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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Corporate governance mechanisms and efficiency of insurance firms: evidence from an emerging market

Samuel Nduati Kariuki¹*

Abstract: The paper assessed linkage amongst governance mechanisms and efficiency of insurers in Kenya over 8 year period from 2013 to 2020. The study estimated the efficiency of insurers using DEA approach in light of previous literature during the first stage. During the second stage, the bias-corrected efficiency scores were regressed against corporate governance (CG) proxies and control variables using SW (2007) approach on a sample of 53 insurers. Using this two-stage, bootstrapping SW approach, the study documents that the Kenyan insurers are technically inefficient. Overall, the paper presents evidence showing that CG variables influence technical efficiency of insurers in Kenya. Precisely, board independence, gender diversity and audit quality positively and significantly impact Kenyan insurers' technical efficiency. Further, the paper finds that size of the board negatively affect Kenyan insurers' technical efficiency. However, the study established insignificant relationship between CEO duality, intensity of board activities and



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Samuel Nduati Kariuki is a Senior Lecturer and Chairman of the Department of Business Studies, University of Embu. He holds a Ph.D. in Business Administration (Finance) from Jomo Kenyatta University of Agriculture and Technology. His research interests focus on corporate governance, financial risk management, investment and portfolio management, earnings management, financial innovations, strategic management accounting and corporate finance and has published research articles in reputable journals in these and other related areas.

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The financial health of an economy is hinged on insurers' performance. However, globalization has resulted in a more fluid and competitive business environment and insurers therefore, need to conduct their activities efficiently. Owners of insurance entities, thus, safeguard their interests by controlling the actions of the management through corporate governance (CG). This study contributes to the emerging debate on the CG-efficiency nexus which is critical for insurers to evolve strategies needed to respond to the global challenges such as everchanging regulatory environment, solvency risks and stiff competition. The findings indicated that the Kenyan insurers are technically inefficient, using more inputs to produce outputs. The paper also shows that CG variables influence insurers' technical efficiency. These outcomes are important for regulators, academia, insurers, policy makers, practitioners, shareholders and consumers of insurance products by raising their awareness on the level of efficiency and how it is influenced by CG proxies.





© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent. technical efficiency. The paper makes contribution to the bourgeoning reservoir of empirical works on the insurers' CG-efficiency nexus from an emerging market perspective. Particularly, the article offers empirical insights on some of the least studied CG proxies such as gender diversity, quality of audit and intensity of board activities. The research outcomes also have practical implications for regulators, academia, insurers, government policy makers, practitioners, shareholders and consumers of insurance products by raising their awareness on the influence of CG proxies on the efficiency of the insurers. This is especially beneficial in countries that are pursuing CG and efficiency policy reforms.

Subjects: Economics; Finance; Business, Management and Accounting

Keywords: Efficiency; corporate governance; gender diversity; data envelopment analysis; insurance; Kenya

1. Introduction

Owners of corporate entities safeguard their interests by controlling the actions of the management and other corporate insiders through institutionalization of corporate governance (CG) mechanisms. Pacini et al. (2008) emphasize prominence of the corporate Board of Directors (BOD) in exercising organizational power by the shareholders. As a result, CG has attracted major interest from academics in the area of finance, practitioners as well as policy makers as they seek to understand why some firms outperform others (Wang et al., 2007). In the same vein, ElKelish and Zervopoulos (2021) observe that numerous global corporate failures that have occurred recently has generated debate on effectiveness of CG mechanisms. Some scholars (such as Conyon et al., 2011; Kirkpatrick, 2009) attribute major recent financial crises to the collapse of CG systems thus eliciting research interests in this area (Alhassan & Boakye, 2020).

Insurance industry is a vital sector in the advancement of a country's economy (Grmanová & Strunz, 2017). Indeed, the financial health of the overall economy is hinged on insurers' performance. Therefore, insurers should aim at maximizing their value and performance as recommended by Fatma and Chouaibi (2021). As a result, the measurement of insurance firms performance is a fundamental agenda in business research. However, previous studies such as Chen et al. (2015) have criticized the emphasis of earlier studies on financial-oriented measures of performance since they ignore competitive advantage of a firm which is infused in its efficiency in converting inputs into useful outputs. Further, globalization has resulted in a more fluid and competitive business environment and insurers, therefore, need to conduct their activities efficiently. This observation has recently triggered emergence of research studies focusing on the various factors impinging on efficiency of insurance businesses during the past decade.

Efficiency is the capacity of the insurance companies to optimize production from a given level of technology (Ofori-Boateng et al., 2022). Further, M. M. Jaloudi (2019) affirms the importance of distinguishing between efficient and inefficient insurance firms with the view of improving profit-ability and competition in the industry thereby enhancing the policyholders' trust in insurers. As such, scholars have recently developed special interest in evaluating importance of CG structures in promoting performance of corporate entities through estimation of technical efficiency which is a different way of measuring firm performance that is related to the production process (Bozec & Dia, 2007; Lin et al., 2009). Nonetheless, majority of these efficiency- CG-oriented studies are contextualized in developed countries with a small proportion of the studies focusing on African financial markets (Arora & Sharma, 2016). The outcomes from the developed markets cannot be used to make inferences about emerging markets mostly owing to the existing variations in CG structures and cultures (Ntim, 2015). This research article aims to grow geographically the empirical insights on the nexus between CG mechanisms and technical efficiency studies for insurance

firms. This is in tandem with the call for country-specific research on governance structures by Kang et al. (2007) and consequent observation by Ntim (2015) that in spite of this call, the literature focusing on CG from emerging economies remains scarce.

Globally, the insurance sector endures many challenges ranging from an ever-changing regulatory environment, solvency risks to stiff competition (Lee et al., 2019). Particularly, the Kenyan insurance regulator reported persistent decline in insurance penetration from 2.43% in 2018 to 2.34% in 2019 to 2.17% in 2020 against the world average insurance penetration rate of 7.4% in 2020. Additionally, motor vehicle insurers in Kenya announced 50% increment in their motor insurance tariffs from January 2022 to cushion them from obstinate losses due to fraud and price undercutting. Further, Michira et al. (2021) using the discriminative Z-score formula, illustrated that the number of financially distressed non-life insurance companies grew from 48% in 2017 to 52% in 2018. Generally, these observations are indicators of inefficacies in the Kenyan insurance industry.

In order to evolve strategies needed by the insurers to respond to the aforementioned challenges, it is imperative to understand the CG mechanisms-efficiency nexus of the insurance companies with view of safeguarding against corporate failures and eliminating inefficiencies such as delays in claim settlement. In contrast, Alhassan et al. (2021) decry the dearth of empirical support on governance mechanisms and corporate outcomes (such as efficiency) in the insurance segment from emerging economies perspective, particularly in Africa. Subsequent to this line of study, the current article seeks to evaluate the influence of the Kenyan CG mechanisms on technical efficiency of insurers. Generally, efficiency-related studies on insurance companies in Kenya and Africa at large appear to be scanty.

This research article makes contribution to the extant empirical evidence in numerous ways. First, it analyzes the efficiency of insurers which is a significant contribution to the growth of empirical work on efficiency of insurance firms, which is still at infancy phase, from the Kenyan context, an emerging financial market. The concept of efficiency in the insurance firms is currently of ultimate prominence as a result of the global challenges facing the insurance segment such as competition, low insurance penetration rates, financial impropriety among others. Secondly, the research makes contribution to the mushrooming debate on the CG structures-efficiency nexus from emerging market perspective. Specifically, analysis of the CG and insurance efficiency following the ongoing reforms in CG regulatory framework in Kenyan insurance sector since 2012 forms a stimulating background for efficiency analysis in Africa. Thirdly, the study forms an invaluable source of reference to investors, practitioners and policy makers especially when developing policy guidelines for the insurance sector and in formulating appropriate strategies such as mergers and acquisitions to enhance insurance industry efficiency. Finally, the article makes contribution to the effort of unravelling the unsolved puzzle on how CG relates to firm efficiency by providing evidence from previously neglected and unique financial industry through unlisted insurance firms in contrast to a plethora of earlier papers, which have focused on publicly listed firms and banks.

The remaining part of this article is systematized into theoretical literature in part 2, review of empirical literature and development of hypotheses in part 3 and methodology is presented in part 4. Afterwards, empirical findings and discussions are provided in part 5, and summary and conclusion are presented lastly in part 6 of the paper.

2. Theoretical literature review

This paper is anchored on agency, stewardship and resource dependence theories.

2.1. Agency theory

Agency conflicts between the owners who are the principals and those in control of operations of insurance firms arise from incongruence of the two parties' interests such as the tendency of the corporate insiders to undertake favourable suboptimal investment decisions and grow their span

of control (John & Senbet, 1998; Mintzberg, 1984). This delegation of authority by principals to the agents results in agency problems such as monitoring costs and information asymmetry which adversely affects efficiency (Wijethilake et al., 2015). Owing to this conflict, Meckling (1976) emphasizes that the principals need to appoint a BOD to oversee decisions by the management team and their actions with the view of safeguarding their interests, which refers to CG mechanisms (Ali et al., 2021).

High-quality CG mechanism is a key channel for improving managerial efficiency (Alhassan & Biekpe, 2016). By and large, governance mechanisms through the board features for example regular meetings, configuration of audit committees, board size and independence of the board represent key CG attributes to reduce agency problems through checking the disposition of managerial supremacy in the functional areas of a business and thus improve performance of the firms (Hassoun & Aloui, 2017). Nonetheless, CG in insurance firms is unique from non-financial businesses majorly as a result of their size and other complexities such as a broad and wide array of stakeholders. Although agency theory clarifies the linkages between CG mechanisms and the performance of a business (Ramadan & Hassan, 2021), ElKelish and Zervopoulos (2021) critique agency theory propositions for not being comprehensive and therefore agency theory does not explain some of the observed CG practices such as the of BOD composition and CEO duality. As a result, other theories for example the resource dependence theory (Hung, 1998) and theory of stewardship (Donaldson & Davis, 1991) have been developed to further illuminate the debate on CG mechanisms.

2.2. Stewardship theory

Theory of stewardship views directors of a firm as superintendents whose activities are congruent to the goals of the principals. As stewards, the directors focus on the attainment of the insurance firms' goals rather than on nurturing their personal interests (Kiptoo et al., 2021). The theory, therefore, sees directors as being devoted to the insurance business and captivated in accomplishing great efficiency in pursuit of their intrinsic desire of excellent performance. Scholars such as Donaldson and Davis (1991); ElKelish and Zervopoulos (2021) posit that in stewardship theory, shareholders' goals predominantly motivate corporate executives to improve performance through cultivation of mutual trust, loyalty and empowerment in contrast to the self-utility maximization interests observed in the theory of agency. Further, supporters of theory of steward-ship suggest that CEO duality as a leadership structure augments firms' unity and efficiency (Wang et al., 2007). This argument is incongruent with the theory of agency proposition against and chief executive officer duality to discourage power abuse. Further, some prior empirical evidence supports this proposition and recommends inclusion of executive directors in the governance structure of corporate entities (Mashayekhi & Bazaz, 2008; Pamburai et al., 2015). Nonetheless, the optimal level of executive directors (degree of director independence) is still an empirical question.

2.3. Resource dependency theory

This theoretical model illuminates the significance corporate executives' play in connecting the firm with the needed outside resources. The survival and continuity of a firm, therefore, depend on its linkage with the external business environment with the view of accessing external resources (Pfeffer, 1987). Proponents of this theory focus on nomination of independent representatives of other entities as a way pathway for accessing critical inputs for the success of the firm such as competencies, information and linkage to strategic partners such as consumers, policy makers, dealers and gaining acceptability of the larger community.

Empirical evidence from (Alhassan et al., 2021) indicate that the ability of a firm to maximize skills and social capital of its board enhances its performance. Consequently, a firm can improve its values and reputation through formation of a diverse board with varying CG characteristics thus providing access to the exterior business setting and essential interest groups for example corporate experts, support experts and community influencers (Wellalage & Locke, 2013). The existing previous empirical literature notably by Ujunwa (2012); Assenga et al. (2018); Ramadan and

Hassan (2021) illustrate that resource dependency theory (RDT) endorse large boards, large number of autonomous directors, diversity in gender and enhanced BOD activities through frequent meetings as a channel for creating beneficial business linkages with the outside business environment.

3. Review of empirical literature and development of hypotheses

3.1. Board size

One of the major CG pointers, which is vital in monitoring and control of the executive power, is the magnitude of the board (Lee et al., 2019). Hsu and Petchsakulwong (2010) argue that individual members of the BOD provide important organizational resources and create a multiplicity of capabilities necessary in execution of their duties. Some scholars contend that larger boards exhibit superior performance by utilizing varied expertise and capabilities available on BOD to establish superior linkages to the exterior business environments. This is crucial in acquisition of requisite inputs and enhancement of the quality of debate during meetings to enlighten corporate policy selections (Goodstein et al., 1994), and put in place robust mechanisms to monitor actions of the insiders to eliminate corporate fraud and inefficiencies (Kader et al., 2014). For instance, Dalton et al. (1999) demonstrate CG may be improved through reduction of CEO dominion by increasing the size of the board.

The previous empirical evidence supports resource-based theory view for larger boards as a tool for attracting members with diverse capabilities, expertise and building superior linkages to enhance BoD effectiveness (Hardwick et al., 2011; Hillman et al., 2011; Yeung, 2018). Similarly, Abdullah et al. (2016) using agency theory support larger boards arguing that it has better control on management which ultimately maximizes the firm value. The proponents of the theory of agency have presented empirical evidence supporting growth in performance of a firm arising from increase in the magnitude of the board and verse versa (Gerged & Agwili, 2020; Kiharo & Kariuki, 2018; Mishra & Kapil, 2018; Noja et al., 2021; Weterings & Swagerman, 2012).

In contrast, larger boards may suffer from the free-rider problem (M. C. Jensen, 1993) as well as experience difficulties in building consensus, which hinders ease of coordination resulting in inefficiency of insurers (Hassan & Halbouni, 2013; Hsu & Petchsakulwong, 2010). This line of thought advocates for small board sizes than large ones in order to improve directors effective-ness. For instance, Zabri et al. (2016) contend it is easier to coordinate and communicate with members of a smaller board thus improving its efficiency and value of the firm. Therefore, advocates of small boards have supported through empirical evidence an inverse association of the magnitude of the board and its performance (H. Khan et al., 2017; Obradovich & Gill, 2013; Salem et al., 2019).

Extant empirical literature is still inconclusive on direction of the linkage among magnitude of the board and efficiency of the business. The RBT supports bigger boards due to the latent advantage of attracting members with varied experiences, enriched monitoring capacity and creation of extensive linkages resulting in effective decision making by the board Hillman et al. (2011); Yeung (2018). In contrast, M. C. Jensen (1993) affirms that the effectiveness of the corporate boards diminishes as the size increases due to ensuing coordination challenges. The reviewed empirical literature suggests that CG and efficiency are related positively. From the foregoing literature review, the ensuing hypothesis is tested.

H1: Size of the board and efficiency of insurance firms are positively related.

3.2. Board independence

The magnitude of independence of BOD is estimated from the percentage of autonomous directors against non-autonomous directors on the corporate board (García-Sánchez, 2010; Kweh et al.,

2021). Generally, a board with more outsiders than insiders is viewed to be more independent (John & Senbet, 1998). In India, Garg (2007) underscored that board independence of about 50–60% results in maximum impact on performance of the company. As such, formation of boards with non-executive members, who have improved qualifications and competence, is an appropriate CG mechanism to mitigate against possible goals incongruence between principals and the agents (Arora & Sharma, 2016). Similarly, Kader et al. (2014) affirm the importance of including experienced outsiders on boards to complement insiders on dynamic business issues and maximization of efficiency to safeguard the contractual interests in firms.

In a study of 744 Chinese manufacturing firms, Su and He (2012) present empirical evidence indicating that the level of board independence increases firm efficiency. Correspondingly, Wang et al. (2007) presented evidence for positive impact of BOD's independence on efficiency for property-liability insurers but no significant impact on efficiency for life insurers in Taiwan. Recently, Kweh et al. (2021) illuminate this debate by illustrating a cubic S association between the level of directors' independence and intellectual capital efficiency among Taiwanese semiconductor firms. Other empirical works (Kader et al., 2014; Lee et al., 2019) observe an inverse connection among insider directors and efficiency of insurers. Yet, Karbhari et al. (2018) report mixed results while García-Sánchez (2010) and Rashid (2018) present result showing that the efficiency does not vary with board independence. Although the extant literature on independence of the BOD and insurance efficiency is rich, the findings are mixed and inconclusive. The study, therefore, hypothesizes that:

 ${\rm H_{2}:}$ The efficiency of the insurance companies in Kenya increases with increase in board independence.

3.3. Chief executive officer duality

Duality may be viewed as a state wherever same individual works as chairman and CEO of the corporation (Alnabsha et al., 2018). García-Sánchez (2010) suggests that CEO duality compromises BOD independence when the same individual occupy two critical positions in a firm. In the same vein, Jackling and Johl (2009) blame the CEO duality for the failure of some of the US firms (e.g. WorldCom and Enron) due to ineffectiveness of the BOD. Along the same line of thought, some advocates of the agency theory claim that delinking COB and CEO positions enhances the oversight role by avoiding entrenchment of the CEO (Mahadeo et al., 2013). Similarly, supporters of RDT affirm that distinguishing the role of CEO from that COB promotes acceptance of the firm in its business environment as well as enhancing involvement and contribution of the key stakeholders in the process of making corporate decisions (Alnabsha et al., 2018). Yet, agency theory inclined researchers claim that duality may induce information asymmetry between the CEO the other board members with inadequate insider information of the firm (Ujunwa, 2012). In contrast, stewardship theorists endorse CEO duality as a means of enhancing firm efficiency (Pamburai et al., 2015).

Extant literature on CEO duality and performance of the firm presents mixed findings. A number of studies document insignificant effects (Alnabsha et al., 2018; Arora & Sharma, 2016). Others established that performance of the company is increased by CEO duality (Lin 2005; Kiel & Nicholson, 2003). Conversely, others supported agency theory assertion of a negative linear relationship (Assenga et al., 2018; Bozec & Dia, 2007; Hassan & Halbouni, 2013). Specifically, the prior empirical findings on CEO duality and efficiency nexus are also ambiguous. Some studies have found negative impact such as Wang et al. (2007), others find no clear significant effects (García-Sánchez, 2010; Su & He, 2012) while others such as Kader et al. (2014) present mixed results. Therefore, the study tests the hypothesis:

H₃: The efficiency of the insurance companies in Kenya decreases with increase in CEO duality.

3.4. Gender diversity

In the last few years, championing gender parity and representation of female on boards of corporate entities have gradually become the central plank of governance debate in numerous countries (Pande & Ford, 2009). Although gender diversity is viewed as vital cog on the CG debate, Sanan (2016) decries the limited number of studies in this domain. Additionally, Mahadeo et al. (2013) and Abdullah et al. (2016) generally contend that there are a few or no female board members in spite of the aforementioned extensive efforts to grow female's presence on corporate boards especially in emerging economies. Yet, Low et al. (2015) indicate that in countries with strong cultural resistance, pushing for the nomination of women on boards may result in diminishing performance. Theoretically, both resource dependence and agency theories support positive linkage between women on board and performance (Nguyen et al., 2020). From resource dependence theory standpoint, women on board offer an array of resources to the firm, particularly they are diligent, frequently participate in board meetings, they are focused on organizational goals, and they provide varied experiences and view-points which augment policymaking process on the board (R. B. Adams & Ferreira, 2009). Additionally, some agency theorists particularly Yasser (2012) view gender diversity as a foundation of competitive edge which enriches the monitoring capacity of the BOD.

The outcomes of multiple researches on women on board and efficiency and/or performance document a positive relationship (García-Sánchez, 2010; Ntim & Soobaroyen, 2013; Ramadan & Hassan, 2021). Conversely, other scholars confirm that increase in numerical value of gender diversity decreases performance of the firm (Ahern & Dittmar, 2012; Anh & Khanh, 2017; R. B. Adams & Ferreira, 2009). Yet, others such as (2018) showed that inclusion of female members on BOD has no effect on corporate output. Consequently, the next hypothesis is developed on the foundation of theoretical perspectives and the Kenyan Constitution, 2010 despite the prior empirical evidence being inconclusive:

H₄: Efficiency of the insurance companies in Kenya increases with increase in gender diversity.

3.5. Intensity of board activity

CG scholars have recently focused the spotlight on board activities to understand the effectiveness of boards' operations (Ansong, 2015). García-Sánchez (2010) affirms the prominence of holding regular business board meetings as a communication avenue between corporate insiders and the directors on a broad spectrum of business issues. Pacini et al. (2008) assert that firms where members of the BOD hold frequent and regular meetings generally exhibit better performance. Several scholars present empirical evidence showing that performance increases with regular board meetings (Arora & Sharma, 2016; Lin et al., 2009; Ntim & Osei, 2011; Ramadan & Hassan, 2021). However, Vafeas (1999) documents that frequency of meetings negatively influence performance, whereas another strand of literature documents insignificant relation (Ansong, 2015; Arosa et al., 2012). From the foregoing arguments, there have been inconclusive results from studies on board meetings—efficiency nexus. Additionally, there are minimal studies focusing on emerging markets in this domain of interest. Therefore, the study tests the hypothesis:

H₅: Efficiency of the insurance firms in Kenya increases with increase in the intensity of board activity.

3.6. Audit quality

This an essential governance mechanism which is aimed at minimizing information asymmetry as proposed by agency theory (A. W. Khan et al., 2019). It is an important tool of controlling internal process of making decisions and providing assurance about operational effectiveness to the owners through flow of quality information between the agents and the principals (Arcay & Vázquez, 2005). Existing literature demonstrates that quality of audit can be proxied

by audit of the business financial reports being conducted by any of the four global big auditors (KPMG; PricewaterhouseCoopers; EY and Deloitte). Generally, any business which is audited by any of the four audit partners is more efficient due to their capacity in controlling managerial opportunistic activities (Aljifri & Moustafa, 2007). Empirical evidence indicate mixed results where some studies (El Mir & Seboui, 2008; Jusoh & Ahmad, 2013) established that audit quality positively impacted performance of the business, whereas others (Hassan & Halbouni, 2013) documented that linkage was not significant. Therefore, the study tests the hypothesis:

H₆: Efficiency of the insurance firms in Kenya increases with quality of audit.

4. Methodology

The paper sought to analyze how efficiency of insurance entities in Kenya is influenced by CG mechanisms using two-stage bootstrapping Simar and Wilson (SW) DEA methodology. The research collected data from a panel of 53 insurance firms with complete data and were certified by Insurance Regulatory Authority (IRA) to operate in Kenya. The data were extracted from audited financial statements for 8 years duration (2013–2020) and the industry annual reports published by the Kenyan Insurance Regulatory Authority.

4.1. Stage 1: Estimation of insurance firms' efficiency

Estimation of efficiency of insurers focuses on the identification of the decision-making units (DMUs) with the best conversion of inputs into outputs to act as the model for the inefficient DMUs (Alhassan & Biekpe, 2015). From extant literature, two methodologies specifically DEA (non-parametric) and SFA (parametric) have prominently featured for estimation of efficiency (Cummins et al., 1999; Eling & Jia, 2019). This study employs DEA since previous literature proposes that DEA efficiency scores are more superior to other frontier approaches for efficiency estimation among insurers (Eling & Jia, 2019; M. M. Jaloudi, 2019). DEA efficiency scores vary from 0 and 1 where 1 signifies the greatest efficiency and 0 inefficient firm. Thus, any efficiency score below 1 indicates inefficiency with the the difference between a DMU efficiency score and 1 representing the firm's potential for efficiency improvement.

The input-output variables employed in this paper for estimation of efficiency are as indicated in Table 1. These variables were identified following previous empirical works in DEA efficiency measurement by Lee et al. (2019); Diacon et al. (2002); M. Jaloudi and Bakir (2019).

4.2. Operationalization of study variables and measurement

The paper employed six governance variables and seven control variables as indicated in Table 2.

4.3. Stage 2 analysis: econometric model

During stage two, the study uses the six CG proxies as predictor variables and the bias-corrected DEA efficiency scores generated in stage 1 as the response variable to estimate the following econometric equation:

$$\mathsf{BCTE}_{m,t} = \beta_0 + \sum_{k=1}^n \beta_k \mathsf{CG}_{k,m,t} + \sum_{k=1}^n \beta_k X_{k,m,t} + \varepsilon_{m,t}$$

where BCTE denotes the bias-corrected insurer's m DEA efficiency scores in year t, $CG_{k.m,t}$ CG variables, $X_{k.m,t}$ are control variables which are insurance firm-specific and macro-economicoriented and $\varepsilon_{m,t}$ represents estimation error with double truncation. Table 2 presents a summary of study variable measurements.

The DEA calculated TE scores are generally bounded between 0 and 1, suggesting that they are truncated (Ali et al., 2021). Accordingly, Lin et al. (2009) indicate that the extant literature on use

Table 1. Efficiency analysis in	puts and outputs variables	
Variable	Symbol	Measure
Input variables		
Labour and business services	LBS	This is proxied as management expenses and commissions paid.
Capital from debt	CD	This is proxied using total liabilities.
Owners capital	OC	This is the end of the period overall equity capital.
Output variables		
Net earned premiums	NEP	The difference between written premiums and the direct costs related to the insurance policies.
Income from investments	INC	Earnings from financial instruments.

of DEA efficiency scores as a dependent variable reveal that Tobit model is commonly employed since OLS regression is not appropriate on truncated observations. Nonetheless, debate on statistical shortcomings of the DEA in generating biased efficiency scores has dominated previous literature. For instance, Simar and Wilson (2007) critique invalidate the use of Tobit model in two-stage studies due to serial correlation among the estimated DEA efficiency scores. Instead, SW endorse a heteroskedastic and bias-corrected truncated two-stage, bootstrap regression approach which allows valid conclusions and has turned into a workhorse of DEA analysis in diverse areas of economics (Badunenko & Tauchmann, 2019). This paper, therefore, adopts the two-stage bootstrapping SW DEA regression analysis as also seen in other similar previous works by Alhassan and Boakye (2020); García-Sánchez (2010); Hsu and Petchsakulwong (2010); Karbhari et al., (2018); Lin et al. (2009); and Su and He (2012).

5. Empirical findings and discussions

The descriptive results on efficiency analysis, independent variables, control variables and models' statistical analyses results are provided in the subsequent sections.

5.1. Descriptive statistics

The average technical efficiency (TE) was 34.8% with a standard deviation of 24.29%, pure technical efficiency (PTE) was 45.42% with a standard deviation of 24.36% and scale efficiency (SE) was 76.41% with a standard deviation of 29.12% as presented in Table 3. Average technical efficiency was volatile during study period, fluctuating between 38.99% in 2013 and the lowest figure of 30.02% in 2015, to highest level of 42.14% in 2016, dropped to low figure of 30.84% in 2018 and remained below the average TE at 32.31% in 2020. The summary descriptive statistics on average technical efficiency of 34.8% among insurers in Kenya over the 8 years period from 2013 to 2020 show that the Kenyan insurance firms are technically inefficient as compared to TE of 60.87% for insurers in GCC countries (Al-amri et al., 2012), for Jordanian insurance companies TE was greater than 80% for all the 8 years period (M. M. Jaloudi, 2019), while in South Africa, TE was 52% as shown by Alhassan and Biekpe (2015). Table 4 summarizes the data set which was used in estimation of efficiency scores.

The highest PTE was 53.44% in 2016 while the lowest was 39.56% in 2018. However, scale efficiency was relatively stable during the period of study with lowest figure of 71.5% in 2015 and the highest SE as 79.41% in 2019. The technical inefficiency among insurance firms in Kenya could, therefore, be attributed to technical inefficiencies where on average the insurers used more inputs than needed to generate outputs. Consequently, insurers in Kenya have a big room to improve their efficiency through decreased use of inputs to maximize outputs. This empirical observation

Table 2. Description of indicate	ors of the study	
Indicator	Symbol	Measure
Dependent Variables		
Bias Corrected Technical efficiency	BCTE	Bias modified Technical efficiency DEA scores obtained through Simar and Wilson (2007) procedure
Independent variables		
Size of the board	BS	Overall numerical quantity of the board membership
Board independence	BI	Numerical fraction of autonomous to full membership of the board
Chief Executive Officer Duality	CEOD	This is "1" when the COB also doubles as the CEO, or else "0"
Gender diversity	GD	Overall numerical quantity of females divided by full board membership
Intensity of Board Activity	IBA	Total annual meetings held by the full board
Audit quality	AQ	This is "1" when the insurer's auditor is any of the "4" large global audit firms, and else "0"
Control variables		
Age of the firm	FG	Numeric value representing years from the incorporation of the insurer
Firm size	FS	Numeric value expressing total assets of the insurer as natural logarithm
Leverage of the firm	LEV	Numeric value expressing liabilities as a portion of all assets of the firm
Reinsurance	REIN	This is "1" for firms offering reinsurance services and 0 elsewhere
Life	LIF	This is "1" for life insurance firms only and 0 elsewhere
Macroeconomic control variables		
GDP	GDP	Numeric value expressing Annual growth rate of GDP
Inflation	INF	Numeric value expressing changes in consumer price index annually

Table 3. Sum	nmary of inpu	ts and output	s data sets			
Variable	Average	Median	Min	Max	Std. Dev.	Obs
Inputs (KES.)						
Labour and business services	941,467	652,691	2,169	5,882,697	967,988	424
Debt capital	7,365,388	2,921,548	48,877	90,000,000	13,900,000	424
Total Equity capital	2,389,602	1,351,721	23,463	27,400,000	3,412,889	424
Outputs (KES.)						
Net earned premiums	2,091,381	1,141,775	0.00	17,500,000	2,561,622	424
Investments income	165,361	1,816	0.00	3,714,939	349,566	424

Table 4. Average Keny	able 4. Average Kenyan insurer efficiency for the the period 2013–2020					
Year	Average TE,%	Average PTE, %	Average SE, %			
2013	38.99	51.81	75.06			
2014	39.24	52.04	76.14			
2015	30.02	44.36	71.50			
2016	42.14	53.44	77.42			
2017	31.18	40.13	75.86			
2018	30.84	39.56	76.71			
2019	33.68	41.62	79.41			
2020	32.31	40.40	79.20			
Average	34.80	45.42	76.41			
Std. Dev.	24.29	24.36	29.12			
Min	0.01	3.16	0.03			
Max	100	100	100			

Pure technical efficiency is represented by PTE; Technical efficiency is represented by TE; Scale efficiency is represented by SE

resonates with the results of life insurers empirical work conducted by Alhassan and Boakye (2020) in South Africa (BC-TE = 21.155, BC-PTE = 47.77 % and BC-SE = 47.45 %).

Table 5 and Appendix II present average efficiencies for each insurance company in Kenya during the period 2013–2020. The table shows that DMU 1 had the highest average TE of 79.87% with the lowest TE of 62.57% in 2020 and highest TE of 100% in 2017. A total of four firms had TE greater than 60%, nine (9) DMUs had TE between 50% and 60%, nine (9) DMUs TE between 40% and 50%, and 26 firms TE below the average efficiency of 34.80%. The DMU 8 had the lowest TE of 6.93% with SE of 14.38%. The DMU 8 is both technically and scale inefficient and would therefore benefit by cutting cost of inputs as well as restructuring its scale of production. It is apparent that none of the insurance firms in Kenya was consistently 100% efficient during the whole period under study. Therefore, the insurance companies in Kenya can minimize the level of inputs to improve on their technical efficiency. Further, the average SE of 76.41% confirms that Kenyan insurers do not operate at an optimum size that is they may either be too small or too large. Hence, the firms that are too large would require to improve their efficiency through right sizing to reduce the decreasing economies of scale while the firms which are too small would leverage on acquisitions and mergers to improve their scale of production.

Summary descriptive results for the study are as revealed in Table 6. From the findings, the smallest board membership was 5 and the largest board had 12 members with an average of 8. This indicates that insurers adheres to the IRA guidelines which stipulate that boards in insurance would have at least five members. Independence of the board was between 0.25 and 1 with a mean of 0.795. This affirms compliance with the insurers' code of CG requirement that 0.3 of the directors at minimum should be independent. In terms of gender diversity, on average, 0.184 members of the board were women which fell short of providing women with equal leadership opportunities as underscored by the Constitution of Kenya, 2010. The intensity of board activity was between 2 and 22 annual meetings with an average of 4.625 meetings. Descriptive results on audit quality indicated that on average, 0.868 of the insurance entities were audited by the prominent and reputable four global audit firms which are expected to demonstrate independence as suggested by the CG guidelines. The proportion of firms with CEO duality was 0.002 showing adherence to CG guidelines recommendation against Chief Executive Officer Duality.

Table 5. Av	verage effici	ency scores	per insurer	for the stud	ly duration	2013–2020	
DMU	Average TE,%	Average PTE,%	Average SE,%	DMU	Average TE,%	Average PTE,%	Average SE,%
DMU 1	79.87	81.76	97.48	DMU 28	30.51	38.57	79.20
DMU 2	40.75	43.74	92.13	DMU 29	37.65	44.54	89.95
DMU 3	60.97	62.55	98.27	DMU 30	18.19	18.87	95.33
DMU 4	51.86	74.08	70.45	DMU 31	24.91	26.46	92.63
DMU 5	8.73	23.77	37.63	DMU 32	40.81	42.50	92.06
DMU 6	54.18	55.98	96.90	DMU 33	52.44	55.84	92.65
DMU 7	22.91	23.13	99.13	DMU 34	20.32	53.29	37.30
DMU 8	6.93	54.96	14.38	DMU 35	39.10	63.69	60.57
DMU 9	54.34	72.06	80.62	DMU 36	29.37	31.19	69.89
DMU 10	18.14	19.58	88.01	DMU 37	9.67	11.19	78.14
DMU 11	46.89	51.93	89.49	DMU 38	50.81	54.32	90.40
DMU 12	23.98	58.14	24.35	DMU 39	35.09	37.28	85.39
DMU 13	25.31	35.62	64.69	DMU 40	55.40	55.64	99.53
DMU 14	34.08	63.61	52.16	DMU 41	9.47	45.00	18.57
DMU 15	69.80	70.86	98.28	DMU 42	45.45	48.83	92.41
DMU 16	45.81	50.00	91.84	DMU 43	16.14	17.64	91.19
DMU 17	55.81	61.07	83.95	DMU 44	28.70	35.23	81.49
DMU 18	56.56	58.43	96.36	DMU 45	24.53	29.98	82.67
DMU 19	44.76	46.09	96.63	DMU 46	13.87	33.69	42.54
DMU 20	44.76	46.09	96.63	DMU 47	36.36	47.11	74.84
DMU 21	29.61	31.33	94.54	DMU 48	61.91	63.82	94.69
DMU 22	11.10	60.80	21.19	DMU 49	19.78	24.64	74.13
DMU 23	35.63	38.99	89.15	DMU 50	15.46	52.50	22.76
DMU 24	16.51	66.77	22.15	DMU 51	22.14	25.71	80.72
DMU 25	44.70	49.13	93.15	DMU 52	45.57	58.92	81.17
DMU 26	54.94	64.77	85.17	DMU 53	12.20	15.66	77.00
DMU 27	9.67	9.89	97.83	Average	34.80	45.42	76.41

DMU denotes decision-making unit, Pure technical efficiency is represented by PTE; Technical efficiency is represented by TE; Scale efficiency is represented by SE

5.2. Correlation analysis

The findings of the correlation analysis among predictor and control variables are presented on Appendix I. The correlation matrix indicates low correlation coefficients among the variables ruling out any potential multicollinearity among the predictor and control variables since all the coefficients had a value lower than the recommended maximum of 0.8 by Gujarati and Porter (2008).

5.3. Findings of the regression analysis and discussions

The summary findings after running regression model in STATA are depicted in Table 7. Further, the first model (1) estimates the regression results for CG and insurers efficiency without including control variables as seen in Alhassan and Boakye (2020). Second model (2), on the other hand, estimates the regression results for CG and insurers efficiency while including firm-specific and macroeconomic control variables. As presented in Table 7, both models are statistically significant in demonstrating the connection between CG mechanisms and insurance businesses technical efficiency in Kenya.

Table 6. Summary of inde	pendent and control	variables data sets				
Variable	Average	Median	Minimum	Maximum	Std. Dev.	Obs
Corporate Governance proxies	2					
Board size	8.125	8	5	12	1.838	424
Board independence	0.795	0.857	0.250	1	0.161	424
Chief Executive Officer Duality	0.002	0	0	1	0.049	424
Gender diversity	0.184	0.167	0	0.5	0.122	424
Intensity of Board Activity	4.625	4	2	22	2.154	424
Audit Quality	0.868	1	0	1	0.339	424
Firm specific control variables	5					
Firm age	39.406	35	2	100	26.08	424
Firm size	15.359	15.303	12.387	18.454	1.174	424
Leverage	0.659	0.639	0.172	0.979	0.174	424
Life	0.415	0	0	1	0.493	424
Reinsurance	0.1132	0	0	1	0.317	424
Macroeconomic control variat	oles					
GDP growth	4.013	4.6	-0.3	5.6	1.740	424
Inflation	6.112	6	4.7	ø	0.988	424

First, the paper reports that board size (BS) and technical efficiency are negatively linked which was significant at 10%. The study findings imply that bigger corporate boards are inefficient in management of insurance firms and therefore smaller boards would be preferred. This empirical finding is inconsistent with the recommendation for large boards by proponents RBT and theory of agency which are linked to higher efficiency as a result of diversity in skills, know-how, networking potential and linkage to outside input resources (Kiharo & Kariuki, 2018; Waheed & Malik, 2019). However, the research finding buttresses M. C. Jensen (1993) observation that bigger boards may experience the free-rider problem and may suffer difficulties in building consensus thus adversely affecting insurers' efficiency. Similar negative findings were reported by 2007), Alhassan and Boakye (2020). The study thus supports Zabri et al. (2016) argument for lean boards to enhance communication and coordination of members of the board to realize business efficiency.

Second, the paper documents that independence of the board and efficiency are significantly positively related at 10%. The positive relationship is similar to empirical findings by Su and He (2012); García-Sánchez (2010); and 2021). The observation is in agreement with both RBT and agency theory. Consistent with agency theory, higher independence of the board enhances monitoring capability which discourages insiders' from pursuing personal benefits instead of principals' interests (M. Jensen & Meckling, 1976). Also, in agreement with RBT, directors independence is vital in creating beneficial linkages with the external environment (Assenga et al., 2018; Ujunwa, 2012) and provision of requisite professional mix necessary for enhancing efficiency.

Regarding the connection among CEO Duality and insurers' efficiency, the study finds negligible negative relationship. This finding suggests that the double responsibility of CEO as the manager and the chair of the board insignificantly impact efficiency of the insurance firms in Kenya. Therefore hypothesis 3 is disallowed. The conclusions are inconsistent with preceding empirical outcomes which found negative impact (Lin et al., 2009; Wang et al., 2007) in concurrence with the agency theorists. Similarly, the findings contradict resource-dependence theorists' recommendation that separation of the CEO and COB responsibilities might promote acceptance of the firm in its business environment as well as enhancing contribution of the key stakeholders in its decision-making process (Alnabsha et al., 2018). Interestingly, the findings are in agreement with other empirical works which found no clear significant effects such as Su and He (2012) and García-Sánchez (2010).

The study results further indicate that diversity in gender and efficiency of insurers are related positively at 5%. Hypothesis 4 is therefore accepted. The results support previous studies of Ramadan and Hassan (2021); García-Sánchez (2010); and Ntim and Soobaroyen (2013) which also document similar results. However, this study contradicts previous works from some scholars who provide evidence that proportion of female in BOD is negatively connected to the performance such as R. B. Adams and Ferreira (2009); Anh and Khanh (2017). Theoretically, the empirical evidence affirms both RBT and agency theory endorsement to increase women representation on boards as also confirmed by Nguyen et al. (2020). In support of RBT, women on board offer an array of resources to the firm, particularly they are diligent, frequently participate in board meetings, they are focused on organizational goals, and they provide varied experiences and viewpoints which augment policymaking process on the board (R. B. Adams & Ferreira, 2009). From the agency theory perspective, females on board play pivotal role in enriching monitoring capability of the BOD (Gull et al., 2018; Yasser, 2012).

The intensity of board activity was found to positively but insignificantly influence efficiency of insurers in Kenya. The hypothesis 5 is rejected although, the study had correctly predicted a rise in efficiency as a result of increased board activities. This evidence is congruent to previous studies from Ansong (2015) and Arosa et al. (2012) who documented similar results. The findings however, diverges from empirical evidence which supports increase in business performance when intensity of board activity increases and vice versa on the (Arora & Sharma, 2016; Ntim & Soobaroyen, 2013; Ramadan &

			Simar &	Wilson analysis2	007) eff.			
Model		Coeff	f. for			CO	eff.	
Regressors	Model 1	Std. Er	z	P> z	Model 2	Std. Er	z	P> z
B ₀	-0.0280	0.0573	-0.49	0.625	0.0576	0.1325	0.43	0.664
BS	0.0100**	0.0048	2.08	0.038	-0.0097*	0.0059	-1.66	0.096
BI	0.1108**	0.0387	2.06	0.040	0.1026*	0.0599	1.71	0.087
CEOD	-0.0820	0.1609	-0.51	0.610	-0.1599	0.1855	-0.86	0.388
GD	0.1490**	0.0674	2.21	0.027	0.14073**	0.0714	1.97	0.017
IBA	-0.0101**	0.0041	-2.47	0.014	-0.0043	0.0045	-0.97	0.333
AQ	0.0992***	0.0239	4.15	0.000	0.0873***	0.0265	3.29	0.001
FAGE					-0.0003	0.0003	-1.02	0.307
FSIZE					0.0192**	0.0095	2.01	0.045
LEV					-0.2221***	0.0731	-3.04	0.002
Reins					-0.1468***	0.0219	-6.71	0.000
LI					-0.0203	0.0349	-0.58	0.562
GDP					0.00239	0.0049	-0.48	0.628
INF					0.00072	0.0088	0.08	0.935
Sigma	0.1631***	0.0056	29.31	0.000	0.1727***	0.0060	28.61	0.000
Number of Observations	424				424			
Wald chi ²	35.18***				140.24***			
Prob > chi ²	0.00				0.000			
Number of Bootstrap. reps	2000				1000			
B ₀ is the constant, BS signifies age of the fir annual GDP growth ro	signifies Size, BI signifi m, FSIZE denotes Firm ite and INF denotes inf	es Independence, CEOD size, LEV signifies Leve. flation. ***, ** and * sign) signifies Chief Executi rage, LIF denotes "1" f ify significant p-values	ive Officer Duality, GD or life insurance firms for Simar and Wilson	denotes Gender diversit: only and 0 elsewhere, F (2007) Bootstrapped tr	y, IBA denotes Intensity KEIN denotes 1 for rein uncated regression at (y of Board Activity, AQ surance companies an 0.01, 0.05 and 0.1, cor	is Audit quality, FAGE d 0 elsewhere, GDP is respondingly.

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Table 7. Two-stage bootstrapping simar and Wilson DEA regression analysis results

Censored Tobit r	egression							
Model		Сое	ff.			Coe	ff.	
Regressors	Model	SE	t	P> t	Model	SE	t	P> t
Bo	0.1081	0.0696	1.55	0.121	0.3006*	0.1727	1.74	0.083
BS	0.0031	0.0133	0.23	0.818	-0.0053	0.0122	-0.43	0.666
BI	0.0169	0.0112	1.50	0.134	0.0111	0.0106	1.05	0.293
CEOD	-0.1615	0.2469	-0.65	0.513	-0.2579	0.2213	-1.17	0.245
GD	0.17314*	8660.0	1.74	0.083	0.1250	0.0898	1.39	0.165
IBA	-0.0079	0.0059	-1.32	0.186	-0.0035	0.0056	-0.61	0.540
AQ	0.12879***	0.0545	3.63	0.00	0.1166***	0.0321	3.63	0.000
FAGE					-0.0004	0.0004	-0.86	0.388
FSIZE					-0.0069	0.0118	-0.59	0.559
LEV					0.1442	0.0908	1.59	0.113
Reins					0.1292***	0.0423	3.05	0.002
					-0.2375***	0.0269	-8.8	0.000
GDP					0.0005	0.0061	0.07	0.941
INF					0.0031	0.0107	0.29	0.775
Variance	0.0583	0.0041			0.0458	0.0032		
Number of Observations	424				424			
Log likelihood	-16.591				32.338			
LR chi ²	23.75				121.61			

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(Continued)

Censored Tobit r	egression							
Model		Co	eff.			Co	eff.	
Regressors	Model	SE	t	P> t	Model	SE	Ļ	P> t
Prob > chi ²	0.0006				0.0000			
Pseudo R ²	0.4172				2.1360			
B ₀ is the constant, B: signifies age of the fi annual GDP growth r	signifies Size, BI signifi irm, FSIZE denotes Firm ate and INF denotes in	ies Independence, CEOL size, LEV signifies Leve flation. ***, ** and * sig	<i>3 signifies Chief Executi</i> rage, LIF denotes "1" f nify significant p-value:	ve Officer Duality, GD (or life insurance firms s for the Censored Tob	denotes Gender diversity, only and 0 elsewhere, RE it regression at 0.01, 0.05	IBA denotes Intensit IN denotes 1 for rein 5 and 0.1, correspond	ty of Board Activity, AQ surance companies an dingly.	is Audit quality, F d 0 elsewhere, G

Table 8. (Continued)

/ of Board Activity, AQ is Audit quality, FAGE	surance companies and 0 elsewhere, GDP is	ingly.
ty, IBA denotes Intensity	REIN denotes 1 for rein	.05 and 0.1, correspona
denotes Gender diversit	only and 0 elsewhere,	bit regression at 0.01, 0
) signifies Chief Executive Officer Duality, GD (rage, LIF denotes "1" for life insurance firms	nify significant p-values for the Censored Tob
es Independence, CEOI	size, LEV signifies Leve	fation. ***, ** and * sig
signifies Size, BI signifi	m, FSIZE denotes Firm	tte and INF denotes in
o is the constant, BS	ignifies age of the fir.	nnual GDP growth ra

Model	-	Coe	ff.			Cot	eff.	
Regressors	Model 1	Std. Error	z	P>z	Model 2	Std. Error	Z	P>z
Bo	0.0357**	0.202	-2.28	0.023	-0.0268	0.249	-0.11	0.914
BS	0.0357***	0.013	2.65	0.008	0.0027	600.0	0.28	0.778
BI	0.1742	0.149	1.17	0.243	0.0873	0.098	0.88	0.376
CEOD	-0.6621	0.845	-0.78	0.433	-0.5739	0.496	-1.16	0.248
GD	0.3064*	0.185	1.66	0.098	0.1417	0.121	1.18	0.24
IBA	-0.0238*	0.013	-1.86	0.063	-0.010	0.008	-1.24	0.214
AQ	0.32493***	0.086	3.76	0.000	0.2319***	0.052	4.46	0.000
FAGE					-0.0006	0.001	-1.08	0.28
FSIZE					0.0121	0.016	0.74	0.458
LEV					-0.0308	0.125	-0.25	0.806
Reins					0.1151**	0.054	2.10	0.036
п					-0.3771***	0.045	-8.29	0.000
GDP					0.0005	0.008	0.06	0.954
INF					0.0008	0.014	0.06	0.954
Sigma	0.3035	0.026	11.84	0.000	0.2257***	0.013	16.83	0.000
Number of Observations	413				413			
Wald chi ²	21.29				106.56			
Log likelihood	106.026				178.355			
Prob > chi ²	0.0016				0.0000			
B ₀ is the constant, BS signifies and of the fi	signifies Size, BI signifi im ESIZE denotes Eirm	ies Independence, CEOD	signifies Chief Execut.	ive Officer Duality, GD	denotes Gender diversit	y, IBA denotes Intensit	y of Board Activity, AQ	is Audit quality, FAGE

annual GDP growth rate and INF denotes inflation. ***, ** and * signify significant p-values for the truncated regression at 0.01, 0.05 and 0.1, correspondingly.

Table 9. DEA truncated regression results

Hassan, 2021; Wijethilake et al., 2015). Further, the study findings contradicts agency theory prediction of direct linkage between business performance and numerical number of full board regular meetings.

Finally, on the audit quality (AQ), the paper finds evidence that AQ and efficiency are significantly positively related. This inference confirms that the AQ enhances efficiency since the board of directors are cautious that credible independent auditors are expected to notice doubtful accounting practices. This supports previous empirical debate that businesses which are audited by credible global auditors are more efficient due to their capacity in controlling managerial opportunistic activities (Aljifri & Moustafa, 2007). These findings are aligned to the results of prior scholars such as Jusoh and Ahmad (2013) who also reported similar findings. The study further supports agency theory and the IRA CG guidelines recommendation for shareholders to appoint independent auditors in order to eliminate information asymmetry with the directors.

On control variables, each of the variables has a different association with efficiency of insurance in Kenya. Insurer size (FS) had a significant positive association with technical efficiency of insurance at 5% significance. This implies that big insurance companies are possibly more efficient due to economies of scale in their operation. Both leverage ratio and reinsurance dummy had a negative as well as significant impact on technical efficiency of Kenyan insurers at 1%. This is an indication that high leveraged insurers are technically inefficient. This suggests that inefficient firms are unable to generate adequate profits and therefore results in high debt levels to shore up their operations. Also, reinsurance firms are less efficient compared to non-reinsurers in Kenya. Finally, firm age, whether a firm offers solely life insurance or not, GDP growth rate and inflation rate all had insignificant effect on technical efficiency.

5.4. Robustness analysis

To further confirm the robustness of the Simar and Wilson (2007) bootstrapping method regression results reported in the preceding part, censored Tobit regression and truncated regression are also used as presented in Tables 8 and 9.

Censored Tobit regression analysis output in Table 8 and truncated regression analysis output in Table 9 for robustness check indicates that both models 1 and 2 results remained significant as previously reported in Simar and Wilson (2007) bootstrapping technique. Additionally, almost all the variables retained their coefficient signs although a few were not significant as previously reported. The robustness check using censored Tobit regression and truncated regression analysis therefore, confirms that the regression analysis results were robust and reliable for making study conclusions and recommendations.

6. Conclusion, recommendations and policy implications

The paper assessed linkage amongst CG mechanisms and efficiency of insurers in Kenya over 8 year's period from 2013 to 2020 using two-stage DEA bootstrapped methodology. The DEA efficiency scores indicated that the mean technical efficiency for insurers in Kenya was 34.8%. This is an indication that Kenyan insurers are technically inefficient, using more inputs to produce outputs than necessary and would, therefore, benefit from cutting cost of inputs as well as restructuring their scale of production to achieve economies of scale. The inferential exploration indicated that technical efficiency and size of the board were inversely related while board independence, gender diversity and audit guality has significant positive effect on insurers' technical efficiency. However, CEO duality and intensity of board activities were determined to have insignificant negative association with technical efficiency. Therefore, large boards are not efficiency enhancing as expected from the agency theory due to the free-rider problem. The findings support increased board independence through inclusion of diverse external non-executive directors to improve efficiency of insurers without exceeding the optimal board size. Further, board diversity through increased ratio of women on the board was observed to enhance efficiency as envisaged in the Kenyan constitutional requirement of at least 30% gender inclusion in all appointments. The study findings also imply that improved quality of audit through engagement of the large four audit firms enhances efficiency since the board of directors are cautious that high-quality independent auditors would pinpoint dubious inefficient operations.

First, the study recommends that regulatory authorities and policy makers should develop strategies and policies for eliminating the observed technical inefficiencies. The implication is that a bigger proportion of the technical inefficiency amongst the insurers may be as result of extraneous causes outside their control. These causes necessitate immediate and radical policy intervention to turn around this critical yet ailing insurance industry. For instance they should encourage small insurers to implement mergers and acquisitions aimed at attaining the optimum firm size to benefit from economies of scale. Second, the study results show that large boards are detrimental to the technical efficiency of the insurer. Therefore, it is critical to establish the optimal size of the board that would areatly improve the insurers' efficiency and ensure strict adherence to the implementation of governance guidelines on size of the board. Third, the study results observed men dominated boards despite the positive impact of gender diversity on efficiency. Thus, strict guidelines should be implemented to ensure inclusion of higher proportions of women on board to realize the benefits of gender diversity in enhancing efficiency. Finally, the study strengthening of quality of audits among insurers through engagement of qualified and independent audit firms such as Big four as well as put in place strong audit committee to oversee audit work.

The study makes contribution to the bourgeoning reservoir of empirical evidence on insurance firms' efficiency from an emerging market perspective. Additionally, the article gives insights on the role of CG mechanisms on the insurers' efficiency from an emerging market. This paper also makes contribution to the scanty empirical evidence on CG mechanisms among insurers in East Africa region and pioneers in focusing on efficiency and CG mechanisms. Particularly, it offers empirical insights on some of the least studied CG proxies such as gender diversity, quality of audit and intensity of board activities. The research outcomes also have practical implications for regulators, academia, insurers, government policy makers, practitioners, shareholders and consumers of insurance products by raising their awareness on the influence of CG proxies on the efficiency of the insurers. This is especially beneficial in countries which are pursuing CG and efficiency policy reforms.

6.1. Suggestion for future research

The study was grounded on data from local insurers in Kenya which is an emerging economy and therefore to validate the findings, similar cross-country studies are recommended in other emerging economies. Further, future studies could extend the scope of CG variables by including professional diversity, audit committee, CEO demographics (age, tenure etc.) and ownership structures among others.

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Variable	1	2.		4.	5.	6.	7.	ø	9.	10.	11.	12.	13.
1. Board size	1												
2. Board independence	0.3171***												
	0.0000												
3. CEO Duality	-0.0033	-0.1646***	1										
	0.9458	0.0007											
4. Gender diversity	-0.0201	-0.1784***	-0.0237	1									
	0.6793	0.0002	0.6261										
5. Intensity of Board Activity	0.3696***	0.1125**	-0.0141	0.1362***	1								
	0.0000	0.0205	0.7719	0.0050									
6. Audit quality	-0.1328***	-0.0923*	0.0190	-0.0171	-0.1716***	1							
	0.0062	0.0577	0.6970	0.7260	0.0004								
7. Firm age	-0.1253***	0.0687	-0.0026	0.0648	-0.0006	0.0628	1						
	0.0098	0.1578	0.9570	0.1829	0.9907	0.1972							
8. Firm size	0.3393***	0.3226***	-0.0040	-0.0212	0.3019***	0.0528	0.1829***						
	0.0000	0.0000	0.9352	0.6637	0.0000	0.2779	0.0002						
9. Leverage	-0.1893***	0.0736	-0.0193	-0.0977**	-0.0668	0.1102**	0.0985**	0.3700***	1				
	0.0001	0.1302	0.6916	0.0444	0.1699	0.0233	0.0426	0.0000					
								-			-	(Conti	(peric

Appendix I: Correlation matrix

(continued)													
Variable	1.	2.	З.	4.	5.	6.	7.	8.	.6	10.	11.	12.	13.
10. Reinsurance	0.2677***	0.1399***	-0.0174	0.1331***	0.2975***	0.2124***	0.0993**	-0.0782	-0.4390***	1			
	0.0000	0.0039	0.7213	0.0061	0.0000	0.0000	0.041	0.1079	0.0000				
11. Life	-0.1460***	-0.0376	-0.0410	-0.0010	0.0667	-0.0672	0.2162***	0.0785	0.4579***	0.0616	1		
	0.0026	0.4396	0.4002	0.9834	0.1702	0.1671	0.0000	0.1063	0.0000	0.2058			
12. GDP growth	-0.0159	0.0022	-0.1206**	-0.0124	-0.0059	0.0156	-0.0377	-0.0664	-0.0343	-0.0000	0.0000	-	
	0.7446	0.9644	0.0129	0.7987	0.9040	0.7483	0.4390	0.1721	0.4811	1.0000	1.0000		
13. Inflation	-0.0559	-0.0100	-0.0351	-0.0338	-0.0971**	0.0148	-0.0343	-0.0563	0.0591	-0.0000	-0.0000	0.0735	7
	0.2503	0.8378	0.4709	0.4874	0.0457	0.7608	0.4814	0.2477	0.2243	1.0000	1.0000	0.1307	
Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$	-												

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DMU	2013	2014	2015	2016	2017	2018	2019	2020	Average
DMU 1	0.6532463	0.8488488	0.890245	0.819138	1	0.912048	0.639999	0.625745	0.7987
DMU 15	0.5607185	0.5586465	0.827896	0.629082	0.610014	0.583513	0.814242		0.6980
DMU 48	0.7159528	0.2027685	0.519987	0.907655	0.612899	0.591753	0.633687	0.767945	0.6191
DMU 3	0.572563	0.8896908	0.448411	0.474779	0.594556	0.752175	0.580669	0.564642	0.6097
DMU 18	0.5527272	1	0.641801	0.437793	0.418147	0.424526	0.514234	0.535668	0.5656
DMU 17	0.506915	0.7152258	0.009981	1	0.776171	0.497234	0.427356	0.532269	0.5581
DMU 40	0.7794297	0.488709	0.418506	0.85124	0.410597	0.461635	0.456076	0.565469	0.5540
DMU 26	0.5467454	0.5198122	0.525961	0.592055	0.589058	0.478018	0.634438	0.508904	0.5494
DMU 9	0.5552332	0.6414202	0.583218	0.403504	0.479682	0.591213	0.611165	0.481694	0.5434
DMU 6	0.3779729	0.4909954	0.525322	1	0.437637	0.447899	0.454847	0.599977	0.5418
DMU 33	0.475511	0.3423104	0.405744	0.630386	0.596491	0.452444	L	0.292012	0.5244
DMU 4	0.505293	0.5548653	0.501434	0.561503	0.493381	0.49331	0.590902	0.448062	0.5186
DMU 38	0.4437215	0.350466	0.119247	0.571878	0.625542	0.637699	0.696934	0.619303	0.5081
DMU 11	0.3413199	0.3670703	0.551213	0.795896	0.424166	0.366784	0.447898	0.457166	0.4689
DMU 16	0.5161744	0.4790587	0.331878	0.577587	0.460277	0.476787	0.407488	0.415532	0.4581
DMU 52	0.5899663	0.6517007	0.486462	0.466369	0.322646	0.403993	0.351338	0.372864	0.4557
DMU 42	0.497037	0.691202	0.349561	0.577253	0.395678	0.386125	0.359493	0.379391	0.4545
DMU 19	0.5647537	0.6596339	0.517569	0.418079	0.459033	0.408581	0.193924	0.358923	0.4476
DMU 20	0.5647537	0.6596339	0.517569	0.418079	0.459033	0.408581	0.193924	0.358923	0.4476
DMU 25	0.6143516	0.5720592	0.500101	0.804712	0.276884	0.276126	0.274667	0.256703	0.4470
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DMU	2013	2014	2015	2016	2017	2018	2019	2020	Average
DMU 32	1	1	0.174338	0.117459	0.207472	0.215992	0.253509	0.296022	0.4081
DMU 2	0.434193	0.4543733	0.399353	0.366834	0.787222	0.301399	0.247137	0.269868	0.4075
DMU 35	0.2159398	0.2373691	0.235756	0.961894	0.322639	0.249507	0.576502	0.328427	0.3910
DMU 29	0.3743459	0.3868172	0.369424	0.545883	0.41305	0.341914	0.309023	0.271717	0.3765
DMU 47	0.2806347	0.2941358	0.277953	0.814054	0.235726	0.301583	0.421034	0.283838	0.3636
DMU 23	0.2181614	0.2143744	0.210999	0.394577	0.417855	0.44981	0.465936	0.478888	0.3563
DMU 39	1	0.0170136	0.349448	0.310405	0.173101	0.209492	0.273718	0.47435	0.3509
DMU 14	0.2420007	0.4292161	0.316268	0.235345	0.246998	0.270799	0.311789	0.674158	0.3408
DMU 28	0.2664563	0.2934934	0.291303	0.319464	0.294291	0.317817	0.332077	0.325625	0.3051
DMU 21	0.2956797	0.2530053	0.254443	0.635509	0.235459	0.270547	0.203583	0.220516	0.2961
DMU 36	0.0201981	0.1122476	0.010348	4	0.136792	0.058202	7	0.012105	0.2937
DMU 44	0.2534811	0.3084275	0.302082	0.286795	0.246882	0.266066	0.329724	0.302434	0.2870
DMU 13	0.7609064	0.1513543	0.167924	0.218788	0.161014	0.132628	0.138113	0.293916	0.2531
DMU 31	0.4950213	0.2785673	0.215708	0.313606	0.191281	0.172471	0.175175	0.150952	0.2491
DMU 45	0.3307551	0.4330782	0.185696	0.169063	0.171751	0.149957	0.257128	0.264729	0.2453
DMU 12	0.9832216	0.9127744	0.005743	0.003237	0.002794	0.001414	0.001633	0.007591	0.2398
DMU 7	0.2115448	0.1510641	0.280883	0.218685	0.224805	0.268101	0.23356	0.244477	0.2291
DMU 51	0.1341065	0.5178856	0.329774	0.293442	0.147968	0.101399	0.123582	0.123358	0.2214
DMU 34	0.475511	0.5389937	0.039543	0.075641	0.131729	0.059726	0.137533	0.166975	0.2032
DMU 49	0.216379	0.2304088	0.219179	0.228447	0.191971	0.005956	0.233902	0.255943	0.1978
DMU 30	0.2236387	0.0681346	0.168167	0.229053	0.208224	0.227213	0.17203	0.158616	0.1819
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DMU	2013	2014	2015	2016	2017	2018	2019	2020	Average
DMU 10	0.0567645	0.4012391	0.107526	0.42667	0.101944	0.109493	0.125449	0.121788	0.1814
DMU 24	0.1676833	0.1502054	0.104526	0.670529	0.048211	0.091444	0.044678	0.043445	0.1651
DMU 43	0.2731294	0.1075933	0.145307	0.124529	0.167232	0.153108	0.142166	0.178485	0.1614
DMU 50	0.0250321	0.1382218	0.309649	0.010562	0.010226	0.682204	0.041278	0.019446	0.1546
DMU 46	0.0891629	0.0013139	0.109338	0.095085	0.063663	0.288273	0.196286	0.266632	0.1387
DMU 53	0.2411163	0.1538947	0.103679	0.082796	0.092389	0.102232	0.127349	0.072226	0.1220
DMU 22	0.0113914	0.275671	0.020656	0.030147	0.000337	0.000148	0.259367	0.289998	0.1110
DMU 27	0.1278417	0.0579179	0.123358	0.079794	0.094784	0.092011	0.102186	0.096023	0.0967
DMU 37	0.0154954	0.0618916	0.250906	0.042687	0.037921	0.12764	0.120736	0.11625	0.0967
DMU 41	0.2014099	0.3238505	0.074777	0.017303	0.010519	0.059603	0.000105	0.070199	0.0947
DMU 5	0.0648488	0.1497298	0.065702	0.071522	0.065398	0.081058	0.098234	0.101634	0.0873
DMU 8	0.023468	0.0082812	0.01752	0.010049	0.240938	0.134501	0.115075	0.004654	0.0693
Average,%	0.3899	0.3924	0.3002	0.4214	0.3118	0.3084	0.3368	0.3231	0.3480