Received: 1 November 2016 | Revised: 22 June 2017 | Accepted: 24 August 2017

DOI: 10.1002/mde.2897

WILEY

RESEARCH ARTICLE

Cost efficiency of insurance firms in Ghana

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The huge infrastructural deficit in Africa requires the establishment of an efficient insurance industry in the pursuance of economic development. Unfortunately, global statistics reveal low patronage of insurance in developing countries, thus making its impact limited in the region. To position the industry for economic development, this study utilizes the stochastic frontier technique to undertake a thorough analysis on the cost efficiency of insurers from the perspective of developing economies using Ghana as a case study. The results on the 30 insurers studied from 2005 to 2014 indicate that insurers in Ghana operate with about 53.8% average cost inefficiency. This stands to confirm the long existed low performance perception of Ghanaians about the industry. Factors identified to explain the cost inefficiencies were firm size, market share, capitalization, reinsurance, regulation, and business type. Several policy recommendations that can help boost the cost efficiency of insurers were derived from the results.

1 | BACKGROUND TO THE STUDY

The economic significance of insurance can be seen from its risk-pooling, intermediation, and real financial services functions in every economy. By these functions, insurance is observed to be an irresistible agent and target for economic development in contemporary economies. This therefore explains why the first meeting of the United Nations Conference on Trade and Development in 1964 acknowledged the development of national insurance and reinsurance markets as essential aspect of economic growth. According to Vadlamannati (2008), the necessary means for development in an emerging economy are through the establishment of a well-developed insurance sector. The reason being that, insurance provides long-term funds for physical and social infrastructure, while simultaneously strengthening risk-taking abilities. In 2009, the World Bank and other multilateral institutions accessed the infrastructural needs of Sub-Saharan Africa. They estimated US$ 93 billion per year as the required amount for curbing the infrastructural gap in the region. Considering this huge infrastructure deficit, pursuing Africa's economic development requires the building of an efficient insurance industry. However, evidences from global statistics on insurance suggest that while insurance penetration of the world is 6.23% and that of the advanced economies is 8.12%, emerging economies is 2.92% (Swiss Reinsurance Company Limited, 2016). Thus, confirming low insurance patronage as one of the reasons for the abysmal economic development in Africa.

In an attempt to understand and address the challenges in the industry, researchers have shifted their focus to insurance efficiency, which fundamentally concerns how insurers successfully produce as large as possible an output from a given set of inputs. A review of 74 studies on insurance efficiency by Cummins and Weiss (2013) reported the domination of the literature by Europe and United States with scanty studies on Africa. Thus, irrespective of the more important economic function of insurance in developing countries than developed parts of the world (Han, Li, Moshirian, & Tian, 2010), there exist a strong neglect of the insurance efficiency literature on developing countries especially those in Africa. Insurance efficiency study on Africa improves the level of efficiency of insurers by determining their inefficiencies and the drivers of such inefficiencies which in returns builds a strengthened industry and economy. Against this background, this study therefore seeks to remedy the identified gap in the literature by studying insurance efficiency from the perspective of developing economies using Ghana as a case study.

Ghanaians do not ordinarily purchase insurance due to their perception of low performance of the insurance companies in Ghana (see Baah-Nuakoh, Osei, Boakye, Turkson, & Owusu-Afriyie, 2001). This perception has become a canker in the minds of Ghanaians and has manifested in several reports and activities. The FinScope survey commissioned by the Government of Ghana on the financial sector reports that excluding national health insurance holders, and only 5% of the population have an insurance product (NIC, 2014). Thus, more than 23 million Ghanaians out of a total population of 25.9 million are living without any form of insurance. Therefore, resulting in an insurance penetration of about 1% compared to South Africa–14.69%, Namibia–6.98%, Kenya–2.98%, and Malaysia–5.05% (Swiss Reinsurance Company Limited, 2016). Attempts to revert this mindset by insurers have resulted into intense competition, price cutting, high management expenses, and duplication of functions among others. In view of these, insurers face regular complaints of repudiation of claims,

delay in settlement of claims, dispute over quantum, and delay in payment of settled claims. Implying that, the interventions rather have been aggravating the perception of Ghanaians, deepening the perception problem year after year in the industry.

Ansah-Adu, Andoh, and Abor (2011) confirmed the cost inefficiency challenge in the industry using only three consecutive years with a constant returns to scale data envelopment analysis (DEA). It is obvious that the short-time period, the choice of methodology which assumes every deviation as inefficiency, and the constant technology assumption imposed by their study can hinder the actual problem in the industry. Hence, this study extends the empirical efficiency literature on Ghana by analyzing the cost efficiency in the insurance industry, utilizing the stochastic frontier methodology on an unbalanced panel data of 30 insurers from 2005 to 2014.

The remainder of the study is organized as follows: Section 2 discusses the overview of the insurance industry of Ghana; Section 3 presents the literature review of insurance efficiency; Section 4 discusses data and methodology of the study; Section 5 discusses the empirical results; and Section 6 presents the conclusion and policy recommendation of the study.

2 | OVERVIEW OF THE INSURANCE INDUSTRY OF GHANA

The Ghanaian insurance industry under the supervision of the National Insurance Commission (NIC) is currently regulated by the 2006 Insurance Act (Act 724) that adopts the core principles of the International Association of Insurance Supervisors. This regulation increased the minimum capital requirement of insurers to the cedi equivalent of US $1 million, repealed the monopoly enjoyed by State Insurance Company (SIC) and Ghana Reinsurance Company and as well prohibited the issuance of composite license. Recently, considering the oil discovery in Ghana as well as the need of efficiency among the insurers in order to underwrite huge risk, NIC reviewed the minimum start-up capital of US$1 million to GH5 million in 2011 (NIC, 2010) and again to GH 15 million in 2015 (NIC, 2014). The Ghanaian insurance industry as of 2013 was composed of 25 nonlife insurers, 17 life insurers, 2 reinsurance companies, 58 brokers, 1 reinsurance broker, 1 loss adjustor, 1 oil and gas company, and 4,523 agents (NIC, 2014).

Table 1 reports the structure of the Ghanaian insurance industry in terms of premium distribution and number of companies from 2000 to 2013. A glance at Table 1 reveals that the industry was dominated by small firms with annual premium below GH 3 million from 2000 to 2005. SIC insurance that remains the only state owned nonlife insurer was the only firm with annual premium above GH 10 million from 2000 until 2005 when Enterprise Insurance Company (EIC), which is the oldest private insurer, also increased their premium revenue to exceed that margin. Their control of large market share in the industry caused them to determine the conduct of insurance during that period. Insurance firms in the industry were predominantly composite in nature as they undertook both life and nonlife businesses. From an initial introduction of marine (cargo) insurance, the classes of business in the industry composed of fire insurance, motor insurance, accident insurance, marine insurance, life/health insurance, and other forms of insurance such as travel and bonds investment insurance.

A study by Price Waterhouse (2013) revealed that despite the nonexistence of fixed agreed and enforceable rates of premiums in

TABLE 1 Structure of the Ghanaian insurance industry

Size	% Of industry premium							Number of companies						
Industry	2000	2003	2005	2008	2010	2012	2013	2000	2003	2005	2008	2010	2012	2013
Over 10 m	39	30	41	66	64	88	89	1	1	2	8	14	20	22
5–10 m	0	22	25	25	12	9	9	0	2	4	10	7	11	13
3–4.99 m	12	15	14	5	6	2	1	1	3	4	4	7	4	2
1–2.99 m	27	21	18	3	3	1	0	4	8	12	6	8	2	2
Below 1 m	22	11	2	1	0	0	0	23	18	10	7	4	4	3
Total	100	100	100	100	100	100	100	29	32	32	35	40	41	42
Nonlife	2000	2003	2005	2008	2010	2012	2013	2000	2003	2005	2008	2010	2012	2013
Over 10 m	44	38	55	68	51	88	87	1	1	2	5	8	13	13
5–10 m	0	28	24	25	14	9	12		2	3	7	5	6	9
3–5 m	14	18	9	4	8	3	0	1	3	2	2	5	3	
1–2 m	26	10	11	1	3	0	1	3	3	6	2	4		2
Below 1 m	16	6	0	1	0	0	0	10	6	2	4	1	2	1
Total	100	100	100	100	100	100	100	15	15	15	20	23	24	25
Life	2000	2003	2005	2008	2010	2012	2013	2000	2003	2005	2008	2010	2012	2013
Over 10 m	0	0	0	61	83	88	92				3	6	7	9
5–10 m	0	0	27	23	8	10	6			1	3	2	5	4
3–5 m	0	0	28	8	4	1	2			2	2	2	1	2
1–2 m	34	67	39	8	5	1	0	1	5	6	4	4	2	
Below 1 m	68	33	7	1	0	0	0	13	12	8	3	3	2	2
Total	100	100	100	100	100	10	100	14	17	17	15	17	17	17

Source: Authors' compilation from NIC reports.

the industry, there is a similar trend in premium rate, as most firms adopted the trade practices of SIC insurance that happens to be the former home of all senior management staff members in the industry. This observation in the industry makes its conduct resemble a mixed price leadership–collusive arrangement.

Another noticeable observation in the industry was the shift of domination from below GH 3 million to above GH 5 million in the period 2008–2013. Two major reasons accounted for this observation. First, the specialization condition of the Act 724 caused premiums of both life and nonlife sectors to increase, hence leading to a general increase in the premiums of the industry. Second, the introduction of innovative index insurance policies in the form of micro-insurance, agricultural insurance, and oil and gas insurance among others. By these innovations, there was a prolonged average growth of 26.42%, 34.47%, and 36.11% in total gross premiums, total asset, and total investment, respectively, since 2008 (NIC, 2013). Total gross premium of GH 278 million in 2008 grew to GH 1.052 billion in 2013 while total asset that was GH 599.1 million in 2008 grew to GH 1.582 billion in 2013. This trend is also seen in total investment as it grew from GH 302.4 million in 2008 to GH 1.158 billion in 2013.

A critical look at the structure of the industry in terms of concentration ratio also revealed that there has been a decline in the predominance of the two largest firms. Figures 1 and 2 clearly show a trade-off of some market power from the two and four largest firms in the industry to smaller firms. The reason behind this trend is the decrease in the concentration ratios for the nonlife firms compared to the rise in the life firms. As of 2013, the two largest firms in the industry were life firms (i.e., SIC life and Enterprise Life) clearly showing the outstanding performance of the subsector. Life firms were more concentrated than the nonlife firms in the industry as the two and four largest firms control 54.24% and 76.28% of sector premiums compared to the 28.17% and 48.23% recorded in the nonlife sector, respectively. This shows that the level of competition among the nonlife companies is keener than the life companies due to the infant nature of the life sector that is characterized by several new and young companies in the industry. Again, the control of market share in the insurance industry is in the hands of small large firms which suggest that the insurance market in Ghana exhibits the qualities of an oligopolistic market structure.

3 | LITERATURE REVIEW

Results from efficiency studies on insurance industries vary according to the type of efficiency, methodology, economic issues analyzed, sample size, and economies among others. These differences have attracted several attention leading to huge empirical literature on

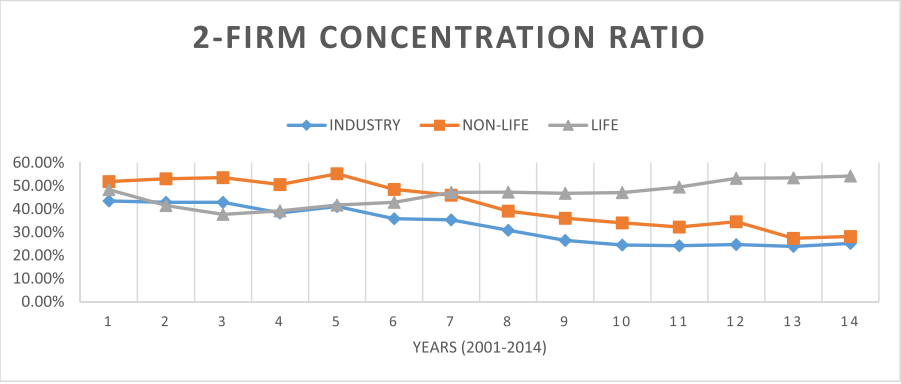

FIGURE 1 2-Firm concentration ratio [Colour figure can be viewed at wileyonlinelibrary.com]

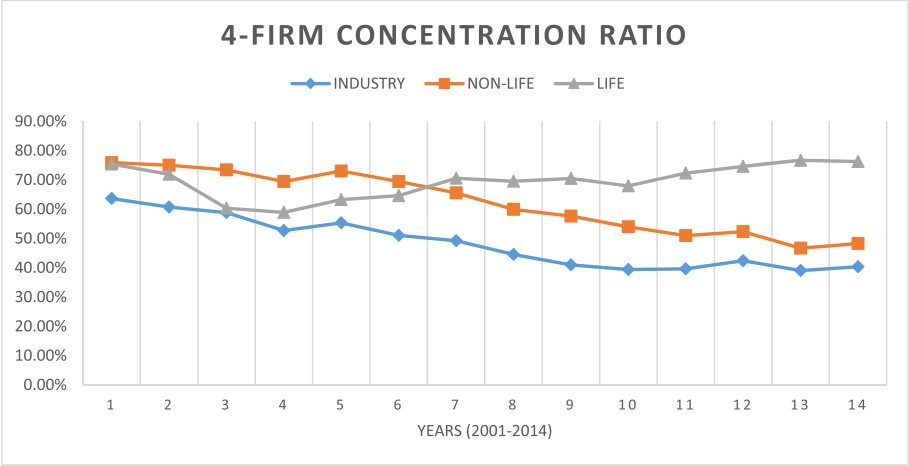

FIGURE 2 4-Firm concentration ratio [Colour figure can be viewed at wileyonlinelibrary.com]

efficiency analysis on insurance. One notable innovation which also stirred up the rise in insurance efficiency studies was the regulation by the European Union to unify all European insurance industries as a single insurance market by 1994.

Rai (1996) examined the cost efficiency of 106 insurance firms within Europe, Japan, and USA over a period of 5 years from 1988 to 1992 using a half normal translog cost stochastic frontier and a distributional-free (DFA) models of efficiency estimation. There existed inconsistency between the two parametric models, but he attributed it to the short-time period in the DFA model, hence chose the half normal translog cost stochastic frontier for his analysis. The average cost inefficiency among the firms was 27.3% attributed to firm size, specialization, and countries. He reported that smaller firms were more efficient than larger firms; specialized firms were more efficient, and firms in countries like Finland and Denmark were more efficient than UK firms. To confirm these findings, he undertook a second stage regression together with the estimation of economies of scale and cost complementarity that all confirmed his claims above. The study provided an idea of the level of cost inefficiency and its drivers in the international insurance efficiency literature.

Irrespective of the contributions of Rai (1996), the use of parametric technique as against other frontier techniques was questionable. Cummins and Zi (1998) studied the choice of methodology on cost efficiency using data on 445 US life insurers for the same period used by Rai (1996). They reported seven parametric (stochastic frontier analysis, SFA) models with different distributional assumptions and two nonparametric (DEA) models. Average cost efficiencies varied among the models as free disposal hull obtained the highest average efficiency of 91%, and the distributional free method recorded the lowest score of 44%. The parametric models had an average rank correlation of 96% whereas the nonparametric models had 67%, indicating a strong preservation of ranks in the parametric models. In identifying the best and least firms, they estimated a pairwise agreement statistics which confirmed the parametric models as reasonable in identifying firms, with an average accuracy of 85–90%. Cummins and Zi (1998) confirmed the robustness of distributional assumptions in parametric models but explained that choice of methodology (i.e., parametric or nonparametric) has effect on efficiency results. By these findings, they argued that it is appropriate to use more than one methodology in analyzing efficiency. Their cost efficiency estimates showed a positive relationship between firm size and cost efficiency and a higher cost efficiency in mutual relative to stock insurers in all the models.

The operation of Australian general insurers at cost above international best practices and the increased competition due to the deregulation and relaxation of bank and insurance regulations motivated Worthington and Hurley (2002) to examine the cost efficiency among the Australian general insurers. They used the variables return to scale DEA methodology on a cross section of 46 insurers in 1998. From a second stage Tobit regression, Worthington and Hurley (2002) argued that the major determinant of cost efficiency in the Australian general insurers is firm size as both small and large firms recorded a positive relationship with cost efficiency.

Hao and Chou (2005) analyzed the influence of market share, optimal scale, and product diversification strategies on cost efficiency in the Republic of China using an unbalanced panel on 26 insurers during the period 1977–1999 with both DFA and BC92 models. Results from the DFA model reported an average cost inefficiency of 33.98% whereas that of BC92 reported 81%. According to Hao and Chou (2005), the high inefficiency recorded in the BC92 indicated wrong distributional assumption that does not fit their data hence they chose the DFA over the BC92. This finding is opposite that of Rai (1996) but both contradict the robustness of distributional assumptions argument of Cummins and Zi (1998). Their second stage results confirmed that market share and firm size have positive relationship with cost efficiency.

Considering deregulation of the financial industry as well as the legal adjustments requiring insurers to specialize in either life or nonlife businesses before 1994, Kasman and Turgutlu (2009) analyzed the cost efficiency and the scale economies of 85 Turkish insurance firms over the period 1990–2004 using the SFA technique. From a minimum cost inefficiency of 18.3% and a maximum of 36.9%, the Turkish insurance industry recorded an average of 30.6% cost inefficiency. According to Kasman and Turgutlu (2009), the highest inefficiency level was recorded after the specialization regulatory Act in 1994 with an average of 35.9% inefficiency indicating that the regulation worsened the cost inefficiencies of the firms in the industry. It was also observed that all firms in the industry operated under increasing returns to scale indicating that economies of scale existed at every level of production in the industry. A second stage regression model confirmed that the drivers of cost efficiency in the Turkish insurance industry were capitalization, market structure, and ownership type. The excess of equity capital over total asset as well as the high concentration of the insurance market led to lower efficiencies whereas the firms owned by foreigners in the market were more efficient than the domestic firms.

Eling and Luhnen (2009) investigated the issue of different methodologies, organizational form, different countries, company size, and line of business using data on 6,462 insurers from 36 countries (including Egypt, Nigeria, Tanzania, and Tunisia) for the period 2002–2006. They observed a steady growth of technical and cost efficiency in the international insurance market which was characterized by higher efficiency values for developed economies and lower values for emerging countries. Small and medium firms exhibited increasing returns to scale whereas large firms exhibited decreasing returns to scale, confirming that smaller firms were more efficient than larger ones. The expense preference hypothesis was not confirmed as mutuals were found to be more efficient relative to stock, and also diversification in different line of business was not always better than strategic focus on one line. There was a negative relationship between capitalization and efficiency (technical and cost) for nonlife firms as well as technical efficiency for life firms, but cost efficiency for life firms recorded a positive relationship. Despite the similarity in trend relationship between DEA and SFA, they used the standard conditional mean approach to conclude that irrespective of technical or cost efficiency capitalization (solvency), company size, and organization form are the main drivers of efficiency in the international insurance industry.

Pottier (2011) analyzed the impact of regulation on cost, profit, and revenue efficiency by using a cross-sectional data on 277 US life firms in 2005 with a Variable Returns to Scale (VRS) DEA model. The observed average efficiencies recorded were 66.2%, 43.2%, and 64.9% for cost, revenue, and profit efficiency, respectively. These

averages were also consistent with conventional performance measures such as cost to benefit, revenue to benefit, and return on assets ratios. Their two-stage multivariate ordinary least square regression reported a positive relationship between firm size and all the three frontiers and a negative relationship of the three efficiencies with entities (number of insurers affiliated to a group) and capitalization (premiums/capital). State licensed (regulatory compliance cost) had a significant and negative relationship with cost efficiency but not significant with revenue and profit efficiency. From their study, firm size, capitalization, entities, and states licensed were the determinants of cost efficiency among US life insurers.

There are however many studies on efficiency of insurance companies in Africa. Most of these studies have analyzed efficiency in single country as well as across countries in Africa. The studies by Chaffai and Ouertani (2002), Barros and Obijiaku (2007), Barros, Caporale, and Ibiwoye (2008), Ansah-Adu et al. (2011), Alhassan and Addison (2013), Barros, Dumbo, and Wanke (2014), Barros et al. (2014), Wasseja and Mwenda (2015), Alhassan and Biekpe (2015), and Alhassan and Biekpe (2016) among others have focused on individual African countries. For instance, Barros and Obijiaku (2007) and Barros et al. (2008) studied the efficiency of insurance companies in Nigeria. Barros and Obijiaku (2007) utilized DEA to evaluate the performance of Nigerian insurance companies, from 2001 to 2005, combining operational and financial variables. Barros and Obijiaku (2007) identified firm size, market share, and insurance connection with bank networks to be the drivers of technical efficiency in the Nigerian insurance industry. Barros et al. (2008) also developed a two-stage procedure of Simar and Wilson to estimate the efficiency determinants of Nigerian insurance companies. Using a representative sample of Nigerian insurance companies between 1994 and 2005, Barros et al. (2008) found that competition for market share is the main driver of efficiency in the Nigerian insurance market. Ansah-Adu et al. (2011) examined the cost efficiency of 30 insurers in Ghana from the period 2006–2008 using an output orientation Charnes, Cooper and Rhodes (CCR)–DEA approach. The average cost efficiency score for the three consecutive years recorded were 31%, 23%, and 43%, respectively, with only one firm obtaining 70% average efficiency score over the period. Life insurers obtained higher average efficiency values (31%) than nonlife insurers (28%). Their two-stage regression model confirmed that market share and firm size were positively related to efficiency whereas the ratio of equity to total invested asset was negatively related to cost efficiency in the Ghanaian insurance industry. Barros et al. (2014) described a variety of approaches used to assess the efficiency of a sample of major insurance companies in Angola between 2003 and 2012. Barros et al. (2014) combined neural networks with DEA results as part of an attempt to produce a model for insurance companies' performance with effective predictive ability. Their findings indicate that older insurance companies with Portuguese origin tend to be more efficient. Wasseja and Mwenda (2015) also found a technical efficiency of 52.9% among life insurers in Kenya using DEA. They attributed the inefficiencies to firm size, listed stock exchange firms, and composite firms. The paper by Alhassan and Biekpe (2015) examined insurers in South Africa. Using the DEA, they found that technical, scale, and allocative efficiencies are determined by reinsurance, leverage and age of insurers, product line diversification, and firm size.

With regards to the cross country studies on African insurance industry, Gaganis, Hasan, and Pasiouras (2013) investigated whether the capital market values the efficiency of insurance firms across 52 countries including Egypt, Republic of South Africa, and Tunisia during the 2002–2008 period. After tracing stock returns and efficiency changes of 399 listed insurance firms over the period, the paper reports a positive and statistically significant relationship between profit efficiency change and market adjusted stock returns. Singh and Zahran (2013) carried out an analysis that compares the cost efficiency of Islamic and conventional insurers. Using data from 32 insurers operating in eight countries (including Egypt and Tunisia), Singh and Zahran (2013) concluded that Islamic insurers are no more or less efficient than conventional insurers. Al-Amri, Cummins, and Weiss (2014) also investigated scope economies, organizational form, and insolvency risk for a sample of takaful firms in 19 countries including Egpyt, Libya, Mautitania, Senegal, and Sudan. Data envelopment analysis is employed to estimate firm efficiency; performance is also gauged using return on equity and return on assets, and insolvency risk is measured using distance to default. The findings suggest that strategic focus is superior to conglomeration for takafuls in terms of performance, efficiency, and insolvency risk. Finally, Biener, Eling, and Jia (2016) discusses the existence of a systematic relationship between internationalization and performance of life insurance companies (including firms from Republic of South Africa). Biener et al. (2016) find that the impact is negative on life insurers' profitability. Moreover, incorporating the DEA to study the internationalization and performance relationship, they found that cost efficiency mediates the relationship between globalization and profitability.

The review of the literature shows that many of the studies have employed the DEA methodology (largely the two-stage approach) with a focus on the analysis of technical efficiency or performance of the firm relative to cost efficiency. The study on Ghana (Ansah-Adu et al., 2011) among others follows this same approach. Clearly, there exists a gap in the utilization of the SFA methodology to examine particularly cost efficiency in the insurance literature on Africa. This study amends the gap by examining cost efficiency in the Ghanaian insurance industry using a one-stage SFA methodology. By this approach, we are able to control for the inability of the DEA to distinguish or disentangle random errors from inefficiency estimates. The study again extends the empirical literature on insurance efficiency in Ghana. This would in turn provide valuable insights to policy managers and stakeholders in managerial decision-making in the industry.

4 | METHODOLOGY

4.1 | Theoretical framework

From the microeconomic theory of the firm, every firm whose basic task is to transform inputs into outputs produces maximum outputs at minimum cost. Suggesting that firms operate at minimum cost as they produce output (y) at input prices (w) with the best technology available. This can be expressed as

$$C_{it} = f\left(Y_{it}, W_{it;}\, \beta\right), \tag{1}$$

where C_{it} is the cost of production of firm i at time t, f (.) is the suitable functional form, Y_{it} and W_{it} are the outputs and input prices of firm i at time t, respectively, and β are unknown parameters to be estimated. Contrary to this theory, Leibenstein (1975) proposed a theory which argues that firms are not able to operate at the cost minimizing output levels due to the presence of x-inefficiencies (cost inefficiencies). Hence, measured x-inefficiencies as the difference between the minimum cost and the observed cost of production, thus attributing every deviation from the minimum frontier to inefficiencies. This measurement approach is deterministic in nature and serves as the conceptual idea of the nonparametric DEA that is generally utilized in almost all the studies on insurance efficiency in Africa. Intuitively, DEA constructs a frontier with the observations of the best practice firms in an industry then compares each firm's observations with the frontier to obtain the inefficiencies of each of the firms. By this approach, random shocks or errors are not accounted for but considering the unpredictable nature of insurance in Ghana such approach could be highly bias.

Unlike the DEA, the SFA jointly proposed by Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977) argues that a production process is subjected to two economically distinguishable random disturbances with different characteristics. The stochastic form of Equation 1 when logarithms are applied to, it becomes

$$\ln C_{it} = \ln f(Y_{it}, W_{it,}\beta) + \epsilon_i, \text{where } \epsilon_i = U_{it} + V_{it}. \quad (2)$$

The symmetric term (V_{it}) permits the random variation of the frontier across firms and captures the effect of measurement error and statistical noise as well as random shocks beyond a firm's control whereas the one sided term (U_{it}) captures the inefficiency relative to the stochastic frontier. According to Coelli (1996), the Farrell input orientation cost efficiency is measured as the ratio of the frontier cost (Equation 2) to the observed cost of production that can be represented by

$$\exp(U_{it}), \text{that is,} \frac{C(Y,W)e^{v}e^{u}}{C(Y,W)e^{v}} = e^{u} = \exp(u). \quad (3)$$

A firm becomes fully cost efficient when Equation 3 = 1 and less cost efficient when Equation 3 < 1. Corrected Ordinary Least Squares (COLS), modified Ordinary Least Squares (MOLS), and maximum likelihood estimator are the mostly used techniques for estimating Equation 3, but the several weaknesses of COLS and MOLS make maximum likelihood estimator a preferred choice for undertaking SFA. This estimation technique uses probability distributions to separate the inefficiencies from the random errors. The SFA methodology undertakes optimization over the whole sample to obtain mean (in)efficiency which the (in)efficiency of each firm is determined. Coelli, Rao, and Battese (1998) utilized the conditional probability concept of Jondrow, Lovell, Materov, and Schmidt (1982) and the re-parameterization of Battese and Cora (1977) to measure the mean inefficiency as

$$E(u_i/\epsilon_i) = 1-\phi\left(\frac{\sigma + (\gamma\epsilon_i/\sigma)}{1-\phi(\gamma\epsilon_i/\sigma)} \exp\left(\gamma\epsilon_i + \left(\frac{\sigma^2}{2}\right)\right)\right), \quad (4)$$

where $\sigma = \sigma_u^2 + \sigma_v^2$ and $\gamma = \frac{\sigma_u^2}{\sigma}$.

The parameter γ lies between zero and one and indicates the importance of the inefficiency term. If γ = 0, the inefficiency term is irrelevant to the cost frontier and the result of the frontier equals that of the OLS estimation. However, if γ = 1, the random error term is irrelevant implying that the cost frontier is only explained by the cost inefficiency term. A cost (production) function is stochastic only when the residual term is right (left) skewed, implying that 0 < γ < 1.

Two main approaches exist in the SFA literature for examining the determinants of efficiency. The two-stage approach estimates the efficiency score of the decision making units (DMU) then uses these values as a dependent variable on possible independent exogenous variables in a regression model to discover the possible drivers of efficiency of the DMU (see Kalirajan, 1981; Pitt & Lee, 1981). This approach is heavily criticized because the first step assumes an independent and identically distributed relationship existing between the inefficiency terms whereas the second step tries to find factors that have some relationship with the inefficiency term. Thus, making the second step a contradiction of the first step (see Danquah, Barimah, & Ohemeng, 2013; Danquah & Ouattara, 2015; Danquah & Quartey, 2015). This contradiction identified in the SFA literature led to the innovation of the one-stage approach that the challenges of the two-stage approach by undertaking the two separate processes in one step (see Battese & Coelli, 1995; Greene, 2008). The study therefore employs the Battese and Coelli (1995) one-stage SFA model for the empirical analysis.

4.2 | Data

The data used in this study were drawn from the regulatory annual statements filed by insurance companies with the NIC. Firms were included on the basis of their registration under the 2006 Insurance Act 724 by NIC in 2007. Out of the 34 registered firms, 30 were used in the study due to the liquidation of two firms and data challenges on the two other firms over the period. Observations were eliminated when firms recorded large missing, negative, or zero values in any of the input and output variables. The final data used in estimating the efficiency of the firms were an unbalanced panel of 280 observations comprising 30 firms observed from 2005 to 2014. All the monetary variables were deflated with the consumer price index using 2005 as the base year.

The study adopted the value added approach to define outputs as net incurred benefits (life), net claims incurred (nonlife), and investment income (both life and nonlife) to represent the risk bearing and the intermediation functions of insurance respectively as used by Alhassan and Biekpe (2015). Because of data challenges, we followed Eling and Luhnen (2009) and Ansah-Adu et al. (2011) to define inputs and input prices, respectively. Hence, inputs were defined as equity capital, debt capital, and operating expenses whereas input prices were defined as equity capital/total asset, debt capital/total asset, and operating expenses/total asset. Table 2 provides a description of the variables used in the study. From Table 2 , the large values of standard deviations over mean for all the input and output variables indicate the heterogeneity in the insurance industry, that is, firms in the industry vary from each other by all variables used in the study.

TABLE 2 Descriptive statistics

Variables	Mean (GHC)	Standard deviation (GHC)	Minimum (GHC)	Maximum (GHC)
Inputs				
Operating expenses(×1)	6,184,060	10900000	10832.55	75100000
Equity capital(×2)	10,100,000	19200000	25814	116000000
Debt capital(×3)	18,300,000	43300000	32721	370000000
Outputs				
Net claims incurred/benefit(Y1)	5556882	13600000	1952.701	126000000
Investment income(Y2)	2554296	8113748	29.55569	89900000
Input prices				
Price of operating expenses(W1)	0.282592	0.141687	0.010886	0.962063
Price of equity capital(W2)	0.36465	0.178885	0.006472	0.962063
Price of debt capital(W3)	0.628875	0.206645	0.00998	1.39987
Others				
Reinsurance	3710239	8675665	0.98987	56700000
Solvency	0.36465	0.178885	0.006472	0.962063
Market share	0.03336	0.040888	0.000139	0.297474
Asset	28600000	58500000	130566	436000000
Consumer price index	259.3761	94.47594	116.6	404

Note. The above monetary variables are deflated by the CPI using 2005 as base year.Source: Author's computation using STATA 13.

4.3 | Empirical model

The cost function of insurance is unknown, but there is a wide utilization of the translog cost function over Cobb–Douglas and other functional forms in the insurance literature. Because it is able to make inefficiency an additive term and does not put prior restrictions on the functional form. For consistency with literature, the study assumes translog cost function with a nonneutral technology, linear homogeneity in prices, and symmetry. Hence, Equation 3 becomes

$$\ln\left(\frac{C_{it}}{W_{Kit}}\right) = \delta_0 + \sum_{m=1}^{M}\delta_{mi}\ln(y_{mit}) + 0.5\sum_{m=1}^{M}\sum_{n=1}^{N}\delta_{mn}\ln(y_{mit})\ln(y_{nit}) + \sum_{k=1}^{K}\delta_k\ln(W^*_{kit}) + 0.5\sum_{k=1}^{K-1}\sum_{l=1}^{L-1}\delta_{ki}\ln(W^*_{kit})\ln(W^*_{lit}) + \sum_{k=1}^{K-1}\sum_{m=1}^{M}\delta_{km}\ln(W^*_{kit})\ln(y^*_{mit}) + \delta_1 t + 0.5\delta_{11}t^2 + \sum_{m=1}^{M}\delta_{1m}t\ln(y_{mit}) + \sum_{m=1}^{M}\delta_{1k}t\ln(W^*_{kit}) + U_{it} + V_{it}, \quad (5)$$

where C_{it}, W_{kit}, and y_{mit} represent the total cost (obtained by multiplying the inputs by their prices) of the ith firm at t year, the kth input price of the ith firm at t year, and the mth output of the ith firm at time t, respectively. We used operating expenses for the linear homogeneity assumption in this study (i.e., $W^*_{kit}=\frac{W_{ki}}{W_{Ki}}$). The time factor *t* included as a regressor in the model account for the technological assumption whereas δ are coefficients to be estimated in the model. The one-stage approach proposed by Battese and Coelli (1995) that controls for observed heterogeneity of firms over the period in the cost frontier is represented as

$$u_{it} = z_{it}\delta + W_{it}, \quad (6)$$

where u_{it} are the nonnegative variables associated with cost inefficiencies assumed to be independently distributed such that it is obtained by truncation (at zero) of the normal distribution with mean, z_{it} and variance σ_u^2. z_{it} is vector of explanatory variables associated with cost inefficiency whereas are vector of unknown coefficients. W_{it} is random variables defined by the truncation of normal distribution with mean zero and a constant variance, σ^2, such that the point of truncation is $z_{it}\delta$ (i.e, $W_{it} \geq z_{it}\delta$). V_{it} is the statistical noise assumed to be identically and independently distributed $N(0, \sigma_v^2)$ and is independent of u_{it}.

The controlled observed heterogeneities that comprise large firms (large), small firms (small), capitalization, market share, business type, ownership type, regulation, and reinsurance, in this study serve as the possible determinants of cost (in)efficiencies. Therefore, the determinants model is defined as

$$u_{it} = \delta_0 + \delta_1\text{large} + \delta_2\text{small} + \delta_3(\text{capitalization})_{it} + \delta_4\text{businesstype} + \delta_5\text{ownershiptype} + \delta_6(\text{marketshare})_{it} + \delta_7(\text{reinsurance})_{it} + \delta_8(\text{regulation}) + W_{it}. \quad (7)$$

5 | EMPIRICAL RESULTS

5.1 | Cost efficiency estimates

On the basis of the Battese and Coelli (BC) specification, we proceed to discuss the cost efficiency estimates of insurers considered in our study. Table 3 showed remarkable observations in the Ghanaian insurance industry during the period under review. It was observed that the 10 best insurers were all life insurers. This observation is remarkable especially having Quality Life (DMU 10) as the dominant insurer with an average cost efficiency of 78.7%. Quality Life controls an average of 0.7% insurance premiums in Ghana but its performance in 2005, 2006, 2010, and 2011 as the best cost efficient insurer actually accounted for their domination in the industry. The study of Ansah-Adu et al. (2011) also ranked Quality Life as the best cost efficient

TABLE 3 SFA cost efficiency scores

SFA Cost efficiency scores												
DMU	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Average**	**Rank**
1	0.659	0.697	0.549	0.897	NA	0.666	0.667	0.502	0.28	0.283	**0.578**	9
2	0.411	0.444	0.469	0.835	0.685	NA	NA	NA	0.445	0.884	**0.596**	8
3	0.19	0.361	0.315	0.354	0.398	0.305	0.245	0.301	0.249	0.224	**0.294**	26
4	0.724	0.705	NA	0.74	0.788	0.778	0.677	0.679	0.394	0.496	**0.665**	7
5	NA	NA	0.552	0.578	0.806	0.694	0.843	0.915	0.761	0.788	**0.742**	3
6	NA	NA	0.113	0.114	0.374	0.263	0.358	0.361	0.298	0.311	**0.274**	28
7	NA	0.59	0.653	0.876	0.642	0.485	0.551	0.54	0.395	0.442	**0.575**	10
8	0.836	0.647	0.559	0.698	0.738	0.714	0.685	0.806	0.616	0.608	**0.691**	5
9	0.686	0.809	0.796	0.869	0.942	0.738	0.601	0.795	0.183	0.266	**0.669**	6
10	0.9	0.699	0.812	0.745	0.832	0.81	0.875	0.89	0.631	0.671	**0.787**	1
11	0.213	0.251	0.239	0.265	0.444	0.496	0.37	0.378	0.287	0.302	**0.324**	23
12	0.475	0.509	0.349	0.486	0.518	0.483	0.462	0.402	0.295	0.296	**0.428**	14
13	0.533	0.565	0.642	0.753	0.667	0.743	0.839	0.863	NA	0.643	**0.694**	4
14	0.677	0.876	0.728	0.862	0.845	0.796	0.824	0.796	0.625	0.739	**0.777**	2
15	0.493	0.409	0.493	0.487	0.561	0.37	0.482	0.475	NA	0.383	**0.461**	12
16	0.314	0.342	0.308	0.297	0.334	0.4	0.375	0.542	0.274	0.312	**0.35**	22
17	0.239	0.258	0.235	0.201	0.251	0.143	0.608	0.334	0.277	0.304	**0.285**	27
18	0.487	0.497	0.56	0.551	0.273	0.351	0.417	0.413	0.125	0.103	**0.378**	21
19	NA	0.311	0.54	0.464	0.639	0.318	0.419	0.393	0.27	0.252	**0.401**	19
20	NA	NA	0.437	0.402	0.354	0.432	0.679	0.66	0.182	0.263	**0.426**	15
21	0.309	0.351	0.376	0.367	0.467	0.427	0.441	0.486	0.305	0.328	**0.386**	20
22	0.42	0.653	0.442	0.545	0.449	0.475	0.39	0.401	0.302	0.234	**0.431**	13
23	NA	NA	0.219	0.412	0.589	0.461	0.633	0.42	0.177	NA	**0.416**	17
24	0.296	0.197	0.163	0.265	0.339	0.351	0.505	0.479	0.256	0.251	**0.31**	25
25	0.472	0.322	0.483	0.536	0.57	0.487	0.354	0.426	0.217	0.223	**0.409**	18
26	0.835	0.168	NA	0.296	0.529	0.497	0.64	0.718	0.397	0.272	**0.484**	11
27	0.114	0.123	0.101	0.098	0.121	0.101	0.121	0.188	0.133	0.176	**0.128**	30
28	0.27	0.3	0.302	0.317	0.315	0.274	0.258	0.213	0.154	0.156	**0.256**	29
29	0.522	0.366	0.426	0.463	0.468	0.452	0.413	NA	0.319	0.38	**0.423**	16
30	0.354	0.308	0.343	0.324	0.355	0.362	0.389	0.276	0.227	0.259	**0.32**	24
Average	**0.476**	**0.452**	**0.436**	**0.503**	**0.527**	**0.478**	**0.521**	**0.523**	**0.324**	**0.374**	**0.462**	
Observations from average scores												
Firm size			Ownership				Business type				Regulation	
Small	0.574		Domestic	0.461			Life	0.578			1989	0.454
Medium	0.418		Foreign	0.464			Nonlife	0.363			2006	0.465
Large	0.289											

Note. DMU = decision making units; SFA = stochastic frontier analysis.

insurer therefore this observation serves as a confirmation of their reliance on best cost practices. Ghana Union Assurance (GUA) life on the other hand controls only 0.3% of insurance businesses but was the third best practice insurer in the sample with an average efficiency of 72.8%. The second position of Vanguard Life together with the positions of Quality Life, Ghana Union Assurance, Unique Life (DMU 13), Ghana Life (DMU 4), and Donewell Life (DMU 2) clearly point the cost prudence of smaller firms in the industry.

Large firms in the Ghanaian insurance industry in terms of premium revenue and assets were observed to be the least cost efficient insurers. SIC insurance (DMU 27), Star Assurance (DMU 28), Glico Life (DMU 6), EIC (DMU 17), Enterprise Life (DMU 3), Provident Insurance (DMU 24), Vanguard Insurance (DMU 30), and SIC life (DMU 11) who determine the conduct of insurance operation in Ghana attained the least average cost efficiencies during the period under review. SIC insurance that is the only state owned nonlife insurer and also the largest nonlife insurer in terms of premium revenue and assets recorded an average cost efficiency of 12.8%, thus making it the least cost efficient insurer. Again, SIC life that is currently the largest insurer in Ghana in terms of premium revenue since 2013 and controls an average of 27.9% of life businesses occupied the 23rd position with average efficiency of 32.4%. This indicates that the difficulty associated with monitoring managerial behavior when firm size increases converted the economies of scale and scope supposed to have been enjoyed by these large firms into cost inefficiencies (Fama & Jensen, 1983).

Decomposing the efficiency scores into firm size in Table 3 reveals that small insurers (representing insurers below the median firm size in the sample) had an average of 57.4% which is more than the 41.8% and the 28.9% obtained by medium (insurers with size below the third quartile) and large insurers (insurers with size above the third quartile), respectively. This indicates that smaller insurers were more cost efficient during the period.

Foreign firms recorded average cost efficiency of 46.4% compared to the 46.1% recorded by the domestic firms. Suggesting that the existence of subsidiaries and branches of foreign firms on several continents make them acquire numerous technologies for undertaking their activities in the industry. Hence making them more cost efficient than domestic firms.

The increased minimum capital requirements characterizing the 2006 regulatory period also caused firms to operate with several new technologies due to the expansion in their capital reserves hence making them more cost efficient in those period covering the Act.

The average cost efficiency of life insurers (DMU 1–14) recorded was 57.8%, higher than that of the nonlife insurers (DMU 15–30) estimated at 36.3%. This observation had the same trend reported in Ansah-Adu et al. (2011) but differs in terms of values as they obtained average cost efficiency of 28% for nonlife and 31% for life insurers. We attribute this observed difference in average efficiencies to the input and output variables and the methodology choices between the two studies.

From Table 3, the average cost efficiency was 46.2% indicating an inefficiency of 53.8% due to an average growth rate of −21.41% over the period suggesting a deteriorating performance in the industry. Irrespective of the small sample size advantage, this overall average falls below the averages of most studies in the insurance efficiency literature. The average cost efficiencies of 69.1%, 62.7%, and 66.02% recorded in the studies of Kasman and Turgutlu (2009), Rai (1996), and Hao and Chou (2005), respectively, clearly shows a low cost efficiency of insurers in the Ghanaian economy. Figure 3 reveals that, the negative growth is due to the steep decrease recorded in the periods 2005–2007, 2009–2010, and 2012–2013 against the gradual rise in 2008–2009 and 2011–2012. The period 2009 to 2011 marked a period of fluctuations in the industry. But, however, coincides with the discovery and production of oil in commercial quantities that led to the formation of a consortium by the nonlife firms to be able to underwrite the new oil and gas risk introduced in the economy.

5.2 | Determinants of cost efficiency

The efficiency estimates above revealed trends in the cost efficiency scores but as a confirmation of the actual influences of these observations, Table 4 below provides the results of the determinants of cost efficiency following the conditional mean approach proposed Battese and Coelli (1995).

The likelihood-ratio test rejects at 1% significance level the hypothesis that the inefficient term is not significantly different from zero in the model. Thus, indicating the presence of inefficiencies among firms in the sample. This observation confirms the use of stochastic frontier in analyzing the firms in the study. From Table 4, the 0.7546 γ revealed that the model comprise both inefficiency and random error, but cost inefficiency turns to be the major contributor of errors in the insurance industry. The time variable (year) used to test technological change revealed a positive but insignificant relationship with the cost frontier, implying that changes in cost techniques were not observed over the period under review. Input and output elasticities were observed to be monotonic nondecreasing. But the ratio of debt capital (w3) and operating expenses (w1) was the actual variable that increased cost of production in the Ghanaian insurance industry because their elasticity recorded a significant relationship.

From Table 4, the cost inefficiencies increased proportionately with large firm size and inversely with small firm size over the period at 1% significance level. Smaller insurers reduced their cost inefficiencies relative to medium and large firms during the period. Insurers who engaged in asset expansions during the period increased their cost inefficiencies since those initiatives did not attract any unique benefits. Smaller insurers decreased their inefficiencies by 29.1% whereas large insurers increased cost inefficiencies by 40.2%. This observation contradicts the findings of Kasman and Turgutlu (2009) and Ansah-Adu et al. (2011) but rather supports Fenn, Vencappa, Diacon, Klumpes, and O'Brien (2008) and Rai (1996) who observed high inefficiencies among large firms. These largely indicate the lack of harmony in terms of the relationship between cost efficiency and firm size in the insurance literature. Firm size of an insurer serves as security for policyholders that attract several new businesses for an insurer (Pottier, 2011). But the ability of the insurer to manage the increase in businesses as well as other growth challenges determines whether their cost can increase or decrease because of (dis)economies of scope and scale. This seems to be the case for large insurance companies in Ghana. From our sample data, the total cost of operation for these identified large firms seems to increase substantially over the years

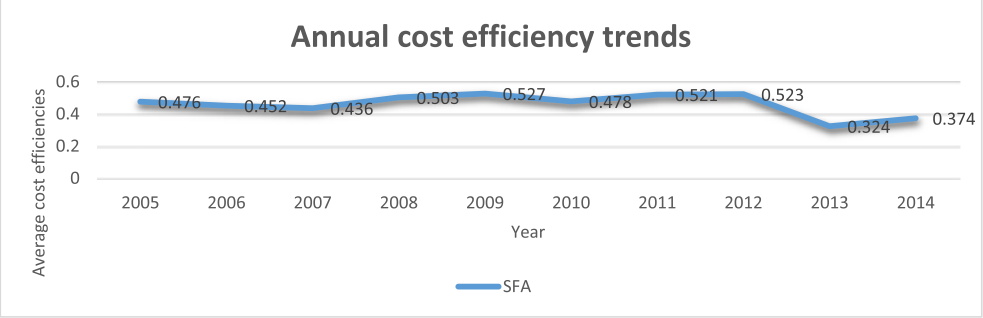

FIGURE 3 Trends in yearly average cost efficiencies. SFA = stochastic frontier analysis [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 4 Maximum likelihood estimates for parameters of the translog stochastic frontier cost function with inefficiency component

	Coefficient	Standard error	z value
Cost function			
Constant	8.824804	1.1650365	7.5747***
Log(w2/w1)	0.1120727	0.2518545	0.445
Log(w3/w1)	1.1342318	0.2452556	4.6247***
Log(y1)	0.1944823	0.2161669	0.8997
Log(y2)	0.0838507	0.1673061	0.5012
(0.5*Log(w2/w1)^2)	0.1054228	0.0424593	2.4829**
(0.5*Log(w3/w1)^2)	0.4782632	0.0494791	9.666***
Log(w3/w1)*log(w3/w1)	−0.2249724	0.0401429	−5.6043***
0.5*Log(y1)^2)	0.0578163	0.0349689	1.6534*
0.5*Log(y2)^2	0.0521109	0.0195322	2.668***
Log(y1)*log(y2)	−0.0426314	0.0263444	−1.6182
Log(w2/w1)*log(y1)	−0.027698	0.0329734	−0.84
Log(w2/w1)*log(y2)	0.0279964	0.0344334	0.8131
Log(w3/w1)*log(y1)	−0.0367426	0.0346116	−1.0616
Log(w3/w1)*log(y2)	0.0021837	0.0384113	0.0569
Year	0.137967	0.1107766	1.2455
Year*log(w2/w1)	0.0310972	0.0110487	2.8146***
Year*log(w3/w1)	0.0133699	0.0158822	0.8418
Year*log(y1)	−0.0121709	0.0126527	−0.9619
Year*log(y2)	0.0053372	0.0107671	0.4957
0.5*Year^2	0.0026832	0.010404	0.2579
Inefficiency effects			
Constant	0.5274604	0.2029093	2.5995***
Large	0.4019997	0.0917191	4.3829***
Small	−0.2910508	0.0792881	−3.6708***
Capitalization	1.1070089	0.29464	3.7572**
Marketshare	3.1630009	1.0413387	3.0374***
Businesstype	0.4600707	0.081036	5.6774***
Ownershiptype	0.0295187	0.0584654	0.5049
Regulation	−0.1868504	0.1029539	−1.8149*
Reinsurance	−0.0205854	0.0112102	−1.8363*
Variance parameters			
2	0.1102061	0.0122624	8.9873***
γ	0.7546793	0.1574503	4.7931***
Log-likelihood	−73.06444		
Observation	280		

Source: Author's computation using R-Software
Note. Significance at:
*10%,
**5% and
***1%.

as the firms expand. From an initial cost of GH3,193,184.00 in 2005, the total cost of operations for the larger firms in our sample grew to GH329,476,489.6 in 2014. This indicates an increase in total cost by about 110 times over the period.

Insurers finance their assets by equity and debt, therefore, debt ratio (total debt over total assets) and capitalization (equity over total assets) determine the proportion of equity and debt used by an insurer. This study observed a positive relationship between capitalization and cost inefficiency at 1% significance level. Thus, when capitalization increases by 10%, cost inefficiencies increase by 11.07%. This implies that firms which increased the portion of their assets owned by shareholders increased their cost inefficiencies through the dividends and

other agency problems they encountered. The descriptive analysis of the sample data, (see Table 2), show that insurers were more dependent on debt capital resulting in the rate of growth of debt more than equity capital. Amidst the increasing debt ratio, insurers who increased their capitalization attracted a lot of cost leading to their cost inefficiencies during the period under study. Kasman and Turgutlu (2009) recorded the same observation in the Turkish insurance industry.

Ansah-Adu et al. (2011) identified a positive relationship between market share and cost efficiency, but this study contradicts that observation as market share rather increases with cost inefficiencies. During the period, an increase in market share by 10% increases cost inefficiencies by 30.16% but with a high standard deviation of 10.41%. This observation is due to the recent phenomenon of increasing acquisition cost that turns to be more than the first year premium revenues. Competition in the industry has driven insurers to spend more than what they receive from premium revenue, hence leading to a negative relationship between market share and cost efficiency. Fenn et al. (2008) reported a similar trend in their study.

Amidst the several regulations, the 2006 Insurance Act 2006 was intended to increase the efficiency of insurers in Ghana. This study observes that the periods covering the implementation of the Act made insurers reduce cost inefficiencies by 18.7% more than the period covering the 1989 insurance Act at 10% significance level. We attribute this observation to the increased competition introduced by the 2006 Act. The Act opened the insurance industry up for foreign competition thereby forcing insurers to improve their operations in order to cope the new environment introduced.

Insurers undertake reinsurance to diversify their risks in order to underwrite more insurance businesses. This study identifies a negative relationship between diversifying risks (reinsurance) and cost inefficiency, that is, firms who undertook reinsurance benefited by reducing their cost inefficiencies over the period at 10% significance levels. The security attained by insurers helped them exercise good cost management practices that reduced their cost inefficiencies. This means that as an insurer increases its reinsurance contracts by 100%, cost efficiencies increase by 2.06%. This same observation was recorded in Alhassan & Biekpe, 2015 as they discussed technical efficiency and reinsurance.

Business type was the major determinant of cost efficiency over the period considering the highest *t* statistic it recorded. It had a positive relationship with cost efficiency. Nonlife insurers who served as reference point in this study increased their cost inefficiencies compared to that of the life insurers. By this observation, nonlife insurers increased their cost inefficiencies by 46.0% more than life insurers over the period at 1% significant levels. Implying that life firms were more cost efficient than nonlife firms over the period. Ansah-Adu et al. (2011) recorded the same trend but statistically insignificant relationship, which may be because of their short-time period. Using Kruskal–Wallis test, Wilcoxon rank–sun test, and one-way ANOVA test (see Appendix, Table A,C), the study rejected the hypothesis that life and nonlife average cost efficiencies were from the same population. Suggesting that life and nonlife insurers operate in different environment with different technology and skills, hence needs to be treated separately.

A critical study of the life insurers confirmed product innovation as the factor causing their cost efficiency. Life firms innovated cultural valued products that were appreciated and cherished by Ghanaians during the period hence disabusing the negative perception and concept about insurance and attracting more clients. Ghanaians understand their culture and traditions; designing a product in line with these values caused several citizens to understand what insurance is about, therefore causing life insurers to enjoy large numbers that increased their cost efficiencies. C. C. Bruce, CEO of Enterprise Life (the second largest insurer in 2013) confirmed this observation as he explained that 65% of his company's revenue came from funeral policies (KPMG Africa, 2014).

Ownership type on the other hand had a positive relationship with cost inefficiencies, thus, domestic firms' cost inefficiencies increased by 0.03 more than foreign firms over the period. But this observation was not statistically significant in this study.

6 | CONCLUSIONS AND POLICY RECOMMENDATIONS

The primary objective of the study is to examine the cost efficiency of the insurance industry in Ghana for the period 2005 to 2014. Achieving such an objective required an initial task of measuring the level of cost efficiency among insurers in the industry. Therefore, using an unbalanced panel data on 30 insurers comprising both life and nonlife insurers, the study estimated the cost efficiencies of the insurers by using SFA model. Adopting the conditional mean approach of Battese and Coelli (1995), the study examined the determinants of cost efficiency in the insurance industry of Ghana.

From the results, the overall average cost inefficiency for the period was 53.8% indicating a challenge of cost inefficiency in the insurance industry. This stands to confirm the long existed perception of Ghanaians on the poor performance of insurers in the industry. Most of the firms were utilizing more inputs especially debt capital and operating expenses than required as well as misallocating their inputs for operating their insurance business. This implies that the average insurer could have increased its efficiency by 53.8% in order to operate on the efficiency frontier.

The study identified firm size, market share, capitalization, reinsurance, regulation, and business type as the determinants of cost efficiency in the insurance industry of Ghana. Although firm size, market share, and capitalization had a negative relationship reinsurance, business type and regulation had a positive relationship with cost efficiency. From these variables, business type was observed to be the major determinant of cost efficiency over the period. By this observation, comparing life and nonlife firms on the same level of operation, life firms turn to have advantage of being cost efficient than nonlife firms in Ghana. The basic reason accounting for this result is the appreciation and understanding of life insurance policies due to their consistency with the cultural values of Ghanaians. This suggests that limited knowledge of insurance products is one of the major factors for low patronage of insurance especially among nonlife insurers.

Rigorous education on insurance by all shareholders would obviously turn to curb the huge cost inefficiencies that exist in the

insurance industry. Again, the elimination of bureaucracies and the huge financial demands by NIC for implementing the recently introduced cultural based policies can greatly improve cost efficiencies. The study identified the uniqueness of the two business types in the industry, therefore regulatory requirements of NIC that treats life and nonlife insurers on equal ground especially in terms of cost must be amended. The adoption of efficiency frontier approaches in assessing insurers can reveal the true state of firms and as well help distinguish between efficient and inefficient firms which may give early signals of liquidation. Policies geared towards merger and acquisition between small and large firms can also improve the efficiency of firm in the industry. Streamlining reinsurance policies by both NIC and insurers to attractive more reinsurance contracts can go a long way of aggravating cost efficiency among insurers in Ghana.

Future studies can undertake separate analyses for life and nonlife insurers. This knowledge will help identify the actual cost efficiency of the individual business types. The study can also be replicated in examining technical, allocative, profit, revenue, scale, and scope efficiencies in the industry.

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How to cite this article: Danquah M, Otoo DM, Baah-Nuakoh A. Cost efficiency of insurance firms in Ghana. *Manage Decis Econ*. 2018;39:213–225. https://doi.org/10.1002/mde.2897

APPENDIX

Table A. Kruskal–Wallis equality-of-populations rank test

Business type	Observation	RankSum
0	129	23,532
1	151	15,808
Chi-squared	64.106	
Probability	0.0001	

Table B. Two-sample Wliconxon rank-sum (Mann–Whitney)

Business type	Obs	Rank sum	Expected
0	129	23,532	18,124.5
1	151	15,808	21,215.5
Combined	280	39,340	39,340
Unadjusted variance	456,133.25		
Adjustment for ties	0		
Adjusted variance	456,133.25		
Ho: ce95vrssfa ~ a(business type==0) = ce95vrssfa ~ a(Bussiness type==1)			
	Z = 8.007		
	Prob > |Z| = 0.0000		

Table C. Analysis of variance

Source	SS	Df	MS	F	Prob > F
Between groups	3.2337	1	3.2337	99.37	0
Within groups	9.0466	278	0.03254		
Total	12.28032	279	0.044102		
Bartlet's Test for equal variances: chi2(1) = 23.6220 Prob > chi2 = 0.000					