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Enterprise risk management, corporate governance and insurers risk-taking behaviour in South Africa: evidence from a linear and threshold analysis

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Abstract

Purpose – This study examines the linear and non-linear effects of enterprise risk management (ERM) and corporate governance (CG) on insurers' risk-taking behaviour.

Design/methodology/approach – The study employed panel data of 63 insurers from South Africa over the period 2015 and 2019. The study used the generalised method of moments (GMM) to determine the direct relationship, while the dynamic panel threshold technique was utilised to discover whether there is non-linearity in the relationship and the threshold level at which ERM and CG stimulate insurance risk-taking.

Findings – The result from the GMM elicits a positive relationship between ERM and risk-taking, implying that insurers with a robust ERM system are more likely to pursue higher risks. The empirical evidence also suggests that board size and board independence improve insurers' risk-taking. Contrarily, gender diversity shows an inverse relationship with risk-taking. The dynamic panel threshold regression confirms non-linearities between ERM, CG and risk-taking. The empirical evidence indicates a U-shaped relationship between ERM and risk-taking, implying that a robust ERM system increases insurers' risk-taking and vice-versa. Further, board size and independence reveal an inverted U-shaped relationship, suggesting that larger boards and a higher proportion of independent directors exhibit lower risk-taking. However, gender diversity presents a negative relationship, demonstrating a strong impact at higher threshold levels. This tells that the presence of females on the board reduces insurers' risk-taking preferences.

Practical implications – Due to the risk-bearing nature of the insurance business, it is required that they ensure a robust ERM system for prudent risk-taking decisions. This demands strict adherence to ERM principles and allocating sufficient resources for effective implementation. Also, there is a need for strong CG structures that pay more attention to diversity when selecting board members due to their influence in ensuring improved risk-taking choices.

Originality/value – This study contributes to the existing literature by providing insights into the under-researched role of ERM and CG in insurers' risk-taking behaviour. The study further extends the literature by providing evidence on the non-linearity and threshold levels at which ERM and CG influence insurers' risk-taking choices. The findings are unique and contribute to the growing body of literature documenting the need for strong ERM and CG systems in insurance companies.

Keywords Corporate governance, Enterprise risk management, Insurance, Risk-taking

Paper type Research paper

1. Introduction

Risk-taking is very critical to the success of every organisation. Without the willingness to take risks, very little is anticipated in return (Stulz, 2022). Although organisations seek to minimise risks, firms cannot succeed if they do not take ex-ante profitable risks (Stulz, 2016). In light of this, scholars argue that businesses that embrace risk-taking are more likely to explore new products, ideas, and markets and become more competitive. As a result, Sobel and Reding (2004) highlight that some risks should be exploited for the opportunities they present, while others must be minimised because of their threats. Given this, several regulatory developments on corporate governance (CG) and enterprise risk management

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(ERM) have been introduced to ensure prudent risk-taking decisions. This has also provoked different schools of thought on how these factors promote firm risk-taking decisions. The essence of implementing ERM is to ensure that firms are proactive and have adequate resources to manage and control their risk in a holistic manner (Horvey and Odei-Mensah, 2023). Nonetheless, it remains in doubt whether the implementation of ERM influences firms to take more, less or no change in their risk. Given the significance of ERM, some may assume its robustness is related to high risk-taking. However, the complexity of ERM implementation demands that this relationship is empirically tested to determine whether ERM increases or reduces risk-taking choices. Arguments from the literature assert that even though ERM supports firms in managing their risk activities within an acceptable risk appetite level, there are certain situations where risk management fails to ensure that firms take the right amount of risk (Stulz, 2008). Among these are the detailed rules and principles which sometimes limit firms from taking up certain risky projects that may enhance firm value (Stulz, 2014). This includes the risk-based supervision framework, which determines the level of risk a firm can accept based on its risk portfolio. Smith and Stulz (1985) also highlight that firms with a strong risk management system may take on higher risks, while firms with a weak risk management system may take on lower risks. In contrast, Ellul and Yerramilli (2013) posit that firms with a robust risk management system may pursue lower risks because their risk culture dictates their risk-raking preferences regardless of the strength of the risk management system. These differing perspectives obscure the true impact of risk management system on risk-taking, necessitating empirical investigation.

Further, the board of directors of every institution is regarded as the cornerstone of an effective internal governance system (Beasley *et al.*, 2021; Ahmed and Uddin, 2022). The board's responsibility is to monitor, evaluate, and regulate policies and set the tone for firms' risk-taking culture. This ensures that firms' risk-taking decisions are consistent with the firm's risk appetite levels. Despite the board's role in promoting sound CG practices, there is also a significant effect on how CG failures or success affect their risk-taking decisions (Srivastav and Hagendorff, 2016). Laeven and Levine (2009) posit that the power of the board and the potential conflicts between the board and managers affect their risk-taking decisions. Also, the board of directors may lack the time, experience and necessary information required for effective risk-taking. The risk management agency theory further highlights the predisposition of owners and managers in their risk-taking preferences. Owners prefer higher risk for higher returns. Therefore, shareholders' view of risk management does not mean lower risk-taking, which reduces firm value because firms sometimes undertake higher risks to increase shareholders' value. In contrast, managers, in most cases, have the appetite for lower risk-taking to maintain their reputation and jobs (Ballester *et al.*, 2020). In this situation, management decisions could be costly for shareholders, especially when taking lower risks means avoiding valuable investment, affecting shareholders' value (Aebi *et al.*, 2012).

Based on the foregoing, this study contributes to the literature by examining the effect of CG and ERM on insurers' risk-taking in South Africa. While assertions on the impact of CG on bank risk-taking have been well documented in the literature (Su and Lee, 2013; Berger *et al.*, 2014; Mathew *et al.*, 2016; Dong *et al.*, 2017; Pradhan *et al.*, 2019; Ballester *et al.*, 2020), empirical investigation designed to validate the conceptual development of this relationship from an insurance perspective is sparse (Eling and Marek, 2014; Elamer *et al.*, 2018). More so, gleaning from the ERM literature, scholars over the past two decades have focused on three different strands, which include the value and performance of ERM (Farrell and Gallagher, 2015; Silva *et al.*, 2019; Horvey and Ankamah, 2020), the determinants of ERM (Lechner and Gatzert, 2018; Bohnert *et al.*, 2019) and its implementation (Paape and Spekle, 2012; Soltanizadah *et al.*, 2014). However, evidence on how ERM affect risk-taking behaviour remains egregiously limited. This is essential, considering ERM implementation not only foresees and avoids threats but also gives firms the capacity to assess and prudently take risks when necessary. This aligns with

Stulz's (2014) argument that risk management does not imply less risk-taking but identifies the threats and opportunities that risk brings and how it affects strategic objectives. Hence, an effective ERM system is essential to maximise the benefits of risk-taking while minimising its potential downsides. However, there is a dearth of empirical studies assessing how ERM affects risk-taking behaviour, thus requiring further studies to understand this relationship, particularly from an insurance context where less attention has been given.

Further, recent literature has documented a linear relationship between CG and risk-taking decisions, revealing inconclusive results (Elamer *et al.*, 2018; Huang and Wang, 2015; Ellul and Yerramilli, 2013). For instance, some studies suggest that a higher proportion of independent directors and gender diversity on the executive board may lead to higher risk-taking because they provide diverse perspectives and are more effective in their risk management process, which encourages risk-taking (Berger *et al.*, 2014; Akbar *et al.*, 2017; Yahya *et al.*, 2022). On the contrary, other scholars find that excessive board independence and gender diversity may lead to risk aversion and lower risk-taking (Pradhan *et al.*, 2019; Jouber, 2023). This suggests that a non-linear relationship may exist. However, despite the extant literature on CG and risk-taking, studies have yet to test the non-linear effects and threshold levels at which CG is likely to influence insurers' risk-taking. By decomposing the analysis into different thresholds, the study contributes to the body of knowledge to explore whether these CG factors behave differently at different levels. Similarly, the literature on ERM suggests that an advanced level of ERM ensures its effectiveness in defining a firm's risk-taking decisions and vice versa (Florio and Leoni, 2017). This is affirmed by Horvey and Ankamah (2020), who posit that there is a certain level where ERM become excessive in affecting firm decisions. However, empirical evidence designed to validate this argument remains incipient. Given the significance of CG and ERM, many assume that this may reduce firm risk-taking. Nevertheless, the complexity of insurance firms, risk managers' attitudes, and shareholders' interests might trigger higher risk-taking preferences (Mikes and Kaplan, 2014). Thus, a threshold analysis is required to understand the influence of CG and ERM on risk-taking decisions. In light of the above, this study advances knowledge in the existing literature by deepening our understanding of the non-linearities between CG, ERM and insurers' risk-taking. This provides information to policymakers and researchers to help understand the dynamics in these relationships and the thresholds at which CG and ERM are likely to influence insurers' risk-taking. We do so by investigating the insurance industry in South Africa, which has been less explored. Considering the above premise, our methodological strategy will revolve around these two concerns – the linear and non-linear relationships between ERM, CG and risk-taking. This provides a richer analysis of the effect of ERM and CG on insurers' risk-taking than has been provided in prior literature.

The insurance industry offers an interesting setting for the study due to its unique characteristics, which warrant an independent investigation. For instance, compared to banks, the insurance industry operates in a different regulatory environment, has various business structures and complexities and deals with multiple risk profiles (Horvey and Odei-Mensah, 2024). Hence, Jouber (2023) posit that the insurance industry is a risk-taking and risk-bearing business in which policyholders pay premiums to insurers regularly in exchange for a pledge to honour future obligations on the occurrence of a loss. Therefore, the diversity of their business operations and the risks they face demand robust CG and risk management procedures. Given this, scholars assert that insurers are more likely to embrace ERM and sound CG practices than other industries due to the risk-bearing nature of their business operations (Horvey and Odei-Mensah, 2023). Also, insurers undertake two businesses simultaneously (the insurance production business and the investment business). All of these involve risk. Hence, insurers undertake activities that are likely to affect their risk-taking decisions. Given this, it is imperative to understand how CG and ERM influence insurers' risk-taking choices. Additionally, insurers are pivotal in stabilising a country's financial system

by providing their clients with insurance, risk management services, and investment opportunities (Horvey *et al.*, 2023). As a result, by ensuring sound CG and risk management practices, insurers can protect individuals and businesses against risks and strengthen the economy's resilience (Elamer *et al.*, 2018).

More so, the focus on the South African insurance industry is motivated by the fact that it has the strongest insurance industry in Africa as defined by its high penetration level (12%) and has seen several regulatory developments on risk management and CG due to its complex business activities (PwC, 2018; Horvey *et al.*, 2024). The introduction of the King III CG code in 2009 ensures compliance with CG practices, a robust risk management system, and risk-taking decisions. More so, South Africa's Solvency Assessment and Management (SAM) Framework, published in 2014, emphasises ERM implementation among insurers in its Pillar II. These regulatory reforms ensure appropriate risk management practices to manage and control their risk-taking behaviour. However, little is known about how these reforms on ERM and CG in South Africa drive insurers' risk-taking within this context. Also, South Africa has gained a significant attractiveness in the internationalisation of its insurance business, with spillover effects on other African economies (Horvey and Odei-Mensah, 2024). As a result, issues concerning the South African insurance market are frequently adopted by other African economies. Hence, there are many lessons that other African countries could draw from this context.

In this light, our study contributes to the literature in three distinct avenues. First, as far as we could ascertain, this is one of the initial studies to provide evidence of the relationship between ERM and risk-taking behaviour. By so doing, we provide a more comprehensive picture of the effectiveness of ERM and extend knowledge on how it influences the risk-taking preferences of insurance companies. Second, this study advances knowledge by exploring the non-linearities and threshold levels at which CG and ERM influence risk-taking decisions, which, to the best of our knowledge, has not been explored. We do so by recruiting the dynamic panel threshold, an estimation technique advanced by Seo *et al.* (2019), to determine the non-linearities and threshold levels at which CG and ERM influence insurers' risk-taking behaviour. This provides information to policymakers and researchers on the required levels of CG and ERM to influence risk-taking decisions. The study also offers valuable insights into ERM and CG from the perspective of developing African countries, specifically the insurance market in South Africa, as no prior research has been done on this topic in this particular context. Given that the South African insurance industry remains the dominant market in Africa, policymakers, practitioners, and researchers will be informed of the importance of ERM and sound CG practices and their influence on risk-taking. This will also incentivise investors interested in the South African insurance market due to robust risk management and CG practices. This research is worthwhile and timely given that most insurers in South Africa face financial crises amid the recent COVID-19 pandemic, and regulators are encouraging a robust risk management system for the different kinds of risks.

Presaging the main findings, evidence from the GMM analysis indicates a significant positive relationship between ERM and risk-taking, suggesting that insurers with strong ERM programs are more inclined to pursue higher risk. Additionally, the results indicate a positive influence of board size and independence on risk-taking. On the other hand, gender diversity shows an inverse relationship. The dynamic panel threshold estimation confirms non-linearities between ERM, CG and risk-taking. The empirical evidence indicates a U-shaped relationship between ERM and risk-taking, implying that a robust ERM system increases insurers' risk-taking and vice-versa. Further, board size and independence reveal an inverted U-shaped relationship, suggesting that larger boards and independent directors' ratio exhibit lower risk-taking. However, gender diversity presents a negative relationship, demonstrating a strong impact at higher threshold levels. This tells that the presence of females on the board reduces insurers' risk-taking preferences. The rest of the sections are

structured as follows. Section 2 discusses the theory and literature on ERM, CG and risk-taking decisions. The data and methodology are detailed in Section 3, followed by the interpretation and discussion of the empirical result, and Section 5 provides a conclusion and recommendations.

2. Literature review

2.1 Theoretical underpinning

Governance and risk management have become important issues in the insurance industry due to the highly volatile, uncertain, complex and ambiguous risk environment. This is believed to have a controlling role in the behaviour of managers (Elamer *et al.*, 2018). This phenomenon is explained by the risk management agency theory, which has greatly impacted managers' attitudes toward risk-taking behaviour (Smith and Stulz, 1985). This theory expounds that shareholders and managers have different interests and opportunistic behaviour, and their risk management objectives differ (Mayers and Smith, 1987). While owners may demand high risk to high return on investments, managers desire low risk and return on investment due to job security, reputation and personal wealth. More so, agency problems in the insurance industry are more likely to arise due to their excessive risk-taking. This is due to the critical function of the insurance business, which is to assume risks from policyholders (Jouber, 2023). As a result, shareholders are more likely to exert power over managers, which may result in agency conflict. Depending on the level of control, firms may be exposed to increasing levels of risk. An agency problem may result in higher risks, particularly if managers choose to take on more risk than is prudent or go against shareholder wishes when faced with the prospect of unfavourable results.

The agency theory stresses that risk management should line up the interests of shareholders and managers to increase organisational performance, as risk management helps manage and monitor managers' activities (Jensen and Meckling, 1976). Iqbal and Mirakhor (2011) add that strong risk management techniques can help firms reduce risk exposure, improve their risk-taking decisions, and enhance financial performance. Despite the importance of risk management in answering the disparities between managers and shareholders, the emergence of ERM has brought much doubt to managers' propensity for risk-taking. This is because ERM might encourage the board to take a lower or no risk or can be an incentive to go for a higher risk (Stulz, 2014). There is growing evidence that organisations do not adopt ERM solely to adhere to regulatory policies and business survival but also to manage risk decisions within their risk appetite level. As a result, implementing ERM helps an organisation monitor and control its risk to optimise its risk-taking decisions (Farrell and Gallagher, 2015).

Furthermore, agency theory explains that CG is essential in determining organisations' strategic decisions and risk-taking choices (Elamer *et al.*, 2018), especially if they have large boards, independent directors, and females (Adams and Jiang, 2016). The agency theory posits that managers are naturally risk-averse due to their reputational and employment risks (Eisenhardt, 1989). This theory further reveals that managers who are more secure in their positions take lower risks (Fama, 1980). In contrast, Mishra (2011) states that board-level monitoring with large shareholders leads to higher risk-taking. This argument reveals that agency conflicts influence the risk preferences of firms. The agency theory also narrates that the number of directors affects the decision outcomes of organisations. Thus, the decision-making process of a larger board is time-consuming and has several difficulties; hence, they settle for lower risk (Jensen, 1993). Additionally, smaller boards are more efficient, have fewer coordination problems, and may choose higher risks.

Additionally, the agency theory highlights possible non-linearities in the impact of CG and risk management. For instance, performance incentives may motivate managers to take on higher risks to increase their short-term rewards. However, the risk-return trade-off may

exhibit non-linearities due to decreased marginal returns or the adverse consequences of assuming excessive risks beyond a specific threshold (Jensen and Murphy, 1990; Edmans and Gabaix, 2011). Further, decisions on risk management are intrinsically strategic and context-specific, as acknowledged by agency theory. In reaction to changes in stakeholder expectations, legal requirements, competitive dynamics, and market conditions, managers may strategically modify their risk management procedures. As businesses attempt to strike a balance between risk reduction, value creation and competitive advantage, these strategic adjustments may produce non-linearities in the link between risk management efforts and risk-taking behaviour (Froot *et al.*, 1993). More so, the effectiveness of CG mechanisms in affecting risk-taking behaviour may suggest non-linear relationships. For instance, increased board independence and supervision may improve risk management procedures and prevent managerial opportunism. Yet, overzealous monitoring may inhibit managerial creativity and autonomy, limiting the risk-taking required for sustained development and competitiveness (Core *et al.*, 2008).

2.2 Enterprise risk management and risk-taking

In the past two decades, ERM has received much recognition among corporate institutions, investors, and regulators because it provides a competitive advantage over firms that manage risk individually (Horvey and Ankamah, 2020). ERM adopts a portfolio approach to managing risks compared to the silo system. ERM is seen as a critical strategic decision for businesses looking to effectively navigate an increasingly complex and uncertain economic climate. At the heart of ERM implementation is the interplay between risk management and risk-taking. The theory of corporate risk management explains that ERM helps in the risk management activities of a firm and reduces the cost of financial distress. This implies that firms with strong risk management procedures are able to take calculated risks and grasp strategic opportunities (Nguyen and Vo, 2020).

In spite of the importance of ERM in reducing the cost of financial distress, there are still concerns about the optimal amount of risk a firm should take. That is, whether ERM increases or decreases a firm's risk-taking decisions (Horvey and Odei-Mensah, 2023). While it is natural to expect that firms with ERM programs are less likely to engage in risk-taking behaviour, it is also important to acknowledge that there are situations where ERM may incentivise higher risk-taking. As a result, Nocco and Stulz (2006) assert that management must not limit their risks but rather limit the probability of financial distress to the level that maximises firm value to achieve the purpose of ERM. Thus, managers should optimise their risk portfolio regarding the associated costs and benefits to reflect their risk-taking decisions. Stulz (2014) supports this assertion by explaining that ERM is not meant to eliminate risk *per se*, which can be costly to shareholders. Thus, ERM does not mean low risk-taking, which may prevent the firm from undertaking worthwhile projects. Hence, risk-taking decisions should not be made in isolation but must be assessed with their impact on the optimal risk.

In addition, Mikes and Kaplan (2014) elucidate that risk management does not necessarily imply lower risk-taking, as this prevents the company from taking on valuable projects that may enhance firm value. Pooser and McCollough (2012) further argue that firms sometimes change their risk-taking preferences depending on their performance. In the empirical literature, Ellul and Yeramilli (2013) argue that implementing ERM leads to lower risk-taking. This happens when the risk culture is embedded in a firm's business model. This determines the amount of risk and the strength of the risk management system. '*That is, some firms may have a conservative risk culture and choose to take lower risks and put in place stronger risk management systems, whereas others may have an aggressive risk culture and may choose to take higher risks and also have weaker risk management functions* (Ellul and Yeramilli, 2013, p. 1763). On the contrary, evidence from Eckles *et al.* (2014) shows that ERM reduces the

impact of risk events on a firm by reducing their stock return volatilities and increasing profitability. This is affirmed by Berry-Stölzle and Xu (2018), who say that ERM does not imply lower risk-taking but rather reduces a firm's risk outcome.

According to Lundqvist and Vilhelmsson (2018), there is a negative correlation between the extent of ERM implementation and a firm credit default swap (CDS) spread, suggesting that ERM lowers default risk. These assertions suggest ERM does not necessarily mean lower risk-taking because ERM provides a better understanding of the full spectrum of risks, their interconnections, and their management. Similarly, Liu and Xu (2024) present that organisations' risk-taking habits are reshaped by ERM, which identifies risky business and external macroeconomic risk factors and adjusts risk transfer/retention policies accordingly. This is further supported by Nocco and Stulz (2006) and Horvey and Moloi (2024), who states that ERM improves risk management by increasing awareness of all possible sources of risk and integrating the firm's risk tolerance with its policies and procedures. Dong *et al.* (2017) argue that having an adequate understanding of the level of risk supports the alignment of a firm's strategic decision with risk-taking. Despite the various assertions in the literature, empirical investigation into this relationship is still nascent and inconclusive. It is also important to highlight that the relationship between ERM and risk-taking is multifaceted and influenced by regulatory, contextual and organisational characteristics. ERM may enhance value generation and risk-aware decision-making; nevertheless, its impact on risk-taking behaviour varies based on the organisation and the circumstances. Hence, there is a need for further investigation into this phenomenon, particularly in South Africa, where there have been significant improvements in their CG codes. The introduction of the King III corporate governance codes and Pillar II of the SAM framework underscore the importance of effective risk management and corporate governance practices. This study contributes to the literature by providing further insight into the ERM-risk-taking nexus. To achieve this, the study hypothesises that:

H1. There is a positive relationship between ERM and risk-taking.

2.3 Corporate governance and risk-taking

It is argued that CG plays a significant role in an organisation's risk decisions (Ballester *et al.*, 2020). This is explained by Mathew *et al.* (2016), who states that though the role of the executive board is not to manage risk directly, its CG activities directly affect its risk-taking decisions. Hence, the board must be actively involved in the risk-taking decision-making process for effectiveness. This is done by providing risk directions, authority, and oversight responsibilities. Elamer *et al.* (2018) add that a good CG system is connected to good risk-taking of insurance companies; therefore, there is a need to improve CG structures among insurers due to their effect on risk decisions. Similarly, Stulz (2016) highlights that good CG aids management in adopting mechanisms so that the level of risk chosen maximises shareholders' value subject to the constraints imposed by regulation. As a result, the board structure of an organisation is a key driver of performance and firm risk-taking (Akbar *et al.*, 2017). The board provides oversight roles to manage the risk taken by management. Thus, they play essential roles in strategic decision-making and risk-taking choices. Despite the importance of this concept, there is a paucity of research on how CG affects insurance risk-taking decisions. To explore this relationship, the study examines how the following CG factors (board size, board independence, and board gender diversity) affect risk-taking. The choice of these factors aligns with the ongoing discussions on the board's effectiveness, diversity and oversight roles in risk management. They have been identified in the literature as important factors relevant to risk-taking at the firm level. The agency theory further supports these factors. For instance, agency theory argues that the presence of independent directors reduces agency conflicts and increases oversight, thereby influencing risk-taking

propensities. Also, gender diversity highlights the potential benefits of diverse perspectives and cognitive styles in decision-making processes, such as risk assessment and management. The importance of these factors is discussed below.

2.3.1 Board size and risk-taking. One of the characteristics of CG that influences board activities is board size. Generally speaking, larger boards are better equipped to supervise and monitor the risk management procedures used by insurance businesses. Hence, insurers may gain from more oversight and accountability if more board members are willing to commit time and energy to risk-related issues. This would lessen the possibility of careless risk-taking (Elamer *et al.*, 2018). This implies that a large board of directors may provide value to agents by routinely analysing and evaluating insurance businesses' management plans and strategies (Laas and Siegel, 2013). Contrarily, some scholars argue that larger boards slow the decision-making process, making the board ineffective. Hence, firms must embrace small board sizes as they are viewed to be more efficient due to fewer communication and coordination issues (Akbar *et al.*, 2017; Beasley *et al.*, 2021). This is because larger boards are challenged to reach a consensus on essential issues, which may influence them to go for lower risk-taking. Pathan and Faff (2013) support this argument by narrating that large boards may have several issues, such as inadequate coordination and communication, which will have a detrimental effect on their capacity to oversee management. However, Mishra (2011) is of the view that board-level monitoring with large shareholders leads to higher risk-taking. This is because large boards have a great diversity of expertise and decision-making skills. Hence, they have a more balanced approach to taking risks (Kalia and Gill, 2023).

This is not without empirical evidence. Adams and Jiang (2016) reveal a positive relationship between board size and firm risk-taking decisions. They explain that large boards that are knowledgeable and effective have an enhanced moderating role in managerial behaviour and bring diversities which improve their risk-taking decisions. Conversely, Huang and Wang (2015) explain that smaller board sizes are sensitive to higher pay-to-performance and go for riskier investments than bigger board sizes, which are conservative in using debt financing. Ballester *et al.* (2020) also support the argument that smaller boards undertake more risky investments than larger boards. Notwithstanding, it is reasonable to assume that a board with a varied skill set and an adequate size could positively affect firm risk-taking. Against this backdrop, a negative relationship between board size and risk-taking is expected. The study, therefore, states our hypothesis as follows:

H2. There is a negative relationship between board size and risk-taking.

2.3.2 Gender and risk-taking. There has been growing interest in gender differences in board decision-making. Gender diversity is defined as the proportion of females on the board and is considered one of the most important CG features due to their positive influence on firm decisions and outcomes (Jouber, 2023). Ballester *et al.* (2020) explain that women have strong emotions such as fear and nervousness; hence, risky situations negatively affect satisfaction, which makes them more risk-averse. This concurs with the agency theory, which emphasises the risk-averse nature of females (Yahya *et al.*, 2022). This is because females are more sensitive to risks than gains in the context of losses. Hence, females are interested in safer policies in their managerial and risk-taking decisions (Pradhan *et al.*, 2019). Adams and Funk (2012) reveal that female directors have higher benevolence than male directors. As a result, the presence of women on the board reduces risk-taking by the firms. This argument is supported by Chen *et al.* (2016), who said that the riskiness of a firm investment is likely to reduce when more females are on the executive board.

Similarly, Jouber (2023) expounds that women are inherently more risk-averse and less overconfident than males. While men tend to overestimate the precision of their risk knowledge, women have less overconfidence and are hence less inclined to take extreme stances on risk-taking (Elamer *et al.*, 2018). As a result, even if they have the same level of risk

aversion, women's decisions may be less risky. In contrast, Berger *et al.* (2014) report that the presence of females on the executive board leads to higher risk-taking. However, Silva *et al.* (2019) did not find evidence that gender diversity affects risk-taking. Similarly, Loukil and Yousfi (2016) said the relationship between gender diversity and risk-taking is not statistically significant. Again, Midavaine *et al.* (2016) find no increase in firms' risk-taking due to the inclusion of women on the board. Also, Dong *et al.* (2017) find an inverse relationship between the proportion of female directors and traditional banking risk. This argument is supported by Hurley and Choudhary (2020), who state that the presence of females on the board leads to lower risk-taking. Based on the above discussion, the hypothesis of this study is stated as follows:

H3. There is a negative relationship between board gender diversity and insurance risk-taking.

2.3.3 Board independence and risk-taking. Board independence is the presence of non-executive members on the board (Guest, 2010). Board independence, high competence, and improved qualifications suggest to shareholders that firm risk-taking reflects management choices. Independent directors protect shareholders' interests using CG principles and are more likely to have higher risk tolerance levels to increase shareholders' value. It is further argued that independent directors ensure that firm risk-taking decisions reflect management choices due to their qualifications and competencies; hence, they are believed to make trustworthy judgements (Akbar *et al.*, 2017). Adams and Jiang (2016) state that agency theory reveals the importance of independent directors in mitigating inconsistent interests. Therefore, increasing the number of independent directors can reduce agency conflicts between managers and shareholders (Jensen and Meckling, 1976). This is because independent directors provide effective monitoring as they are independent and are less likely to be influenced by management (Eling and Marek, 2014). They further expound that greater board independence among insurance firms is associated with establishing efficient risk management frameworks and decision-making procedures, which in turn promote proactive risk-taking that aligns with strategic goals. Also, Pradhan *et al.* (2019) explain that independent directors want to protect their reputations; hence, they are more likely to support less risky projects to avoid losses and protect the firm image. This argument is consistent with the monitoring hypothesis, which assumes that independent board members help to reduce corporate risk-taking.

Empirical findings support the inverse relationship between board independence and risk-taking. For instance, Akbar *et al.* (2017) support this argument that independent board members reduce the firm's risk-taking activity. Elamer *et al.* (2018) also found that board independence has an insignificant negative relationship with risk-taking. Bradley and Chen (2015) believe that independent directors reduce the cost of debt due to strong credit conditions or lower leverage and vice-versa. They suggest that independent directors set policies that increase corporate risk-taking and further explain that the board is less risky when there are more independent directors, explaining that firms take higher risks ex-ante in the interests of their shareholders. The study, therefore, expects a negative relationship between board independence and risk-taking. Hence, we hypothesise that:

H4. There is a negative relationship between board independence and insurance risk-taking.

3. Research design

3.1 Sample and data considerations

This study adopts a panel data strategy to examine the relationship between ERM, CG and the risk-taking behaviour of 63 insurance companies from South Africa between 2015 and

2019. The choice of the beginning of the sample period was because new recommendations on ERM based on Pillar II of the SAM framework in South Africa were released in 2014 and became effective in 2015. The sample period was limited to 2019 due to data availability issues from the Financial Sector Conduct Authority (FSCA) database. Using panel data provides a further understanding of ERM and CG practices and their implications on insurers' risk-taking over time. This is essential because the benefits of ERM and CG are not always apparent immediately. In addition, panel data provides more reliable results because it incorporates and corrects the constraints associated with time series and cross-section data (Brooks, 2019). Data on insurance risk-taking and the control variables were extracted from the FSCA database of South Africa. Data on the CG variables were obtained from individual insurers' CG reports. The variables used for analysis are explained below.

3.2 Dependent variable

To measure insurers' risk-taking, the study follows the approach in the literature (Alhassan and Biekpe, 2018) by adopting the solvency ratio in the Z-score. The Z-score indicates insurers' equity and profits and the standard deviations of profits and measures the distance from insolvency (Laeven and Levine, 2009). It also assesses the distance to default by displaying the number of standard deviations in revenue that must fall for equity capital to be eroded (Alhassan and Biekpe, 2018). As a result, larger values signify a greater distance to default, a greater level of solvency and stability, and vice versa. The estimation for the Z-score is provided below in Equation (1).

$$Z - SCORE_{it} = \frac{ROA_{it} + EQR_{it}}{\sigma ROA_{it}} \tag{1}$$

Where subscript i and t represent individual insurers and time, respectively; ROA represent insurers' return on asset, which is measured as net profit divided by total asset; EQR represents equity ratio, which is proxied as the ratio of total equity to total assets; while σROA_{it} represents the standard deviation of return on assets.

3.3 Independent variable

3.3.1 Enterprise risk management index (ERMI). According to the literature, most scholars rely on ERM keyword searches such as the Chief Risk Officer (CRO), ERM adoption and risk committee, among others, to establish a binary proxy (Silva *et al.*, 2019). Some scholars employ risk governance features (Florio and Leoni, 2017; Horvey and Ankamah, 2020) and COSO ERM components (Gordon *et al.*, 2009). Other studies created an ERM index based on the Standard and Poor's (S&P) risk management rating (McShane *et al.*, 2011) and RIMS ERM maturity level (Farrell and Gallagher, 2015) to measure ERM sophistication. As Horvey and Odei-Mensah (2023) highlight, each of these techniques is subject to several limitations. Hence, this study adopts two techniques to collect ERM information from the insurance companies to overcome the challenges associated with simple proxies and insufficient information on the ERM ratings within our context. First, the study manually extracted information from insurers' CG reports and collected a cluster of 12 ERM features following Florio and Leoni's (2017) methodology. Further, as advised by Horvey and Odei-Mensah (2023), we complement this approach by following González *et al.*'s (2020) survey technique to learn more about the ERM features in creating an index. This was necessary because it provides a comprehensive assessment of an insurer's ERM system, which addresses the measurement issues that have plagued earlier studies. The survey questions indicate whether an insurer has an ERM programme and when it was implemented. Furthermore, specific questions about insurers' ERM activities were asked, including the year they initiated

such programmes. Each feature is treated as binary, given the value of one (1) in the year the firm adopts an ERM activity and cut off in the subsequent years, and zero otherwise (Lundqvist and Vilhelmsson, 2018). Anonymous risk experts first helped with a pilot study to ensure the reliability and accuracy of the instrument.

The study focuses on several features captured into three broad categories. The first category of features relates to risk governance, which specifies the direction and control of an insurer's risk management system and the guidelines for making risk management decisions (Lundqvist, 2015; Aebi *et al.*, 2012). This category is fundamental as organisations require a well-governed system to manage their risk holistically. The risk governance feature includes the appointment of a CRO, the presence of the CRO on the executive board, the presence of a risk management committee, whether the risk committee reports to the executive board and the firm's risk appetite level. The second category of features relates to the operating mechanism, which establishes the procedures and tools needed to implement an ERM system (Florio and Leoni, 2017; Horvey and Ankamah, 2020). The feature for this category includes the firm's risk assessment frequency, level, methodology, and risk management framework. The last category relates to risk oversight, which reveals the committee's quality of risk oversight. It also examines the characteristics of the committee designated to oversee and manage risk (Ellul and Yerramilli, 2013). The ERM features included in this category are the existence of an active risk committee, the risk committee's experience, and the CRO's expertise. An index was created for each category to explore their impact on risk-taking. Additionally, an overall ERM index was created by aggregating the twelve individual features under each category. While previous studies (Florio and Leoni, 2017; Aebi *et al.*, 2012; Horvey and Ankamah, 2020) adopt a composite index by summing the dummy ERM features, this study uses the Multiple Correspondence Analysis (MCA), which is more appropriate in creating an index for binary variables (Abdi and Valentin, 2007). Using MCA helps examine the relationship pattern among several categorical variables, thereby creating an index.

3.3.2 Corporate governance. As discussed in Subsection 2.3, the study employs three CG variables. These include the board size (BODSIZE), board independence (BODIND) and gender diversity (GENDER). Board size represents the total number of executive and non-executive directors (Sekerci and Pagach, 2019). Board independence represents the ratio of independent directors on the executive board (Wu and Li, 2015), whereas Gender diversity measures the ratio of females to males on the executive board (Sekerci and Pagach, 2019).

3.4 Control variables

To ensure the robustness of our results, the panel regressions include a list of control variables that manage the effect of exogenous factors. The control variables include financial leverage, firm size, investment yield and financial slack. The diverse relationship between market evaluation and capital structure is controlled by financial leverage (LEV). This is calculated as total debts/liabilities divided by total equity (Florio and Leoni, 2017). Firm size (SIZE) is measured as the natural log of total assets (Horvey and Ankamah, 2020). The extent of a firm's risks is likely to be influenced by its size, as are the resources available for the ERM system (Florio and Leoni, 2017). Investment yield (INVYIELD) assesses the quality of the investment portfolio. This is also measured as the ratio of investment income to total investment. Financial slack is also measured as the ratio of cash and short-term investment to the total asset. While insurers with ERM may increase financial slack to lower the risk of financial distress, it is also possible that insurers may decrease their financial slack level because of improved risk management decisions (Bohnert *et al.*, 2019).

3.5 Empirical strategies

The empirical analysis for this study is in two parts. First, the study examines the linear relationship between ERM, CG and insurers' risk-taking behaviour. Second, the study

estimates the non-linear relationship between ERM, CG and risk-taking behaviour. For this reason, the study employs two estimation techniques: a linear system GMM and a dynamic panel threshold.

3.5.1 Linear relationship. This study adopts the dynamic generalised method of moments (GMM) estimator proposed by (Arellano and Bond, 1991) to assess the linear relationship. From the econometric literature, the GMM provides more advantages than the static model. It addresses endogeneity problems by exploiting the data's time series variations and controlling for unobserved firm-specific effects (Horvey *et al.*, 2023). It is important to note that incorporating the lagged term of the dependent variable in the regression model may cause endogeneity problems since the lagged dependent variable depends on the lagged error term, which is a function of the firm-specific fixed effects. Again, a possible endogeneity problem is suspected between ERM and risk-taking. While ERM may influence risk-taking behaviour, insurers' risk-taking decisions may affect the implementation of ERM (Stulz, 2016; Horvey and Ankamah, 2020), therefore validating the adoption of the dynamic GMM estimator. Using this technique, the study set a model where the dependent variable depends on its lag and a vector of observations of the independent variables. Further, a two-step GMM is employed instead of the one-step GMM because it controls heteroscedasticity and autocorrelation while capturing omitted variable problems and measurement errors (Blundell and Bond, 1998). Hence, following the models by (Alhassan and Biekpe, 2018) and modifying them, our specific model is stated as:

$$RT_{it} = \beta_1 RT_{it-1} + \beta_2 ERM_{it} + \beta_3 LEV_{it} + \beta_4 INVYIELD_{it} + \beta_5 SIZE_{it} + \beta_6 SLACK_{it} + \mu_i + \partial_t + \varepsilon_{it} \tag{2}$$

$$RT_{it} = \beta_1 RT_{it-1} + \beta_2 CG_{it} + \beta_3 LEV_{it} + \beta_4 INVYIELD_{it} + \beta_5 SIZE_{it} + \beta_6 SLACK_{it} + \mu_i + \partial_t + \varepsilon_{it} \tag{3}$$

Where RT denotes insurers' risk-taking behaviour, which is measured by the z-score; RT_{it-1} represents the one-period lag of the dependent variable; ERM denotes the overall enterprise risk management index (ERMI) and its categories, which include the risk governance index (RGI), operating mechanism index (OMI), and risk oversight index (ROI); CG represents the corporate governance characteristics (i.e. the board size, board independence and gender diversity); LEV represents financial leverage; INVYIELD represents investment yield; SIZE represents firm size; SLACK represents financial slack; β represents the parameters to be estimated; μ_i represents the unobserved firm-specific fixed effects; ∂_t represent the time fixed-effect and ε_{it} is the idiosyncratic error term.

3.5.2 Non-linear relationship. The study adopts the dynamic panel threshold model developed by Seo and Shin (2016) and Seo *et al.* (2019) to examine the non-linear relationship. The dynamic panel threshold technique is built on the principles of GMM and helps to establish non-linearities and thresholds in the model. The general model is specified in Equation (4) as:

$$y_{it} = x'_{it}\beta + \left(1, x'_{it}\right)\delta 1\{q_{it} > \gamma\} + \mu_i + \varepsilon_{it}\, \mathrm{i} = 1, \ldots, \mathrm{n};\ \mathrm{t} = 1, \ldots, \mathrm{T} \tag{4}$$

Where y_{it} is the dependent variable (i.e. risk-taking) for firm i in period t; q_{it} is the threshold variable (i.e. ERM and CG features) and x_{it} includes the lagged dependent variable and control variables. $1\{.\}$ is the indicator function specifying the regime, γ is the threshold parameter in the model. T is assumed to be fixed, whereas the sample size n grows to infinity. Therefore,

the fixed effect μ_i is removed through the first difference process, and then the unknown parameters are estimated using GMM. Thus $\theta = (\beta', \delta', \gamma)'$.

4. Results and discussion

4.1 Descriptive statistics

This section describes the variables used for the regression analysis. A summary of the mean, standard deviations and the range of the variables are reported in Table 1. The Z-score, which measures insurance risk-taking behaviour, has a mean value of 9.208. The average board size for the sample is about 12 members (mean = 11.914). Out of this sample, 57% of the board members are independent directors, while only 24% are females. The report indicates a large gender disparity on the board of insurance companies. The average value suggests that over half of the board members are independent directors. In terms of the control variables, it can be seen that the insurance industry has a positive total asset with an average of 14.571 million South African Rand. The average value for leverage is 0.654. This explains that South African insurers rely more on their assets than debts to generate value. The yield on investment, representing the total income on investment, has an average value of 2.446, while financial slack averaged 0.399. This shows that South African insurers are making higher yields on their investment. Table 2 provides a report on the correlation analysis. The report indicates low correlations among the independent variables, showing no presence of multicollinearity. This is further validated by the variance inflation factor (VIF) in Table A1 (see Appendix). These results are far below the VIF threshold of 10 (Ayyangar, 2007). Therefore, the variables are considered fit to be used in the regression analysis.

Table 3 further highlights the distribution of the ERM features over five years. This explains the features considered when measuring the comprehensive ERM index. Table 3 shows that the ERM features have been steadily increasing among insurers. It also reveals that some insurers still lack most of these features. The table indicates that a risk committee is more present, with about 91% of insurers having a risk committee. The study finds that CRO appointment is present in about 76% of the sample. The feature with the lowest score was the presence of the CRO on the executive board, which was 14%, indicating that most insurers do not have their CROs represented on the board. This will likely affect the level of power and influence the CRO can have in risk decisions.

Variable	Obs.	Mean	Std. dev.	Min	Max
Z-score	315	9.208	20.708	−7.807	161.208
Enterprise risk management index	315	0.000	1.002	−1.209	3.438
Risk governance index	315	0.000	0.998	−1.890	2.688
Operating mechanism index	315	0.000	0.890	−0.740	3.703
Risk oversight index	315	0.000	1.000	−0.850	2.921
Board size	315	11.914	3.870	5.000	24.000
Independent directors	315	0.569	0.134	0.000	0.923
Gender diversity	315	0.239	0.132	0.000	0.769
Leverage	315	0.654	0.643	−2.574	9.948
Investment yield	315	2.446	6.414	−6.694	64.101
Size	315	14.571	2.336	10.008	20.298
Slack	315	0.399	0.449	0.000	6.385

Source(s): Authors own work

Table 1.
Descriptive statistics

Table 2.
Correlation matrix

Variables	*Z*-score	ERMI	RGI	OMI	ROI	BODSIZE	BODIND	GENDER	LEV	INVYIELD	SIZE	LEV
Z-score	1.000											
ERMI	0.093	1.000										
RGI	0.050	0.828	1.000									
OMI	0.132	0.608	0.240	1.000								
ROI	0.062	0.848	0.635	0.294	1.000							
BODSIZE	0.179	−0.057	−0.019	0.092	−0.138	1.000						
BODIND	0.009	−0.210	−0.177	−0.131	−0.144	0.092	1.000					
GENDER	−0.062	0.080	0.094	0.090	−0.019	0.054	0.232	1.000				
LEV	0.027	−0.001	−0.044	0.109	−0.043	−0.029	−0.066	−0.040	1.000			
INVYIELD	0.032	0.081	0.072	0.125	0.059	−0.045	−0.038	−0.102	0.014	1.000		
SIZE	0.322	−0.138	−0.168	0.062	−0.189	0.455	0.065	−0.034	0.282	−0.081	1.000	
SLACK	−0.081	0.023	0.094	−0.190	0.102	−0.320	−0.059	0.020	−0.137	0.075	−0.449	1.000

Source(s): Authors own work

Distribution of ERM features over the years (2015–2019)

ERM features	2015		2016		2017		2018		2019		Freq (2015–2019)		%(2015–2019)	
	0	1	0	1	0	1	0	1	0	1	0	1	0%	1%
CRO appointment	17	46	16	47	14	49	14	49	14	19	61	191	24.21	75.79
CRO executive	56	7	55	8	53	10	53	10	53	10	217	35	86.11	13.89
Risk committee	7	56	7	56	5	58	4	59	4	59	22	230	8.73	91.27
Risk appetite	7	56	7	56	7	56	5	57	5	58	26	225	10.32	89.29
Risk com'te report to board	10	53	9	54	8	55	8	55	8	55	35	217	13.89	86.11
Risk assessment frequency	7	56	6	57	5	58	4	59	4	59	22	230	8.73	91.27
Risk assessment level	12	51	11	52	9	54	8	55	8	55	40	212	15.87	84.13
Risk assessment method	23	40	21	42	21	42	18	45	18	45	83	169	32.94	67.06
Risk framework	9	54	9	54	7	56	5	58	5	58	28	224	11.11	88.89
Active risk committee	29	34	29	34	29	34	29	34	29	34	116	136	46.03	53.97
Directors with insurance exp	8	55	7	56	7	56	6	57	6	57	28	224	11.11	88.89
CRO expertise	20	43	19	44	18	45	18	45	6	57	75	177	29.76	70.24

Source(s): Authors own work

Table 3. Distribution of ERM features

4.2 Empirical findings

4.2.1 The relationship between ERM and risk-taking behaviour. The system GMM estimation technique was adopted to examine the linearity between ERM, CG and risk-taking behaviour. The estimated results are reported in Table 4. Models (1)–(3) present the breakdown of the impact of the ERM categories; thus, risk governance index (RGI), quality of risk oversight index (ROI) and Operational mechanism index (OMI) on insurance risk-taking behaviour, whereas model (4) presents the empirical information for the overall ERM index and risk-taking. Models (5)–(7) reveal the results of the CG factors on risk-taking. The assumptions regarding the use of GMM are satisfied. As shown in Table 4, the coefficients of the lagged dependent variable (Z-Score) are positive and statistically significant across all the models. The significance of the lagged dependent variable justifies the dynamic GMM's appropriateness. It shows a strong inertia of insurance risk-taking behaviour over time, implying that the previous values of insurance risk-taking affect its current risk-taking decisions. The reliability of the results is backed by several estimations. The Hansen test for over-identifying restrictions confirms the joint validity of the model's internal instruments, indicating no instrument proliferation. Furthermore, the absence of second-order serial correlation in the residuals, as evidenced by the insignificant p-values, reaffirms the robustness of the findings. The significance of the Wald statistics (Prob > F) confirms that all our models have been correctly specified and reliable for examining the linkages between ERM, CG and risk-taking.

Regarding the individual categories, the index for risk governance (RGI) and risk oversight (ROI) reveal a positive relationship with risk-taking. This relationship is statistically significant at 1% and 5%. The significant positive result indicates that effective risk governance and risk oversight are more likely to improve insurers' risk-taking decisions (Smith and Stulz, 1985). This implies that organisations with strong risk governance structures and oversight roles mostly feel more confident when exploring opportunities that might involve some risk because they know they have the controls and

Table 4. ERM, CG and risk-taking (dep. var.: *Z*-score)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Z-score(−1)	0.563***	0.577***	0.564***	0.361***	0.066**	0.071**	0.046**
	(0.024)	(0.025)	(0.026)	(0.018)	(0.025)	(0.029)	(0.022)
RGI	0.613***						
	(0.619)						
ROI		0.510**					
		(0.533)					
OMI			−0.081				
			(0.671)				
ERMI				3.344**			
				(1.312)			
Board size					0.733**		
					(0.324)		
Gender						−3.043**	
						(5.071)	
BODIND							1.171
							(5.846)
Lev	−1.353***	−1.150***	−1.187***	−0.960*	−0.571	−1.157***	−1.164***
	(0.239)	(0.247)	(0.233)	(0.540)	(0.373)	(0.328)	(0.349)
InvYield	0.028	0.029	0.041	−0.050	0.153*	0.134*	0.158*
	(0.033)	(0.037)	(0.039)	(0.096)	(0.078)	(0.072)	(0.080)
Size	1.333***	1.304***	1.203***	4.933***	1.864**	2.075**	2.134**
	(0.280)	(0.288)	(0.303)	(0.548)	(0.924)	(0.783)	(0.940)
Slack	3.823*	3.724*	3.510*	43.915***	3.152	0.703	0.116
	(2.029)	(2.166)	(1.969)	(3.959)	(4.712)	(4.207)	(4.257)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	252	252	252	252	252
Number of firms	63	63	63	63	63	63	63
Number of instruments	18	18	18	18	18	18	18
AR(1)	0.000	0.000	0.000	0.000	0.013	0.038	0.012
AR(2)	0.611	0.509	0.510	0.614	0.495	0.499	5.792
Hansen	0.269	0.273	0.275	0.247	0.200	0.136	0.219

Note(s): Standard errors in parentheses; ***, **, * denotes significance level at 1%, 5 and 10% respectively. Estimations are done using xtabond2 in Stata
Source(s): Authors own work

oversight to manage and mitigate those risks effectively. This aligns with Magee *et al.*'s (2019) assertion that strong risk governance practices, including risk management guidelines, clear risk management policies, efficient risk reporting systems, and active board oversight, are linked to increased risk-taking. This is affirmed by Dupire *et al.* (2022), who assert that firms with strong risk governance tend to take more risks because they have the capability to identify, manage and monitor risks. Also, the operating mechanism index (OMI) shows an inverse relationship. The inverse relationship denotes that risk assessment is likely to reduce insurers' risk-taking; however, this was insignificant. The negative relationship suggests that the risk management practices may be affected in the presence of weak risk assessment, thereby lowering their risk-taking decisions. Also, in a situation where insurers are not able to implement and integrate their risk management practices effectively, it may distort their risk-taking decisions. To improve their risk-taking decisions, insurers are encouraged to strengthen their operating mechanism structures by employing risk assessment tools and methodologies for risk management effectiveness. The overall ERM index (ERMI), which combines the features within the individual categories, is reported in Model 4. The results reveal a significant positive relationship with insurers' risk-taking. The results indicate that a robust ERM system could serve as a catalyst for insurers to embrace risk-taking with more confidence. This is because a strong ERM system can help predict and manage adversities surrounding business operations (Horvey and Odei-Mensah, 2023). Since insurers are more exposed to financial vulnerability, implementing ERM provides the ability to better assess and manage their risk (Nguyen and Vo, 2020), giving them the confidence to pursue insurance activities such as underwriting and investment while minimising their potential losses. In light of this finding, insurers involved in higher-risk activities are encouraged to advance their ERM system to manage any adverse effects associated with higher risk-taking (Liu and Xu, 2024). This finding is in accordance with the idea that ERM does not necessarily mean lower risk-taking but reduces the cost of financial distress. Stulz (2014) argues that better risk management leads to better risk-taking; hence, management does not need to lower its risk. According to Iqbal and Mirakhor (2011), robust risk management techniques can help firms reduce risk exposure and improve their risk-taking decisions, which enhance financial performance. This will help create value for shareholders. Nocco and Stulz (2006) add that to achieve the purpose of ERM, management must not limit their risks but rather should limit the probability of financial distress to the level that maximises firm value.

4.2.2 The relationship between CG and risk-taking behaviour. This section presents and discusses the empirical results between CG and risk-taking behaviour. As informed by the literature, we employ three CG features: board size (BODSIZE), board independence (BODIND), and gender diversity (GENDER). The finding indicates that some CG factors react more rigorously to risk-taking than others. The results from the estimated models show a significant positive relationship between board size and risk-taking. The positive results show that board size is associated with high risk-taking. This study concurs with other studies that find a positive relationship between board size and firm risk-taking (Adams and Jiang, 2016). The results imply that larger boards provide insurers access to broader perspectives and areas of expertise, which can help them make better decisions about taking on risk. Despite the challenges large boards face, the evidence suggests that the diversity on the board enriches their decision-making process, which leads to a more thorough evaluation of their risk-taking choices. Adams and Jiang (2016) agree with this finding by stating that large boards that are knowledgeable and effective have an enhanced role in managerial behaviour and bring diversities, which improves their risk-taking decisions.

Gender diversity reveals a significant negative relationship with insurers' risk-taking, implying that having more females on the board leads to lower risk-taking. While gender diversity may lead to positive outcomes, their presence leads to a more cautious approach to risk-taking. Hence, insurers with more female representation on the board may show lower

risk-taking behaviour. This is consistent with the agency theory, which explains that females are risk-averse and are more likely to reduce their losses than gains, making them lower their risk-taking choices (Ballester *et al.*, 2020). This argument is supported by Yahya *et al.* (2022) and Chen *et al.* (2016), who said that the riskiness of a firm investment is likely to reduce when there are females on the executive board. Pradhan *et al.* (2019) add that women are interested in safer policies in their managerial and risk-taking decisions; as a result, the presence of women on the board may lead to lower risk-taking. Our findings further indicate that board independence positively influences insurers' risk-taking behaviour. The positive result explains that an increased number of independent directors on the executive board could lead to higher risk-taking. This is because greater board independence among insurance firms is associated with establishing efficient risk management frameworks and decision-making procedures, which in turn promote proactive risk-taking that aligns with strategic goals. They also bring different perspectives, experiences, and skills to the board, which improves risk-taking discussions (Eling and Marek, 2014). Also, independent directors protect shareholders' interests who are more interested in higher returns, leading to high risk-taking (Akbar *et al.*, 2017). Therefore, independent directors are more likely to have higher risk tolerance levels to increase shareholder value. The implication is that these CG features are key determinants of insurers' risk-taking incentives, so any attempt to understand insurers' risk-taking should consider these factors.

The study controlled for firm-level variables which could influence insurers' risk-taking behaviour. These variables include financial leverage, investment yield, firm size and financial slack. Financial leverage was negative and significant, while firm size showed a significant positive effect, suggesting that large firms are more likely to take higher risks as they have enough resources to manage the associated costs. This supports the argument that the extent of a firm's risks is likely to be influenced by its size, as are the resources available for the ERM system (Florio and Leoni, 2017). The result for investment yield was also positive. This indicates that insurers earning higher returns on their investment have more appetite for risky investments. Financial slack, measured as the ratio of cash and short-term investment to total assets, shows a significant positive relationship with risk-taking. Bohnert *et al.* (2019) explain that financial slack helps to reduce the cost of financial distress, which in turn affects their risk-taking behaviour.

4.3 Dynamic panel threshold regression analysis

4.3.1 ERM and risk-taking behaviour. This section discusses the non-linear relationship between ERM and insurers' risk-taking behaviour. The dynamic threshold was estimated using the approach by Seo *et al.* (2019) and Seo and Shin (2016). Table 5 shows the estimated results based on the dynamic threshold model. The bootstrap *p*-value test for linearity was evaluated at 100 bootstrap replications and trimmed by the default 0.4 rates. The bootstrap *p*-value (0.000) rejects the null hypothesis of no threshold effect in all the models, confirming non-linearity in the ERM and risk-taking nexus. Hence, the samples can be split into two. The various factors are divided into upper regime/lower regime when the threshold value is greater than/less than or equal to the threshold indicator. The non-linear relationship affirms Horvey and Ankamah's (2020) arguments, which assert that there is a certain level where ERM becomes excessive in affecting firm decisions. Table 5 presents the threshold result of the ERM index (ERMI) and the individual categories: risk governance index (RGI), operating mechanism index (OMI) and risk oversight index (ROI) for insurers in South Africa. Insurers with values below the threshold indicator are classified as having a weak risk management system, and those above the threshold indicator are classified as having a strong risk management system. The results in Table 5 show the existence of a threshold for ERMI and the individual categories. This is based on the significance of the *p*-values of the linearity test

Table 5.
Threshold effect of ERM on risk-taking (dep. var.: Z-score)

	RGI		OMI		ROI		ERMI	
Variables	Lower Regime	Upper regime	Lower Regime	Upper regime	Lower Regime	Upper regime	Lower Regime	Upper regime
Z-score(−1)	−0.196***	0.359***	−0.254***	0.345***	−0.169***	0.373***	−0.327***	0.513***
	(0.023)	(0.024)	(0.031)	(0.015)	(0.007)	(0.013)	(0.017)	(0.017)
Size	−12.013***	17.961***	0.974	−3.587***	0.013	3.775	−2.103***	7.737***
	(3.405)	(3.076)	(0.670)	(1.076)	(0.296)	(3.454)	(0.608)	(2.788)
Lev	−4.223***	−3.666	−0.894	−0.311	−1.300***	2.362***	−0.710***	−3.083
	(1.182)	(4.026)	(2.137)	(2.263)	(0.298)	(8.458)	(0.169)	(9.038)
InvYield	2.540***	−2.572***	0.662***	−0.556*	−0.201***	0.225**	0.740*	−0.777*
	(0.666)	(0.670)	(0.195)	(0.285)	(0.070)	(0.088)	(0.399)	(0.419)
Slack	14.540**	−13.041**	0.897	−21.780***	2.952**	−2.778*	−21.210***	18.780***
	(6.179)	(6.145)	(1.553)	(8.014)	(1.385)	(1.479)	(5.991)	(6.513)
Threshold variables	−19.330**	20.590**	−8.073	15.751*	−7.944***	7.619***	−17.100***	15.371***
	(9.702)	(9.486)	(9.045)	(9.545)	(1.252)	(2.277)	(2.605)	(2.673)
Threshold indicator	−0.421***		0.041		0.358***		0.453***	
	(0.092)		(0.245)		(0.103)		(0.127)	
Linearity (p-value)	0.000		0.000		0.000		0.000	
No. of Obs	63		63		63		63	

Note(s): Standard errors in parentheses; ***, **, * denotes significance level at 1%, 5% and 10% respectively. Estimations are done using xtabond2 in Stata
Source(s): Authors own work

and the threshold indicators. The significance of the lagged dependent variable confirms the dynamism of risk-taking.

According to the results, the coefficient estimate for the ERMI in the lower regime is negative and significant. This indicates its decreasing effect on risk-taking at lower levels. In the upper regime, the coefficient estimate for the ERMI is significantly positive. This suggests a direct U-shaped relationship, which indicates that insurers with a robust ERM system may exhibit higher risks. The result also implies that firms with a strong risk management system have a great appetite for risk because a robust risk management system helps firms manage any sophistication and adverse effects associated with risk-taking (Nguyen and Vo, 2020). The findings are consistent with both theoretical and empirical arguments. Mikes and Kaplan (2014) elucidate that risk management does not necessarily mean lower risk-taking as this prevents the company from taking on valuable projects which may enhance firm value. This supports the theory of corporate risk management, which explains that ERM helps in the risk management activities of a firm and reduces the cost of financial distress (Horvey and Ankamah, 2020). Mathew *et al.* (2016) state that risk-taking plays a significant role in the success of every business, as there is no reward without risk decisions. Hence, some risks should be exploited to take advantage of the opportunities they present. This becomes possible when insurers strengthen their ERM system. Stulz (2014) adds that a robust risk management system makes it less likely for businesses to miss their target, which is associated with high risk-taking.

Turning to the ERM categories (risk governance, risk oversight and operating mechanisms), the study finds similar patterns in the relationships. For instance, risk governance presents a significant positive relationship when it falls above the threshold level and vice-versa. This underscores the importance of risk governance to insurance companies because it provides resilience to insurers in managing adversities associated with taking up risky projects. Dupire *et al.* (2022) affirm this argument by explaining that companies with good risk governance are able to manage their risk and return and take advantage of opportunities that fit their risk tolerance and strategic goals. In terms of risk oversight, the study argues that improved oversight assists insurers in better understanding their risk exposures and handling uncertainty surrounding them (Horvey and Odei-Mensah, 2023). Because they are more aware of the risks involved, insurers may take calculated risks with more assurance because they have the systems and procedures to manage and reduce such risks efficiently, affirming its positive relationship above the threshold and negative impact in the lower threshold. Similarly, the results for the operating mechanisms present that well-thought-out risk management operating mechanisms could give insurers the knowledge and resources they require to accurately assess risks and decide which cases to underwrite, which ultimately allows them to take advantage of profitable opportunities while reducing the possibility of losses.

4.3.2 CG and risk-taking behaviour. Following the same estimation procedure in sub-Section 4.3.1, the threshold dynamics for the CG variables for insurers were examined. The threshold variables are board size (BODSIZE), gender diversity (FEMRATIO), and board independence (BODIND), whereas *Z*-Score is the dependent variable. The linearity test (*p*-values) indicates an overall significant non-linear relationship, employing a bootstrap procedure with 100 replications. Therefore, the study rejects the null hypothesis of no threshold effects because the threshold indicator and linearity test are significant at 1%. The results in Table 6 suggest significant threshold values for insurers in South Africa, which are 10.03, 0.274 and 0.547 for board size, gender diversity and board independence, respectively. The empirical results for board size reveal an inverted U-shaped relationship, exerting a significant positive influence on insurers' risk-taking in the lower regime. This suggests that insurers with smaller board sizes promote higher risk-taking. This is because small board sizes are sensitive to higher pay to performance and are more likely to go for riskier

Variables	BODSIZE Lower regime	BODSIZE Upper regime	GENDER Lower regime	GENDER Upper regime	BODIND Lower regime	BODIND Upper regime
Z-score(−1)	0.236***	−0.604***	−0.123***	0.026	−0.239***	0.454***
	(0.077)	(0.063)	(0.047)	(0.047)	(0.061)	(0.038)
Size	−0.612	−2.159**	−8.466***	2.985	−3.259***	4.814***
	(1.065)	(0.976)	(1.692)	(2.165)	(1.076)	(1.010)
Lev	−1.314***	13.14***	7.000***	−7.980***	−1.539	−6.046
	(0.470)	(2.635)	(1.021)	(3.196)	(0.955)	(8.335)
InvYield	0.154	−0.064	−0.011	−0.044	−0.010	0.261**
	(0.098)	(0.160)	(0.019)	(0.136)	(0.061)	(0.116)
Slack	−7.523***	6.907**	4.020	−5.771***	−3.192**	−0.778
	(2.661)	(2.862)	(5.443)	(1.110)	(1.396)	(5.610)
Threshold variable	0.843***	−0.616	−4.43*	−5.95***	7.164**	−14.000
	(0.289)	(0.449)	(2.64)	(1.850)	(3.138)	(11.181)
Threshold indicator	10.03***		0.274***		0.547***	
	(0.416)		(0.027)		(0.042)	
Linearity test(*p*-value)	0.000		0.000		0.000	
No. of Obs	63		63		63	

Note(s): Standard errors in parentheses; ***, **, * denotes significance level at 1%, 5% and 10% respectively. Estimations are done using xtabond2 in Stata
Source(s): Authors own work

Table 6. Threshold effect of CG on risk-taking (dep. var.: *Z*-score)

investments (Huang and Wang, 2015). The study lends support to the argument that smaller boards have fewer communication and coordination issues, making them more efficient in their risk-taking decisions (Pathan and Faff, 2013). A possible explanation for the negative relationship above the threshold could be related to the challenges associated with large boards. For instance, larger boards which are poorly coordinated lack confidence in risk-taking decisions; hence, they are less likely to undertake risky projects (Beasley *et al.*, 2021). This is because large board sizes sometimes face difficulty reaching a consensus on important issues. As a result, firms may be cautious and risk-averse in their decision-making process, which may influence them to go for lower risk-taking. To ensure prudent risk-taking decisions, the board should ensure proper coordination and leverage the skills and expertise of each board member.

For gender diversity, the study finds a negative relationship, showing a strong influence in the upper regime. The significant negative coefficient estimate for gender diversity aligns with the argument that females are naturally risk-averse and are more likely to go for lower risks (Pradhan *et al.*, 2019). Thus, the riskiness of a firm investment is expected to reduce when there are more females on the executive board. Similarly, Jouber (2023) expound that women are inherently more risk-averse and less overconfident than males. While men tend to overestimate the precision of their risk knowledge, women have less overconfidence and are hence less inclined to take extreme stances on risk-taking (Elamer *et al.*, 2018). As a result, even if they have the same level of risk aversion, women's decisions may be less risky. For board independence, the study suggests a positive impact below the threshold and a negative influence above the threshold, which also indicates an inverted U-shaped relationship. The negative relationship in the upper regime is explained by Pradhan *et al.* (2019), narrating that independent directors want to protect their reputations; hence, they are more likely to support less risky projects to avoid losses and protect the firm image. Notwithstanding, the result is insignificant. This contradicts Akbar *et al.* (2017) argument that independent directors protect shareholders' interests and are more likely to have higher risk tolerance levels to

increase shareholders' value. This suggests that firms take higher risks ex-ante in the interests of their shareholders (Bradley and Chen, 2015). However, when independent directors lack an understanding of the insurance business, they are ineffective in providing insightful guidance, which may weaken the firm's risk-taking preferences (Eling and Marek, 2014).

4.4 Robustness analysis

To ensure the robustness and validity of our findings, the study introduces underwriting risk as an alternative measure for insurers' risk-taking as defined by the literature (Eling and Marek, 2014; Jouber, 2023). Underwriting risk is the standard deviation of insurers' loss ratio, defined as the total net claim payments and adjustments to earned net premiums (Horvey and Odei-Mensah, 2024). The results from the robustness analysis provide compelling evidence of a significant positive relationship between ERM and risk-taking, as shown in Table 7. This upholds the argument that a robust ERM system allows firms to take on higher risk due to their proactiveness in managing any adversity associated with it. The CG variables were also consistent with our previous findings. The same can be said about the threshold regressions (see Tables 8 and 9). The notable difference is board independence, which reveals a significant positive relationship in the upper threshold and vice versa. This aligns with the argument that independent directors protect shareholders' interests using CG principles and are more likely to have higher risk tolerance levels to increase shareholders' value. Since underwriting is a key feature of the insurance business, independent directors are more likely to recommend rigorous risk assessment for prudent underwriting decisions, ensuring high risk-taking.

5. Conclusions and recommendations

While governance and risk management have gained considerable attention in the literature, the nexus between ERM, CG and risk-taking is still apparent. Given this, this study examined the linearity and non-linearity between ERM, CG and risk-taking behaviour on a panel of 63 insurers from South Africa between 2015 and 2019. This is based on the notion that there is a threshold level where these factors either exacerbate or reduce insurers' risk-taking choices. Z-score was used as a proxy for risk-taking, and an ERM index was developed based on risk governance, operating mechanism and risk oversight characteristics. The significance of the lagged dependent variable across all the models in the GMM results justifies the choice of the dynamic model. It also shows that there is a strong inertia of insurance risk-taking behaviour over time, implying that the previous values of insurance risk-taking affect its current risk-taking decisions.

The empirical results from the system GMM suggest diverse impacts between the ERM categories (risk governance, operating mechanism and risk oversight) and risk-taking. The study reveals risk governance and risk oversight are significantly and positively associated with insurers' risk-taking, indicating that insurers with strong risk governance and oversight are more likely to engage in high-risk projects because they exhibit greater efficiency in the ERM process. It was also observed that operating mechanisms inversely affect risk-taking, but this was insignificant. More so, the results indicate a significant positive relationship between the ERMI and risk-taking, suggesting that insurers with a robust ERM system are more likely to undertake higher risks because they are able to leverage their risk management capabilities to identify and take advantage of opportunities while managing the associated adversities. The results elicit another interesting finding from the CG variables. The estimated result shows a significant positive relationship between board size and risk-taking. The results appear to suggest that insurers with a strong board system are predisposed to

Table 7.
ERM, CG and risk-taking (dep var:: underwriting risk)

	(2)	(3)	(4)	(1)	(5)	(6)	(7)
UR(−1)	0.600***	0.609***	0.604***	0.595***	0.304***	0.412***	0.410***
	(0.041)	(0.041)	(0.041)	(0.040)	(0.033)	(0.013)	(0.012)
RGI	0.033**						
	(0.014)						
ROI		0.054					
		(0.070)					
OMI			−0.007				
			(0.043)				
ERMI				0.039*			
				(0.028)			
Board size					0.011*		
					(0.008)		
Gender						−0.268*	
						(0.183)	
BODIND							−1.081***
							(0.377)
Lev	−0.021	−0.008	0.000	−0.015	0.592	0.007	0.008
	(0.100)	(0.100)	(0.097)	(0.102)	(0.575)	(0.143)	(0.111)
InvYield	0.015*	0.011*	0.021*	0.018*	0.033	0.025**	0.024*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.021)	(0.009)	(0.012)
Size	0.039	0.042	0.048*	0.045	0.170**	0.094***	0.068*
	(0.030)	(0.032)	(0.028)	(0.031)	(0.069)	(0.033)	(0.039)
Slack	0.164	0.192	0.179	0.191	0.423	0.344	0.254
	(0.253)	(0.256)	(0.224)	(0.266)	(0.443)	(0.305)	(0.279)
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	252	252	252	252	252
Number of firms	63	63	63	63	63	63	63
Number of instruments	15	15	15	15	15	15	15
AR(1)	0.009	0.012	0.008	0.000	0.000	0.001	0.000
AR(2)	0.170	0.171	0.170	0.169	0.105	0.137	0.126
Hansen	0.220	0.237	0.264	0.230	0.585	0.524	0.727

Note(s): Standard errors in parentheses; ***, **, * denotes significance level at 1%, 5% and 10% respectively. Estimations are done using xtabond2 in Stata
Source(s): Authors own work

Table 8.
Threshold effect of ERM on risk-taking (dep. var.: underwriting risk)

Variables	(1) RGI		(2) OMI		(3) ROI		(4) ERMI	
	Lower regime	Upper regime	Lower regime	Upper regime	Lower regime	Upper regime	Lower regime	Upper regime
UR(−1)	0.063***	0.006	0.131***	−0.017*	0.127***	0.289***	0.268***	−0.389***
	(0.007)	(0.006)	(0.009)	(0.010)	(0.005)	(0.057)	(0.016)	(0.003)
Size	−0.027	0.100*	−0.201*	−1.570***	0.087	−5.175***	0.021	0.280***
	(0.028)	(0.055)	(0.116)	(0.234)	(0.064)	(0.540)	(0.036)	(0.097)
Lev	0.031*	−0.142	−0.065	−0.400	0.025	−7.080***	0.052	−1.912***
	(0.016)	(0.259)	(0.345)	(0.337)	(0.036)	(1.256)	(0.103)	(0.291)
InvYield	−0.041***	0.054***	0.023*	−0.018	0.044***	0.041***	0.023	0.0221
	(0.007)	(0.008)	(0.012)	(0.012)	(0.015)	(0.015)	(0.022)	(0.023)
Slack	−1.141***	1.131***	−0.384	1.913***	0.276	−0.158	0.231	−0.297
	(0.373)	(0.367)	(0.250)	(0.527)	(0.182)	(0.172)	(0.217)	(0.226)
Threshold variable	−0.126	0.187	0.346	−0.492	−0.217	4.523***	−0.440	0.088**
	(0.156)	(0.156)	(0.481)	(0.492)	(0.187)	(0.576)	(0.322)	(0.039)
Threshold indicator	−0.421***		0.0409		0.358***		−0.190**	
	(0.151)		(0.056)		(0.033)		(0.089)	
Linearity (*p*-value)	0.000		0.000		0.000		0.000	
No. of Obs.	63		63		63		63	

Note(s): Standard errors in parentheses; ***, **, * denotes significance level at 1%, 5% and 10% respectively. Estimations are done using xtabond2 in Stata
Source(s): Authors own work

Variables	(1) BODSIZE Lower regime	(1) BODSIZE Upper regime	(3) Gender Lower regime	(3) Gender Upper regime	(2) BODIND Lower regime	(2) BODIND Upper regime
UR(−1)	0.086***	−0.451***	−0.103***	0.154***	−0.064**	1.299***
	(0.018)	(0.018)	(0.017)	(0.037)	(0.029)	(0.080)
Size	−0.092	−0.755***	−0.260	−0.455*	−0.247	−0.063
	(0.066)	(0.195)	(0.194)	(0.248)	(0.192)	(0.338)
Lev	−0.039	3.986***	−0.790	0.755	−0.064	3.277**
	(0.027)	(0.636)	(1.024)	(1.018)	(0.051)	(0.940)
InvYield	0.016**	−0.204***	0.003	−0.002	0.002	−0.138
	(0.001)	(0.077)	(0.002)	(0.009)	(0.003)	(0.191)
Slack	−0.043	−0.136	0.167	−4.458***	0.060	−5.071***
	(0.043)	(1.266)	(0.501)	(0.876)	(0.068)	(1.085)
Threshold variable	0.003*	−0.007	0.259**	−6.337**	−0.210*	2.32***
	(0.010)	(0.089)	(0.130)	(2.847)	(0.195)	(0.501)
Threshold indicator	11.000***		0.279***		0.600***	
	(0.175)		(0.017)		(0.007)	
Linearity test (p-value)	0.000		0.000		0.000	
No. of Obs	63		63		63	

Note(s): Standard errors in parentheses; ***, **, * denotes significance level at 1%, 5% and 10% respectively. Estimations are done using xtabond2 in Stata
Source(s): Authors own work

Table 9. Threshold effect of CG on risk-taking (dep. var.: underwriting risk)

taking higher risks due to their knowledge and competence. Further, the study reveals an inverse relationship between gender diversity and risk-taking. This concurs with the agency theory predicting that females are more risk-averse in their risk-taking decisions; hence, the presence of females on the board will most likely lead to lower-riskier policy choices.

Regarding the threshold result, the empirical evidence suggests a non-linear relationship between ERM and risk-taking, presenting a direct U-shaped relationship which indicates a negative impact below the threshold and a positive impact above the threshold, which implies that a robust or mature ERM system is essential to the risk-taking decisions of insurers. This will assist managers in assessing the pros and cons of their risk-taking choices, helping them to make improved risk-taking decisions. The ERM categories also present similar patterns of a direct U-shaped relationship, showing adverse effects below the threshold level. At higher levels, risk governance and operating mechanisms positively impact risk-taking. This indicates the importance of these factors in ensuring risk management effectiveness, thereby optimising their risk-taking choices. The threshold effects for board size, board independence and gender diversity are also examined in this study. The study again confirms a non-linear relationship between CG and insurers' risk-taking. Below the threshold level, board size and independence positively influence insurers' risk-taking and a negative influence when they fall above the threshold, which denotes an inverted U-shaped relationship. However, gender diversity presents a negative relationship, demonstrating a strong influence at higher threshold levels, explaining that having females on the board is more likely to lead to lower risk-taking due to their risk-averse nature.

Our paper provides some practical implications. The findings suggest that ERM and CG structures within an insurance company are likely to improve their risk-taking preferences; hence, we recommend that insurers looking forward to enhanced risk-taking capabilities should consider the proper implementation and effectiveness of governance and risk management factors. Also, the findings appear to support the need for a robust ERM system

and CG practices among insurers in South Africa as outlined in the King III CG code and the SAM framework. As an industry that is committed to upholding governance and risk management, prioritising these factors could ensure strong CG and ERM frameworks. This will help insurers to make more informed and deliberate decisions about risk-taking. This is very important amid the highly volatile, uncertain, complex and ambiguous risk environment, which demands effective ERM and CG for prudent risk-taking decisions. They should consider how the ERM categories are connected to lower the cost of accepting risks. As a result, treating ERM as a "window dressing" activity may not suffice. It is recommended that insurers comply with the fundamentals of ERM implementation and promote risk assessment tools and methodologies capable of understanding the complexities associated with risk-taking for its effectiveness. Regulators may take cues from this study by providing suggestions in reviewing their current regulations for boards to reflect a balance of independence, diversity, and size when selecting board members due to their influence in ensuring improved risk-taking decisions. A better composition may ensure that the interests of shareholders are not compromised. This may require emphasising the need for independent directors and urging boards to maintain the optimal size that facilitates efficient decision-making. Given that gender diversity on boards may have an impact on risk-taking behaviours, policies might additionally encourage it. The study suggests an independent-director ratio of at least half the board size and about one-third of the board being females for insurers in South Africa. This will likely promote diverse perspectives and higher oversight of management decisions and risk management activities, leading to more prudent risk-taking behaviour. Current and potential investors in the South African insurance market should consider the risk and governance framework when making an investment decision within the South African insurance industry.

Despite the contribution of the study, there are some limitations which provide avenues for future research directions. First, the study was limited to only the insurance industry in South Africa due to the distinctive nature of their business operations. However, risk is inevitable in other sectors requiring a robust ERM system. Therefore, scholars could consider other financial and non-financial institutions to test the importance of ERM and CG on risk-taking behaviour. Also, the study did not consider all the insurance companies in South Africa and the sample period was limited to 2015–2019 due to the availability of data obtained from the FCSA database. As a result, we recommend a larger sample size and period to validate these results. Also, scholars could extend the study to other emerging economies while considering other proxies for insurance risk-taking. By broadening our lens to cover other contexts, scholars and practitioners would understand how the different regulatory and economic structures define ERM and CG factors in affecting risk-taking behaviour. As additional avenues for future research, we suggest that studies investigate how competition, regulation, and reinsurance affect the level of risk-taking by insurers. Last but not least, researchers should further test the robustness of the ERM index in other contexts for in-depth understanding while considering other ERM features. Another extension of this work could be to consider other CG variables such as the number of board meetings, CEO duality, ownership concentration, educational level and experience.

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Appendix

Variable	VIF	VIF	VIF	VIF
Z-score				
Enterprise risk management index	1.09			
Risk governance index		1.08		
Operating mechanism index			1.12	
Risk oversight index				1.06
Board size	1.35	1.33	1.29	1.35
Independent directors	1.13	1.35	1.10	1.09
Gender	1.10	1.10	1.11	1.08
Leverage	1.13	1.13	1.14	1.13
Investment yield	1.03	1.03	1.04	1.06
Size	1.63	1.65	1.61	1.63
Slack	1.29	1.29	1.33	1.29

Source(s): Authors own work

Table A1. Variance inflation factor

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