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Article

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Efficiency, market structure and performance of the insurance industry in an emerging economy

Kenneth Ofori-Boateng 1* , Williams Ohemeng 2 , Ernest Ahawaadong Boro 3 and Elvis Kwame Agyapong 4

Abstract: This paper investigated the structure of the market, efficiency and performance (profitability) of the general insurance industry in the Ghanaian economy. The overriding objective was to evaluate the impact that regulatory informed market structure would have on the pricing behaviour; examining the hypothesis of the Structure Conduct Performance (SCP) for the general insurance market. Using data comprising a panel of 29 general insurance firms from 2008–2019, the paper used the Herfindahl Hirschman Index and the concentration ratio to measure the SCP in addition to computing efficiency as a measure for the Efficient Structure (ES) hypothesis. Using a Panel Corrected Standard Error and settling on Random Effect techniques, the paper found no evidence to suggest collusive firm behaviour among general insurers. The findings therefore supported the ES hypothesis, and rejected the SCP hypothesis. The paper presents insight into understanding the behaviour of insurance companies in the new markets inspired by regulation.

Subjects: Statistics for Social Sciences; Education – Social Sciences; Economics; Finance; Insurance

ABOUT THE AUTHOR

Over the past five years, a group of us have concerned ourselves in understanding efficiencies of institutions in developing economies. Starting with the commercial banks in Ghana, we then moved on to the rural banks. There after we decided to look further to the insurance industry and the mutual fund industry in Ghana. The findings of some of our submissions on Bank inefficiencies was confirmed by the regulator during the Banking reforms in Ghana. Among the papers published/submitted for publication include: Banking Reforms and Bank Efficiency in Transition; Banking Reforms, Efficiency and Competition; Efficiency of the mutual fund industry; and Life Insurance Companies: Determinants of Cost Efficiency and Profitability. These papers have appeared in reputable journals. After our last article on the efficiency of life insurance industry in Ghana, it became relevant to understand the impact that regulatory informed market structure would have on pricing behaviour by examining the Structure Conduct Performance hypothesis for the general insurance market of Ghana.

PUBLIC INTEREST STATEMENT

The insurance industry in Ghana took a leap growth in terms of participation, assets, premiums, and penetration after the segregation of the Life Insurance industry from the General Insurance business. The article evaluated the impact that regulatory informed market structure have on the pricing behaviour by examining the Structure Conduct Performance (SCP) hypothesis for the general Ghanaian insurance market. The paper found no evidence to suggest collusive firm behaviour among general insurers but firms in the industry were not efficient enough. There was inconclusive evidence to back the SCP Hypothesis. Also, evidence was noted for the Efficient Structure (ES) proposition that profitability was preceded by efficiency in the insurance industry. Leverage, underwriting risk and inflation were noted as significant variables for insurance profitability in the market. Unhealthy underwriting practices should be avoided, especially at the firm level, as it negatively affects profitability performances. The paper presents insight into understanding the behaviour of companies in the new markets inspired by regulation.





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Keywords: market structure; efficiency; profitability; Herfindahl Hirschman Index; concentration ratio; Ghana JEL: A11; C10; C23; D22; D40; G22

1. Introduction

The insurance industry in Ghana took a leap growth in terms of participation, assets, premiums, and penetration after the segregation of the Life Insurance industry from the General Insurance business upon the promulgation of the Insurance Act 724 in 2006. For instance, prior to promulgating the new law, market participants were 25 for the composite businesses. However, as at the year 2018, the insurance industry was made up of 29 general insurance companies, and 24 life insurance companies (National Insurance Commission (NIC), 2019). This means the total number of insurance companies as at 2018 was 53, representing almost 112% growth in participation. This paper deliberately ignores other market participants like reinsurance companies, brokers, insurance agencies, and loss adjusters, for purposes of simplification.

Total industry premium as at the end of the year 2019 amounted to GHS 3.5, representing a growth of almost 21% from GHS2.9bn in the year 2018. Of this amount, general businesses accounted for 52.6% (GHS 1.83bn) and the remaining 47.4% (GHS 1.65bn) was accounted for by the life businesses. Ten out of the 29 General Insurance firms controlled almost 63% (GHS 1.16bn) of the gross premiums generated. On the other hand, 10 out of the 24 life insurance companies controlled approximately 93% (GHS 1.53bn) of the gross premiums generated (NIC, 2019). This used to be the contribution of only fiveleading firms before the promulgation of the Insurance Act 724 (2006). These growths observed in the premium incomes for both divides in the market has been attributed to the effects of rolling out the Financial Sector Strategic Plan II in 2012 (Alhassan et al., 2015). Such alterations are likely to trigger an effect on the structure of the insurance industry.

Authors such as Nyaga and Muema (2017), Pantelous and Passalidou (2013) as well as Ekundayo (2012) pointed out that the pricing strategy of insurance firms are usually segregated, i.e., risky consumers are projects and associated high likely risks, thus, they are charged higher with higher risk premiums. On the other hand, consumers evaluated as having lower likely risks, are projected and associated as such, thus, they are charged low risk premiums. Such variations in the strategy are aimed at maintaining a balance in the insurance pool. Nevertheless, Nyaga and Muema (2017) advanced that an insurer's ability to appropriately categorize insurance patrons is dependent on interplaying marketplace variables. Alhassan et al. (2015) pointed out that in the marketplace, the interplay of variables is usually impacted by the structure of the market and the pricing behaviour of companies. For this reason, Alhassan et al. (2015) pointed out that several inquiries have been done on the phenomenon from an industrial organization perspective.

Bain's (1951) classical SCP hypothesis claims that pricing and conducts of a firm is a function of the structural characteristics of its operating market, and with the aim to obtain abnormal profits, a few big firms will always want to collude in setting prices. Such a hypothetical assessment of the market structure hypothesis was consequently tested by Peltzman (1977) and Demsetz (1973) with the Efficient Structure (ES) proposition. The ES hypothesis asserts that firms produce efficiently lower price to make higher sales, often resulting in obtaining higher share of the market, and consequently resulting into concentration. The interplay between the two hypothetical claims leaves room for enquiries into the existing interconnections between the structure of the market, efficiency and performance (profitability). Ability to inform on the interconnections seems appropriate for purposes of improving market competition and market development. As effective regulation and supervision is necessary for protecting both consumer and firm behaviour, this paper proposes the need for regulators, in this case insurance regulators to possess a clear understanding of pricing behaviour dynamics, market structure and profitability. More information on the phenomena pointed earlier is expected to enhance policy formulation and market stability.

Considering the plethora of studies reporting mixed findings concerning the link exiting between market structure and pricing behaviour of firms, the current study sets out to add to regulatory insight on characteristics of firms in the context of an emerging market.

Furthermore, the new market structure of Ghana's insurance space has not been adequately perused within the context of market efficiency and profitability. Thus, this paper attempts to provide an enhanced insight into the industrial economics of Ghana's insurance sector by carrying out an investigation on the impact that market structure and efficiency have on firm performance or profit-ability. The novelty of this paper lies in the empirical demonstration of the SCP and ES models within the context of an emerging market. Besides, this paper adds to Akotey et al. (2013) by exploring market structure effects on profitability in the insurance sector, and also adds to Alhassan et al. (2015) as well as Ansah-Adu et al. (2012) by looking at the links existing among efficiency and performance (profitability) using current data from the industry, most importantly using data that is predominantly after the 2008 financial crisis. More so, the Ghanaian economy envisaged financial crisis from 2017 to 2020 (which led to consolidation of about seven banks to form the Ghana Consolidated Bank-GCB) that have greatly shaped the regulatory framework of the financial system. In the period between 2015 and 2018, Ghana had also gone to the IMF for bailout due to the overgrown public expenditure and low revenue generation. All these had effect on the insurance sector of the economy, hence an opportunity to understand the strength of this important industry.

The rest of the paper is structured to cover the literature review, the methodology where the results are also discussed. This is followed by the conclusion and the policy implication of the research.

2. Literature review

This section focuses on a review of relevant works about performance of financial institutions, and to be specific, on the insurance industry and the models that have been applied in assessment of the industry. We begin by generally discussing studies that evaluate the performance of the finance, banking and insurance industry, after which we take a look at studies that have focused on models for assessing the insurance industry.

Focusing on the performance of Moroccan banks from 1997 to 2018, Derbali (2021a) found bank size as having significant effect on performance (size boosts performance of banks). Derbali (2021) measured performance by using three indicators-return on assets (ROA), return on equity (ROE) and net interest margin (NIM). Similarly, for the Tunisian banking industry, Khalfaoui and Derbali (2021) focused on assessing the effect of money creation from two perspectives (theory of money creation out of nothing, by the use of the central bank in refinancing and theory of financial intermediation) on banking industry performance. Results from the study showed that both forms of money creation impact positively on profitability (ROA and ROE). Bachiller (2016) also approached the subject matter by analysing the determinants of performance of saving banks in Spain. Bachiller (2016) found efficiency and core capital as factors that greatly boost performance, but found a higher delinquency ratio resulting in reduction in performance. For the Pakistani economy, Yao et al. (2018) found size, higher solvency, operating cost, market power, labour productivity, financial structure and economic growth as the factors that explain bank profitability via a two-step system generalized method of moments estimator. Again, Derbali (2021) used 34 listed firms on Dhaka Stock Exchange (DSE) in Bangladesh and 34 listed firms on NASDAQ in the United States (US) in evaluating the impact of capital structure on performance of listed engineering companies. The study revealed that for the USA, capital structure negatively affects profitability of engineering companies whilst for Bangladesh, it positively affects ROE and Tobin's Q but adversely influences earning per share and ROA for listed engineering firms.

Ullah et al. (2016) also analyzed the performance of the insurance industry in Bangladesh from 2004 to 2014; results from ordinary least square estimate indicated that underwriting risk and size have adverse impact on ROA, whilst expense ratio, growth and solvency margin showed positive

influence on ROA. In a similar study that focused on Philippines from 2000 to 2012, Cudiamat and Siv (2017) found firm-level factors (size, age, liquidity, leverage and number of locations) as having significant impact on ROA, whilst the industry-level and macroeconomic factors were found to be insignificant. Again, A. M. S. Derbali and Lamouchi (2021) approached the subject by verifying both microeconomic and macroeconomic determinants of profitability of the insurance industry in Tunisia from 2002 to 2018. The study identified microeconomic factors such as capital structure, solvency, capital risk management, volume of capital, financial investment, age and premium growth as significantly influencing performance. The macroeconomic factors were found to have insignificant effect on profitability of the insurance industry in Tunisia. The aforementioned factors were confirmed as determinants of performance of the insurance industry in an earlier work by Derbali and Jamel (2019) for the insurance industry in Tunisia. Again, for the life insurance industry in Tunisia, Derbali and Jamel (2018) identified size, age and growth as significantly influencing the performance (ROA) of the industry, whilst leverage, liquidity tangibility and risk were found to be insignificant. In Poland, Ortyński (2016) found that underwriting activity and net operating expenses adversely impact profitability of general insurance industry, but size was found to positively affect profitability. Again, Ortyński (2016) found a positive nexus between macroeconomic variable (gross domestic product). Boadi et al. (2013) also focused on the insurance industry in Ghana from 2005 to 2010 and found a positive nexus between leverage, liquidity and profitability, but a negative relationship between tangibility and profitability from an ordinary least square estimate.

Market power may be a firm's ability, derived from an honorary endowment, to receive profits that attract capital to the current firm alone and not to current or potential rivals, or to different companies within the business ecosystem. Elzinga and Mills (2011) give original work on the significance of market power. Zeroing in on syndication and imposing business model force, there stands out restraining infrastructure from a firm whose lead doesn't affect market cost. The restraining infrastructure can set its value, subject to purchaser interest, suggesting a falling interest bend. The social expense to imposing business model is the extra weight misfortune, i.e., the distinction between buyers' readiness to pay for creation that doesn't happen on the grounds that the monopolist limits yield, and the creation costs that would have been caused. They estimate the level of imposing business model force with what is called Lerner index.

Fisher investigates pointers of market force and shows that the capacity to bar rivalry is critical. Landes and Posner (2018) analysed the utilization of syndication power in antitrust cases. They dissect the highlights of the Lerner record and infer that portion of the overall industry can be a deceptive pointer of market power. They likewise build up the establishments for characterizing market limits by investigating substitutability of items and the geographic furthest reaches of purchasers' capacities to acquire substitute items. Evans and Schmalensee (2019) add to Landes and Posner (2018) by clarifying the contrast between short run and a long time ago run examination, and the intricacies of characterizing markets with separated items. They likewise recognize pointers of market power, including constantly high benefits and certain types of direct, for example, predation.

Among the first scholars who studied the SCP model for the insurance industry is Joskow (1973), on the competitive structure of US general insurance companies. Joskow (1973) reported that insurers set prices notwithstanding competitive market structure through cartel-like rating agencies. Thus, the collusive actions of insurers lead to supply cuts, deficient system of sales and an over-capitalized industrial sector. Chidambaran et al. (1997) examined the financial performance of 18 property and liability insurance firms from 1984 to 1993. Chidambaran et al. (1997) asserted that market concentration was as a result of growth in profit in reference to the SCP model. Choi and Weiss (2005) examined the efficiency, structure of the market and profitability of US property and liability insurance industry from 1992 to 1998 and reported that firms that are cost-efficient charge lower prices and have higher profitability growth rate. Their findings showed evidence that support ES hypothesis. In subsequent years, Choi and Weiss (2008) again studied the Relative Market Power (RMP), SCP and ES models, this time around taking into consideration the differences in regulatory provisions across states in the USA. Choi and Weiss (2008) reported that market power is commonly applied by

insurance companies in relaxed regulatory, yet competitive markets. Bajtelsmit and Bouzouita (1998) as well evaluated the SCP and ES propositions in the US automobile industry over the period starting 1984–1992; the study revealed that there exist no evidence to support the ES hypothesis. Testing the SCP hypothesis on the insurance industry in Austria, Jedlicka and Adusei (2006) considered 52 companies from 2002 to 2003 and rejected the SCP hypothesis of collusive behaviour among the companies; thus, the Austrian insurance market was fairly concentrated. Pope and Ma (2008), through a 23 cross-country panel regression analysis of life insurance markets, also found the effects of market concentration on profitability or performance to be dependent on the extent of openness in the respective markets of the sampled countries. Thus, their conclusion supports the SCP hypothesis.

Berry-Stölzlea et al. (2011) reported robust backing for the ES model while rejecting the SCP hypothesis in the liability and property insurance industries for 12 European countries over the period starting from 2003 to 2007 after the restructuring and consolidation of the insurance markets. Njegomir and Stojic (2011) used data comprising of a panel sourced from 2004 to 2008 to advance evidence in favour of SCP after an evaluation of the effects of liberalization on the structure of the market and profitability of general insurance companies in Eastern Europe. Liebenberg and Kamerschen (2008) could not confirm the SCP proposition for the auto insurance industry of South Africa after examining data from 1980 to 2000.

In conclusion, it is clear that the reviewed literature show that a significant number of factors influence the performance trajectory of the financial and insurance industry, with varied results observed from various geographical jurisdictions and sub-sectors of the industry. This current study focuses on the subject matter, with emphasis on examining the hypothesis of the Structure Conduct Performance (SCP) for the general insurance market in Ghana. It also computes efficiency as a measure for the Efficient Structure (ES) hypothesis. This paper, therefore, presents insight into understanding the behaviour of insurance companies in the new markets inspired by regulation.

3. Methodology

Methods considered in this section are intended to assist the paper in exploring the relationship between market structure, efficiency and performance (profitability) among general insurance businesses in Peltzman (1977) he Ghanaian economy. The choice of measure for market structure and how it is computed are briefly described, followed by expounding on how the Data Envelopment Analysis was carried out. Panel data of 29 companies in Ghana's general insurance industry from 2008 to 2019 were obtained from the National Insurance Commission (NIC) annual reports and the respective general insurance companies reports. The remaining fourgeneral companies left out of the sample were due to unavailability of enough data.

3.1. Measures of market structure

There are several approaches to measuring market structure, and such approaches involves using the Herfindahl Hirschman Index [HHI], concentration ratios, and the Lerner Index. The HHI and concentration ratio (4-firm CR) are looked at in this paper as measures of market structures. The HHI is the aggregate of the squares of the firm's share of the market in an industry. Mathematically expressed as

$$\textit{HHI}_t = \sum_{i=1}^n ms_i^2$$

• ms_i^2 represents market share of company i, and is evaluated as the ratio of a firm's gross premium to the total gross premium of the industry.

Similarly, the concentration ratio which is the percentage of industry contributions coming from the few largest firms was also used to measure the market structure. Particularly the CR4 measure. This is also expressed mathematically as

- $4 Firm \text{ Concentration Ratio} = \frac{S_1 + S_2 + S_3 + S_4}{\text{Total Industry Gross Underwriting Premium}}$
 - S₁₋₄ is respective gross premium of the largest few fourcompanies in the market.

3.1.1. Efficiency estimation: Data Envelopment Analysis [DEA]

In estimating the efficiency of players in the general insurance industry the DEA technique was used. It evaluates the relative performances of companies by conducting a matching of multiple outputs and inputs. Efficiency score is calculated as a proportion of the weighted sums of outputs and inputs. Let *n* represent the number of Decision Making Units (DMU's), with *m* inputs and *s* outputs; this results in a relationship called the Relative Efficiency [RE] score of a test *DMUp* over the model estimation (Charnes et al., 1978; Farrell, 1957). The mathematical expression is illustrated below:

$$\max h_0 = \sum_{r=1}^{s} u_r y_{r_0}$$
 (1)

subject to : $\sum_{i=1}^{s} v_i x_{i0}$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{s} v_i x_{ij} \le 0, j = 1, 2, \dots, n$$
(2)

 $u_r, v_i \geq 0r = 1, 2, \ldots, si = 1, 2, \ldots, m$

 x_{ij} represents the amount of input *i* consumed by company *j*, y_{rj} denotes the amount of output *r* generated by company *j*, and u_r and v_i point to weights selected for output *r* and input *i*, correspondingly:

$$minh_0 = 0(3)$$

subject to:
$$\theta_0 x_{i0} - \sum_{j=1}^n \lambda_j x_{ij} \ge 0$$
 (4)

$$\sum_{j=1}^{m} \lambda_{jr} \mathbf{y}_{rj} \ge \mathbf{y}_{r0}$$
(5)

$$\mathsf{ROA}_{it} = \alpha_i + \beta_1 \mathsf{MP}_t + \beta_2 \mathsf{EH}_{it} + \beta_3 \mathsf{Size}_{it} + \beta_4 \mathsf{LEV}_{it} + \beta_5 \mathsf{RISK}_{it} + \beta_6 \mathsf{Inf}_{it} + \beta_7 \Delta \mathsf{GDP}_{it} + \mu_i + \mathsf{e}_{it} \tag{6}$$

The input-oriented model that has been presented attempts to reduce cost in obtaining an anticipated output level. An efficient *DMU* gives efficiency score θ , of 1 which is a reference for the *DMU*'s using similar technologies in an industry. The linear programming model adopts constant returns to scale, implying that each DMU operates at an optimal scale, a rise in inputs corresponds to a proportionate rise in outputs (Charnes et al., 1978). The efficiency scores approximated with the hypothesis of a constant return to scale is Technical Efficiency [TE]. It refers to the capability of

companies to use technology for maximizing output. Nevertheless, in the instance input changes corresponds to disproportionate variations in the output variables, the DMU's can then be said to be operating at variable returns to scale described as Pure Technical Efficiency [PTE] (Banker et al., 1984).

3.1.2. Input and output variables

General agreement on constitutes of input variables is well known; thus, the input variables are categorised as labour inputs and capital inputs. Labour inputs comprise business amenities input and cost of labour, whereas capital input is made up of equity capital and debt capital. Input variables considered in this paper comprised total operating expenses, and equity capital. The motivation for selecting such input variables were first based on data availability, and the fact that it aligns to Ansah-Adu et al. (2012). Total operating expense represents a measure for labour and business services input. Regardless of the disagreements on what constitutes insurance outputs, this paper resorts to Leverty et al. (2004), and settles on net premiums as output variable considering that any rational insurer would want to maximize its premiums potential than maximizing claims. Net income after tax is also considered as another output measure. Estimated efficiency scores in the paper are motivated by the assumption that all things being equal, a rational insurer would prefer to maximize premiums and profits so as to adequately cover for likely losses in the future.

3.2. Empirical model

The HHI and CR4 values obtained in examining the market structure, as well as the efficiency scores under Technical Efficiency, and Pure Technical Efficiency are employed in modelling the respective SCP and ES propositions. Performance (profitability) is estimated as a ratio of profit after tax to total assets. The empirical model deployed is given as Equation (7) below.

$$Y_{it} = \alpha_i + \beta_1 M S_t + \beta_2 E S H_{it} + \beta_3 X_{it} + \varepsilon_{it}$$
⁽⁷⁾

- *i*, andt represents insurance company *i* at time *t*.
- Y measures financial profitability of insurers. This is calculated as Return on Assets [ROA].
- MS denotes market structure. It is estimated with HHI and CR4.
- ES denotes efficiency scores. The efficiency scores are calculated with the DEA methodology of TE and PTE.
- X comprises firm specific and macroeconomic factors that affect profitability of insurance firms.
- ε_{it} is the error term.

3.3. Control variables

Firm-specific factors, comprising of size, leverage and risk are used as control variables. Equally, macroeconomic determinants of profitability, i.e. GDP growth, and inflation are also inserted into the model as control variables. The selection of these variables has been justified by Akotey et al. (2013). Except for the macroeconomic variables of GDP growth and inflation that are sourced from Economic Development databases, those firm-specific variables are computed as:

- Size = the natural logarithm of total assets.
- Risk = incurred losses to earned premiums ratio.
- Leverage = unearned premiums from unexpired policies minus claim amount outstanding.

3.4. Model specification

Thus, specified form of the equation to be estimated is derived from the generic empirical equation. The model specification is presented below as Equation (8)

$$ROA_{it} = \alpha_i + \beta_1 MP_t + \beta_2 EH_{it} + \beta_3 Size_{it} + \beta_4 LEV_{it} + \beta_5 RISK_{it} + \beta_6 Inf_{it} + \beta_7 \Delta GDP_{it} + \mu_i + e_{it}$$
(8)

All the definitions as provided earlier apply; however, μ_i represents the firm-specific fixed effects. Whereas e_{it} refers to firm-specific unobserved effect.

3.5. Estimation procedure

Panel data estimation technique was used. It moderates for specification identification and measurement issues ignored in models for cross-sectional and time series data. Baltagi (2001) mentioned that panel data models allow for testing complex behavioural concepts. How the error terms are captured in panel data approaches renders the OLS estimator relatively biased, and inefficient. Correlation among the error terms for the different periods are increased by the time-series data, nonetheless, concerns of homoscedasticity does not often prevail in panel data specifications. Furthermore, after observing the presence of heteroscedasticity in the preliminary estimations, the paper considers the use of the Least Squares Panel-Corrected Standard Errors (OLS-PCSE). This is because, Beck and Katz (1995) advanced that non-spherical error terms, i.e. heteroskedasticity are taken care of by the OLS-PCSE. Estimating the Fixed and Random Effects, the Hausman (1978) test is employed to identify the appropriate estimations. Table 1 and 2

4. Data presentation, analysis discussions

Observations regarding the market structure of the Ghanian general insurance sector using both measures of HHI and CR4 are presented in Table 3. Throughout the years, the market gets saturated, i.e. less concentrated. With an HHI of 17.2% in 2008, it had dropped to almost 7% in 2019. This could be attributed to the introduction of new firms almost any other year.Table 4, Table 5, Table 6

Table 3 also presents the results of the scores obtained for efficiency using the Data Envelopment Analysis technique. The table presents both TE and PTE scores.

Through both the TE and the PTE scores, it is observed that the efficiency scores over the years kept decreasing. The implication is that general insurers are not being efficient in resource usage over the years. Interestingly, this observation was also noted in earlier reports from Ansah-Adu et al. (2012), who evaluated cost efficiencies of insurance firms in the Ghanaian economy, as well as from Alhassan et al. (2015), who also observed dwindling efficiency scores for general insurance businesses compared to their life insurance counterparts. The next table below shows the test for mean differences in the efficiency scores computed for the general insurance industry.

Clearly there exist significant differences in the means of the scores of efficiency. Using the *t*-test for difference in means, significant *p*-values are observed for TE and PTE. Inferring from the correlation coefficient, it suggests that general insurers are not able to maximize their outputs from their production inputs.

The possibility of observing multicollinearity compelled the paper to carry out a correlation analysis among the various variables.

There are strong and significant correlations existing among the market structure variables and both efficiency scores. The correlations coefficients between the independent variables enabled the paper to examine the presence of multicollinearity. Using the rule of thumb at 40%, not enough of the variables were noted to have coefficients of exceeding 40%, i.e. only three [3] variables recorded coefficients greater than 40%. This suggests that possible problems as a result of multicollinearity will not be faced in considering the various independent variables in the regression model.

Regarding the regression analysis, first, the validity and reliability of the estimates are pointed to in reference to the Wald χ^2 . The Wald χ^2 tests examine the overall significance of the explanatory variables in accounting for variations in financial performance (profitability). The probability values of the χ^2 test (Prob. > χ^2) are significant at 5%. Hence, the conclusion that the variables in the model are significant in explaining variations in the profitability (performance) of general insurance

Table 1. Summary statistics						
	Mean	Std. Dev.	Min	Max		
Premiums	684,626,311	471,010,709	142,572,607	1,567,574,557		
Net Profit	83,998,651	22,132,179	60,651,447	108,122,466		
Expenditure	540,027,889	313,049,622	202,480,064	717,308,995		
Equity	21,426,504	23,470,928	123,559,788	3,192,549,072		

Source: Author's computation from NIC Data (2008-2019)

Table 2. Indicators of market structure in the general insurance industry in Ghana					
Years	HHI	CR4			
2008	0.172	0.670			
2009	0.131	0.580			
2010	0.113	0.590			
2011	0.105	0.540			
2012	0.099	0.510			
2013	0.082	0.470			
2014	0.075	0.434			
2015	0.080	0.398			
2016	0.074	0.362			
2017	0.071	0.326			
2018	0.069	0.290			
2019	0.070	0.254			

Source: Author's computation from NIC Data (2008-2019)

Table 3. Indicators of market structure in the general insurance industry in Ghana						
Years	Technical Efficiency	Pure Technical Efficiency				
2008	0.290	0.570				
2009	0.778	0.885				
2010	0.773	0.857				
2011	0.617	0.779				
2012	0.692	0.759				
2013	0.613	0.734				
2014	0.573	0.708				
2015	0.695	0.683				
2016	0.671	0.766				
2017	0.649	0.633				
2018	0.637	0.607				
2019	0.683	0.582				

Source: Author's computation from NIC Data (2008–2019)

firms in the Ghanaian economy. Besides, the *R*-squared value shows that more than 65% of variations in the profitability performance of general insurers are explained in the regression model. Results from the series of tests carried out are presented in the table below.

Table 4. Test for mean differences in the efficiency scores					
	TE	PTE			
Means	0.639	0.714			
Pearson Correlation	0.616				
t-Stat	-2.519				
t Critical one-tail [P(T $\leq t$) one-tail]	1.795 [0.014**]				
t Critical two-tail [P(T $\leq t$) two-tail]	2.201 [0.028**]				

** p < 0.05 (significant at the 5% alpha level).

Source: Author's computation from NIC Data (2008-2019)

Table 5. Correlation matrix										
	ROA	HHI	CR4	PTE	TE	SIZE	LEV	RISK	GDP	INFL
ROA	1.00									
HHI	0.01	1.00								
CR4	0.04	0.16**	1.00							
PTE	0.15***	0.20**	0.16	1.00						
TE	0.30***	-0.28***	-0.49**	-0.31***	1.00					
SIZE	-0.07	0.16***	-0.14	0.40	0.62	1.00				
LEV	0.13***	-0.17***	-0.33	0.08	0.28**	0.12*	1.00			
RISK	-0.29***	-0.14	0.06	-0.33***	0.36	0.24	0.23	1.00		
GDP	0.09	-0.21***	-0.33**	0.04	0.18	0.21*	0.20*	0.35*	1.00	
INFL	-0.18**	-0.22	-0.33***	0.03	0.29**	0.16	0.13	0.16	0.39	1.00

* p < 0.1, ** p < 0.05, *** p < 0.01. (Significant at the 10%, 5% and 1% alpha levels, respectively). Source: Author's computation from NIC Data (2008–2019)

From the regression results, using both the HHI and CR4 measures for market structure, enough evidence is observed to reject the SCP hypothesis in all the estimations. There appears to be some sort of inconsistency in the SCP hypothesis. For instance, with the HHI significant direct relationships were observed at 5%, and that of a significant inverse relationship at 10% was noted for CR4 as measures for the structure of general insurance industry in Ghana. The results suggest tendencies for companies in the general insurance sector to shadow leaders in the sector. The pricing conduct could provide insight into the inconsistent evidence for the SCP hypothesis. Alhassan et al. (2015) pointed out that such posture encourages oligopolistic markets; leaders contest each other for market superiority. The measures for ES [PTE and TE] indicated significant direct associations with profitability measured by Return on Assets (ROA). This was significant at 1%, and gives enough evidence to support the ES hypothesis. The implication is that firms that are efficient in the general insurance sector may often have to lower production prices in order to shore up sales and market shares. These findings appear to be in tandem with observations reported by Alhassan et al. (2015), as well as that of Liebenberg and Kamerschen (2008) who reported mixed findings for the SCP proposition in Ghana and South Africa respectively.

Regarding the control variables, leverage, inflation and underwriting risk indicated significant nexuses with performance (profitability). Size on the other hand recorded an insignificant relationship with profitability. The observation for size suggests that general insurers could not take advantage of their sizes to increase profitability in the market. The extent to which an insurance business is exposed to risk, which was measured with underwriting risk recorded a significant and negative relationship with profitability performance at 1%. As high-risk policies are sold out, chances of high-claim pay-out decreases underwriting profits, thus, reducing return on a company's asset. This

Table 6. OLS panel-corrected standard errors estimation					
	Model 1	Model 2	Model 3	Model 4	
Constant	-0.13	-0.17	-0.09	1.45	
Herfindahl Hirschman Index	0.25	1.74**	1.62**	1.12**	
4 Firm Concentration Ratio			-0.27	-3.70*	
Pure Technical Efficiency	0.25**		0.21***		
Technical Efficiency		0.30***		0.34***	
Firm Size	0.27	0.22	0.12	0.32	
Underwriting Risk	-0.52***	-0.26***	-0.17***	-0.36***	
Leverage	0.34***	0.33***	0.37***	0.30***	
Economic Growth Rate	0.01	-0.01	0.02	0.01	
Inflation Rate	-0.07***	-0.03***	-0.08***	-0.02***	
R ²	0.6931	0.6741	0.6833	0.6964	
Adj. R ²	0.575	0.642	0.5752	0.6445	
Wald χ^2 (7)	82.37	128.94	82	131.22	
Prob > χ^2	0	0	0	0	
Heteroskedasticity Test	5.28	7.45	5.36	7.39	
Prob > χ^2	0.0215	0.0064	0.0206	0.0066	
Autocorrelation Test AR (1)	0.0096	0.611	0.075	1.074	
Prob > F	0.7618	0.4475	0.7886	0.3176	
Insurers	29	29	29	29	
Observations	348	348	348	348	

* *p* < 0.1, ** *p* < 0.05, *** *p* < 0.01. (Significant at the 10%, 5% and 1% alpha levels, respectively).

Source: Author's estimations of NIC Data (2008–2019) in STATA12

observation suggests that NIC should ensure regulatory stringency when it comes to underwriting practices, i.e. undercutting, etc. Leverage indicated a significant positive relationship with profitability at 1%. This shows that highly levered general insurance companies are profitable. With the macroeconomic factors, inflation recorded significant inverse nexus with profitability at 1%.

To check for robustness, both RE and FE estimations were carried out. To decide the most efficient estimates, the Hausman Test was used. With the Hausman Test, estimates from the RE model was appropriate in explaining variations in all the specified models. The Breusch and Pagan (1979) test indicated the presence of heteroscedasticity, and autocorrelation; thus, the RE estimation was done with heteroscedasticity and serial correlations. In line with the OLS-PCSE results, the observed outcomes for the SCP proposition was inconsistent following evidence of significant direct relationship with profitability considering HHI for market structure, and a significant inverse relationship when considering the concentration ratio as a measure for market structure. However, according to the basic estimation, the ES proposition is accepted for the general insurance sector in the Random Effect estimations.

5. Conclusions and policy implication

This paper empirically tests the SCP and ES propositions on the general insurance sector in the Ghanaian economy and gives insight into how the companies behave in the new market that was formed to shape competition, regulatory, and supervisory policies. The structural proxies for market

structure revealed the concentration levels, i.e. premiums were concentrated among the four biggest general insurers. From the Data Envelopment Analysis, general insurance companies were not efficient with their inputs given the outputs that were observed. Again, inconclusive evidence is observed to back the SCP hypothesis. Yet, enough evidence was noted for the ES proposition that profitability was preceded by efficiency in the insurance industry. Leverage, underwriting risk and inflation were noted as significant variables for insurance profitability in the market.

The findings did not give enough grounds to suggest there is any form of collusive tendencies in the concentrated Ghanaian general insurance market. One implication for the regulatory agency is that rejecting the SCP hypothesis alongside the deeper extent of concentration signals that policies leaning towards enhancing competition would improve profitability performances in the industry. The spill-off instance of such policy would be enhancing consumer welfare. Thus, the regulatory agency should work at promoting competition within an atmosphere conducive for the overall health of the industry.

General insurance companies as participants in the industry must invest in labour development, and technology to drive efficiency up. Consequences of improved labour and technology include product innovation, service development, and quality delivery channels that optimize the input resources of the firm. Unhealthy underwriting practices should be avoided, especially at the firm level, as it negatively affects profitability performances. Additional noteworthy factors of profitability recognized serves as a standard for general insurance companies in improving profitability performances.

The paper recommends that subsequent enquiry may want to consider the likely effect of competition in the insurance sector on other dimensions of insurance operations. Equally, other efficiency forms could be examined in association with other profitability measures in the insurance industry. In relation to methodology, a more robust estimation approach could be used in examining the phenomenon within the market.

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