Governance Mechanisms and Efficiency: Evidence from an Alternative Insurance (Takaful) Market

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Abstract

This study examines the relationship between corporate governance attributes and both technical and scale efficiencies of the global *Takaful* Insurance operators. Using alternative estimators for efficiency, our results show that *Takaful* operators are inefficient suggesting the presence of widespread managerial lethargy and operational inefficiency. Additional analyses indicate that non-executive directors, audit committees, and product diversification do not improve technical efficiency. Rather, audit committees and regulatory jurisdiction tends to reduce scale efficiency. We also find that CEO/chair duality, board size, organizational age, regulatory jurisdiction and firm size have a positive relationship with technical efficiency. We further report that non-executive directors, Shari'ah board, product diversification and institutional ownership improve scale efficiency. In particular, the study provides new and extended regional evidence on the efficiency of the *Takaful* industry in the Middle East North Africa (MENA) and the Southeast East Asian (ASEAN) region. Our findings provide important policy implications for investors, regulators, and other market participants.

Keywords: Board characteristics, Bootstrap DEA, Corporate governance, Data Envelopment Analysis, *Takaful*, Technical efficiency

1. Introduction

It has long been argued that governance mechanisms provide shareholders with incentive to invest in a firm by ensuring that managers act in the best interest of shareholders to avoid agency problems with a view to maintaining balance between the varied interests of stakeholders (see Ogden & Watson, 1999). Governance mechanisms also assure stakeholders that the actions of the organization are congruent with the norms of society. Governance in Islam, albeit similar to the Anglo-American model, is likely to be perceived as being more complex. Managerial incentives are also present in Islam. In the conventional setting, agency problems arise when managerial interests deviate from interests of shareholders (which mainly emanates from wealth maximization). However, in an Islamic framework, any deviation from placing all shareholders' funds in investments that are deemed to be *Shari'ah*[1]-compliant brings about an additional source of agency problem (Safieddine, 2009). In particular, the operations of Islamic financial institutions (IFIs) are principally driven by a constrained business model with a dual governance layer. This distinct model involves both moral accountability values and legal responsibilities (Abdelsalam et al., 2016, 2017). In assuring stakeholders that actions of the firm are in line with Islamic norms, besides being governed by board of directors like conventional financial institutions, IFIs are required to incorporate additional monitoring mechanisms represented by Shari'ah supervisory boards (SSB) in order to provide the all-important religious-ethical legitimacy expected by stakeholders[2].

While corporate governance and efficiency measurement matters, both have captured a great deal of attention within the conventional insurance industry (e.g. Akhigbe & McNulty, 2005; Byeonyong & Weiss., 2005; Huang et al., 2011; Zheka , 2005; Wang et al., 2007; Har Eling & Luhnen; 2010; Hardwick et al., 2011). However, only scant attention has been given to identify the impact of governance mechanisms on technical and scale efficiencies[3] in an

[1] The word 'Shari'ah' literally means the path to follow and denotes the all-embracing legal system that regulates the lives of Muslims. In relation to the underlying principle of Islamic law governing commerce and finance is the doctrine of 'permissibility', which maintains that everything in economic affairs is permitted except those explicitly forbidden by divine guidance (Kamali, 2000). Prohibitions under Islamic law can be broadly classified as riba (usury) and gharar (uncertainty) amongst others (see Siddiqi, 2004; El-Gamal, 2001; Al-Dhareer, 1997).

[2] It is well accepted that Shari'ah supervisory boards (SSB) operating in Islamic financial institutions like *Takaful* carry a responsibility for providing religious assurance which contributes to the soundness of the Islamic governance system by endorsing the religious-ethical legitimacy to stakeholders (Bougatef, 2015). The SSB also has added responsibility for issuing an annual Shari'ah report on the religious compliance of operations which is communicated in annual reports of all Islamic financial institutions (see Maali et al., 2006; Ullah et al., 2016).

[3] Technical efficiency refers to the effectiveness with which an output is produced with a given set of inputs. This is related to productive efficiency in the sense that productive efficiency deals with producing at the lowest point on the short run average cost. Alternatively, a firm is said to be scale efficient when its operations is most favorable whereby any adjustment on its size will render it less efficient.

alternative insurance industry, like the Islamic insurance market (hereafter referred to as *Takaful*) [4] (Kader et al., 2010; 2014). The size of the global *Takaful* market has shown exponential growth and popularity across the globe due to its appeal as a complimentary form of insurance suitable to Muslims. With the accelerated rise of the *Takaful* industry worldwide, the case for exploring the influence of board characteristics on the efficiency of *Takaful* operators becomes even more compelling.

The major difference between the conventional insurance and *Takaful* is the treatment of investment of funds. Unlike conventional insurance companies, which invest mainly in interest-based businesses, *Takaful* is the paradigm of profit-and-loss sharing. Shari'ah compliance also plays a pivotal role in *Takaful* where financial and investment issues (e.g. reserving, design of policy contracts, premium ratings etc.) should conform to the laws and regulations prescribed by religious doctrine (Iqbal and Greuning, 2008). Thus, examining the corporate governance-efficiency relationship in the *Takaful* industry is important because the fiduciary responsibilities of directors in this sector not only extend to policyholders and shareholders, but they are also bound to supervision by individual company's SSB and industry regulators across different jurisdictions.

We employ a comprehensive sample of 134 global *Takaful* insurers in 21 countries for the period 2002 to 2013. In particular, we examine the relationship between CEO/ Chair duality, ownership structure, board size, SSB size and audit committees on both technical and scale efficiency. To extend prior evidence, we utilize four separate estimators, (i) DEA, (ii) (ii) Free Disposal Hull (FDH), (iii) Order M, DEA and (iv), the DEA Bootstrap method[5]. This empirical setting allows us to make vigorous comparative assessment of efficiency. To the best of our knowledge; this is the first study to use alternative efficiency measurement techniques to obtain efficiency scores.

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[4] The term Takaful, refers to a scheme based on solidarity and mutual assistance which aims at providing mutual financial aid and assistance to participants in case of need (Wahab et al., 2007: p.374). Takaful is supported by four principles of Islamic finance, which are the avoidance of impermissible business, uncertainty, interest, and gambling.

[5] The estimator is deterministic and similar to The Free Disposal Hull (FDH) is deterministic and similar to the DEA estimator, non-parametric, very sensitive to outliers and highly sensitive to noise. The FDH estimator was introduced by Deprins, Simar, and Tulkens (1984). Unlike the DEA estimator, it also relaxes the convexity assumption. The Order-M estimator, introduced by Cazals et al. (2002) is also a non-parametric and a simulation method. It is non-convex, not affected by noise or outliers and its root-n property helps avert dimensionality problem. Alternatively, the DEA Bootstrap developed by Simar and Wilson (2007) is also a non-parametric estimator. However, as opposed to the DEA in which the application of statistical inference is impossible due to its deterministic nature (there is no random error to introduce unexplained variability), the bootstrap method allows this. The bootstrap DEA is also asymptotically consistent.

Our findings show that the CEO/chair duality has a significantly positive association with both technical and scale efficiencies of *Takaful* insurers. We also find that the ownership structure tends to significantly reduce technical efficiency of *Takaful* firms, but significantly increases scale efficiency. Moreover, board size reveals a positive relationship with technical efficiency of global *Takaful* insurers. In relation to the SSB size, we find this extra governance mechanism significantly promotes higher scale efficiency for *Takaful* firms. Interestingly, however, we show that the presence of audit committees does not affect both technical and scale efficiencies of *Takaful*.

Our regional comparative analyses on the Middle East and North Africa (MENA) and Southeast East Asian (ASEAN) regions show that both the ownership structure and CEO/chair duality significantly reduces technical efficiency for operators in the MENA region. For the scale efficiency of *Takaful* operators in the MENA, board size indicates a negative association, while both the separation of power and SSB size reveals a positive association. Within the ASEAN region, we find that only the CEO/chair duality significantly relates with technical efficiency. Audit committees and SSB size have a positive association with scale efficiency, while ownership structure has a negative relationship.

This study contributes to existing literature in a number of ways. First, using a unique dataset, we present cross-country evidence on the association between corporate governance and technical and scale efficiency which extends the prior literature in conventional insurance (Huang et al., 2011; and Wang et al., 2007). Second, by employing alternative and more robust estimation methods, our paper extends the limited evidence on efficiency particularly with respect to the *Takaful* sector. In reality, both Kader et al.'s (2010; 2014) studies failed to consider the effects of noise, outliers[6] and country governance/macroeconomic environment surrounding *Takaful* operators, which all tend to have potential significant effect on efficiency outputs. Moreover, these studies ignore the SSB double-governance, which forms an important monitoring mechanism for *Takaful* companies' world-wide. Finally, our study offers additional insights beyond existing literature through identifying a regional effect for the Takaful industry

[6] We contend that because gross contributions are used as outputs, where large variations across units exist, outliers are likely to be present. Our view is supported by researchers such as Liu et al. (2010) who argue that the presence of outliers could substantially inflate estimates. Furthermore, the DEA estimators used by both the Kader et al's. (2010, 2014) studies are, indeed, susceptible to dimensionality problems. In fact, this strand of literature has been overwhelmed with debate concerning the statistical weakness of the DEA estimator (see Simar & Wilson, 2007; 1999; 1998). Additionally, the efficiency scores produced by the DEA strongly depend on each other statistically and as a result, relying on such scores might lead to inaccurate interpretations. This is because a DEA efficiency score is a comparative efficiency index, instead of an absolute efficiency index and the statistical properties of the DEA, therefore, cannot be obtained since efficiency scores are estimated rather than calculated (Assaf et al., 2011).

across two key regions: the MENA and ASEAN which are characterized by a high concentration of Muslim majority populations and a fast-growth of *Takaful*.

Taken together, our findings provide important policy implications to investors, regulators and other market participants engaged in both the *Takaful* and conventional insurance industries. For example, we highlight that a mechanism such as the SSB, which ultimately distinguishes Islamic corporate governance from its conventional counterpart, performs a pivotal role in the efficiency of *Takaful* operators. We also provide strong evidence showing the effect of global market jurisdictions on the efficiency of these operators. In particular, our findings reveal the presence of significant association between firm location and *Takaful* operators' efficiencies. Operators located in established and well-regulated markets tend to be technically better off. In contrast, regulatory environment does not improve scale efficiency, but actually worsens it.

The remainder of the paper is structured as follows. Section 2 discusses background on the *Takaful* market. Section 3 outlines the study's hypotheses. Section 4 provides a discussion of the study data and sample, while Section 5 presents our methodology. Results are discussed in Section 6 with Section 7 reporting additional analyses. Finally, Section 8 concludes the study and highlights the policy implications.

2. Background on the Takaful Industry

Takaful insurance is cooperative in nature where the insurer assists participants or contributors to provide protection against unforeseen occurrence. Since its inception in the late 1970s in Malaysia and South East Asia followed by a marked growth in the Gulf state countries, *Takaful* has experienced unparalleled growth especially over the last decade. Global *Takaful* expanded substantially between the period 2004 and 2007, from a contribution of US$2.1 billion to US$3.4 billion, equivalent to a compound annual growth rate (CAGR) of about 30%, with the largest markets being Saudi Arabia and Malaysia. Regionally, the ASEAN region has been characterized as the biggest market for the period 2005-2008. In 2008-2010, adjusted for global inflation, the sector grew at 28% as against the conventional market which stood at 5% in the respective Muslim countries and 8% in the MENA regions during the same period (Ernst & Young, 2014).

Overall, global *Takaful* premiums are expected to have exceeded US$14 billion following its continuous increase from US$12.3 billion in the previous year (Ernst & Young, 2014). Even though the sector experienced a slight reduction in growth between 2007 and 2011, the growth rate between 2012 and 2014 remained healthy at 15%. Considering the continuous growth and

development of the *Takaful* sector, it is believed that by contributing to understanding the technical efficiency and its contributing factors, this study assists in allowing greater comprehension of the dealings of *Takaful* firms which could be beneficial to industry regulators, policyholders, shareholders and various industry stakeholders. This will help them make well-informed decisions regarding investment and risk management.

3. Hypothesis development

In today's corporations, where block-ownership is widely held, agency theory holds that managerial activities deviate from those necessary to maximize shareholder profits (Pratt & Zeckhauser, 1985; Berle & Means, 1932). Thus, the need for corporate governance (CG) mechanisms emerges due to such agency problems. With an effective CG system in place, shareholders could be assured that managers utilize their funds efficiently and pursue their interests of achieving a reasonable return on their investment (Zheka, 2005).

3.1 Non-Executive Directors (NEXECS): According to Fama and Jensen (1983b), non-executive directors monitor managers better because they deeply value the maintenance of their reputation in the corporate world. The literature on the effects of non-executives on performance is inconclusive. One strand of the literature contends that the presence of external directors on a firm's board reduces agency problems and lessens conflict of interest. For example, Klein (2002) argues that earnings quality increases with the ratio of external directors on the board, Rosenstein & Wyatt (1990) report a positive excess return on a firm's stock following the announcement of an external director appointment to the board. Meanwhile, Perry & Shivdasani (2005) indicate that companies with more external directors report higher financial performance. This is consistent with Wang et al. (2007) study which highlights a positive relationship between the ratio of external directors and cost efficiency of Taiwanese non-life insurers. Similar results are obtained by Hardwick et al. (2011). On the other strand of the literature, Kader et al. (2014) indicate a negative correlation between outside directors and cost efficiency of *Takaful* firms, which is consistent with the finding of Coles et al. (2008) in relation to the conventional insurance industry. Nevertheless, literature on the effect of outside directors on the technical efficiency of *Takaful* firms is scarce. Hence, in line with the above arguments, we predict a positive association between the proportion of non-executive directors and the technical efficiency of *Takaful* firms.

3.2 Audit Committee (AUDIT): Primarily, the role of an audit committee is to supervise financial reporting, internal audit and control processes to certify that accounting information is unbiased. Furthermore, other authors (such as Menon and Williams, 1994) believe that the audit committee perform many crucial corporate governance functions and advice firms on both regulatory and operational matters as well as facilitate the prompt release of objective accounting information to stakeholders thereby reducing agency problem and information asymmetry between internal and external parties. Firm managers may also achieve efficiencies with the help of audit committees through their role of identifying poor operating practices and resource wastage, advising on matters of risk and uncertainty. In addition to strengthening the internal audit function; it is also frequently entrusted with scrutinizing the cost-benefit side of internal control system to ensure shareholders yield positive returns from the operation. This can undoubtedly reduce agency problems in *Takaful* firms because it can help in enhancing the quality of financial reporting (Hardwick et al., 2011). Hence, we expect the presence of audit committee on the board to positively affect the scale and technical efficiencies of *Takaful* operators.

3.3 CEO/Chairman Position (CEO): The concentration of power of CEO and the chair position in one individual, as argued by Jensen (1993), affords too much authority to the individual and could impair decision-making in minority shareholder's best interest. Studies have provided conflicting results on the importance of CEO duality. Individuals who retain both positions tend to exert considerable influence over the appointment of board members, thereby selecting outsiders who are unlikely to perform their monitoring and controlling roles effectively (Hermalin & Weisbach, 1991). This view is supported by Yermack (1996) who views CEO-Chair duality to decrease board independence. Pi and Timme (1993) show that within the U.S. context, return on assets and cost efficiency are lower for banks where the CEO serves as a chair. Kader et al. (2014) indicate that CEO-Chair duality has a negative effect on the cost efficiency of *Takaful* firms. Hardwick et al. (2011) show that separation of these positions has a positive effect on profit efficiency, nonetheless, in the presence of an audit committee and a low proportion of outside directors, that effect appears to be negative and marginally significant. Indeed, an alternative view maintains that separation of these roles can make decision-making problematic when two individuals fail to settle on strategies. In an earlier study, Brickley et al. (1997) find that separating these key roles has potential costs and benefits, with the costs larger than the benefits. Rogers (2002) also reveals that separating the chair position from the CEO decreases the possibility of high cash flow volatility resulting from extreme risk-taking. These mixed results suggest that CEO/Chair separation is an

important determinant of efficiency in insurance industries in general terms. We therefore, conjecture, in line with prior literature, that technical and scale efficiencies of *Takaful* firms are expected to be higher where these roles are separated.

3.4 Board Size (BSIZE): Prior studies have argued that board size can play a significant role in deciding how effective the governance of an institution is (see Jensen & Meckling, 1976; Pearce & Zahra, 1992; Raheja, 2005). After all, large boards are capable of providing additional skills, extensive networking and increased monitoring ability. In contrast, smaller boards reduce the risks of conflict and disagreement among directors (Hardwick et al., 2011). Jensen (1993) contend that due to issues such as coordination, flexibility in decision making and control, the effectiveness of large corporate boards tend to be less. This argument is supported by Yermack (1996) and Eisenberg et al. (1998). Both studies indicate that companies with smaller boards report a better performance. Other studies have, nevertheless, given contradicting evidence by stating the fact that larger boards are capable of bringing more expertise to the firm and increased supervision of managers. For multi-segment organization, Coles et al. (2008) find that performance is positively influenced by a large board. Hardwick et al. (2011) finds no support for effect of board size on profit efficiency of UK life insurance firms while Kader et al. (2014) show a positive association with the cost efficiency of *Takaful* firms. However, the influence of board size on the technical efficiency of *Takaful* firms is unresolved in the empirical literature. Accordingly, consistent with Pearce & Zahra (1992), we predict a positive relationship between size and technical efficiency. This implies that larger boards promote higher efficiency given that more board members bring additional knowledge and expertise which could improve fund/resource allocations.

3.5 Ownership Structure (OWN): Ownership structure, particularly director ownership, is a core governance mechanism which could align the interests of managers and shareholders and hence, mitigate agency costs (Conheady et al., 2014). According to Zheka (2005), a firm's ownership structure significantly affects managerial incentives, the process of decision-making, monitoring and control systems and the overall financial performance. Grossman & Hart (1980) suggest that managers of companies with concentrated stockholding are subject to high monitoring and control by shareholders than their counterparts in companies with more dispersed ownership structures, where individual minority owners have incentives to free-ride on the monitoring expenditures of larger investors. Therefore, we contend that a positive relationship is predicted between concentrated ownership and technical efficiency of *Takaful* firms.

3.6 Shari'ah Supervisory Boards (SSB): Measured as the number of individuals on the SSB, this extra governance mechanism constitutes a crucial role in the *Takaful* market by making sure that business, financial, and investment issues (e.g. reserving, design of policy contracts, premium ratings etc.) conform to the laws prescribed by the Shari'ah (Iqbal & Greuning, 2008). Conversely, SSB can be viewed as a mechanism that promotes public trust as well as provide legitimacy to undertake Islamic finance and business (Mollah and Zaman, 2015). By attracting customers and investors, the performance of institutions tends to improve. We, therefore, predict a positive effect of SSB on the technical efficiency of *Takaful* firms.

3.7 Firm Size (CPS): Researchers such as Cummins (1999) is of the opinion that a firm can achieve efficiency when it has a large market share (i.e. economies of scale due to its size). Meanwhile, Diacon, et al., (2002) also report that firm size affects efficiency in some European life insurance firms. However, Fama and Jensen (1983b) argue that monitoring activity is more effective in smaller firms than larger ones. Hence, we test for the effect of firm size on the technical and scale efficiencies of Takaful firms.

3.8 Macroeconomic factors (i.e., GDP and INF): According to Haley (1993), cyclical macroeconomic factors such as economic growth (GDP), interest rates and inflation affect the operational efficiency and the underwriting profitability of insurance firms. In high economic growth and interest rate periods, operators are likely to sustain losses due to the possible enhanced returns on their investments (in either the stock or bond markets). However, during inflationary periods, contributors claim may increase together with the level of prices generally. Also, cyclical macroeconomic factors may affect input prices; hence they may significantly influence the technical and scale efficiencies of Takaful operators. But due to the nature of the markets many of our sample firms are drawn from, we exclude interest rates (for example, Sudan and Iran run totally interest free economies while data on interest rates in Saudi Arabia and a host of other GCC countries is virtually non-existent). Therefore, taking this into account, we predict a positive effect from GDP and a negative effect from inflation on both types of inflation.

3.9 Takaful insurance model and location (LOC): Generally, there appears to be a marked difference in markets with regards to tax policy, regulatory quality and the type of *Takaful* business model used. For example, countries in the GCC mostly run a tax free economy while

countries such as Malaysia offer tax advantages to *Takaful* operators which may help them become more scale efficient. Also, Abouzaid (2007) highlights those countries such as Sudan and Bahrain do not give managers the flexibility to choose the type of *Takaful* model to run while others such as Malaysia and the UAE empower managers to choose the business type. This can, therefore, have tendency to affect both technical and scale efficiencies of operators. Consequently, we predict that location will exert a positive and a non-directional effect on technical and scale efficiencies respectively.

3.10 Governance/Institutional Quality (WGI/ICRG): It is well recognized that better governance in a country is believed to enhance overall productivity and efficiency in the country. This is according to several studies, for example, Olsen et al. (2000) observe that poor or bad institutions are often associated with slower efficiency and productivity while Hall and Jones (2000) opine that bad institutions reduce aggregate efficiency and productivity. Interestingly, in a study of an aspect of institutions, namely economic freedom, Adkins et al. (2002) shows that lack of economic freedom leads to lower aggregate efficiency while Meon and Weill (2005) are also of the view that better governance is related to greater efficiency. Hence, we predict a positive relationship between country governance and institutional quality and both types of efficiencies tested in this paper.

3.11 Other control variables: Other firm specific factors can also influence the technical and scale efficiencies of *Takaful* operators. For the sake of this analysis, we control for the effect of organizational form/product offering, firm age and institutional ownership. We outline our motivation for using these variables below.

According to Mayers and Smith (1981), the two major forms of business that dominate the insurance sector reflect the agency relationship that exists within the firm. Mayers et. al. (1997) also empirically show that in the insurance sector, the extent of agency incentive and the structure of the corporate board in firms is directly affected by the organizational form. Meanwhile, Cummins et al., (2004) supports empirically that stock type insurers in Spain are generally more efficient than mutual insurers. *Takaful* basically operates a mutual type insurance, however, product offering varies in the industry (i.e family and general *Takaful*) and besides, Harhoff et al., (1998) state that firms with a much less diversified product offering tend to have greater growth variability whilst others (like Byeongyong & Weiss (2005); Jovanovic, 1982) are of the opinion that firms with a less diversified product offering may be less efficient than those with several product lines.

Alternatively, researchers (such as Dunes & Hughes, 1994) have proposed that the life cycle effect of the firm (or age) may be a key determinant of growth in an industry. For example, younger firms with less experienced managers tend to be less technical and scale efficient than older ones.

4. Data

We use a comprehensive sample which includes 134 *Takaful* firms operating in 21 countries[7] which are characterized with high concentration of Muslim population for the period 2002-2013. Data on *Takaful* insurers were collected from the World Islamic Insurance Directories (WIID). The WIID is initiated by *Takaful* Re (a leading global provider of Takaful services) and published by the Middle East Insurance Review (the publisher of Asia Insurance Review). Missing data were hand collected from annual reports of respective firms. The choice sample period was based on available information from the data source (i.e. WIID).

Consistent with prior evidence, country governance data was collected from both the World Governance Indicators (WGI) and the International Country Risk Guide (ICRG) (Al-Marhubi, 2004; Bjørnskov, 2006; Huynh & Jacho-chavez, 2009; Baltagi et al., 2009; Law and Habibullah, 2009; Law et al., 2013, 2014). To model the insurance product process, we follow Bhatty (2007) and categorize *Takaful* insurers of producing four main types of output: (i) vehicle insurance (ii) property insurance (iii) marine and aviation insurance and (iv) other insurance. Four inputs are used to produce these outputs: (i) Admin Expenses (ii) Labor Input (iii) Labor Expenses and (iv) Capital Assets. Appendix A presents our sample distribution and list of countries.

5. Methodology

5.1 Efficiency Measurement

This study uses the Data Envelopment Analysis (DEA) method to estimate technical and scale efficiencies of *Takaful* insurers. In a number of service industries involving complex input-output relationships, DEA has been shown to be an effective tool for benchmarking (Cooper et al., 2007; Zhu, 2014)[7] . In theory, DEA is a sound framework for studies on performance as it provides numerous advantages over orthodox approaches such as regression

[7] The ratio analysis technique has been criticized on the grounds that various ratios may possibly denote the performance of a unit equivocally in various directions whilst the regression analysis technique presumes a form of functional correlation between inputs and outputs, and is able to handle only a single output at a time (Manandhar & Tang, 2002). Moreover, the weighted index technique also holds some defects due to the absence of an objective way in determining the weight for an unbiased allocation.

analysis and performance ratios (Schaffnit et al., 1997). DEA technically represents some set of linear programming, non-parametric technique utilized to construct empirical production frontiers to assess the relative efficiency of production units. This method effectively handles complex processes, where the units, usually termed decision making units, make use of multiple inputs and outputs (Schaffnit et al., 1997).

The DEA technique also permits the evaluation of the performance of a unit and is undertaken by comparing its performance with that of the best performer parallel to the concept of efficiency. The performance measure is expressed in the form of an efficiency score (Manandhar & Tang, 2002). In this study, the principal DEA formulation presumes that the *Takaful* operators, each use different quantities of the inputs available to produce equally different amounts of outputs, under the assumptions of convexity, positive monotonicity, and free disposability of inputs and outputs for all observations (Kader et al., 2014). We apply an output oriented model assumption which can be derived for the *i*th *Takaful* insurer by solving the following:

$$\hat{\delta}_i = \max_{\hat{\delta}_i,\lambda}\{\delta > 0 \mathrm{I} \hat{\delta}_i y_i \leq \sum_{i=1}^{n} Y\lambda; x_i \geq \sum_{i=1}^{n} X\lambda; \sum_{i=1}^{n} \lambda = 1; \lambda \geq 0\}, \qquad (1)$$

$$i = 1 \ldots\ldots n \; Takaful \; insurers$$

Where,

Y is a vector of *Takaful* operator outputs, X is a vector of operator inputs, λ is a $\mathrm{I} \times 1$ vector of constants. The value of $\hat{\delta}_i$ obtained is the technical efficiency score for the *i*th *Takaful* insurer. A score of $\hat{\delta}_i = 1$ indicates that the operator is technically efficient, and otherwise, if the score is less than 1.

This linear programming function must be solved *n* times, one for each *Takaful* operator in the sample. It should be noted that the DEA model can be estimated in two different ways: the variable return to scale and the constant return to scale assumptions. This study relies on the variable return to scale assumption only because the constant return to scale assumption is only accurate in a situation where the assumption is that *Takaful* insurers are operating at an optimal level of scale. This assumption (the CRS) is perhaps implausible because level of technology and regulation might differ across *Takaful* operators in different size groups and markets, so utilizing the VRS would allow the modeling to take into account these considerations.

To estimate the efficiency of the *ith Takaful* firm, we utilise the profit frontier model consistent with Hardwick et al. (2011) which is specified as :

$$\diagup w_m = {}_0 + \sum_{i=1}^{n} {}_i q_i + \sum_{k=1}^{m\ 1} {}_k \left(w_k \diagup w_m \right) + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} {}_{ij} q_i q_j + 0.5 \sum_{k=1}^{m\ 1} \sum_{h=1}^{m\ 1} {}_{kh} \left(w_k \diagup w_m \right) \left(w_h \diagup w_m \right) + \sum_{i=1}^{n} \sum_{k=1}^{m\ 1} {}_{ik} q_1 \left(w_k \diagup w_m \right) + u + \quad (2)$$

$$i, j = 1, 2, 3, \ldots\ldots n; \qquad k, h = 1, 2, 3, \ldots\ldots m \quad 1$$

From equation (2), each company's total profit is represented by , m and n represents the total number of inputs and outputs. w_k stands for the input price (proxy by admin expenses, labor input, price of labor and capital input) for the kth firm, q_i for the output (Marine and aviation insurance, property insurance, motor insurance, and other insurance) (i.e. gross premiums) of the *ith* firm, while ' and are the parameters to be measured. Consistency demands that ${}_{ij} = {}_{ji}$ and ${}_{kh} = {}_{hk}$ and linear homogeneity is ensured from normalization by the *m*th input price. While linear homogeneity is not a pre-requisite for a profit function, it represents a cost function (Hardwick et al., 2011). Furthermore, Berge et al. (2000) indicate that input prices are prone to positive correlation with output prices, and it is reasonable to assume that a doubling in profits and output prices is associated with doubling the input prices.

is a normally distributed, random error term with zero mean and constant variance, while u is presumed to follow a half-normal distribution, which is taken to be a sign of profit inefficiency. (*u* is presumed to be 0).

5.2 The Bootstrap Approach

Prior literature has been overwhelmed with debate concerning the statistical weakness of the DEA estimator. According to Simar and Wilson (1998, 1999, 2007), the efficiency scores produced by the DEA strongly depend on one another statistically and as a result, relying on them might lead to inaccurate interpretation of results. This is because the DEA efficiency score is a comparative efficiency index, instead of an absolute efficiency index and the statistical properties of the DEA cannot be obtained due to the fact that efficiency scores are not estimated but calculated (Assaf et al., 2011).

The bootstrap method was first used in obtaining statistical properties of the DEA by Simar and Wilson (1998)[8]. The authors extended their approach in a 2007 study by considering the effects of environmental variables on efficiency based on double bootstrap. This method allows consistent inference (in the second stage regression) from efficiency scores, while concurrently constructs confidence intervals and generates standard errors for DEA efficiency scores.

In this study, we specifically employ the Simar and Wilson (2007) method due to its relative importance; among others, it generates a set of bias-corrected estimates of $\hat{\delta}_i$ and confidence intervals which assists in resolving the problem of DEA which is occasionally criticized for its potential to produce bias efficiency estimates and its exclusion of random error. The bias-corrected efficiency estimates are generally preferred over the original DEA estimates because the bias-corrected estimates are within the upper and lower bounds of the DEA bootstrap confidence interval while in contrast, the original DEA estimates do not show biasness in the scores (Lee, 2011). Details on a step-by-step analysis of estimating the bootstrap score is documented in prior studies (e.g. Barros and Assaf, 2009 ; Assaf et al., 2011; Barros and Garcia-del-Barrio, 2011).

Our motivation for adopting the DEA bootstrap method further emerges from specifying the second stage regression model as follows:

$$\hat{\partial}_i = x_i\beta + \varepsilon_i \qquad (3)$$

Where,

x_i is a vector of governance characteristics that explain the efficiency between the *Takaful* insurers under consideration and β denotes a vector of parameters and ε_i refers to statistical noise (or the error term). Traditionally, factors that determine technical efficiency are estimated using Tobit regression, however, according to Simar and Wilson (2007), there exist a number of problems with two-stage studies that make use of non-parametric distance function estimators in the first stage (similar to ours) and then utilize Tobit regression in the second stage. Conducting a Monte Carlo simulation, we argue that a truncated regression is more suitable and gives accurate results.

[8] The bootstrap method is also non-parametric like the DEA. As opposed to DEA in which the application of statistical inference is impossible due to its deterministic nature (i.e., there is no random error to introduce unexplained variability), the bootstrap allows this. In addition, the bootstrap DEA is asymptotically consistent and produces robust results. The bootstrap method is based on a simulation technique produced by replicating or iterating the original dataset 2000 times in order to obtain reliable estimates. The method was first introduced by Efron (1979).

Accordingly, we employ truncated regression to determine the effects of corporate governance mechanisms, institutional quality and macroeconomic conditions on the efficiency of the global *Takaful* industry. Table 1 presents our variable definitions.

[Insert Table 1 here]

6. Results

6.1 Descriptive statistics

Table 2 presents our descriptive statistics for the overall sample (Panel A); the MENA region (Panel B); and the ASEAN region (Panel C). For the overall sample, board size (BSIZE) reports a mean of over seven members which is less than the maximum reported by Jensen (1993), which recommended eight members. This average is also considered smaller than those reported for the US, UK and Taiwanese property liability insurance market, life insurance market, and life & non-life insurance market by Huang et al., (2011); Hardwick et al., (2011) and Wang et al., (2007) who reported 11, above 8 and 11 respectively for the three countries. On average, the board is comprised of four non-executive directors (NEXECS) and a maximum of ten members. Interestingly, this ratio is similar to the 37 percent and 40 percent composition of outside directors reported in 2011 and 1992 for the UK life and non-life insurance firms by O'Sullivan and Diacon, (2003) and Hardwick et al., (2011) but is much higher than the 11 percent reported for family *Takaful* providers by Kader et al., (2014). When comparing the ratios between non-executives in family *Takaful* providers and overall *Takaful* providers, our results show that general *Takaful* providers use significantly more outside directors than those offering only the family segment. This may be explained due to the wider product offering which might require additional expertise with other product lines of insurance compared to those only offering a single product.

Interestingly, our results show that more than 88 percent of *Takaful* providers separate the role of Chairman and CEO; with 24 percent of these firms located in markets with established regulatory systems, 95 percent offer both family and general *Takaful* products, 72 percent with 3 shareholders with investments above 5 percent, 24 percent reporting an established audit committee with an average of 4 members per each SSB. In terms of *Takaful* experience, most of the firms in our sample have, on average, been operating for 13 years, with 73 percent having institutional investors.

Based on our regional analysis, firms from the MENA have a mean board size of 8 members which is as recommended by Jensen (1993) but smaller compared to those reported in the US,

UK and Taiwanese insurance sector reported above. Their board is made up of 4 non-executive directors on average which takes a considerably low proportion of the maximum number of board members (which is 16). This is similar to those reported for the UK insurance sector in 2011 and 1992. This study also finds that 86 percent of the firms consider separating the Chair office from the CEO important while only 17 percent regard audit committee to be significant, with 68 percent having institutional investors. In addition, 99 percent of firms diversify their product line, offering family and other forms of *Takaful*, with over 68 percent having 3 shareholders who own shares above 5 percent. With respect to the SSB in the MENA *Takaful* sector, the average number of members is 2, with most of the firms being in existence for more than 13 years. Additionally, the MENA region reports very low in relation to governance and institutional quality with the former average running in the negative out of a score of 6 while the latter averaging 16 (out of a total score of 30). Economic growth in the region is, however, stable along with the inflation rate which averages 7 percent.

Conversely, *Takaful* firms from the South East Asia region (ASEAN) have a much higher board composition of 23 members with a mean size of four. The number of board members comprise of an average of 4 non-executives with a maximum of 9. Moreover, 42 percent of the firms report having an audit committee which is higher than that reported for the MENA region. In addition, while 95 percent of the operators in the region separate the CEO from the Chair, 82 percent of firms in this region have a diversified product line offering different types of *Takaful* with approximately 84 percent of the operators owned by investors with shares over 5 percent. The mean Shari'ah board size in this market is 4 with more than 87 percent of firms having institutional investors. However, the governance and institutional landscape in the sub region did not fare better than that reported for the MENA (having scored -0.6 and 18.75 respectively). In terms of macroeconomic environment, both economic growth and inflation in the region is appears similar to that witnessed in MENA.

[Insert Table 2 here]

Table 3 presents the correlation matrix for the variables used in the second stage regression indicates that the ratio of non-executives is negatively related to both technical efficiency (TE) and scale efficiency (SE). This demonstrates that non-executives on the board are detrimental to the efficiency of *Takaful* firms, as does audit committee and board size which is consistent with expectation. In addition, the positive relationship between CEO separation and TE shows that firms with separate CEO and chairmanship positions are better in terms of management.

Also, firm size (in natural log form), location, and institutional shareholding are all positively related to the efficiency scores signifying that larger *Takaful* firms located in jurisdictions with an established regulatory framework and partly owned by institutions tend to be more efficient (as is evident in the positive correlation among all these variables). The correlation coefficients between the various board characteristics and the efficiency scores appear to be modest.

[Insert Table 3 here]

6.2 Empirical Results and Discussion

We report the original DEA, FDH and Order M scores in Tables 4 and 5 respectively. The efficiency estimates of the different *Takaful* insurers obtained from iterating the DEA score 2000 times are reported in Table 6 to enable comparison with the original DEA estimates.

A. Technical Efficiency Based on DEA Estimator

Table 4 below presents the summary of the *Takaful* firms' mean efficiency scores as well as the disaggregated technical efficiency scores based on TE (variable returns to scale), and SE under the *Takaful* sector for the full, MENA and ASEAN samples. In short, the TE estimates indicate that all firms appear to operate between an efficiency range of 0.015 and 1.00 with a mean score of 0.51. On average, global *Takaful* firms operate at 51 percent efficiency, which also translates into an inefficiency ratio of 49 percent. Furthermore, the average efficiency estimate indicates that under present operating technology, *Takaful* firms can potentially withdraw the supply of inputs by 49 percent and still attain the same level of output. This result implies low prospects of withdrawing the supply of inputs to increase efficiency. The wide efficiency range reported offers some evidence that there is substantial variation in return among firms. In other words, *Takaful* insurers seem to operate at comparatively different levels of return. This is relatively lower than the result reported by Kader et al. (2010, 2014) who reported 74 and 62 percent respectively. However, this is justified and in line with Tziogkidis (2014) who asserts that owing to diversity in group of firms and time period, it is possible to obtain different results even when employing the same efficiency measurement techniques.

On the other hand, our SE estimates are low, ranging between 0.02 and 1.00 with a mean score of 0.44. This score is also lower than those obtained by Kader et al. (2010, 2014). Following Padilla-Fernandez & Nuthall (2009), which compare their findings to the TE scores, having low scale efficiency score suggests that the small size of the industry or firms operating in the industry appear to be the main cause of inefficiency rather than the presence of

managerial problems. Therefore, a good approach to improve efficiency in the *Takaful* sector is to increase the size of the industry, which would encourage greater competition and possible consolidation.

Arguably, the high inefficiency level estimate under the two assumptions is plausible as many of these *Takaful* firms are relatively new and small[9], with only several years of experience could be a rationale for high technical inefficiency. Huang et al. (2011) attribute high efficiency in insurance companies largely to the advancement in technology and modes of operation. This undoubtedly suggests that *Takaful* operators have yet to benefit from the advantages of new technology and recent best practices in the industry. A further reason for high technical inefficiency could be attributed to the hypothesis surrounding the DEA estimator. According to De Witte & Marques (2010) the DEA estimator is not robust to noise, therefore other factors (such as institutional factors) which may improve efficiency or increase inefficiency (factors beyond *Takaful* industry control) may not be estimated using DEA.

[Insert Table 4 here]

B. Technical Efficiency Based on FDH and Order-M Estimators

Based on the weaknesses of the DEA mentioned above, we consider other efficiency estimators to increase the robustness of the scores. Table 5, therefore, presents TE estimates based on the Free Disposal Hull (FDH) and Order-M estimators for the *Takaful* industry. The FDH estimator indicates that *Takaful* firms operate from 0 to 1.00 with mean efficiency level of 58.3 percent indicating that on average; all *Takaful* firms operate at 58 percent efficiency, but displaying potential for 42 percent inefficiency level. This result is anticipated because FDH relaxes the convexity assumption, thus inclining towards higher scores compared to the DEA estimator whose production is extremely convex. Several researchers (such as Borger et al., 1994; De Witte & Marques, 2010) compare between the FDH and DEA estimators, using the same data set, and obtained lower DEA estimates against those from the FDH. This can be attributable to the divergence in convexity assumption[10]. The result from the Order-M estimates

[9] Where Technical efficiency score is higher than scale efficiency, it is likely that the major cause of inefficiency is size. See Padilla-Fernandez and Nuthall (2012).

[10] According to Levin & Milgron (2004) the convexity assumption fails in cases where there are fixed costs of production or where the production sets exhibits increasing returns. Their findings suggest that comparative statics conclusions are largely independent of convexity assumptions and they solve for the problem of comparative statics using methods that do not rely on convexity.

show that the efficiency level of the industry ranges between 0.00 and 1.00, providing a mean score of 0.51 indicating 51 percent efficiency level.

Therefore, comparing the TE results under the three estimators (DEA, Order-M and FDH) is imperative in order to accommodate the shortcomings of each of the estimators. As noted earlier, each of the estimators has its strength and weakness.

[Insert Table 5 here]

C. Homogeneous Smoothed Bootstrap

We further conduct and estimate homogeneous smoothed bootstrap for optimizing TE. Such analyses are based on the simulation technique produced by replicating or iterating the original dataset. The results presented in Table 6 report the bootstrap outcome on the non-bias corrected efficiency (original DEA scores). Our findings indicate that the bias corrected TE score for the *Takaful* industry ranges between 0.001 and 1.00 with an average efficiency level of 0.47; implying 47 percent efficiency level. Therefore, subtracting the bias corrected efficiency score from the non-bias corrected TE result yields the bias estimate score.

The bias estimates account for factors beyond *Takaful* operators control such as regulatory changes, institutional factors, external shocks to the (financial) market and other policy factors. The higher the mean bias estimate, the higher is the noise in the system, which is generally beyond the control of operators. For the *Takaful* industry, this is attributable to a lack of sound regulatory framework as these firms operate under similar exogenous factors; such as a single main regulatory body to scrutinize industry practices, shocks to the global financial environment, except additional market (country) level regulations. Furthermore, many of the firms used in the sample operate in jurisdictions with weak regulatory frameworks and poor institutional quality. The above-mentioned observations on regulation, institution and dependency are the inferences that account for high noise or bias in the efficiency of the industry. Nevertheless, it should be noted that the non-bias corrected TE score was estimated following the conventional DEA approach with a simulation effect in it, which does not account for the noise component of the DEA. The bias corrected TE takes care of the noise which correlates with the bias. Consequently, the bias corrected yields a lower score relative to the non-bias corrected.

Moreover, the evidence presented in Table 4 (full sample) shows a high degree of scale inefficiency in operation across the industry with a mean SE score of 0.39 indicating that the industry is scale inefficient; essentially, the industry is 61 percent away from the scale frontier.

It is also noteworthy that the VRS (TE) score of 47 percent is higher than the SE score. This demonstrates that the main cause of inefficiency seems to be less related to technical issues (like management) but more scale related. This further implies that the increase in (technical) efficiency is possible through increasing the scale of operation in the industry (size of firms). This is expected due to the fact that many firms operating in the industry are small (compared to conventional insurance firms) or operating through a window. Therefore, the zero frontiers assumption surrounding the DEA-bootstrap estimation is unsurprising.

[Insert Table 6 here]

D. Determinants of Technical Efficiency

The results of our truncated regression are reported in Tables 7a (with institutional ownership control) and 7b (without institutional ownership control). In each of the regressions, the bias corrected TE scores are used as the dependent variable.

In Table 7a, in relation to the ratio of non-executives (NEXECS) serving on boards, our results show a negative and highly significant effect on the TE of the global *Takaful* firms. This finding is consistent with prior evidence reported in both *Takaful* (see Kader et al., 2010, 2014) and conventional insurance studies such as, Coles et al. (2008) and Pathan and Faff (2013). When we interact non-executive and board size (N EXECS*BSIZE), we find a positive and significant association with TE implying that non-executive directors may facilitate the attainment of TE in *Takaful* firms, due to their financial expertise, networking in the insurance industry as well as their backgrounds in risk management. In contrast, under the SE measurement the coefficient on the *NEXECS* variable is positive and significant, suggesting that those external directors are indeed effective contributors to SE of *Takaful* operators. However, the interaction between *NEXECS* and *BSIZE* generates a negative and significant coefficient suggesting that non-executive directors serving on large boards might still impair the actualization of SE in the industry. When examining the effect of audit committees, the presence of an audit committee member on the board can reduce the TE of *Takaful* insurers, albeit insignificantly. This demonstrates that in a board where there is separation of board chairman and CEO positions and a presence of a large board, the need for extra supervision may be minimized. Hence, this reduces the added advantage of an audit committee. In terms of the control variables, disputing prediction, ownership is found to be negative but statistically insignificant to both technical and scale efficiencies of *Takaful* insurers. However, when institutional ownership is excluded (as shown in Table 7b), the coefficient becomes positive but statistically insignificant to TE but significant at 5 percent to scale efficiency. This finding

suggests that individual owners tend to pay less attention to their monitoring role where an institution owns a substantial part of the firm. This situation may be because established institutions give considerable attention to monitoring their investments in other entities. This relationship is also similar on the scale efficiency, which may also suggest that individual shareholders may show more interest in maximizing their wealth instead of value. This result is in line with Huang et al. (2011) and Mura (2006).

For the separation of chairman and CEO positions, the coefficient on the CEO shows a positive and significant effect on both TE and SE of *Takaful* insurers. These results consistent with our predictions and imply that it is possible that in a situation where the positions are held by a single individual, the holder becomes too powerful to be supervised by other members of the board, especially the non-executive members. This result also highlights the importance of separating these strategic positions to promote high performance of the *Takaful* industry. Our findings are in line with the agency theory and with prior studies (such as Wang et al., 2007; Jermias & Gani, 2014; Pi & Timme, 1993). In contrast, when interacting the CEO and board size variable, the effects becomes negative and highly significant; suggesting that separation of power in large boards could negatively impair TE of *Takaful* firms.

With board size (BSIZE), our result shows a positive and significant association with TE and supports the findings of Pearce and Zahra (1992) who argue that larger boards are more profitable thereby increasing TE given their expertise in fund and resource management/allocations. Essentially, our findings show no significant influence of the impact of board size on SE.

In addition, our results do not reveal a significant relationship between institutional ownership (OWN) and the SSB to technical efficiency of *Takaful* operators. Nevertheless, the negative coefficient on the SSB is unsurprising because not only is the SSB an additional monitoring and oversight mechanism, but it is also seen as a constraint on the operations of Islamic financial institutions (see Mollah & Zaman, 2015), however, they have a positive and significant effect at 1 percent to their scale efficiency. This reveals that the SSB gives the operator the much needed (religious) ethical and social legitimacy, prompting individuals to subscribe to the venture and shareholders to invest in the firm.

Our regression further delineates that firm size (in natural log form) is likely to exert a positive and statistically significant influence on technical efficiency (at the 5 percent level) which is consistent with our prediction, indicating that larger operators are more technically efficient than smaller sized operators. This for example may arise due to the fact that the size

of a company may increase its operational efficiency by means of economies of scale[11]. Similarly, the relationship is also likely to be significant to scale efficiency at 5 percent.

Also, our regression results demonstrate that older firms are more technically efficient, where the relationship between age and efficiency is positive and significant at the 1 percent level. The regression supports the view that firms located in markets with established regulatory frameworks are more technically efficient at 1 percent but are less scale efficient. This suggests that *Takaful* operators in countries such as Malaysia, Bahrain, and the U.A.E find it more difficult to increase their scale of production (or expand) due to prescribed regulations. Evidently, *Takaful* insurers that specialize in a single product offering (for example family *Takaful*) are found to be more technically efficient but less scale efficient. This arises because managers become more familiar and highly skilled where there is a specialization on a single product rather than dealing with many. This may also affect the size of the firm in that a firm tends to be bigger when producing and offering diverse products and services.

Table 7(a) and 7(b) depicts several macroeconomic (i.e., GDP and inflation) and governance variables. It shows that economic growth in a country tends to significantly enhance both technical and scale efficiencies of *Takaful* firms at the 1 percent level. However, while better governance is significantly associated with better technical efficiency (at the 10 percent level) but is insignificant to scale efficiency. This is similar to the study of Meon and Weill (2005) who find that better governance is generally linked with greater efficiency.

[Insert Tables 7a & 7b here]

7. Additional analyses

This study employs an alternative indicator for country governance as robustness check for the second stage regression and we report the results in Table 8a and 8b respectively. Here, we substitute the WGI with the *International Country Risk Guide* (ICRG) institutional quality indicators. This monthly dataset is obtained from Political Risk Services (PRS), a world leader in quant-driven political risk and country risk forecasts. Following Law et al. (2013 and 2014), three PRS indicators are employed to measure institutional quality, namely: (i) *Government Stability* (ii) *Democratic Accountability* and (iii) *Bureaucratic Quality*; the first indicator is scaled from 0-12 while the second and last are 0-6 and 0-4 respectively, with higher values

[11] For example, see Diacon et al. (2002)

demonstrating better institutions while aggregating them into a single measure by adding up[12]. Owing to their different scaling method, we re-scaled them appropriately[13], hence, the theoretical range of our institutional quality index is 0-30. As shown in Tables 8a/8b below, all the coefficients on the variables have the expected size and show similar significance and is consistent with our main findings. This suggests that results are robust to the alternative indicators.

[Insert Tables 8a & 8b here]

We also deemed it worthwhile to extend our analyses to cluster our full sample into the MENA and ASEAN countries to identify any regional effect for the impact of governance on *Takaful* efficiency. Our results are reported in Appendix B.

Our efforts reveal that geographic location also appear to have direct influence CG mechanisms have on operators' efficiency. For example, a proportion of non-executive directors, separation of CEO and Chair positions and organizational form all tend to significantly reduce technical efficiency while firm age, inflation, size, economic growth and governance significantly increase technical efficiency in the MENA region. A one percent increase in the proportion of non-executives on the board reduces the technical efficiency of these firms by 3 percent. A surprising result in this analysis is the positive and significant coefficient on inflation because Haley (1993) is of the opinion that inflation undermines the operational efficiency and underwriting profitability of insurers. SSB is also negative but insignificant to technical efficiency of operators in this region. Regarding the scale efficiency, factors such as board size, SSB, firm age, organizational form and institutional ownership are positive and highly significant at the 1 percent level. This indicates the relative importance of product specialization on the continuous growth of the *Takaful* sector. Country governance or institutional quality is also positive, but weakly significant at the 10 percent level. However, presence of audit committee on the board as well as inflation negatively affects scale efficiency of MENA operators in a significant manner. The negative coefficient on inflation here is predictable because *Takaful* is a form of savings and investment, and inflation erodes purchasing power and according to Li et al. (2007), inflation affects the demand for insurance

[12] According to Knack and Keefer (1995), there exists high correlation among these indicators which may result in multi-collinearity. For fear of omitting any of them from the estimation, the 3 institutional quality variables are summed together as one.

[13] The variables are converted to 0-10 by multiplying the first by 5/6, the next 1 by 5/3 and the last by 5/2 to unify them.

products and by extension, the growth of the sector. Additionally, inflation also causes uncertainty because the value of money changes during inflationary periods, planning for retirement or future use of money (as in the case of insurance) becomes difficult. This effect may be cushioned by interest rates; however, *Takaful* operators do not deal in interest.

Curiously, technical efficiency of operators in ASEAN is negatively affected by the presence of an audit committee member serving on the board, inflation, country governance or institutional infrastructure, SSB, board size and institutional ownership, however, only country governance appears to be significant albeit weakly (at 10% level). This is, indeed, surprising because according to Meon and Weill (2005) better governance is often associated with greater efficiency in a country. Factors such as separation of CEO and Chairman improve TE in a significant manner while firm age and location softly improves technical efficiency of *Takaful* firms. Economic growth, firm size and organizational form are also found to be positive. In contrast, ratio of non-executive directors, board size, ownership structure, firm location, product specialization, and inflation all appear to be detrimental to the scale efficiency of *Takaful* operators in South East Asia while audit committee, separation of office, SSB, firm age, institutional ownership, economic growth and governance positively affects scale efficiency. However, only audit committee, SSB and country governance were found to be significant. In particular, the negative coefficient on the SSB in both regional analyses further supports the assertion of Mollah and Zaman (2015) that not only are SSB an added layer of monitoring and oversight, they are also regarded as a constraint on the operations of IFIs. Nevertheless, the positive and significant coefficients on the scale efficiency of operators in both regions highlight the importance of the SSB in fulfilling the legitimacy and *modus operandi* of *Takaful* operators.

8. Conclusion

This study extends conventional and Islamic corporate governance literature by examining the relationship between corporate governance characteristics and technical and scale efficiencies of global *Takaful* operators. Using a comprehensive sample of 134 Takaful insurers in 21 countries for the period 2002 to 2013, our study finds Takaful insurers to be inefficient suggesting possible managerial and operational apathy. We also find that non-executive directors, audit committees, and product diversification do not improve technical efficiency. Whilst, CEO/chair duality, board size, organizational age, regulatory jurisdiction and firm size have a positive relationship with technical efficiency, non-executive directors, Shari'ah board, product diversification and institutional ownership are found to improve scale efficiency. Our

study incorporates new evidence relating to the (MENA) and the Southeast East Asian (ASEAN) regions. We find that in the MENA, both ownership structure and CEO/chair duality significantly reduces technical efficiency with board size indicating a negative association for scale efficiency. Within the ASEAN region, only the CEO/chair duality significantly relates with technical efficiency with audit committees and SSB size displaying a positive association with scale efficiency.

Our findings could be of potential benefit to policy makers, investors and other market participants as well as informing future research on the efficiencies of *Takaful* operators. For instance, examining corporate governance determinants that influences the likelihood of efficient performance in this alternative and fast growing insurance industry provides strong evidence on the importance of separating the CEO and chair positions and its role in improving technical efficiency. A comparative evaluation with the conventional insurance industry would also provide valuable evidence on the level of progress of this alternative insurance sector. Overall, this study finds that the ratio of non-executives on the board engenders technical inefficiency in *Takaful* firms. However, board size is shown to have positive association with both technical and scale efficiencies, suggesting that larger operators are more likely to promote higher efficiency than small operators. Furthermore, product specialization appears to drive *Takaful* inefficiency, demonstrating that *Takaful* firms are not fully realizing economies of scope. Finally, firms in established jurisdictions appear to benefit more technically, but do not benefit in terms of scale of operation. This shows that regulations in established markets are hampering the growth of the industry. This is becoming more evident due to the pressures of new initiatives issued by regulators, low *Takaful* penetration, composite license regulations and the requirement to maintain adequate capitalization. Undoubtedly, this will have a profound effect on the *Takaful* landscape. For these reasons, we surmise that mergers and acquisitions, perhaps through international foreign participation, will become inevitable especially if the industry is to continue to grow and support itself. This may be through consolidation intended to create a stronger, sustainable and a more resilient platform as currently experienced in several markets such as in Malaysia and the GCC. For now, our study raises some pertinent issues that future researchers can build on.

Acknowledgement:
We would like to thank the editor, the associate editor and two anonymous reviewers for their constructive feedback and directions. The authors thank Professor Khelifa Mazouz and Professor Jason Xiao (Cardiff University,UK), Dr. Marwan Izzeldin (Lancaster University, UK) and Professor Stephen Owusu-Ansah (Baptist University, Houston, Texas, US) for their valuable comments.

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TABLE 1: Variable definitions			
Variables	***Notations***	***Definition***	**Data Source**
Non-Executives	**NEXECS**	This are the outside, independent directors on the board. This variable is measured as the ratio of non-executive directors on the board	WIID, firms annual reports
Audit Committee	**AUDIT**	Presence of auditors on the board. Measured as the dummy, with a firm taking 1 if there exists an audit committee on the board and 0 otherwise	WIID and company annual reports
CEO	**CEO**	The separation of the CEO and chairman positions. Measured as the dummy, with a firm taking 1 if there exists an audit committee on the board and 0 otherwise	WIID and company annual reports
Board Size	**BSIZE**	Size of the board of directors. Measured as the total number of individuals on the board	WIID and company annual reports
Ownership Structure	**OWN**	Directors block ownership. The ratio of shares held by the top three.	WIID and company annual reports
***Shari'ah* Board**	**SSB**	The number of individuals on the *Shari'ah* board.	WIID and company annual reports
Location	**LOC**	Country where operator is based Measured as dummy, with a firm taking 1 if is located in established markets (Malaysia, UAE, Indonesia, KSA and Bahrain) and 0 otherwise.	WIID
AGE	**AGE**	Age of the firm. The difference between the sample year and the year of a firm's first appearance.	WIID
Organizational form	**ORG**	Type of product offered by operator. Measured as dummy where a firm carries 1 if offers only family *Takaful* and 0 if it offers both general and family *Takaful*	WIID
Institutional ownership	**INSOWN**	Operators partly owned by other institutions. The ratio of shares held by an institution.	WIID
Company Size	**CPS**	This is the size of the *Takaful* operator measured as natural logarithm of company profit	WIID
Institutional quality	**INSQ**	This is an assessment of the strength of political institutions and risk factors in a country. Represents the sum of rule of law, corruption, democratic accountability, government stability, and bureaucratic quality (each scaled 0 to 10)	ICRG
Country Governance	**WGI**	This variable measures the quality of governance in over 200 countries. Sum of control of corruption, rule of law, regulatory quality, government effectiveness, political stability, as well as voice and accountability (each scaled 0-6).	WGI, World Bank
Inflation	**INF**	Annual rate of inflation.	World Bank
GDP	**GDP**	Annual Gross Domestic Products (GDP) growth rate.	World Bank
Output 1	**-**	Vehicle insurance. Total amount of contributions received for vehicle insurance	WIID

Output 2	**-**	Property insurance. Total amount of contributions received for property insurance	WIID
Output 3	**-**	Marine and Aviation Insurance. Total amount of contributions received for marine and aviation insurance.	WIID
Output 4	**-**	Other Insurance. Total amount of contributions received for other insurance such as health, family, fire, etc.	WIID
Input 1	**-**	Administrative expenses incurred by the operator including but not limited to cost of general services.	WIID
Input 2	**-**	Labor Input. Total number of labor utilized by the operator in a given calendar year.	WIID
Input 3	**-**	Labor Expenses. Total amount of salaries paid to staff in the firm	WIID
Input 4	**-**	Capital Assets. Pieces of properties owned and investments held by the operator in a given year	WIID

TABLE 2: Descriptive Statistics					
Panel A: Overall Sample					
Variables	***Observations***	***Mean***	***Std. Dev.***	***Minimum***	***Maximum***
Output1	689	10300000	11300000	1001.001	16200000
Output2	689	864017.4	6315348	1001	73500000
Output3	689	997454.9	9268698	1001.001	18000000
Output4	689	1883508	1970000	1001.001	41100000
Input1	689	1232207	1050000	1001.001	20400000
Input2	689	267.344	513.7519	12	4001
Input3	689	6811.633	39970.51	1001	650748.8
Input4	689	5812735	40000000	1001.152	65000000
NEXECS	690	4.31	2.07	0	10
AUDIT	690	0.24	0.42	0	1
CEO	690	0.88	0.32	0	1
BSIZE	690	7.40	2.81	1	23
OWN	689	72.23	27.45	8.01	100
SHARB	681	2.83	2.05	0	17
LOC	690	0.24	0.43	0	1
AGE	690	12.90	12.58	0	70
ORG	689	0.95	0.23	0	1
INSTOWN	689	72.83	33.30	0	100
LSIZE	686	5.52	0.98	0	6.52
INF	668	6.85	5.59	-4.86	37.39
GDP	684	25.30	1.13	22.14	26.94
INSQ	685	16.74	2.89	11.53	23.75
WGI	690	-1.04	2.48	-5.36	3.41
Panel B: MENA Sample					
Variables	***Observations***	***Mean***	***Std. Dev.***	***Minimum***	***Maximum***
Output1	538	1290000	12700000	1001.001	162000000
Output2	538	922336	6877166	1001	73500000
Output3	538	1097043	1030000	1001.001	18000000
Output4	538	2196668	2220000	1001.001	41100000
Input1	538	1426253	1180000	1001.001	20400000
Input2	538	186.7565	407.9433	12	4001
Input3	538	7630.32	44462.25	1001.001	650748.8
Input4	538	6632150	4450000	1002	65000000
NEXECS	538	4.40	2.00	0	10
AUDIT	538	0.17	0.38	0	1
CEO	538	0.86	0.35	0	1
BSIZE	538	7.45	2.43	1	16
OWN	537	68.37	27.59	8.01	100
SHARB	517	2.29	1.34	0	6
LOC	538	0.13	0.34	0	1
AGE	538	13.37	12.74	0	42
ORG	537	0.99	0.12	0	1
INSTOWN	537	68.01	34.35	0	100
INF	519	6.94	5.80	-4.86	37.39
LSIZE	534	5.52	0.96	0	6.52
GDP	535	25.20	1.14	22.14	26.94
INSQ	533	16.07	2.57	11.53	21.67
WGI	538	-1.16	2.51	-5.36	3.03
Panel C: ASEAN Sample					
Variables	***Observations***	***Mean***	***Std. Dev.***	***Minimum***	***Maximum***
Output1	151	878774.9	3855232	1001.001	2850000

Output2	151	656233.6	3682341	1001.001	2850000
Output3	151	642631.2	3683065	1001.001	2850000
Output4	151	767744.4	3705915	1001.001	2850000
Input1	151	540838.3	2818687	1001.001	2120000
Input2	151	554.4702	713.1266	16	2783
Input3	151	3894.721	15479.26	1001	118842.2
Input4	151	2893229	1550000	1001.152	11800000
NEXECS	151	4.05	2.27	1	9
AUDIT	151	0.42	0.50	0	1
CEO	151	0.95	0.21	0	1
BSIZE	151	7.34	3.75	3	23
OWN	151	83.46	23.83	12	100
SHARB	151	4.38	2.77	2	17
LOC	151	0.59	0.49	0	1
AGE	151	11.41	12.12	1	26
ORG	151	0.82	0.38	0	1
INSTOWN	151	87.37	25.20	0	100
INF	151	6.57	4.95	-2.31	22.56
LSIZE	151	5.50	1.05	0.69	6.51
GDP	151	25.59	1.03	22.94	26.78
INSQ	151	18.75	2.90	11.95	23.75
WGI	151	-0.68	2.38	-4.25	3.41

Notes: The table presents descriptive statistics of all variables used in the regression models of the study for the full sample (Panel A); the MENA countries (Panel B); and ASEAN countries (Panel C). See Table (1) for variable definitions.

Table 3: Correlation Matrix

	TE	SE	NEXECS	AUDIT	CEO	BSIZE	OWN	SSB	LOC	AGE	ORG	INSTOWN	LSIZE	INF	GDP	INSQ	WGI
TE	1.00																
SE	-0.13	1.00															
NEXECS	-0.31	-0.01	1.00														
AUDIT	-0.06	-0.06	0.22	1.00													
CEO	0.11	-0.03	0.30	0.09	1.00												
BSIZE	-0.14	-0.15	0.39	0.07	0.03	1.00											
OWN	0.12	0.05	-0.23	0.09	-0.16	-0.33	1.00										
SSB	-0.03	0.03	0.02	0.10	0.15	0.37	-0.08	1.00									
LOC	0.15	-0.10	-0.04	0.38	0.19	-0.13	0.31	0.21	1.00								
AGE	0.20	-0.02	-0.21	-0.24	-0.08	0.05	0.08	-0.14	-0.10	1.00							
ORG	-0.13	0.23	0.13	-0.07	-0.05	-0.25	0.08	-0.35	-0.02	0.13	1.00						
INSTOWN	0.05	0.13	-0.08	0.20	-0.11	-0.31	0.68	-0.04	0.29	-0.10	0.12	1.00					
LSIZE	0.05	0.00	-0.03	0.05	-0.01	-0.01	-0.01	-0.02	0.05	0.02	-0.01	-0.05	1.00				
INF	0.23	-0.21	-0.17	-0.15	-0.01	-0.04	-0.08	-0.11	-0.28	0.25	-0.11	-0.02	0.01	1.00			
GDP	0.11	-0.29	-0.06	0.06	-0.11	0.01	0.01	-0.23	0.21	-0.13	-0.13	0.02	-0.01	-0.08	1.00		
INSQ	0.24	-0.02	-0.14	0.21	0.01	-0.15	0.19	0.21	0.67	-0.14	0.02	0.24	0.03	-0.28	0.05	1.00	
WGI	-0.10	0.14	0.14	0.28	-0.09	-0.08	0.11	0.02	0.36	-0.41	0.15	0.15	0.03	-0.63	0.16	0.54	1.00

Note: The table shows the Pearson pair-wise correlation matrix among main variables employed in our analysis for the full sample between years 2002-2013. See Table1 for variable definitions.

Table 4: Summary of Operators' Mean Efficiency Scores		
Panel A: Overall Sample		
Year	*Technical Efficiency*	*Scale Efficiency*
	Non-Bias Corrected	*Non-Bias Corrected*
2002	0.98	0.92
2003	0.64	0.40
2004	0.64	0.38
2005	0.46	0.40
2006	0.61	0.50
2007	0.65	0.65
2008	0.41	0.18
2009	0.33	0.17
2010	0.30	0.15
2011	0.36	0.19
2012	0.81	0.71
2013	0.98	0.94
2002-2013	0.51	0.44
Panel B: MENA Sample		
Year	*Technical Efficiency*	*Scale Efficiency*
	Non-Bias Corrected	*Non-Bias Corrected*
2002		
2003	0.96	0.42
2004	0.96	0.38
2005	0.89	0.26
2006	0.96	0.42
2007	0.91	0.36
2008	0.93	0.17
2009	0.93	0.15
2010	0.93	0.12
2011	0.93	0.13
2012	0.90	0.11
2013	-	-
2002-2013	0.89	0.11
Panel C: ASEAN Sample		
Year	*Technical Efficiency*	*Scale Efficiency*
	Non-Bias Corrected	*Non-Bias Corrected*
2002		
2003	0.30	
2004	0.99	0.91
2005	0.99	0.84
2006	0.99	0.74
2007	0.99	0.81
2008	0.99	0.92
2009	0.99	0.79
2010	0.99	0.56
2011	0.98	0.55
2012	0.96	0.69
2013	-	-
2002-2013	0.98	0.47
Note: The table presents the yearly efficiency scores for full sample (Panel A); the MENA countries (Panel B); and the **A**SEAN countries (Panel C). Limited year-observations for 2013 across the two subsamples contributes to error in estimations for R software. Hence, these were omitted.		

Table 5: Efficiency Scores Based on the FDH and Order-M Estimators				
	Mean	**Std. Dev.**	**Minimum**	**Maximum**
ORDER-M	0.583	0.361	0.00	1.00
FDH	0.509	0.455	0	1.00
Note: FDH= Free Disposal Hull; Analysis computed using the *R* software				

Table 6: Homogeneous Smoothed Bootstrap Efficiency Scores				
	Mean	**Std. Dev.**	**Minimum**	**Maximum**
Technical Efficiency	0.47	0.38	0.001	1.00
Scale Efficiency	0.39	0.32	0.013	1.00
Note: Analysis computed using the *R* software				

Table 7a: Truncated Regression Results with Institutional Ownership

Variables	Technical Efficiency (TE)		Scale Efficiency (SE)	
	Coefficient	P-Value	Coefficient	P-Value
NEXECS	-0.02***	0.00	0.08***	0.00
AUDIT	-0.04	0.19	-0.04	0.20
CEO	0.15*	0.08	0.09**	0.03
BSIZE	0.02**	0.04	0.01	0.17
OWN	0.00	0.94	-0.00	0.46
SHARB	-0.00	0.78	0.03***	0.00
LOC	0.16***	0.00	-0.20***	0.00
AGE	0.00***	0.00	0.00	0.16
ORG	-0.18***	0.00	0.36***	0.00
INSTOWN	-0.00	0.36	0.00***	0.00
INF	0.01***	0.00	-0.01***	0.00
LSIZE	0.01**	0.04	0.03**	0.04
GDP	0.02***	0.00	0.02***	0.00
WGI	0.01*	0.08	0.01	0.50
CEO*BSIZE	-0.03***	0.01		
NEXECS*BSIZE			-0.01***	0.00

Notes: Regression carried out using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**

Table 7b: Truncated Regression Results excluding Institutional Ownership

Variables	Technical Efficiency		Scale Efficiency	
	Coefficient	P-Value	Coefficient	P-Value
NEXECS	-0.02***	0.00	0.09***	0.00
AUDIT	-0.04	0.15	-0.03	0.47
CEO	0.15*	0.09	0.08*	0.08
BSIZE	0.02	0.11	0.01	0.21
OWN	0.00	0.55	0.00**	0.03
SHARB	-0.00	0.77	0.03***	0.00
LOC	0.16***	0.00	-0.23***	0.00
AGE	0.00***	0.00	0.00	0.50
ORG	-0.19***	0.00	0.38***	0.00
INF	0.01***	0.00	-0.01***	0.00
LSIZE	0.01	0.43	0.02*	0.10
GDP	0.02*	0.10	0.02***	0.00
WGI	0.01*	0.09	0.01*	0.08
CBS	-0.03***	0.01		
NBS			-0.01***	0.00

Notes: Regression carried out using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**

Table 8a: Regression including Institutional Ownership, controlling for International Country Risk Guide				
Variables	**Technical Efficiency**		**Scale Efficiency**	
	Coefficient	*P-Value*	*Coefficient*	*P-Value*
NEXECS	-0.01**	0.05	0.08***	0.00
AUDIT	-0.02	0.49	-0.04	0.25
CEO	0.23***	0.01	0.09**	0.04
BSIZE	0.02**	0.03	0.01	0.16
OWN	0.01	0.31	-0.00	0.50
SHARB	-0.00	0.50	0.03***	0.00
LOC	0.01	0.907	-0.23***	0.00
AGE	0.01***	0.00	0.00	0.21
ORG	-0.20***	0.00	0.36***	0.00
INSTOWN	-0.00*	0.09	0.00***	0.00
INF	0.01***	0.00	0.01***	0.00
LSIZE	0.01	0.46	0.03**	0.05
GDP	0.03**	0.02	0.02***	0.00
INSQ	0.04***	0.00	0.01	0.18
CBS	-0.04***	0.00		
NBS			-0.01***	0.00
Notes: Regression undertaken using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**				

Table 8b: Regression Excluding Institutional Ownership, controlling for International Country Risk Guide				
Variables:	**Technical Efficiency**		**Scale Efficiency**	
	Coefficient	*P-Value*	*Coefficient*	*P-Value*
NEXECS	-0.02**	0.03	0.09***	0.00
AUDIT	-0.03	0.36	-0.03	0.47
CEO	0.22***	0.01	0.08*	0.08
BSIZE	0.02**	0.03	0.01	0.21
OWN	-0.00	0.94	0.00**	0.03
SHARB	-0.01	0.43	0.03***	0.00
LOC	0.01	0.86	-0.23***	0.00
AGE	0.00***	0.00	0.00	0.49
ORG	-0.20***	0.00	0.38***	0.00
INF	0.01***	0.00	-0.01***	0.00
LSIZE	0.01	0.37	0.02*	0.10
GDP	0.03**	0.02	0.02***	0.00
INSQ	0.03***	0.00	0.01*	0.08
CBS	-0.04***	0.00		
NBS			-0.01***	0.00
Notes: Regression undertaken using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**				

APPENDIX A

Final Sample distributions for the Whole Sample Period

Countries	***Observations***	***Number of Firms***	***Percentage***
Algeria	7	1	0.75
Bahrain	27	4	2.99
Bangladesh	9	1	0.75
Brunei	16	3	2.25
Egypt	29	7	5.25
Indonesia	57	13	9.75
Iran	43	9	6.75
Jordan	18	3	2.25
Kuwait	58	11	8.25
Malaysia	49	10	7.5
Palestine	5	1	0.75
Pakistan	29	5	3.75
Qatar	34	7	5.25
Saudi Arabia	120	27	20.25
Senegal	3	1	0.75
Sri Lanka	10	1	0.75
Sudan	106	15	11.25
Syria	7	2	1.5
Tunisia	11	2	1.5
U.A.E	38	9	6.75
Yemen	13	2	1.5
Total	689	134	100

Notes: The sample comprises of 134 Takaful firms (689 observations) operating across 21 countries between 2002 and 2013.

APPENDIX B

MENA Regression Analyses with ICRG Variable

Variables	*TE*		*SE*	
	Coefficient	P-Value	Coefficient	P-Value
NEXECS	-0.02***	0.00	-0.00	0.78
AUDIT	0.02	0.66	-0.07	0.14
CEO	-0.08**	0.02	0.10**	0.02
BSIZE	-0.00	0.48	-0.03***	0.00
OWN	-0.00	0.67	0.00	0.83
SHARB	-0.01	0.46	0.09***	0.00
LOC	0.14***	0.00	-0.07	0.27
AGE	0.00***	0.00	0.00**	0.02
ORG	-0.56***	0.00	0.26**	0.30
INSTOWN	-0.00*	0.07	0.00***	0.00
INF	0.01***	0.00	-0.01***	0.00
LSIZE	0.02*	0.07	0.02	0.22
GDP	0.01**	0.05	0.02**	0.02
INSQ	0.04***	0.00	0.02***	0.01
CBS	-0.08***	0.01		
NBS			-0.07**	0.05

Notes: Regression performed using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**

APPENDIX B

MENA Regression Analyses with WGI

Variables	*Technical Efficiency (TE)*		*Scale Efficiency (SE)*	
	Coefficient	P-Value	Coefficient	P-Value
NEXECS	-0.03***	0.00	0.01	0.43
AUDIT	0.05	0.23	-0.10**	0.04
CEO	-0.09**	0.03	0.12***	0.01
BSIZE	-0.00	0.61	0.03***	0.00
OWN	-0.00	0.12	0.00	0.99
SHARB	-0.00	0.64	0.09***	0.00
LOC	0.06	0.24	-0.01	0.85
AGE	0.00***	0.00	0.00***	0.01
ORG	-0.43***	0.00	0.31***	0.01
INSTOWN	-0.00	0.74	0.00***	0.00
INF	0.02***	0.00	-0.01***	0.00
LSIZE	0.03***	0.01	0.02	0.13
GDP	0.03***	0.00	0.01	0.20
WGI	0.01*	0.10	0.02*	0.10
CBS	-0.08**	0.06		
NBS			-0.13*	0.09

Notes: Regression carried out using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**

APPENDIX B

South East Asia Regression Analyses with WGI

Variables	***Technical Efficiency (TE)***		***Scale Efficiency (SE)***	
	Coefficient	P-Value	Coefficient	P-Value
NEXECS	0.01	0.60	-0.02*	0.09
AUDIT	-0.11	0.13	0.10**	0.04
CEO	0.33***	0.01	0.12	0.11
BSIZE	-0.01	0.37	-0.01	0.43
OWN	0.00	0.97	-0.00	0.72
SHARB	-0.02	0.24	0.02*	0.08
LOC	0.13*	0.07	-0.16***	0.00
AGE	0.01*	0.09	0.00	0.84
ORG	0.01	0.91	-0.03	0.53
INSTOWN	-0.00	0.59	0.00	0.14
INF	-0.01	0.28	-0.01	0.19
LSIZE	0.01	0.70	-0.01	0.73
GDP	0.01	0.40	0.00	0.61
WGI	-0.03*	0.09	0.07***	0.00
CBS	-0.16***	0.01		
NBS			-0.05***	0.01

Notes: Regression performed using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**

APPENDIX B

South East Asia Regression Analyses with ICRG Variable

Variables	Technical Efficiency (TE)		Scale Efficiency (SE)	
	Coefficient	P-Value	Coefficient	P-Value
NEXECS	0.00	0.81	-0.01	0.23
AUDIT	-0.09	0.18	0.15***	0.00
CEO	0.28**	0.02	0.12	0.15
BSIZE	-0.01	0.41	-0.11	0.12
OWN	0.00	0.82	-0.00	0.71
SHARB	-0.01	0.74	0.03***	0.00
LOC	0.24***	0.00	-0.18***	0.00
AGE	0.01**	0.02	0.00	0.36
ORG	0.04	0.61	-0.02	0.78
INSTOWN	-0.00	0.50	0.00**	0.04
INF	-0.01	0.16	-0.02***	0.00
LSIZE	0.02	0.37	0.00	0.86
GDP	0.04***	0.01	0.01	0.25
INSQ	-0.05***	0.00	0.00	0.77
CBS	-0.18**	0.03		
NBS			-0.08***	0.04

Notes: Regression performed using Truncated Regression**.** ***, ** and * demonstrate statistical significance at the 1%, 5%, and 10% levels respectively**.**