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Evaluating the cost efficiency of insurance companies in Ghana

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Abstract

Purpose – The purpose of this paper is to evaluate the efficiency of insurance companies in Ghana using a two-stage procedure to ascertain whether insurance companies are cost efficient and also to examine the efficiency determinants of insurance companies.

Design/methodology/approach – Using a cross-sectional data set of 30 firms over the period 2006-2008, the study evaluates the efficiency scores by applying a data envelopment analysis that allows the inclusion of multiple inputs and outputs in the production frontier. The study also employs a regression model to identify the key determinants of efficiency of the Ghanaian insurance industry.

Findings – The empirical results in the first stage suggest higher average efficiency scores for life insurance business than non-life insurance companies. In the second stage, the authors observe that the drive for market share, firm size and the ratio of equity to total invested assets are important determinants of an insurance firm's efficiency.

Originality/value – The findings of this study provide insights into the cost efficiency of insurance companies in Ghana. This has implications for the efficient management of insurance firms in the country.

Keywords Ghana, Insurance companies, Cost effectiveness, Life insurance, Data envelopment analysis

Paper type Research paper

1. Introduction

Cost efficiency among financial and non-financial institutions has been an area that has received some attention in the literature. Cummins *et al.* (1998) defines cost efficiency as the ratio of the costs of a fully efficient firm with the same output quantities and input prices (i.e. a firm operating on the efficient cost frontier) to the given firm's actual costs. The method used for analysing cost efficiency among insurance companies span from the parametric to the non-parametric models. The findings deduced and inferred from these studies have been various. This is traceable to a myriad of factors among which are differences in the determinants of efficiency, differences in measurement methodology, differences in input and output prices, differences in the sample sizes, differences in the nature of insurance companies used and differences in operating environments or markets.

In most of the studies on cost efficiency in the insurance industry, data envelopment analysis (DEA) appears to be the most widely used non-parametric approach. However, a few of the cost efficiency literature in the insurance industry employ parametric methodologies. DEA is a technique which measures the cost efficiency of an insurance company relative to a non-parametric, maximum likelihood estimate of an unobserved true frontier, conditional on observed data resulting from an underlying data-generating process. These methods have been widely applied to examine technical and allocative efficiency in a variety of industries; especially the insurance industry. According to Cummins *et al.* (1998), firms achieve cost efficiency by adopting the best practice technology (becoming technologically efficient) and by adopting

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the cost-minimizing mix of inputs (becoming allocatively efficient). Thus, an overall cost efficiency score reflects both technical and allocative efficiency. Insurance firms may fail to reach the production and cost frontiers due to technical and/or allocative inefficiencies. That is they fail to get the best out of their inputs and/or they fail to employ the cost-minimizing combination of inputs (Kader *et al.*, 2009).

Previous empirical studies in this area have been concentrated in North America, Europe and Asia where most of the insurance companies operate in markets that can least be described as near-efficient. It is important to further our understanding by also focusing on developing markets. This current study therefore aims at examining the determinants of cost efficiency of insurance companies in a developing country context, specifically in Ghana.

The Ghanaian insurance industry has recently been characterised by an unhealthy rivalry resulting in rate cutting. It is also groaning under high production cost as result of premium fraud which is believed to account for the rise in the cost of acquiring business to 45-50 percent as against 25-30 percent in developed markets (www.ghanabusinessnews.com). Unlike its counterparts in the sub-region, the Ghanaian insurance industry is seen to be undersized, undercapitalized and can rarely participate in underwriting large risks. The companies also operate in an environment where inflation is quite volatile, insurance awareness is low and financial regulation less rigorous. These are factors that are believed to reduce the efficiency of a firm.

These developments would seem to suggest that the Ghanaian insurance industry is inefficient. This conclusion, however, cannot necessarily be justified because to the best of our knowledge, no empirical study exists on cost efficiency of insurance companies in Ghana. This study therefore evaluates the cost efficiency scores of insurance companies in Ghana using DEA. The study also examines the determinants of the efficiency of these insurance companies. The rest of the study is organised as follows. In Section 2, we give an overview of the Ghanaian insurance industry from pre-independence era to the current state of the industry. Section 3 discusses the literature whereas Section 4 contains the methodology and the description of data for the analysis. Section 5 discusses our results and Section 6 concludes the study with some recommendations.

2. Overview of the insurance industry in Ghana

The pre-independence era of the Ghanaian insurance space was characterised by the dominance of overseas insurance companies. These companies had their head offices located mostly in the UK. There was very little local knowledge, experience and involvement. Policies were designed to cover British nationals who resided or traded in the then Gold Coast. The first local insurance company, Gold Coast Insurance Company, was formed in 1955 to transact only life business.

In 1962 the government of Ghana established the State Insurance Corporation (SIC) and in an attempt to improve the insurance industry in Ghana, laws were passed which granted SIC monopoly over all government businesses. The insurance of imports with companies operating in Ghana was also made compulsory; however its enforcement were not effective. Subsequently, the Ghana Reinsurance Organisation (GRO) was established and by a statutory requirement, all registered insurers were to cede at least 20 percent of all their non-life business to it without the payment of profit commission. In addition, at least 5 percent of all international non-life treaties were to be ceded

to the organisation. Insurance companies needed a certificate from GRO before any reinsurance could be placed outside.

Further legislation made it compulsory for all insurance companies operating in the country to be incorporated in Ghana with at least 40 percent of the proprietary interests owned by Ghanaians. The result was that, foreign companies withdrew almost completely from the Ghanaian market.

In compliance with the International Association of Insurance Supervisors (IAIS) core principles and to provide a level playing field for all companies, the Insurance Law, 2006 makes it impossible for SIC and GRC to enjoy any monopoly since January 2009. The act among other things prohibits composite insurance companies. All composite insurance companies therefore had to separate their life and non-life operations into different companies by December 2008. As at July 2009, the insurance industry was made up of 21 non-life companies, 18 life companies, two reinsurance companies, 38 brokerage companies, one reinsurance broking company and one loss adjusting company. The insurance industry collectively also had 986 agents in total. About 12 of life and non-life companies doing business in the country have some form of foreign participation. This strong presence by foreign-owned insurance companies indicates the untapped insurance potential in the country despite the assertion by some local industry players that the market is saturated (www.ghanabusinessnews.com).

The structure of the non-life market has not seen any major change over the past five years in spite of the keen competition. State Insurance Company (SIC) Limited, Metropolitan Insurance Company Limited and Enterprise Insurance Limited together still control more than 60 percent of the entire market as measured by the amount of gross premium received. Apart from the increase in the market share of other insurance firms, the only noticeable movement was the fall in the market share of SIC from 39 percent in 2006 to 37 percent in 2007. The rise in the market share was mainly due to an increase in the market share of CDH Insurance Company and Quality Insurance Company to 3 percent each. Phoenix Insurance Company, GLICO Insurance Company and Global Alliance Insurance Company all had 2 percent each. Similarly, despite the increase in intensity of the competition in the life sector in 2007, SIC Life, GLICO Life, and Enterprise Life still maintain a significant chunk of the market in terms of market share, as measured by the amount of gross premium received annually.

It is, however, worth noting that the most sustained improvement in the life insurance sector has been from Enterprise Life which has consistently increased its market share every year since it was establish in 2001 (www.nicgh.org).

The insurance industry in Ghana is governed by the Insurance Act of 2006, Act 724. Act 724 complies significantly with the IAIS core principles and gives greater regulatory powers to the National Insurance Commission, the regulator of the industry.

3. Literature review

Cummins *et al.* (2006) tested the role of risk management and financial intermediation activities in value creation by analysing three samples of US property-liability insurers over the period 1995-2003. They argued that risk management and financial intermediation are activities that may be used by insurers to improve efficiency, where efficiency is gauged by the capacity to reduce the costs of providing insurance. They measured insurer efficiency by estimating an econometric cost frontier by treating risk management and financial intermediation as endogenous activities to insurers.

The paper contributed to existing knowledge by formulating a theoretical model of value added in the property liability in insurance industry. It suggests that this is necessary because output estimation for financial services firms had been based primarily on the value-added approach in the recent literature. The model extended and generalised the earlier value-added models in the insurance industry. The two major generalisations were; to incorporate the role of solvency risk as a determinant of demand for insurance to explicitly add risk management as part of value added. The paper also generalised prior models with respect to the financial intermediation function.

Another notable contribution of this paper was to introduce a new approach for the estimation of efficiency, which is particularly appropriate for financial institutions; the use of the econometric methodology, to estimate the shadow prices of risk management and financial intermediation and thereby to show their contribution to insurer cost efficiency. This, the study contended was appropriate for financial institutions because many of their services are intangible and not explicitly priced.

Finally, on the basis of empirical analysis, Cummins *et al.* (2006), concluded by indicating that risk management and financial intermediation contribute significantly to enhancing efficiency for property-liability insurers. This was because the average shadow price for both services was found to be positive; indicating that, on average, insurance firms in the sample could reduce their costs further by increasing their level of risk management and financial intermediation activities.

Barros *et al.* (2008) analysed the technical efficiency in a representative sample of Nigerian insurance companies between 1994 and 2005. This period in Nigerian insurance history was characterised by intense volatility due to the deregulation of the market. Their analysis was based on a two-stage procedure proposed by Simar and Wilson (2007). A DEA-CCR index model that allows for multiple inputs and outputs in determining relative efficiencies are estimated simultaneously with a bootstrapped truncated regression model that explains the efficiency drivers. Benchmarks are provided for improving the operations of poorly performing insurance companies. The study found that competition for market share is the main driver of efficiency in the Nigerian insurance market, at least for the period analysed. They also contend that even though the Nigerian insurance market had been characterised by some degree of consolidation, they did not find sufficient evidence to suggest that this consolidation had improved the efficiency of the market. However, it was evident based on their findings that the majority of insurance companies in Nigeria operated on declining efficiency. This development was attributed to inadequacies in management, scale and technology.

Luhnen (2008) undertook a comprehensive analysis of efficiency in the German property-liability market. This research was necessitated by recent deregulatory efforts following a rather traditionally high level of regulation in the German insurance market. By employing a large sample of 148 insurers for the years 1995-2006, the cost, technical, allocative, and scale efficiency scores were calculated employing DEA.

One remarkable innovation derived from this research was the use of the recently developed regression and bootstrapping approach proposed by Simar and Wilson (2007) to analyse six efficiency determinants; size, distribution systems, ownership, specialisation, leverage and growth. A positive relationship was found to exist between size and efficiency, i.e. large insurers were found to be more efficient than medium-sized and small insurers.

In the area of distribution systems, Luhnen (2008) finds that exclusive agent insurers are more efficient than independent agent insurers. Mutual ownership were found to be more efficient than stocks and in line with many insurance literature whereas specialised insurers were found to be more technical and cost efficient than those who spread their business across several lines. Little could, however, be deduced from the relationship between efficiency and leverage on one hand as well as growth on the other.

Furthermore, Yao *et al.* (2007) employ 22 insurance companies over the period 1999-2004 to study the technical efficiency of China's insurance industry. The study first calculates the efficiency scores and then runs a regression to identify the key determinants of efficiency. The methodology used was DEA. The research was principally pivoted on the hypothesis that firm size, ownership structure, human capital and mode of business are important factors affecting firm performance. It was found that many of the 22 firms have improved their technical efficiency over the period. It also found that competition in the Chinese insurance industry may require companies to commit more inputs to produce the same amount of outputs. It also showed that Chinese insurance companies can increase their productivity either by improving their technical efficiency or by making a technological advance. Furthermore, it was evident that larger firms are more efficient than smaller ones and this was attributed to economies of scale enjoyed by larger firms. Direct sales were also found to be more efficient than indirect sales as result of the savings made on agency costs form direct sales. The study also proved that higher education had an important positive impact on firm performance. The paper could not, however, find significant evidence to prove this that non-state firms tend to outperform state firms, even though the result seem to contradict most literature. A possible explanation provided was that state firms still enjoy some special marketing power that is not available to non-state firms. Another possible explanation given was that state ownership may not be necessarily less efficient than non-state ownership.

Kader *et al.* (2009) applied DEA to examine the cost efficiency among a balanced panel of 26 insurers operating in ten Islamic countries over the three years 2004-2006. It was found that non-executive directors contributed negatively to cost efficiency. This was attributed possibly to a lack of financial management expertise among the non-executive directors of Takaful insurance firms.

Again, the separation of the CEO and chairman functions proved to be inimical to cost efficiency. This was largely believed to be as a result of Takaful's unique institutional features and product-market structure. However, board size and firm size was found to have positive effects on the cost efficiency of Takaful insurers, suggesting that the larger firms are better placed than smaller entities to realise operational improvements because of the relatively large number of expertise they can draw from.

Furthermore, cost efficiencies appear to emerge from specialised product lines rather than more diversified outputs indicating that economies of scope are not being fully realised by Takaful insurers. Finally, the effect of regulatory environment was found not to be statistically significant in determining insurance efficiency.

Again, using DEA, Chen *et al.* (2009), evaluated the efficiency of life insurers operating in China and compared foreign firms with domestic firms. They found that foreign insurers have not brought efficiency into the Chinese market, and that the market is still dominated by domestic giants. They showed that domestic insurers possess advantages in terms of both pure technical efficiency and scale efficiency, although the gap has narrowed quickly since 2005. In addition, the empirical results

suggested that foreign insurers should focus on scale economy for future development. Maintaining growth was seen to be an important strategy for foreign insurers competing in the Chinese market. Decreasing returns to scale was observed to pose a risk to both domestic insurers and foreign insurers. Evidence supported controlling inputs, as opposed to outputs, as more important for inefficient insurers.

Again, using the MI approach, Chen *et al.* (2009) investigated productivity, change in efficiency and technical progress. They found that technical progress was more readily achievable than change in efficiency by Chinese life insurers and, therefore, served as the principal factor driving productivity. In addition, Chinese insurers did not manifest consistent behaviour with regard to change in efficiency. Other empirical evidence on non-US insurance industries also exists (Fukuyama, 1997; Diacon *et al.*, 2002).

4. Methodology

4.1 Estimation of technical efficiency scores

To estimate efficiency scores for each observation, a DEA estimator is used. The DEA approach usually assumes that all decision-making units (DMU) within a sample have access to the same technology for transforming a vector of N inputs, x, into a vector of M outputs, y. The assumption is that technology can be characterised by the technology set, T, defined as:

$$T = \left\{(x,y) \in \mathbb{R}_+^N \times \mathbb{R}_+^M : x \in \mathbb{R}_+^N \ \textit{can produce}\ y \in \mathbb{R}_+^M\right\}$$

It is also based on the assumption that standard regularity conditions of the neo-classical production theory holds (Fare and Primont, 1995). Having access to the same technology, any of the DMUs may or may not be on the frontier; the distance of a particular DMU from it may depend on various factors, specific to the DMU. These factors may be endogenous to the DMU, such as internal economic incentives influenced by the ownership structure, management quality, capital structure and mode of doing business and/or exogenous, such as different macroeconomic and demographic conditions, government regulation policies, cultural/social conditions and technological conditions.

The distance from the actual location of each DMU given its technology set T from the frontier of T is thought to represent its inefficiency, caused by the DMU's specific endogenous or exogenous factors and some unexplained statistical noise.

The aim of this study is to measure such inefficiency and investigate its dependency on efficiency drivers or determinants. In the first stage of the analysis, efficiency scores for each DMU, is estimated using the Farrell/Debreu-type output-oriented technical efficiency measure:

$$TE(x^j, y^j) = \max_{\theta \in \mathbb{R}} \{\theta : (x^j, \theta y^j) \in T\}$$

for $j = 1,\ldots n$.

In practice, T is unobserved, thus we replace it with the DEA estimate, $\hat{T}$ given by:

$$\hat{T} = \left\{(x,y) \in \mathbb{R}_+^N \times \mathbb{R}_+^M : \sum_{k=1}^{m} z_k y_m^k \geq y_m,\ \ m = 1, \ldots, M, \sum_{k=1}^{n} z_k x_i^k \geq x_i,\ \ i = 1, \ldots, N\right\}$$

where $z_k \geq 0$ is the intensity variable over which optimisation (2) is done. Geometrically, $\hat{T}$ is the smallest convex free-disposal cone (in the (x,y)-space) that contains (or "envelopes") the input-output data.

According to Barros *et al.* (2008), this is a consistent estimator of the unobserved true technology set T, under the assumption of constant returns to scale (CRS). Consistent with insurance efficiency literature, CRS is chosen over other efficiency measures because of the following:

- It satisfies a set of desirable mathematical properties. These properties include various forms of continuity, (weak) monotonicity, commensurability, homogeneity and (weak) indication for all technologies satisfying certain regularity conditions.
- It is relatively easy to compute and straightforward to interpret, and therefore the most widely adopted in practice.

4.2 Estimation of cost efficiency and allocative efficiency scores

DEA cost efficiency is also estimated by solving linear programming problems. In this case, the problem is to choose input quantities to minimize costs holding constant input prices and output quantities. The solution for firm i is the cost-minimizing input vector X_i^*. Cost efficiency for firm i is then calculated as the ratio:

$$\eta_i = \frac{W_i^T X_i^*}{W_i^T X_i}$$

where W_i^T is the transpose of firm i's input price vector, and X_i is its actual input quantity vector. Thus, cost efficiency η_i is the ratio of frontier costs for insurer i's output vector and input prices to its actual costs, where $0 \leq \eta_i \leq 1$, and $\eta_i = 1$ for fully efficient firms.

Cost efficiency is the product of technical efficiency and allocative efficiency, i.e. firms can have higher costs than represented by the frontier because they are not using the most efficient technology (technical inefficiency) and/or because they are not using the cost-minimizing input mix (allocative inefficiency). Having cost and technical efficiency enable us to back out estimates of allocative efficiency using the relationship:

$$CE = TE*AE$$

where CE is the cost efficiency, TE is the technical efficiency, and AE is the allocative efficiency. AE is thus computed by the formula:

$$AE = \frac{CE}{TE}$$

Both technical and allocative efficiency lies in [0, 1], with fully efficient firms having efficiency score equal to 1.

4.3 Determinants of efficiency

In the second stage, the study employs regression analysis in examining the determinants of the efficiency scores. We assume and test the following specification:

$$CE_j = \alpha + Z_j\delta + \varepsilon_j, \quad j = 1, \ldots, n$$

which can be interpreted as the first-order approximation of the unknown true relationship, where α is the constant term, ε_j, is statistical noise, and Z_j's are observation-specific variables for DMU_j that we expect to affect its cost efficiency score, CE_j, through the parameters δ (common for all j) that we need to estimate.

The dataset used in this study comprises 30 insurance companies; 16 non-life insurance companies and 14 life insurance companies. This sample accounts for about over 90 percent of the total number of insurance companies in Ghana. Data used for this study were obtained from the annual financial reports submitted by the various insurance companies to the National Insurance Commission for the period, 2006-2008.

To estimate the production frontier, financial data for the years 2006-2008 supplied by insurance companies to the National Insurance Commission is analysed. This conforms to the DEA convention requiring that the minimum number of DMUs is greater than three times the number of inputs plus output (Raab and Lichty, 2002).

Insurance output is measured by profit or loss, net premium and investment income. Three indicators measure insurance inputs: total capital, total operating cost and total investments. Three indicators measure input weights: total capital/total asset, total operating cost/total asset and total investment/total asset.

The DEA index can be calculated in several ways. We estimate an output-oriented, technically efficient (TE) DEA index, assuming that insurance companies aim to maximise the profits resulting from their activity. In this context, inputs are exogenous and outputs endogenous because of the competitive environment in which the units compete (Kumbhakar, 1987).

The CCR (Charnes *et al.*, 1978) efficient score model is probably the most widely used and best-known DEA model. It assumes CRS and measures the overall efficiency for each unit, namely aggregating pure technical efficiency and scale efficiency into one value (Gollani and Roll, 1989).

The BCC (Banker *et al.*, 1984) efficient score model assumes variable returns to scale and measures pure technical efficiency alone (Gollani and Roll, 1989). The efficiency score obtained with the BCC model gives a score which is at least equal to that obtained using the CCR.

Following from previous study, we employ the following empirical model:

$$logEFF_{i,t} = \beta_1 + \beta_2 Type + \beta_3 log(size)_{i,t} + \beta_4 Quoted + \beta_5 log(CastNew)_{i,t} + \beta_6 log(MarketShare)_{i,t} + \varepsilon_{i,t}$$

where t and i denote year and firm, respectively.

EFF represents the cost efficiency scores obtained in the first stage of the study. *Type* is a dummy variable and refers to the type of insurance business. It has a value of one for life insurance companies and zero for non-life insurance companies. *Size* denotes the size of an insurance company as measured by its total assets. *Quoted* is a dummy variable and assumes a value of one for insurance companies listed on the stock exchange and zero otherwise. *CastNew* denotes the ratio of equity to total invested assets. Finally, *MarketShare* denotes the size of market share that a particular insurance company commands in the sector as measured by the percentage of the particular company's gross premium to the total gross premium.

5. Empirical results

5.1 Efficiency scores

Table I provides the estimated cost efficiency scores for the years 2006-2008. These values were obtained from the product of technical efficiency and allocative efficiency. Technical and allocative efficiency scores are shown in Appendices 1 and 2.

It is observed from Table I that only one insurance company in Ghana obtained 70 percent average efficiency score over the period under review; making it the most efficient insurance company and the industrial benchmark. This company is Quality Life Insurance Company Limited.

This finding is quite remarkable judging from the fact that Quality Life commands only a small proportion of market share in the life insurance market in Ghana; measured by the amount of gross premium it accrues. Quality Life accounts for only about 2 percent of life insurance business far behind GLICO Life's 16 percent and SIC Life's 32 percent and Enterprise Life Assurance Company Limited's (ELAC) 15 percent. The suggestion is that Quality Life is combining its inputs better than its peers within the industry in producing its outputs. Again the fact that Quality Life increased its

Company/cost efficiency	2008	2007	2006	Average	Rank
CDH	0.2	0.29	0.39	0.29	13
ELAC	0.49	0.54	0.85	0.63	3
Enterprise	0.68	0.25	0.35	0.43	7
SIC Life	0.32	0.17	0.38	0.29	15
CDH Life	0.22	0.01	0.24	0.16	26
Unique Life	0.22	0.01	0.48	0.24	19
GLICO Life	0.11	0.06	0.56	0.24	18
Provident	0.08	0.03	0.43	0.18	24
Donewell	0.19	0.3	0.12	0.2	22
MET	0.49	0.11	0.51	0.37	8
Vanguard Assurance	0.17	0.27	0.37	0.27	16
SIC Insurance	0.20	0.08	0.35	0.21	21
IGI Life	0.005	0.003		0.004	30
Ghana Life Insurance	0.38	0.01	0.65	0.34	9
Star Assurance (General)	0.43	0.26	0.21	0.3	12
GLICO General	0.8	0.63	0.5	0.64	2
Quality	0.57	0.44		0.5	5
Phoenix	0.38	0.16	0.32	0.29	14
Unique Insurance	0.24	0.38		0.31	11
Star Life	0.3	0.12	0.36	0.26	17
IGI Insurance	0.01	0.04		0.02	28
GUA	0.54	0.43		0.48	6
Metlife	0.56		0.1	0.33	10
International Energy	0.01			0.01	29
Global Alliance		0.05		0.05	27
Provident Life		0.16		0.16	25
Quality Life	0.51	0.95		0.73	1
Donewell Life	0.19			0.19	23
Phoenix Life	0.18	0.27		0.22	20
Vanguard Life		0.2	0.94	0.57	4
Average efficiency	0.31	0.23	0.43	0.30	

Table I.
Overall cost efficiency scores of the insurance companies (2006-2008)

market share from 1 percent in 2006 to over 2 percent in 2008 could be a contributory factor for such an observation.

Another noticeable feature in the efficiency scores in Table I is that of SIC. SIC enjoys a number of advantages over other domestic companies. It is a state-owned insurance company with the largest number of network branches within Ghana, has the strongest financial position in terms of the amount of assets and market share it commands within the industry and has a strong corporate reputation. However, its average efficiency score of 0.21 positions it at the 21st most efficient insurance company out of the 30 insurance companies employed for this study. Its life business, however, ranked 15th with an average efficiency score of 0.29 over the period under review.

This suggests that SIC (non-life) is not combining its input as efficiently as it should in achieving its outputs and has about over 70 percent room for improving its cost efficiency. Most of the large companies in the industry, however, exhibited high efficiency scores.

The performance of the insurance companies sampled in terms of cost efficiency over the three years under review is shown in Figure 1. The figure depicts an inconsistent trend in average cost efficiency in the insurance industry over the period under review.

Table II provides the average cost efficiency score of non-life insurers. It is calculated to be 0.28, which is slightly lower than the average cost efficiency score of life insurers at 0.31, shown in Table III. This suggests that life insurance companies are more efficient than non-life insurance companies in Ghana. This could be attributed to the intense competition in the life business as opposed to the non-life business which did not see any major change in the structure of their market share, over the period under review.

Again, CDH Insurance Company Limited, ELAC and Vanguard Assurance Company Limited are to be increasing their technical efficiencies consistently for the period under review. GLICO Insurance Company Limited and Star Assurance Company Limited, however, experienced regression in their technical efficiency scores over the period under review. The other 25 insurance companies were inconsistent in terms of their efficiency scores over the period under review.

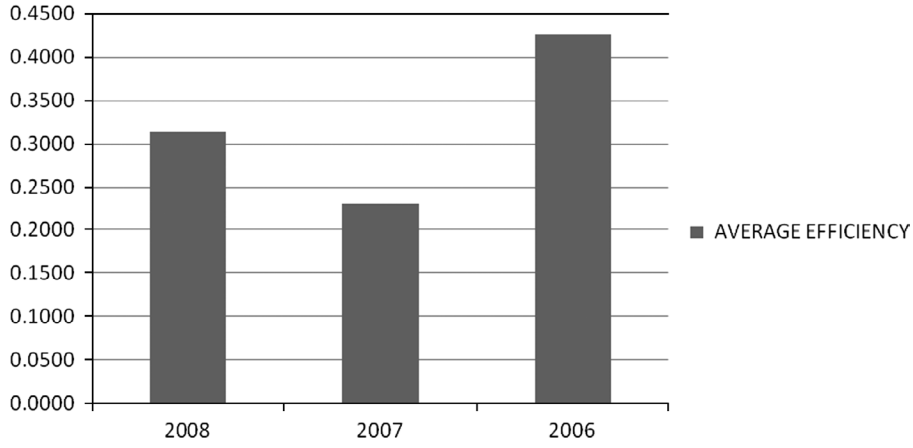

Figure 1.
Average efficiency scores

Non-life insurance companies	Average
CDH	0.2900
Enterprise	0.4300
Provident	0.1800
Donewell	0.2000
MET	0.3700
Vanguard Assurance	0.2700
SIC Insurance	0.2100
Star Assurance	0.3000
GLICO General	0.6400
Quality	0.5000
Phoenix	0.2900
Unique Insurance	0.3100
IGI Insurance	0.0200
GUA	0.4800
International Energy	0.0100
Global Alliance	0.0500
Average cost efficiency	0.2844

Table II.
Average cost efficiency of non-life insurance companies

Life insurance companies	Average
ELAC	0.6300
SIC Life	0.2900
CDH Life	0.1600
Unique Life	0.2400
GLICO Life	0.2400
IGI Life	0.0040
Ghana Life Insurance	0.3400
Star Life	0.2600
Metlife	0.3300
Provident Life	0.1600
Quality Life	0.7300
Donewell Life	0.1900
Phoenix Life	0.2200
Vanguard Life	0.5700
Average cost efficiency	0.3117

Table III.
Average cost efficiency of life insurance companies

Finally, it is observed from the efficiency scores in Table I that none of the insurance companies in Ghana is observed to be fully efficient over the three years under review. This suggests a potential for growth in the insurance industry in Ghana.

5.2 Correlation analysis

Table IV displays the correlation matrix for the independent variables: *Type*, *Size*, *CastNew*, *Quoted* and *MarketShare*. Clearly, there is multi-collinearity between the variables *MarketShare* and *Size* and hence cannot be included together in the same regression model. Therefore, we carried out separate estimations incorporating *MarketShare* and *Size*. The results are shown in Table V.

5.3 Regression results

The results as indicated in column 1 shows a significantly positive relationship between market share and efficiency at 1 percent. This finding supports our hypothesis and is consistent with other related studies. Again, with a *p*-value of 0.0011, market share appears to have the most significant impact on cost efficiency. The regression coefficient for *MarketShare* is found at 0.52. By implication, if market share increases by 10 percent efficiency can be increased by as much as 52 percent. This suggests that insurance companies in Ghana derive a lot of benefits from increasing their market share. This is quite an interesting finding especially when it is interpreted from the angle that few large companies may be driving cost efficiency in the Ghanaian insurance sector.

The regression results as shown in column 1 show that *CastNew* has significantly negative effect on efficiency at 10 percent significant level. With coefficients of −0.83, the results indicate that a 10 percent increase in the ratio of equity to total invested assets may result in about 83 percent reduction in cost efficiency. It is evident that the ratio of equity to total assets (*CastNew*) is found to be significant at 10 percent in explaining the efficiency of insurance companies as shown in column 2. The coefficient of −0.86 indicates that a 10 percent increase in *CastNew* results in an 86 percent decrease in cost efficiency. The results here suggest that insurance firms that employ less equity or more debt finance are able to exhibit higher efficiency level. In other words, insurance companies in Ghana derive no advantages by investing in equity.

In terms of column 2, the results show a significantly positive relationship between firm size and efficiency with significant level of 1 percent. With coefficient of 0.9114, an insurance company can increase its cost efficiency by as much as 91 percent

Table IV.
Correlation matrix for listed variables

	MarketShare	*Size*	*CastNew*	*Type*	*Quoted*
MarketShare	1.0000				
Size	0.5850[a]	1.0000			
CastNew	−0.2229	−0.0902	1.0000		
Type	0.1893	−0.0075	−0.2916	1.0000	
Quoted	0.1195	0.2957	0.0236	−0.2231	1.0000

Note: [a] Shows a high positive correlation between market share and firm size

Table V.
Regression results: determinants of efficiency scores

Variable	1	2
Constant	−0.4878 (−1.3370)	−7.4965 (−3.5910)***
MarketShare	0.5200 (3.2760)***	–
CastNew	−0.8387 (−1.8500)*	−0.8633 (−1.8530)*
Type	−0.0345 (−0.1260)	0.1013 (0.3640)
Quoted	0.2210 (0.4290)	0.0219 (0.0400)
Size	–	0.9114 (2.9520)***
Model Diagnosis		
Adjusted-R^2	0.3232	0.2839
F-statistic	(4.5800)***	(3.9700)**
p-value	0.0062	0.0120

Note: Significance at: *10, **5 and ***1 percent

per every 10 percent increase in its size. This means that insurance companies in Ghana have significant benefits derived from the economies of scale and scope. In the insurance sector in Ghana, as with most developing economies, size is particularly important. This is because reliability and trust are closely related to size. Customers may therefore be reluctant to commit large sum of investments for a less predictable and less reliable return.

Finally, the results from both columns 1 and 2 show that, type of insurance business (*Type*) and information disclosure (*Quoted*) are not significant in determining the cost efficiency of insurance companies in Ghana. This suggests that insurance companies in Ghana derive little benefits from being listed on the Ghana Stock Exchange. Thus, insurance companies in Ghana may not necessarily enjoy cost efficiency benefits, due to the type of insurance business it operates.

The model diagnosis on column 1 shows an Adjusted R^2 value of 32.32 percent. This means that our independent variables *MarketShare* and *CastNew* are able to predict the behaviour of cost efficiency by more than 32.32 percent. With respect to model diagnosis in column 2, we see that *MarketShare* and *Size* explain cost efficiency by 28.39 percent.

6. Conclusion

The DEA analysis provides information as to how to improve the efficiency of inefficient firms by providing each inefficient firm a reference efficient firm to compare with. In the three years data studied, out of a sample of 30 insurance companies, three firms improved their cost efficiency, 25 firms were inconsistent as far as their cost efficiency scores were concerned and two firms experienced regression in its efficiency scores. This regression may be directly attributed to the consistent loss of market share over the period under review.

It was also evident that competition for market share was keen between the various industry players in the life market, resulting in higher efficiency scores. The implication is that insurance companies in Ghana may have to invest more inputs to produce the same amount of outputs due to the increasing competition in order to increase or at least maintain their market shares. The results also showed that larger firms tend to be more efficient than smaller firms and also showed that the ratio of equity to total invested assets have an inverse relationship with cost efficiency. The major finding from the study is that market share is the key determinant of efficiency among insurance companies in Ghana.

Insurance companies in Ghana should adopt a benchmark management procedure in order to evaluate their relative position and to adopt appropriate managerial procedures for catching up with the frontier of "best practices". Besides, they should upgrade the quality of their management practices that improves market share and firm size. In addition, insurance companies should adopt human resource policies that reduce the principal-agent problem as well as eliminating collective action problems and market-oriented strategies which increase outputs and decrease inputs should be pursued.

Future studies may consider analysing efficiency of insurance companies in Ghana before and after the introduction of Act 724. This will assist in determining whether or not the passing of Act 724 has enhanced or reduced efficiency among insurance companies in Ghana.

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Appendix 1

Company/efficiency score	2008	2007	2006	Average
CDH	0.512	0.624	0.564	0.567
ELAC	0.834	0.814	0.960	0.869
Enterprise	0.761	0.590	0.565	0.639
SIC Life	0.596	0.531	0.619	0.582
CDH Life	0.543	0.124	0.494	0.387
Unique Life	0.578	0.173	0.781	0.511
GLICO Life	0.403	0.422	0.693	0.506
Provident	0.304	0.268	0.653	0.408
Donewell	0.462	0.624	0.439	0.508
MET	0.736	0.396	0.773	0.635
Vanguard Assurance	0.498	0.644	0.652	0.598
SIC Insurance	0.447	0.380	0.595	0.474
IGI Life	0.069	0.067		0.068
Ghana Life	0.628	0.131	0.756	0.505
Star Assurance (General)	0.663	0.513	0.449	0.542
GLICO General	0.873	0.880	0.779	0.844
Quality	0.838	0.747		0.793
Phoenix	0.658	0.463	0.608	0.576
Unique Insurance	0.569	0.650		0.610
Star Life	0.637	0.432	0.607	0.559
IG1 Insurance	0.137	0.264	0.426	0.276
Ghana Union Assurance	0.734	0.609		0.672
Metlife	0.838		0.493	0.666
International Energy	−0.094			−0.094
Global Alliance		0.288		0.288
Provident Life		0.320		0.320
Qualty Life	0.699	0.998		0.849
Donewell Life	0.402			0.402
Phoenix Life	0.493	0.563		0.528
Vanguard Life		0.467	0.994	0.731

Table AI. Technical efficiency scores of insurance companies in Ghana (2006-2008)

Appendix 2

Table AII.
Allocative efficiency scores of insurance companies in Ghana (2006-2008)

Company/efficiency score	2008	2007	2006	Average
CDH	0.393	0.464	0.686	0.514
ELAC	0.586	0.660	0.890	0.712
Enterprise	0.896	0.423	0.620	0.646
SIC Life	0.535	0.324	0.608	0.489
CDH Life	0.396	0.066	0.495	0.319
Unique Life	0.377	0.065	0.614	0.352
GLICO Life	0.276	0.142	0.804	0.407
Provident	0.254	0.127	0.657	0.346
Donewell	0.411	0.482	0.270	0.388
MET	0.659	0.269	0.661	0.530
Vanguard Assurance	0.338	0.420	0.561	0.440
SIC Insurance	0.445	0.221	0.585	0.417
IGI Life	0.066	0.048		0.057
Ghana Life	0.606	0.042	0.856	0.501
Star Assurance (General)	0.649	0.507	0.465	0.540
GLICO General	0.920	0.716	0.641	0.759
Quality	0.675	0.583		0.629
Phoenix	0.583	0.356	0.531	0.490
Unique Insurance	0.430	0.580		0.505
Star Life	0.464	0.274	0.600	0.446
IG1 Insurance	0.086	0.136	0.129	0.117
Ghana Union Assurance	0.734	0.699		0.717
MEtlife	0.666		0.207	0.437
International Energy	0.080			0.080
Global Alliance		0.166		0.166
Provident Life		0.492		0.492
Quality Life	0.731	0.955		0.843
Donewell Life	0.478			0.478
Phoenix Life	0.371	0.474		0.423
Vanguard Life		0.427	0.944	0.686