIRST ASSURANCE	0.14	0.44	1.40
2007	GATEWAY	0.02	0.20	1.14
2007	GEMINIA	0.07	0.20	1.06
2007	GENERAL ACCIDENT	0.06	0.22	1.76
2007	HERITAGE AII	0.23	0.78	4.46
2007	I.C.E.A.	0.29	0.78	18.12
2007	INTRA AFRICA	0.04	0.19	0.81
2007	JUBILEE	0.28	1.51	12.37
2007	KENINDIA	0.70	2.13	7.40
2007	KENYA ORIENT	0.04	0.13	2.30
2007	KENYAN ALLIANCE	0.07	0.24	2.20
2007	LION OF KENYA	0.15	0.63	3.39
2007	MADISON	0.14	0.65	2.86
2007	MERCANTILE	0.02	0.07	1.40
2007	OCCIDENTAL	0.07	0.28	0.86
2007	OLD MUTUAL	0.13	0.08	5.73
2007	PAN AFRICA LIFE	0.40	0.38	4.63
2007	PHOENIX OF E.A	0.09	0.15	1.84
2007	PIONEER	0.05	0.11	0.56
2007	REAL	0.12	0.29	1.10
2007	TAUSI	0.09	0.26	0.94
2007	THE MONARCH	0.04	0.04	0.68
2007	TRIDENT	0.04	0.22	0.95
2007	UAP PROVINCIAL	0.41	0.89	6.51
2008	AIG (K)	0.36	0.62	1.61
2008	AMACO	1.02	0.34	0.74
2008	APA	0.39	1.53	4.42
2008	APOLLO	0.02	0.08	1.61
2008	BLUE SHIELD	0.38	1.14	2.84
2008	BRITISH AMERICAN	0.81	0.99	9.57
2008	CANNON	0.10	0.28	2.22
2008	CFC LIFE	0.23	0.68	9.25
2008	CONCORD	0.14	0.27	0.64
2008	COOPERATIVE	0.21	1.09	2.49
2008	CORPORATE	0.06	0.22	0.68
2008	FIDELITY SHIELD	0.11	0.30	0.96
2008	FIRST ASSURANCE	0.18	0.53	1.43
2008	GATEWAY	0.04	0.16	1.10
2008	GEMINIA	0.08	0.21	1.05
2008	GENERAL ACCIDENT	0.10	0.32	1.75
2008	HERITAGE AII	0.28	0.99	4.45
2008	I.C.E.A.	0.40	0.79	18.31
2008	INTRA AFRICA	0.06	0.23	0.81
2008	JUBILEE	0.38	1.88	12.63
2008	KENINDIA	0.55	1.34	7.40
2008	KENYA ORIENT	0.07	0.18	2.33
2008	KENYAN ALLIANCE	0.06	0.12	2.16
2008	LION OF KENYA	0.17	0.71	3.56
2008	MADISON	0.12	0.60	2.71
2008	MERCANTILE	0.02	0.07	1.28
2008	OCCIDENTAL	0.08	0.34	0.81
2008	OLD MUTUAL	0.11	0.51	5.71
2008	PAN AFRICA LIFE	0.39	0.58	4.53
2008	PHOENIX OF E.A	0.08	0.19	1.95
2008	PIONEER	0.09	0.09	0.56
2008	REAL	0.17	0.32	1.23
2008	TAUSI	0.09	0.20	0.95
2008	THE MONARCH	0.04	0.04	0.59
2008	TRIDENT	0.05	0.21	0.88
2008	UAP PROVINCIAL	0.55	1.08	7.62
2009	AIG (K)	0.38	0.56	1.68
2009	AMACO	0.16	0.56	0.83
2009	APA	0.50	1.94	4.47
2009	APOLLO	0.01	0.03	1.37

2009	BLUE SHIELD	0.85	1.29	2.60
2009	BRITISH AMERICAN	0.93	1.48	9.58
2009	CANNON	0.10	0.38	2.09
2009	CFC LIFE	0.30	0.80	9.29
2009	CONCORD	0.10	0.42	0.64
2009	COOPERATIVE	0.20	1.31	2.45
2009	CORPORATE	0.05	0.22	0.67
2009	FIDELITY SHIELD	0.12	0.39	1.01
2009	FIRST ASSURANCE	0.21	0.73	1.63
2009	GATEWAY	0.05	0.26	1.12
2009	GEMINIA	0.09	0.23	1.04
2009	GENERAL ACCIDENT	0.13	0.44	1.76
2009	HERITAGE AII	0.28	1.12	4.52
2009	I.C.E.A.	0.43	1.37	18.00
2009	INTRA AFRICA	0.06	0.21	0.82
2009	JUBILEE	0.53	2.30	12.73
2009	KENINDIA	0.53	1.25	7.38
2009	KENYA ORIENT	0.05	0.24	2.32
2009	KENYAN ALLIANCE	0.07	0.11	2.23
2009	LION OF KENYA	0.18	0.78	3.59
2009	MADISON	0.12	0.63	2.77
2009	MERCANTILE	0.03	0.07	1.30
2009	OCCIDENTAL	0.08	0.40	0.80
2009	OLD MUTUAL	0.24	0.62	5.76
2009	PAN AFRICA LIFE	0.58	0.78	4.44
2009	PHOENIX OF E.A	0.09	0.22	1.89
2009	PIONEER	0.08	0.19	0.56
2009	REAL	0.19	0.43	1.29
2009	TAUSI	0.10	0.13	1.01
2009	THE MONARCH	0.03	0.04	0.54
2009	TRIDENT	0.06	0.26	1.11
2009	UAP PROVINCIAL	0.56	1.82	7.62

Source: Calculated from data collected from IRA

Where:

t is the year

i is the company

C is the total costs

X is the total outputs

K is the total inputs

Appendix II: K Data Components: Total Capital and Reserves

	Fixed Inputs(K_1)					
	Total Capital and Reserves					
Company	2005	2006	2007	2008	2009	Average Total capital and Reserves
	Ksh. Billion	Ksh. Billion	Ksh. Billion	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.28	0.29	0.32	0.41	0.46	0.35
AMACO	0.17	0.20	0.23	0.34	0.61	0.31
APA	0.88	1.67	1.60	1.26	1.34	1.35
APOLLO	0.53	0.98	0.85	0.08	0.20	0.53
BLUE SHIELD	0.43	0.56	0.50	0.60	0.07	0.43
BRITISH AMERICAN	0.26	0.44	3.91	4.65	4.23	2.70
CANNON	0.46	0.57	0.64	0.64	0.88	0.64
CFC LIFE	0.18	0.58	0.68	1.27	1.19	0.78
CONCORD	0.14	0.15	0.19	0.19	0.17	0.17
COOPERATIVE	0.22	0.22	0.57	0.76	0.99	0.55
CORPORATE	0.16	0.17	0.20	0.23	0.20	0.19
FIDELITY SHIELD	0.19	0.23	0.31	0.31	0.44	0.30
FIRST ASSURANCE	0.24	0.26	0.33	0.43	0.55	0.36
GATEWAY	0.18	0.21	0.23	0.33	0.37	0.27
GEMINIA	0.22	0.26	0.27	0.27	0.62	0.33
GENERAL ACCIDENT	0.47	0.57	0.69	0.65	0.79	0.63
HERITAGE AII	1.28	1.85	1.75	1.30	1.53	1.54
I.C.E.A.	11.65	1.55	1.06	1.09	1.17	3.30
INTRA AFRICA	0.14	0.16	0.26	0.25	0.28	0.22
JUBILEE	0.76	1.48	1.39	0.85	1.32	1.16
KENINDIA	1.24	1.39	0.80	1.11	1.40	1.19
KENYA ORIENT	0.12	0.13	0.22	0.24	0.28	0.20
KENYAN ALLIANCE	0.42	0.54	0.60	0.61	0.95	0.63
LION OF KENYA	0.85	0.92	0.94	1.31	1.50	1.11
MADISON	0.30	0.36	0.46	0.45	0.63	0.44
MERCANTILE	0.25	0.26	0.28	0.31	0.35	0.29
OCCIDENTAL	0.13	0.15	0.20	0.27	0.36	0.22
OLD MUTUAL	1.78	1.71	0.62	0.61	1.11	1.17
PAN AFRICA LIFE	0.23	0.47	0.58	0.58	0.20	0.41
PHOENIX OF E.A	0.82	1.18	1.25	0.99	1.01	1.05
PIONEER	0.05	0.05	0.07	0.07	0.22	0.09
REAL	0.18	0.20	0.25	0.24	0.43	0.26
TAUSI	0.14	0.14	0.14	0.14	0.33	0.18
THE MONARCH	0.22	0.25	0.26	0.25	0.32	0.26
TRIDENT	0.17	0.18	0.21	0.23	0.58	0.27
UAP PROVINCIAL	2.28	4.26	4.22	3.03	2.97	3.35

Source: Calculated from data collected from IRA

Appendix III: K Data Components: Technical Provisions (T)

Insurance Company	Technical Provisions (T)					Average
	2005	2006	2007	2008	2009	T
	Ksh. Billion	Ksh. Billion	Ksh. Billion	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.50	0.57	0.61	0.81	0.83	0.67
AMACO	0.14	0.18	0.28	0.41	0.60	0.33
APA	1.92	1.94	2.68	3.36	3.85	2.75
APOLLO	0.34	0.31	0.30	0.06	0.28	0.26
BLUE SHIELD	1.71	1.53	1.93	2.03	1.64	1.77
BRITISH AMERICAN	3.91	5.41	5.89	7.47	9.91	6.52
CANNON	0.76	0.86	1.06	1.41	1.80	1.18
CFC LIFE	6.71	7.51	7.89	8.51	9.60	8.04
CONCORD	0.32	0.31	0.32	0.34	0.46	0.35
COOPERATIVE	0.98	1.28	1.54	1.91	2.18	1.58
CORPORATE	0.28	0.36	0.41	0.46	0.51	0.40
FIDELITY SHIELD	0.47	0.52	0.57	0.62	0.66	0.57
FIRST ASSURANCE	0.54	0.63	0.77	0.93	1.07	0.79
GATEWAY	0.53	0.83	0.72	0.76	0.97	0.76
GEMINIA	0.48	0.51	0.56	0.61	0.72	0.58
GENERAL ACCIDENT	0.63	0.81	0.91	1.09	1.35	0.96
HERITAGE AII	2.34	2.38	2.55	2.96	3.25	2.70
I.C.E.A.	1.04	12.71	17.50	18.49	21.08	14.17
INTRA AFRICA	0.54	0.55	0.53	0.53	0.47	0.52
JUBILEE	6.55	8.65	10.25	12.09	14.56	10.42
KENINDIA	5.57	6.50	7.83	8.54	0.56	5.80
KENYA ORIENT	0.07	0.13	0.20	0.26	9.71	2.07
KENYAN ALLIANCE	1.75	1.77	1.72	1.75	0.27	1.45
LION OF KENYA	2.05	2.23	2.52	2.83	0.48	2.02
MADISON	1.63	1.68	1.96	2.25	3.16	2.14
MERCANTILE	0.42	0.59	0.46	0.54	2.68	0.94
OCCIDENTAL	0.35	0.44	0.48	0.52	0.57	0.47
OLD MUTUAL	1.80	2.85	5.61	5.27	6.21	4.35
PAN AFRICA LIFE	2.20	2.76	3.67	4.16	5.95	3.75
PHOENIX OF E.A	0.28	0.29	0.81	0.81	0.56	0.55
PIONEER	0.26	0.30	0.40	0.46	0.70	0.42
REAL	0.55	0.68	0.67	0.66	0.70	0.65
TAUSI	0.31	0.71	0.71	0.83	0.79	0.67
THE MONARCH	0.07	0.16	0.17	0.19	0.24	0.17
TRIDENT	0.16	0.59	0.82	0.93	0.11	0.52
TRINITY LIFE	0.17	0.18	0.13	0.13	1.29	0.38
UAP PROVINCIAL	1.54	2.25	2.61	3.21	4.10	2.74

Source: Calculated from data collected from IRA

Appendix IV: K Data Components: Debt Capital

	Debt Capital				
	2005	2006	2007	2008	2009
	Kshs. Billion	Kshs. Billion	Kshs. Billion	Kshs. Billion	Kshs. Billion
AIG (K)	0.51	0.46	0.65	0.59	0.66
AMACO	0.07	0.06	0.11	0.11	0.20
APA	0.22	0.13	0.21	0.32	0.37
APOLLO	0.60	0.61	0.62	0.82	0.58
BLUE SHIELD	0.53	0.63	0.68	0.64	0.40
BRITISH AMERICAN	0.31	0.70	0.45	0.35	0.36
CANNON	0.11	0.21	0.29	0.40	0.27
CFC LIFE	0.31	0.38	0.57	0.42	0.47
CONCORD	0.08	0.09	0.12	0.12	0.12
COOPERATIVE	0.24	0.16	0.33	0.36	0.32
CORPORATE	0.15	0.20	0.10	0.08	0.08
FIDELITY SHIELD	0.07	0.07	0.09	0.09	0.14
FIRST ASSURANCE	0.22	0.26	0.25	0.28	0.48
GATEWAY	0.07	0.07	0.11	0.07	0.09
GEMINIA	0.07	0.13	0.15	0.14	0.14
GENERAL ACCIDENT	0.06	0.05	0.16	0.16	0.17
HERITAGE AII	0.24	0.24	0.22	0.21	0.28
I.C.E.A.	0.67	0.46	0.65	0.84	0.53
INTRA AFRICA	0.05	0.06	0.07	0.08	0.09
JUBILEE	0.42	0.54	0.79	1.05	1.15
KENINDIA	0.47	0.40	0.41	0.41	0.40
KENYA ORIENT	0.03	0.04	0.03	0.06	0.05
KENYAN ALLIANCE	0.11	0.12	0.12	0.08	0.16
LION OF KENYA	0.31	0.29	0.26	0.43	0.46
MADISON	0.44	0.31	0.28	0.13	0.19
MERCANTILE	0.06	0.05	0.17	0.05	0.07
OCCIDENTAL	0.09	0.09	0.16	0.12	0.10
OLD MUTUAL	0.27	0.43	0.22	0.20	0.25
PAN AFRICA LIFE	0.35	0.32	0.47	0.37	0.28
PHOENIX OF E.A	0.16	0.14	0.24	0.34	0.29
PIONEER	0.09	0.08	0.04	0.05	0.05
REAL	0.11	0.10	0.19	0.32	0.38
TAUSI	0.05	0.06	0.10	0.11	0.16
THE MONARCH	0.13	0.19	0.26	0.16	0.12
TRIDENT	0.76	0.17	0.15	0.09	0.32
UAP PROVINCIAL	0.31	0.21	0.41	1.52	1.52

Source: Calculated from data collected from IRA

Appendix V: x Data Components

2005			
Insurance Company	claims	bonuses	aggregate x
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.26	0.00	0.26
AMACO	0.04	0.00	0.04
APA	0.90	0.00	0.90
APOLLO	0.04	0.00	0.04
BLUE SHIELD	0.73	0.00	0.73
BRITISH AMERICAN	0.46	0.00	0.46
CANNON	0.14	0.00	0.14
CFC LIFE	0.48	0.01	0.49
CONCORD	0.27	0.00	0.27
COOPERATIVE	0.59	0.00	0.59
CORPORATE	0.11	0.00	0.11
FIDELITY SHIELD	0.27	0.00	0.27
FIRST ASSURANCE	0.24	0.00	0.24
GATEWAY	0.17	0.00	0.17
GEMINIA	0.17	0.00	0.17
GENERAL ACCIDENT	0.19	0.00	0.19
HERITAGE AII	0.53	0.00	0.53
I.C.E.A.	0.50	0.00	0.50
INTRA AFRICA	0.20	0.00	0.20
JUBILEE	1.00	0.00	1.00
KENINDIA	1.23	0.00	1.23
KENYA ORIENT	0.06	0.00	0.06
KENYAN ALLIANCE	0.19	0.00	0.19
LION OF KENYA	0.47	0.00	0.47
MADISON	0.63	0.00	0.63
MERCANTILE	0.06	0.00	0.06
OCCIDENTAL	0.21	0.00	0.21
OLD MUTUAL	0.11	0.00	0.11
PAN AFRICA LIFE	0.25	0.00	0.25
PHOENIX OF E.A	0.11	0.00	0.11
PIONEER	0.06	0.00	0.06
REAL	0.23	0.00	0.23
TAUSI	0.27	0.00	0.27
THE MONARCH	0.03	0.00	0.03
TRIDENT	0.18	0.00	0.18
UAP PROVINCIAL	0.66	0.00	0.66
2006			
Insurance Company	claims	bonuses	aggregate x
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.36	0.00	0.36
AMACO	0.08	0.00	0.08
APA	0.99	0.00	0.99
APOLLO	0.06	0.00	0.06
BLUE SHIELD	0.88	0.00	0.88
BRITISH AMERICAN	0.51	0.00	0.51
CANNON	0.15	0.00	0.15
CFC LIFE	0.87	0.01	0.88
CONCORD	0.27	0.00	0.27
COOPERATIVE	0.80	0.00	0.80
CORPORATE	0.13	0.00	0.13
FIDELITY SHIELD	0.30	0.00	0.30
FIRST ASSURANCE	0.29	0.00	0.29
GATEWAY	0.17	0.00	0.17
GEMINIA	0.18	0.00	0.18
GENERAL ACCIDENT	0.34	0.00	0.34
HERITAGE AII	0.55	0.00	0.55
I.C.E.A.	1.27	0.00	1.27
INTRA AFRICA	0.19	0.00	0.19
JUBILEE	1.32	0.00	1.32
KENINDIA	1.56	0.00	1.56
KENYA ORIENT	0.09	0.00	0.09
KENYAN ALLIANCE	0.29	0.00	0.29
LION OF KENYA	0.53	0.00	0.53
MADISON	0.57	0.00	0.57
MERCANTILE	0.08	0.00	0.08
OCCIDENTAL	0.24	0.00	0.24
OLD MUTUAL	0.22	0.00	0.22
PAN AFRICA LIFE	0.22	0.00	0.22
PHOENIX OF E.A	0.10	0.00	0.10
PIONEER	0.08	0.00	0.08
REAL	0.28	0.00	0.28
TAUSI	0.31	0.00	0.31
THE MONARCH	0.02	0.00	0.02
TRIDENT	0.21	0.00	0.21
UAP PROVINCIAL	0.61	0.00	0.61

2007			
Insurance Company	claims	bonuses	aggregate x
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.40	0.00	0.40
AMACO	0.17	0.00	0.17
APA	1.34	0.00	1.34
APOLLO	0.07	0.00	0.07
BLUE SHIELD	1.00	0.00	1.00
BRITISH AMERICAN	0.66	0.00	0.66
CANNON	0.20	0.00	0.20
CFC LIFE	0.69	0.00	0.69
CONCORD	0.24	0.00	0.24
COOPERATIVE	0.98	0.14	1.12
CORPORATE	0.16	0.00	0.16
FIDELITY SHIELD	0.29	0.00	0.29
FIRST ASSURANCE	0.44	0.00	0.44
GATEWAY	0.20	0.00	0.20
GEMINIA	0.20	0.00	0.20
GENERAL ACCIDENT	0.22	0.00	0.22
HERITAGE AII	0.78	0.00	0.78
I.C.E.A.	0.78	0.00	0.78
INTRA AFRICA	0.19	0.00	0.19
JUBILEE	1.51	0.00	1.51
KENINDIA	2.13	0.00	2.13
KENYA ORIENT	0.13	0.00	0.13
KENYAN ALLIANCE	0.24	0.00	0.24
LION OF KENYA	0.63	0.00	0.63
MADISON	0.65	0.00	0.65
MERCANTILE	0.07	0.00	0.07
OCCIDENTAL	0.28	0.00	0.28
OLD MUTUAL	0.08	0.00	0.08
PAN AFRICA LIFE	0.38	0.00	0.38
PHOENIX OF E.A	0.15	0.00	0.15
PIONEER	0.11	0.00	0.11
REAL	0.29	0.00	0.29
TAUSI	0.26	0.00	0.26
THE MONARCH	0.04	0.00	0.04
TRIDENT	0.22	0.00	0.22
UAP PROVINCIAL	0.89	0.00	0.89
2008			
Insurance Company	claims	bonuses	aggregate x
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.62	0.00	0.62
AMACO	0.34	0.00	0.34
APA	1.53	0.00	1.53
APOLLO	0.06	0.01	0.08
BLUE SHIELD	1.14	0.00	1.14
BRITISH AMERICAN	0.58	0.41	0.99
CANNON	0.28	0.00	0.28
CFC LIFE	0.68	0.00	0.68
CONCORD	0.27	0.00	0.27
COOPERATIVE	1.09	0.00	1.09
CORPORATE	0.19	0.03	0.22
FIDELITY SHIELD	0.30	0.00	0.30
FIRST ASSURANCE	0.53	0.00	0.53
GATEWAY	0.16	0.00	0.16
GEMINIA	0.21	0.00	0.21
GENERAL ACCIDENT	0.32	0.00	0.32
HERITAGE AII	0.99	0.00	0.99
I.C.E.A.	0.79	0.00	0.79
INTRA AFRICA	0.23	0.00	0.23
JUBILEE	1.88	0.00	1.88
KENINDIA	1.34	0.00	1.34
KENYA ORIENT	0.18	0.00	0.18
KENYAN ALLIANCE	0.12	0.00	0.12
LION OF KENYA	0.71	0.00	0.71
MADISON	0.60	0.00	0.60
MERCANTILE	0.07	0.00	0.07
OCCIDENTAL	0.34	0.00	0.34
OLD MUTUAL	0.51	0.00	0.51
PAN AFRICA LIFE	0.58	0.00	0.58
PHOENIX OF E.A	0.19	0.00	0.19
PIONEER	0.08	0.00	0.09
REAL	0.32	0.00	0.32
TAUSI	0.20	0.00	0.20
THE MONARCH	0.04	0.00	0.04
TRIDENT	0.21	0.00	0.21
UAP PROVINCIAL	1.08	0.00	1.08
2009			
Insurance Company	claims	bonuses	aggregate x
	Ksh. Billion	Ksh. Billion	Ksh. Billion

AIG (K)	**0.56**	**0.00**	**0.56**
AMACO	**0.56**	**0.00**	**0.56**
APA	**1.94**	**0.00**	**1.94**
APOLLO	**0.03**	**0.00**	**0.03**
BLUE SHIELD	**1.29**	**0.00**	**1.29**
BRITISH AMERICAN	**1.05**	**0.43**	**1.48**
CANNON	**0.38**	**0.00**	**0.38**
CFC LIFE	**0.80**	**0.00**	**0.80**
CONCORD	**0.42**	**0.00**	**0.42**
COOPERATIVE	**1.31**	**0.00**	**1.31**
CORPORATE	**0.22**	**0.00**	**0.22**
FIDELITY SHIELD	**0.39**	**0.00**	**0.39**
FIRST ASSURANCE	**0.73**	**0.00**	**0.73**
GATEWAY	**0.26**	**0.00**	**0.26**
GEMINIA	**0.23**	**0.00**	**0.23**
GENERAL ACCIDENT	**0.44**	**0.00**	**0.44**
HERITAGE AII	**1.12**	**0.00**	**1.12**
I.C.E.A.	**1.37**	**0.00**	**1.37**
INTRA AFRICA	**0.21**	**0.00**	**0.21**
JUBILEE	**2.30**	**0.00**	**2.30**
KENINDIA	**1.25**	**0.00**	**1.25**
KENYA ORIENT	**0.24**	**0.00**	**0.24**
KENYAN ALLIANCE	**0.11**	**0.00**	**0.11**
LION OF KENYA	**0.78**	**0.00**	**0.78**
MADISON	**0.63**	**0.00**	**0.63**
MERCANTILE	**0.07**	**0.00**	**0.07**
OCCIDENTAL	**0.40**	**0.00**	**0.40**
OLD MUTUAL	**0.62**	**0.00**	**0.62**
PAN AFRICA LIFE	**0.78**	**0.00**	**0.78**
PHOENIX OF E.A	**0.22**	**0.00**	**0.22**
PIONEER	**0.19**	**0.00**	**0.19**
REAL	**0.43**	**0.00**	**0.43**
TAUSI	**0.13**	**0.00**	**0.13**
THE MONARCH	**0.04**	**0.00**	**0.04**
TRIDENT	**0.26**	**0.00**	**0.26**
UAP PROVINCIAL	**1.82**	**0.00**	**1.82**

Source: Calculated from data collected from IRA

Appendix VI: C Data Components

2005

Insurance Company	Operational costs	Commissions	Aggregate C
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.01	0.08	0.09
AMACO	0.02	0.02	0.04
APA	0.04	0.17	0.21
APOLLO	0.01	0.02	0.02
BLUE SHIELD	0.03	0.19	0.21
BRITISH AMERICAN	-	0.31	0.31
CANNON	0.03	0.03	0.06
CFC LIFE	-	0.15	0.15
CONCORD	0.07	0.08	0.14
COOPERATIVE	0.04	0.12	0.16
CORPORATE	-	0.03	0.03
FIDELITY SHIELD	0.02	0.06	0.08
FIRST ASSURANCE	-	0.09	0.09
GATEWAY	0.00	0.02	0.03
GEMINIA	0.00	0.05	0.06
GENERAL ACCIDENT	-	0.04	0.04
HERITAGE AII	0.01	0.18	0.19
I.C.E.A.	(0.01)	0.22	0.21
INTRA AFRICA	0.02	0.03	0.04
JUBILEE	0.00	0.19	0.20
KENINDIA	0.03	0.43	0.46
KENYA ORIENT	0.01	0.01	0.02
KENYAN ALLIANCE	0.05	0.06	0.11
LION OF KENYA	-	0.15	0.15
MADISON	0.02	0.15	0.17
MERCANTILE	-	0.04	0.04
OCCIDENTAL	0.03	0.03	0.06
OLD MUTUAL	-	0.22	0.22
PAN AFRICA LIFE	-	0.23	0.23
PHOENIX OF E.A	0.01	0.04	0.05
PIONEER	0.00	0.03	0.04
REAL	0.01	0.08	0.09
TAUSI	0.01	0.10	0.11
THE MONARCH	0.01	0.01	0.02
TRIDENT	0.01	0.03	0.04
UAP PROVINCIAL	0.03	0.23	0.26

2006

Insurance Company	Operational costs	Commissions	Aggregate C
	KSh. Billion	KSh. Billion	KSh. Billion
AIG (K)	0.04	0.27	0.31
AMACO	0.02	0.03	0.05

APA	0.04	0.23	0.27
APOLLO	0.02	0.02	0.05
BLUE SHIELD	0.15	0.15	0.30
BRITISH AMERICAN	-	0.39	0.39
CANNON	0.03	0.04	0.08
CFC LIFE	-	0.19	0.19
CONCORD	0.05	0.07	0.12
COOPERATIVE	-	0.13	0.13
CORPORATE	-	0.04	0.04
FIDELITY SHIELD	0.02	0.08	0.10
FIRST ASSURANCE	-	0.11	0.11
GATEWAY	-	0.02	0.02
GEMINIA	0.00	0.06	0.06
GENERAL ACCIDENT	-	0.05	0.05
HERITAGE AII	0.02	0.18	0.20
I.C.E.A.	0.01	0.29	0.29
INTRA AFRICA	0.01	0.02	0.03
JUBILEE	0.09	0.22	0.31
KENINDIA	0.09	0.46	0.55
KENYA ORIENT	0.01	0.02	0.03
KENYAN ALLIANCE	0.02	0.05	0.08
LION OF KENYA	-	0.16	0.16
MADISON	0.03	0.14	0.17
MERCANTILE	-	0.03	0.03
OCCIDENTAL	0.02	0.05	0.07
OLD MUTUAL	-	0.33	0.33
PAN AFRICA LIFE	-	0.24	0.24
PHOENIX OF E.A	0.03	0.05	0.07
PIONEER	0.02	0.04	0.05
REAL	0.01	0.10	0.11
TAUSI	0.01	0.11	0.11
THE MONARCH	-	0.02	0.02
TRIDENT	0.01	0.04	0.05
UAP PROVINCIAL	0.05	0.21	0.26

2007

Insurance Company	Operational costs	Commissions	Aggregate C
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.05	0.29	0.34
AMACO	0.01	0.05	0.06
APA	0.02	0.26	0.28
APOLLO	0.00	0.02	0.02
BLUE SHIELD	0.22	0.27	0.49
BRITISH AMERICAN	-	0.58	0.58
CANNON	0.04	0.08	0.12
CFC LIFE	-	0.20	0.20

CONCORD	0.05	0.07	0.12
COOPERATIVE	-	0.18	0.18
CORPORATE	-	0.06	0.06
FIDELITY SHIELD	0.02	0.09	0.11
FIRST ASSURANCE	-	0.14	0.14
GATEWAY	-	0.02	0.02
GEMINIA	0.01	0.07	0.07
GENERAL ACCIDENT	-	0.06	0.06
HERITAGE AII	0.02	0.21	0.23
I.C.E.A.	0.01	0.28	0.29
INTRA AFRICA	0.02	0.02	0.04
JUBILEE	-	0.28	0.28
KENINDIA	0.19	0.50	0.70
KENYA ORIENT	0.02	0.03	0.04
KENYAN ALLIANCE	0.03	0.05	0.07
LION OF KENYA	-	0.15	0.15
MADISON	0.01	0.13	0.14
MERCANTILE	-	0.02	0.02
OCCIDENTAL	0.02	0.05	0.07
OLD MUTUAL	-	0.13	0.13
PAN AFRICA LIFE	-	0.40	0.40
PHOENIX OF E.A	0.04	0.05	0.09
PIONEER	0.00	0.05	0.05
REAL	0.02	0.10	0.12
TAUSI	0.01	0.08	0.09
THE MONARCH	0.02	0.02	0.04
TRIDENT	0.01	0.03	0.04
UAP PROVINCIAL	0.09	0.32	0.41

2008

Insurance Company	Operational costs	Commissions	Aggregate C
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.03	0.33	0.36
AMACO	0.02	1.00	1.02
APA	0.04	0.35	0.39
APOLLO	0.01	0.01	0.02
BLUE SHIELD	0.07	0.31	0.38
BRITISH AMERICAN	-	0.81	0.81
CANNON	0.02	0.08	0.10
CFC LIFE	-	0.23	0.23
CONCORD	0.06	0.08	0.14
COOPERATIVE	-	0.21	0.21
CORPORATE	-	0.06	0.06
FIDELITY SHIELD	0.01	0.10	0.11
FIRST ASSURANCE	-	0.18	0.18
GATEWAY	-	0.04	0.04

GEMINIA	0.01	0.07	0.08
GENERAL ACCIDENT	-	0.10	0.10
HERITAGE AII	0.05	0.23	0.28
I.C.E.A.	0.12	0.28	0.40
INTRA AFRICA	0.03	0.03	0.06
JUBILEE	-	0.38	0.38
KENINDIA	0.06	0.50	0.55
KENYA ORIENT	0.03	0.04	0.07
KENYAN ALLIANCE	0.03	0.03	0.06
LION OF KENYA	-	0.17	0.17
MADISON	-	0.12	0.12
MERCANTILE	-	0.02	0.02
OCCIDENTAL	0.02	0.05	0.08
OLD MUTUAL	0.01	0.10	0.11
PAN AFRICA LIFE	-	0.39	0.39
PHOENIX OF E.A	-	0.08	0.08
PIONEER	-	0.09	0.09
REAL	0.05	0.13	0.17
TAUSI	0.01	0.08	0.09
THE MONARCH	0.02	0.02	0.04
TRIDENT	0.01	0.04	0.05
UAP PROVINCIAL	0.16	0.40	0.55

2009

Insurance Company	Operational costs	Commissions	Aggregate C
	Ksh. Billion	Ksh. Billion	Ksh. Billion
AIG (K)	0.06	0.32	0.38
AMACO	0.03	0.13	0.16
APA	0.08	0.42	0.50
APOLLO	-	0.01	0.01
BLUE SHIELD	0.62	0.24	0.85
BRITISH AMERICAN	-	0.93	0.93
CANNON	-	0.10	0.10
CFC LIFE	-	0.30	0.30
CONCORD	0.02	0.08	0.10
COOPERATIVE	-	0.20	0.20
CORPORATE	-	0.05	0.05
FIDELITY SHIELD	0.02	0.10	0.12
FIRST ASSURANCE	-	0.21	0.21
GATEWAY	-	0.05	0.05
GEMINIA	0.01	0.09	0.09
GENERAL ACCIDENT	-	0.13	0.13
HERITAGE AII	0.01	0.27	0.28
I.C.E.A.	0.01	0.42	0.43
INTRA AFRICA	0.03	0.03	0.06
JUBILEE	-	0.53	0.53

KENINDIA	**0.04**	**0.49**	**0.53**
KENYA ORIENT	**0.01**	**0.04**	**0.05**
KENYAN ALLIANCE	**0.04**	**0.03**	**0.07**
LION OF KENYA	**-**	**0.18**	**0.18**
MADISON	**-**	**0.12**	**0.12**
MERCANTILE	**0.00**	**0.03**	**0.03**
OCCIDENTAL	**0.02**	**0.05**	**0.08**
OLD MUTUAL	**0.18**	**0.06**	**0.24**
PAN AFRICA LIFE	**-**	**0.58**	**0.58**
PHOENIX OF E.A	**0.04**	**0.05**	**0.09**
PIONEER	**-**	**0.08**	**0.08**
REAL	**0.04**	**0.15**	**0.19**
TAUSI	**0.01**	**0.09**	**0.10**
THE MONARCH	**0.02**	**0.01**	**0.03**
TRIDENT	**0.01**	**0.05**	**0.06**
UAP PROVINCIAL	**0.15**	**0.41**	**0.56**

Source: Calculated from data collected from IRA

Appendix VII: Insurance Companies X-efficiency measures by Deciles

	2005	2006	2007	2008	2009
Decile 1					
CONCORD	**42.71**	**59.09**	**93.47**	**76.60**	**77.33**
KENYA ORIENT	**10.02**	**35.94**	**73.21**	**73.95**	**78.04**
CORPORATE	**16.39**	**40.05**	**84.21**	**71.02**	**69.22**
UAP PROVINCIAL	**63.60**	**87.08**	**204.85**	**161.17**	**199.64**
Decile 2					
INTRA AFRICA	**27.83**	**46.49**	**81.97**	**70.74**	**68.94**
PIONEER	**11.76**	**34.76**	**64.22**	**71.54**	**71.33**
Decile 3					
APOLLO	**9.04**	**28.32**	**44.72**	**54.24**	**52.60**
FIDELITY SHIELD	**34.44**	**54.38**	**98.39**	**77.67**	**76.91**
TAUSI	**33.83**	**52.70**	**83.36**	**62.48**	**57.40**
Decile 4					
AMACO	**10.02**	**36.95**	**91.16**	**95.08**	**106.97**
GATEWAY	**21.78**	**39.85**	**82.01**	**69.18**	**70.61**
GEMINIA	**17.73**	**38.39**	**72.27**	**60.62**	**61.48**
MERCANTILE	**14.56**	**33.24**	**59.13**	**55.45**	**55.63**
KENYAN ALLIANCE	**15.61**	**40.42**	**62.98**	**39.31**	**40.20**
PHOENIX OF E.A	**3.59**	**23.83**	**59.31**	**54.47**	**51.39**
Decile 5					
REAL	**30.53**	**59.07**	**103.11**	**81.52**	**87.77**
AIG (K)	**56.79**	**87.26**	**157.00**	**115.47**	**107.85**
OCCIDENTAL	**27.48**	**52.10**	**104.35**	**87.32**	**84.94**
FIRST ASSURANCE	**23.69**	**48.20**	**115.36**	**99.10**	**102.92**
LION OF KENYA	**23.44**	**46.65**	**97.44**	**67.68**	**60.71**
OLD MUTUAL	**16.83**	**87.01**	**24.10**	**110.41**	**53.55**
KENYA ORIENT	**10.02**	**35.94**	**73.21**	**73.95**	**78.04**
Decile 6					
BLUE SHIELD	**283.46**	**362.87**	**673.76**	**361.04**	**200.64**
TRIDENT	**8.73**	**29.98**	**62.82**	**49.58**	**51.18**
GENERAL ACCIDENT	**12.08**	**42.19**	**78.15**	**68.77**	**71.65**
MADISON	**123.79**	**135.08**	**149.57**	**136.17**	**118.34**
PAN AFRICA LIFE	**64.56**	**105.28**	**151.75**	**226.77**	**235.85**
Decile 7					
CANNON	**4.98**	**22.82**	**61.06**	**58.68**	**57.66**
COOPERATIVE	**89.07**	**148.67**	**156.79**	**218.83**	**237.58**
KENINDIA	**234.22**	**274.88**	**278.54**	**211.22**	**154.96**
Decile 8					
HERITAGE AII	**55.44**	**86.24**	**153.15**	**148.33**	**148.31**
APA	**104.47**	**139.59**	**334.08**	**210.42**	**239.27**
Decile 9					
CFC LIFE	**127.20**	**219.10**	**137.75**	**60.75**	**167.46**
BRITISH AMERICAN	**39.76**	**56.81**	**160.99**	**345.86**	**422.60**
JUBILEE	**134.79**	**198.82**	**163.77**	**422.21**	**441.26**
I.C.E.A.	**99.17**	**112.03**	**0.24**	**116.76**	**119.90**

Source: Calculated from data collected from IRA

Appendix VIII: Total Assets

	Total assets					
Insurance Company	**2005**	**2006**	**2007**	**2008**	**2009**	**Average**
	Ksh. Billion	**Ksh. Billion**	**Ksh. Billion**	**Ksh. Billion**	**Ksh. Billion**	**Ksh. Billion**
AIG (K)	**1.29**	**1.32**	**1.59**	**1.81**	**1.94**	**1.59**
Amaco	**0.38**	**0.44**	**0.63**	**0.85**	**1.41**	**0.74**
APA	**3.02**	**3.74**	**4.49**	**4.94**	**5.56**	**4.35**
Apollo Insurance Co. Ltd.	**1.47**	**1.90**	**1.77**	**0.96**	**1.06**	**1.43**
Blue Shield	**2.67**	**2.72**	**3.11**	**3.26**	**2.12**	**2.78**
British American	**4.48**	**6.55**	**10.25**	**12.47**	**14.50**	**9.65**
Cannon	**1.33**	**1.64**	**2.00**	**2.46**	**2.95**	**2.07**
CFC Life	**7.20**	**8.46**	**9.15**	**10.20**	**11.26**	**9.25**
Concord	**0.55**	**0.54**	**0.62**	**0.66**	**0.76**	**0.63**
Cooperative	**1.44**	**1.66**	**2.44**	**3.03**	**3.49**	**2.41**
Corporate	**0.59**	**0.73**	**0.70**	**0.77**	**0.78**	**0.72**
Fidelity Shield	**0.74**	**0.83**	**0.97**	**1.02**	**1.24**	**0.96**
First Assurance	**1.00**	**1.16**	**1.34**	**1.64**	**2.10**	**1.45**
Gateway	**0.79**	**1.11**	**1.06**	**1.17**	**1.43**	**1.11**
Geminia	**0.77**	**0.90**	**0.98**	**1.02**	**1.48**	**1.03**
General Accident	**1.16**	**1.43**	**1.76**	**1.90**	**2.30**	**1.71**
Heritage AII	**3.85**	**4.48**	**4.52**	**4.47**	**5.06**	**4.48**
ICEA	**13.37**	**14.72**	**19.21**	**20.42**	**22.78**	**18.10**
Intra Africa	**0.73**	**0.77**	**0.86**	**0.85**	**0.84**	**0.81**
Jubilee	**7.74**	**10.67**	**12.43**	**13.99**	**17.02**	**12.37**
Kenindia	**7.28**	**8.29**	**9.04**	**10.06**	**11.51**	**9.24**
Kenya Orient	**0.22**	**0.30**	**0.44**	**0.55**	**0.61**	**0.42**
Kenyan Alliance	**2.28**	**2.42**	**2.45**	**2.45**	**2.74**	**2.47**
Lion of Kenya	**3.21**	**3.44**	**3.72**	**4.57**	**5.12**	**4.01**
Madison	**2.37**	**2.35**	**2.70**	**2.83**	**3.51**	**2.75**
Mercantile	**0.73**	**0.91**	**0.91**	**0.89**	**1.00**	**0.89**
Occidental	**0.58**	**0.68**	**0.84**	**0.91**	**1.02**	**0.81**
Old Mutual Insurance Co. Ltd.	**3.85**	**4.99**	**6.45**	**6.08**	**7.57**	**5.79**
Pan Africa Life Ins. Co. Ltd.	**2.77**	**3.55**	**4.72**	**5.11**	**6.42**	**4.52**
Phoenix	**1.26**	**1.61**	**2.30**	**2.15**	**2.00**	**1.86**
Pioneer Assurance Co. Ltd.	**0.40**	**0.44**	**0.51**	**0.58**	**0.82**	**0.55**
Royal	**0.83**	**0.98**	**1.11**	**1.22**	**1.51**	**1.13**
Tausi	**0.50**	**0.91**	**0.95**	**1.08**	**1.28**	**0.94**
The Monarch	**0.42**	**0.60**	**0.68**	**0.60**	**0.68**	**0.60**
Trident	**1.09**	**0.94**	**1.18**	**1.24**	**2.18**	**1.33**
UAP Provincial	**4.13**	**6.71**	**7.25**	**7.76**	**8.60**	**6.89**

Source: Calculated from data collected from IRA

Appendix IX: Insurance companies by organization type

Insurance Company		
Composite(Both life and non-life)	Life Business only	Non-life business only
Blue Shield	Apollo Insurance Co. Ltd.	AIG (K)
British American	CFC Life	Amaco
Cannon	Old Mutual Insurance Co. Ltd.	APA
Cooperative	Pan Africa Life Ins. Co. Ltd.	Concord
Corporate	Pioneer Assurance Co. Ltd.	Fidelity Shield
First Assurance		Gateway
Geminia		General Accident
Heritage AII		Intra Africa
ICEA		Kenya Orient
Jubilee		Lion of Kenya
Kenindia		Occidental
Kenyan Alliance		Phoenix
Madison		Royal
Mercantile		Tausi
The Monarch		Trident
UAP Provincial		

Appendix X: Government long-term bond lending rates

Year	Government Bond lending rates (%)
2005	10.88
2006	11.92
2007	13.17
2008	12.91
2009	12.67

Source: CBK, Statistical Bulletin