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The determinants of enterprise risk management in Ghanaian and South African insurers: insights from a quantile regression analysis

Sylvester Senyo Horvey[1*]

Abstract

Over the past two decades, business practitioners have been shifting from a silo perspective to a comprehensive perspective of managing risk, which is referred to as enterprise risk management (ERM). Enterprise risk management provides resilience by holistically managing the risks within an organisation. Despite its importance, empirical evidence highlighting the factors influencing ERM adoption remains underexplored, particularly in developing countries like South Africa and Ghana, a gap addressed by this study. Accordingly, this study recruits panel logistic regression to examine the factors influencing the adoption of ERM. Another novel aspect of the study is the inclusion of the quantile regression analysis applied to panel data between 2015 and 2018. This technique accounts for the heterogeneity of the relationships at different levels of ERM adoption. Drawing from the contingency theory, this paper presents that a variety of factors stimulate the adoption of ERM. Thus, the implementation of ERM in both countries is positively influenced by the Big4 audit firms, ownership structure, leverage, firm size, and industrial diversification. Further insights from the quantile regression show that lower levels of firm size and profitability encourage the adoption of ERM in the South African sample, whereas significant increases in these factors weaken it, suggesting an inverted U-shaped relationship. In contrast, leverage exhibits a U-shaped relationship. More so, the study identifies an inverted U-shaped relationship between leverage, profitability, and ERM adoption for Ghana. Additionally, industrial diversification, engagement with the Big4 audit firms, and ownership consistently exhibit significant positive effects on ERM adoption across various quantiles in both samples. The results underscore the importance of these factors to ERM. Given this, insurers should consciously capitalise on their organisational strengths, such as diversification and partnerships with reputable audit firms, to enhance ERM adoption. Also, insurers that are highly diversified and rely on leverage to fund their operations should employ ERM to manage the associated complexities.

Keywords Determinants, Enterprise risk management, Firm-characteristics, Insurance, Quantile regression

JEL Classification C31, G22, G32

Introduction

Business executives, practitioners, and regulators increasingly expect firms to demonstrate strong competencies in managing risks, driven by the growing volume and complexity of risks in today's business environment. This expectation is further heightened by the current competitive industry amid global challenges,

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which have introduced new risks and increased uncertainty levels [12]. Consequently, businesses are adopting new methods and techniques to enhance the robustness of their risk management competence, called enterprise risk management (ERM) [19]. ERM is a modern and dynamic approach to managing all types of risks faced by an organisation in a unified and integrated manner [23]. It is a new approach that ensures that risk activities are managed in a holistic and dynamic manner. This is essential for businesses, as it offers resilience and helps organisations traverse the uncertainties and complexities in the corporate landscape in order to achieve their strategic goals [2]. Given this, businesses are beginning to integrate an ERM system into their risk management framework. While businesses strive to improve their risk management efforts, it is crucial to first establish a solid understanding of the factors that drive ERM activities. Understanding the key determinants of ERM is essential to facilitate its effective and robust implementation. Without a clear understanding of the determinants of ERM, organisations may struggle to implement an effective ERM system, leaving them vulnerable to financial, operational, compliance, and strategic uncertainties [20]. As a result, this study uniquely employs the quantile regression which provides more insights into how the determinants of ERM vary across different levels of adoption, going beyond the conventional mean-based approach, to uncover the distributional effects which is mostly overlooked by scholars. Recognising the critical factors influencing an organisation's ERM program, including its distributional effects, will offer more insights into ERM determinants at varying levels, enabling effective implementation strategies which align with the ERM effectiveness and resource capabilities, ultimately strengthening the firm's strategic initiatives and performance [8].

From a theoretical perspective, the adoption of ERM can be attributed to various factors grounded in contingency and institutional theories [17, 18]. Contingency theory asserts that there is "no one best way" for integrating a system within an organisation. Instead, the most effective approach is to examine the internal and external environmental factors specific to the organisation. The theory identifies key elements that affect the control system, categorised into environment, technology, size, structure, and strategy [44]. Likewise, the institutional or organisational theory posits that different contextual factors influence an organisation's operations and systems [11]. Insights from the institutional theory suggest that organisations must implement ERM processes within a regulated environment to align with external pressure. Building on these theories, Mikes and Kaplan [32] argue that the success of ERM adoption depends on the specific contextual factors and conditions within an organisation, with these determinants varying across different organisations and industries. As a result, firms implementing ERM must consider the factors unique to their context to ensure its effectiveness [29, 44]. Identifying the connections between these organisational factors and ERM adoption is essential for enhancing the growth and development of ERM practices and organisational performance. Hence, this study extends these theories by examining a set of variables that influence an insurer's decision to implement an ERM system.

Insight from the existing literature on ERM primarily focuses on performance [16, 19, 21, 41], ERM frameworks and components [4, 28] and its implementation mechanisms [24, 46]. Other scholars have taken a step further to examine the determinants of ERM adoption. This includes [1, 15, 1336]. Despite these efforts, the literature reveals insufficient empirical evidence explaining why some organisations adopt ERM while others do not. Additionally, studies exploring ERM determinants have mainly concentrated on Europe [8, 26], the US [7, 23, 36] and Malaysia [40, 10] in Nigeria and [30] in Tunisia, who consider the antecedents of ERM adoption. This paucity of research underscores the need to deepen understanding of ERM in the region, particularly in Ghana and South Africa, which lacks evidence explaining why firms adopt ERM. Exploring these contexts is important, given that generalising empirical findings can lead to significant limitations and challenges due to variations in datasets and environmental factors. As a result, conclusions drawn in one country may not be applicable in another context [26]. This highlights the need for further exploration of the determinants of ERM within emerging markets. Further, previous studies have discovered inconsistencies and conflicting arguments on the determinants of ERM. For instance, while some scholars reveal that size, industrial diversification, the Big4 audit companies, and leverage positively stimulate ERM adoption [13, 22, 26], others present an inverse relationship [16, 8]. The divergent results may stem from differences in environmental factors [26] and regulatory challenges, as some organisations face greater exposure to risks than others. Consequently, empirical findings are not anticipated to be uniform. Another possible reason is that the factors influencing ERM adoption have often been carried out using a linear regression approach, thereby limiting our understanding of the levels at which these determinants stimulate the adoption of ERM [20]. This presents an epistemological and methodological setback as scholars have primarily concentrated on estimating parameters for averages, overlooking the

fact that the determinants may differ at various levels, a gap that this study addresses. Quantile regression offers a more comprehensive understanding of the factors at different levels of heterogeneity [6]. However, to the best of the researcher's knowledge, there is no empirical evidence explaining whether the determining factors of ERM remain consistent at different levels. Based on the foregoing, this paper contributes to the literature by addressing these concerns through the use of quantile regression, a technique that allows for variation in coefficients across the entire distribution of ERM adoption. It does so by answering the following questions: (1) What factors determine the adoption of ERM among insurance companies in South Africa and Ghana? (2) Do these factors remain the same at different levels?

The focus on the insurance industry is of great interest given that its core business activity involves risk-taking in the face of uncertainties, making it more likely for insurers to adopt a strong risk management system. Additionally, insurance companies are integral to the global economy and contribute significantly to a country's economic growth and development. Hence, investigating the determinants of ERM is important to ensure that the industry can effectively manage risks, maintain financial stability, and sustain its role in fostering economic growth. Furthermore, the study specifically examines the insurance sectors in Ghana and South Africa for various reasons. South Africa boasts the largest insurance market in Africa, with a penetration rate of approximately 16%. In contrast, Ghana's insurance market is still developing, with a penetration rate of around 2%. Moreover, both countries have experienced significant regulatory changes in the past decade, underscoring the importance of a strong risk management approach. The collapse and mergers of financial institutions like Esich Life, Beige Assure, Avance Life, and Alexander Forbes in these countries have led to the introduction of several new regulations on risk management. These include Ghana's updated solvency and risk management framework, as well as South Africa's Solvency Assessment and Management (SAM) framework. One of the key elements of these frameworks is establishing a risk management committee and adopting an ERM system. As a result, these regulations, along with other environmental factors, have heightened insurers' motivation to implement ERM. The literature supports this, stating that ERM implementation is not only due to regulatory mandates but also organisational factors [20, 26]. Therefore, to assess the importance and effectiveness of ERM, it is essential to understand the factors that drive its adoption [8]. These causative factors influence risk management behaviour and may evolve over time or in response to different events. In this context, this paper explores the key factors stimulating the adoption of ERM, considering the Ghanaian and South African insurers.

This paper makes several unique contributions to the literature. To the best of the author's knowledge, this is the first study using quantile regression to examine the level at which the determinants drive ERM adoption, which goes beyond the average regressions, mostly adopted in the literature. This methodological advancement addresses a significant gap in the literature, which often overlooks the variation in these factors and focuses primarily on average effects. Additionally, this paper explores the drivers of ERM from a developing context, which has not received much attention. The findings offer valuable insights applicable in this setting, which is crucial since risk is a global concern that impacts organisations worldwide, necessitating further exploration across different contexts to support informed decision-making. Furthermore, the results offers valuable information to insurance companies about the key firm-specific factors driving ERM adoption, enabling them to modify their plans and enhance their ERM practices. This will enhance management decisions on how to manage them. It also ensures the proper management and growth of these factors. Additionally, the study's findings about how market dynamics and regulatory frameworks influence the adoption of ERM will be useful to regulators and policymakers in creating focussed regulations that support strong risk management procedures throughout the industry.

The remainder of this paper is organised as follows: The literature review and hypothesis development are discussed in section two, which is followed by the data collection procedure, variables, and estimation techniques, which are presented in section three. The fourth section presents empirical results and discusses their implications, while Section five offers conclusions and suggestions for future research.

Literature review

Literature and hypothesis development

Existing research on ERM has approached the topic from various angles. Some studies employ a quantitative approach, qualitative approach, or mixed methods, exploring ERM's impact on value, profitability, and the factors that drive its adoption [20]. According to the literature, ERM adoption factors are highly regarded as they determine the sustainability and growth of firms [2]. While regulatory policies advocate for the adoption of ERM, other environmental factors also stimulate a firm's decision to implement ERM. Understanding these drivers provides avenues for integrating ERM into a company's operations. Research has demonstrated that these factors originate from different environments,

both external and internal [27], reflecting the broad range of risks faced by organisations. Researchers have looked into the factors that influence ERM in a variety of settings. However, insights from the African context remain incipient, which motivates this study. Based on the existing knowledge, it can be seen that several factors play a pivotal role in influencing ERM adoption.

Industrial diversification

This determinant refers to the extent to which a firm operates across various business segments [26]. Companies with a broader range of business segments tend to be more complex, making them more prone to implement ERM to mitigate potential negative impacts [20]. According to Standard and Poor [42], insurers with diversified operations are driven to adopt ERM programs due to the associated advantages. While industrial diversification is generally linked to enhanced performance [22, 23], it can also lead to challenges, such as information loss [26]. Despite reducing some operational risks, companies with several business divisions encounter increased complexity and higher overall risks, which often prompts them to adopt ERM systems. It is also important to highlight that industrial diversification can lead to group risk. The concept of group risk gained traction during the 2008 financial crisis, when risk transferred to the group through a subsidiary that almost brought down the world's largest insurer, AIG. As a result, regulatory frameworks like Solvency II, which went into effect in 2012, give group risk special consideration [20]. This study adopts the approach used in prior research by employing a dummy variable, assigning a value of 1 for industrially diversified firms and 0 for those without [13, 26]. Existing literature indicates a positive correlation between industrial diversification and the adoption of ERM systems [5, 31], affirming the importance of ERM to diversified companies as it helps them to manage the complexities surrounding their business operations. Notwithstanding, [15] observed a negative relationship, which could be attributed to the fact that many firms in their sample lacked additional business segments. Considering the various advantages of ERM, organisations with strong ERM frameworks are likely better positioned to comprehend the value-enhancing effects of diversification decisions compared to those with weaker systems. In the light of this, the study hypothesises that:

H_1 Firms that are industrially diversified are more like to implement ERM.

Firm size

A firm's size reflects the scale of its business operations. As companies grow larger, the complexity and scope of their activities also expand, impacting the nature and magnitude of the risks they face [18]. Thus, the breadth and complexity of a company's activities increase along with its growth. Because of their complexity, they are more vulnerable to risks, which can impact the type, timing, and magnitude of risks [47]. Therefore, ERM is essential for these firms because it enables them to detect and manage risks throughout the business. According to Lechner and Gatzert [26], as firms get larger, so does their exposure to risks. Consequently, ERM is more likely to be used by larger firms to manage risks related to their growth [1, 14]. Additionally, larger firms are better equipped to allocate sufficient resources for implementing ERM [37]. Typically, firm size is quantified using the 'natural logarithm of total assets' [8]. Most studies reveal that firm size positively and significantly affects ERM adoption [22, 23, 26, 37]. These scholars argue that the number of risks increases as firm size increases proportionately. Larger firms are, therefore, more likely to implement an ERM system since it reduces the risk involved in business expansion. The only exception to this trend is Liebenberg and Hoyt [27] who found the relationship to be negatively related. They attributed this discrepancy to the challenges in finding a closely matched sample for their study. Their measurement of firm size was based on the logarithm of the book value of total assets over the three years prior to the appointment of a Chief Risk Officer (CRO). This observation supports the hypothesis that:

H_2 Firms experiencing growth in their size are more likely to implement ERM.

Auditor type

One other key factor influencing the adoption of ERM is the type of audit firm. Lechner and Gatzert [26] suggest that ERM implementation is more common among insurers audited by one of the Big4, which includes Deloitte, Ernst and Young, PricewaterhouseCoopers, and KPMG. This is due to the fact that these auditors place a high priority on guaranteeing reliability and transparency in the business's operations [20]. Additionally, the Big4 auditors are committed to safeguarding their reputation, and as part of this, they ensure that the internal controls and financial systems of the audited company comply with generally accepted accounting standards. Horvey et al. [20] affirm this argument, explaining that, it is the responsibility of external auditors to check that the internal controls and financial systems of the

companies they examine adhere to generally accepted accounting standards and principles. This is true for all organisations, and one of the most important elements is risk management. Furthermore, insurers that employ the services of these auditors are most likely more dedicated to implementing ERM [35]. In line with prior research, a dummy variable is used, where a value of 1 implies that the insurer is audited by one of the Big4 and vice versa. The literature highlights a positive and statistically significant nexus between the Big4 and ERM [26], indicating that these auditors are more likely to suggest ERM to the firms audited by them. The positive relationship can be attributed to the extensive expertise and experience of the Big4 audit firms in areas such as risk management, governance, and financial reporting, and their involvement in ERM provides a wealth of data, insights, and best practices that can greatly improve an organisation's risk management procedures [20]. Based on this, the study hypothesises that:

H_3 Firms audited by one of the Big4 are more likely to implement ERM.

Institutional ownership

Institutional ownership is another key determinant considered to stimulate ERM adoption [1]. This reflects the proportion of shares held by investors. That is, whether it is foreign-owned or not. Abbas et al. [1] add that institutional ownership outlines the entities and individuals responsible for managing and holding the company's ownership. It is said that shareholder pressure is one of the primary reasons affecting the adoption of ERM [20]. Hoyt and Liebenberg [23] argue that external stakeholders play a key role in determining the adoption of ERM, with firms where foreign institutions possess a greater proportion of shares more inclined to adopt ERM. This is attributed to the influence and authority that institutions hold over individual shareholders [2, 27]. This concept aligns with Syrová and Spička [43] who present a positive relationship between foreign ownership and ERM. Other scholars have also established institutional ownership as an important factor influencing ERM (Pagach and Warr, [23]. Most of these studies find this relationship to be significantly positive, with the exception of [15] who found the relationship to be negative. The study employs a dummy variable to measure institutional ownership, giving the value of 1 if owned by foreigners and 0 otherwise. Based on this, this paper states that:

H_4 Firms with foreign ownership are more likely to implement ERM.

Profitability

Firm profitability refers to a company's ability to generate profits or revenue from its assets. It is considered a significant factor in the adoption of ERM [20]. One reason for this is that highly profitable companies are better positioned to allocate resources to fund their ERM activities [13]. This is supported by Oyewo [34] and Bailey [5], who contend that profitable businesses usually have more financial and human capital. Their solid financial standing allows them to make investments in the implementation of ERM. They can allocate funds to employ the resources, expertise, and other necessities for an effective ERM system. Profitability is measured using various indicators, such as total revenues [7], return on assets (ROA) [26], and a firm's earnings volatility and value chain [25]. For this study, profitability is assessed using return on assets (ROA), calculated as net income divided by total assets. Existing studies have presented varying results in terms of how profitability drives ERM. For instance, Lechner and Gatzert [26] present that insurers with more advanced ERM systems tend to perform better, and those with higher performance levels implement ERM. A study by Razali and Tahir [40] revealed a negative relationship, suggesting that less profitable firms may adopt ERM as a way to mitigate financial distress and improve their performance. In contrast, a significant positive relationship was found by [25]. These discrepancies may be attributed to the different approaches to measuring profitability. Based on these findings, the study hypothesises that:

H_5 Highly profitable firms are more likely to implement ERM.

Industry type

The type of industry is another driver that has been found in the literature to affect the adoption of ERM. Industry type plays a significant role in the adoption of ERM systems [2]. This is because certain industries are subject to more stringent regulations than others. According to Hoyt and Liebenberg [23], companies functioning under strict regulatory frameworks, with complex risks are more likely to implement ERM. This is supported by [35], who also disclosed that certain organisations use ERM to satisfy capital, governance, and solvency criteria. Likewise, industries differ in terms of risk complexity and competition, with some facing more intense challenges than others [18]. Therefore, [15] highlight that companies

operating in more heavily regulated sectors or those facing highly complex risks are likely to embrace ERM. Institutional theory suggests that firms are compelled to implement ERM systems to navigate external pressures in a regulatory environment. This factor was treated as binary. Research shows that industry type plays a crucial role in the adoption of ERM systems. The relationship between industry type and ERM adoption is often positive, with studies such as Lechner and Gatzert [26] confirming its statistical significance. It is evident that firms in sectors such as education, utilities, banking, energy, telecommunications, and insurance are more inclined to embrace ERM. However, regardless of extensive research across different sectors, there is limited investigation into how specific business lines within the insurance industry (life versus non-life insurance) influences the adoption of ERM systems. Given the lengthy lifespan of their products, it appears that life insurers are more inclined to invest in ERM. A dummy variable of 1 is used in this study for life insurance companies and 0 otherwise, hypothesising that:

H_6 Life insurance companies are more likely to implement ERM.

Financial leverage

Financial leverage refers to the extent to which a firm uses debt to finance its assets, often through borrowing to expand its capital base. Research has highlighted financial leverage as a significant factor influencing ERM adoption, as firms with higher leverage face a higher risk of financial distress and are, therefore, more motivated to embrace ERM to manage such risks [1]. Corporate leverage increases the risk that a business may struggle to meet its financial obligations and interests, making it more dependent on external parties or creditors [1]. Conversely, firms may opt to increase their leverage due to heightened risk awareness [8]. Leverage is typically measured as total debt/liabilities over total asset capital [26]. Although financial leverage is important, its relationship with ERM adoption varies. Some studies have found a positive association between leverage and ERM adoption [25, 27, 31], while other scholars revealed an inverse relationship [5; 37]. The positive association implies that companies with significant financial leverage have a higher propensity to embrace ERM, as these firms typically face elevated risk levels and a higher likelihood of bankruptcy. Conversely, Hoyt and Liebenberg [23] explain that the negative association implies that companies implementing ERM might attempt to reduce their leverage in order to lessen their risk of financial distress. Despite the varied results, financial leverage is seen to play a critical role in the decision to adopt an ERM system. Therefore, the study hypothesises that:

H_7 Firms with higher leverage are more likely to implement ERM.

Summary of the literature and gaps

The review of the literature, which is further summarised in Table 1, suggests that several factors drive ERM adoption, notwithstanding some revealing conflicting findings. Also, most empirical studies on the determinants of ERM have been conducted in the US and Europe, with very few empirical investigations from the African context. This geographical difference provides strong justifications to contribute to knowledge by examining this relationship from a new context, particularly Ghana and South Africa, due to their distinct market dynamics and regulatory frameworks, which encourage the practice of ERM implementation among insurance companies. Furthermore, most previous studies employed simple linear regression methods, which mostly overlook the differences in the influence of variables amongst companies at different levels of ERM adoption. This methodological limitation and the conflicting arguments highlight the need for more advanced approaches to estimating these relationships. To address this gap, this study employs the quantile regression approach, which is one of the novelties of this research to determine the impact of these determinants at different levels. The selection of this technique is fuelled by the fact that it provides avenues to explore how these determinants influence ERM adoption at different levels.

By capturing these variations, the analysis contributes to knowledge and offers a more comprehensive understanding of the determinants of ERM adoption, particularly in the understudied African insurance market. Each hypothesis is relevant in both contexts given that the Ghanaian and South African insurers are characterised by smaller and large insurers who are exposed to diverse risks. Additionally, the insurance industry in both contexts is becoming more complex due to their product diversification into life, nonlife, and other business segments, requiring robust risk management systems, such as ERM to manage the associated risks and uncertainties within the evolving business environment. Moreover, most of these insurers engage with one of the Big4 auditors, which mostly encourages ERM adoption. Also, the majority of the insurance companies in both contexts are subsidiaries of global companies that encourage global risk management practices such as ERM. Furthermore, the choice of leverage aligns with Ghana's financial risks

Table 1 Summary of the literature on ERM determinants

Author(s), year and setting	Journal	Methodology	Time Period	ERM Proxy	*Hypothesis (H)*						
					H_1	H_2	H_3	H_4	H_5	H_6	H_7
Liebenberg and Hoyt [27] USA	Risk Management and Insurance review	Logistic regression, 26 Companies	1997–2001	Dummy		−*		+			+**
Beasley, Clune and Hermanson [7] USA	Journal of accounting and public policy	Ordinal Logistic regression, 123 companies	2004	ERM Stage		+**	+***			+***	
Hoyt and Liebenberg [22] USA	Society of Actuaries	Maximum likelihood model, 125 companies	2000– 2005	ERM/CRO key words	−***	+***		+***		+	−***
Hoyt and Liebenberg [23] USA	Journal of Risk and Insurance	Maximum likelihood model, 117 companies	1998– 2005	ERM/CRO key words	+	+***		+**		+	−**
Pagach and Warr [36] USA	Journal of Risk and Insurance	Cox proportional hazard Model, 138 companies	1992 –2005	CRO key words		+***		+**			−
Paape and Speckle [35] Netherland	European Accounting Review	Ordinal Logistic regression 825	2008	Extent of ERM implementation		+***	+	+		+**	
Lin et al. (2012) USA	North American Actuarial Journal	Probit regression	2000–2007	Dummy		+***					
Baxter, Bedard, Hoitash and Yezebel (2013) USA	Contemporary Accounting research	Ordered logistic regression, linear regression 165 firms	2006–2008	S&P ERM rating							−**
Farrell and Gallagher [13] Canada, Europe, UK, USA, others	Journal of Risk and Insurance	Probit Model 225 companies	20,062,011	Dummy using RIMS model		+***					−
Khan et al. [25] France	Management Decision	Cox-proportional hazard model 22 companies	1999–2008	CRO Announcement and timing combined					+***		+**
Lechner and Gatzert [26] Germany	The European Journal of Finance	Logistic and Hazard regression, 160 companies	2013/	Dummy	+	+***	+		−**	+**	−
Mardessi and Arab [30] Tunisia	Journal of Financial reporting and accounting	Logistic regression. 80 companies	2016	ERM Index		+**				+**	
Ai et al. (2018) USA	Journal of Risk and Insurance	Two stage least square regression/76 companies	2006–2013	S&P ERM ratings	+	+**					
Bohnert et al. [8] Europe	The European Journal of Finance	Logistic regression 41 companies	2007–2015	Binary		+***					−***
Rahmawati and Prasetyo [39] Indonesia	International Journal of Innovation, Creativity and Change	Multiple Regression 43 companies	2015–2018	ERM Index using ISO components		+***	−				−
Abbas et al. [1] Indonesia	Accounting	Panel Regression 10 companies	2015–2019	ERM index		+***		+			
Meskovic and Zaimovic [31] Bosnia and Herzekovina	South East European Journal of Economics and Business	Ordinary Least Square/	2019	ERM index	+***	+***			+	+***	
Syrová and Spička [43] Czech Republic	Journal of Risk and Financial Management	Cross-sectional/296 companies	2021	ERM index		+**		+***			
Oyewo [34] Nigeria	Journal of Accounting in Emerging Economies	Panel Regression/14 companies	2008–2017	ERM index using COSO framework		+**			+**		

Table 1 (continued)

Author(s), year and setting	Journal	Methodology	Time Period	ERM Proxy	*Hypothesis (H)*						
					H_1	H_2	H_3	H_4	H_5	H_6	H_7
Bailey [5] US	Journal of Accounting, Auditing and Finance	Ordered Logistic Regression/196 firms	2006–2012	S&P ERM rating	+		+	+	+**		
Pan et al. [37] China	Economic Research-Ekonomska Istraživanja	Maximum Likelihood estimation	2010–2019	Dummy		+***		+***			

Where H_1 = Industrial Diversification H_2 = Firm Size; H_3 = External Auditor type; H_4 = Institutional Ownership; H_5 = Profitability; H_6 = Industry type; H_7 = Leverage;

***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively

resulting from economic volatility and South Africa's capital adequacy regulations, which require leverage insurers to ensure stability, hence, the adoption of ERM.

Method

Data source and description

This research examines the factors influencing the adoption of ERM among Ghanaian and South African insurers, based on a sample of 33 and 63 insurers, respectively. South Africa has approximately 135 insurers, while Ghana has around 54 insurers. The sample was limited due to data availability issues; hence, insurers that existed during the study period (2015 to 2018) and had available data were used for the analysis. Other reasons include the lack of available financial reports for the ERM information for some companies. By focussing on the insurance industry, the study minimises any industry-specific or inter-industry variations that could bias the results [8]. Separate analyses were performed for both South Africa and Ghana to account for differences in the market and regulatory environments for these two contexts.

The databases of the Financial Sector Conduct Authority (FSCA) of South Africa and the National Insurance Commission (NIC) of Ghana were used to distil information on the determinants. These are the regulators of the insurance companies who provide a report on the state of the industry annually on their website. These databases provide data for variables including leverage, return on assets, type of audit firm, size, and insurers' line of business. Additional information on industrial diversification and ownership was sourced from the annual reports and websites of individual firms. This allowed for the identification of other drivers of ERM adoption. Given the absence of ERM disclosures, two techniques were utilised to determine whether an insurer has ERM in place or not. First, this paper adheres to the techniques by [23] by examining the websites and annual reports of insurers for insight into their ERM adoption. Second, a survey approach was employed to further confirm the firms' ERM adoption. The survey was crucial in identifying the specific year each firm adopted ERM, as this information was not publicly available. Additionally, the questionnaire directly inquired whether the firm had an ERM program in place. To mitigate any potential bias, the survey was cross-checked with the public information to ensure that they were consistent with their disclosed practices. This strengthened the general validity and assisted in mitigating any potential biases that could arise from depending solely on the survey. Furthermore, piloting was carried out with the help of anonymous risk experts to ensure the reliability of the instrument. Ethics approval was obtained from the ethics committee of the University of the Witwatersrand for the study. Informed consent forms were distributed, explained, and signed by respondents to declare their agreement to participate in the survey. Their participation was voluntary, and they could opt out at any point in time. Participants were assured of their anonymity and confidentiality. Information from the survey was further confirmed from the annual reports to reduce potential bias.

Estimation techniques

Linear regression

An insurer's adoption of ERM was evaluated using a dummy variable. For the years starting with and following the first instance of ERM adoption, the ERM variable is assigned a value of 1, while for the years prior to the first evidence of ERM adoption, it is assigned a value of 0 [23]. Thus, this study treats the dependent variable as dichotomous, as indicated in Eqs. (1) and (2), where a value of 1 is given to an insurer if ERM is adopted and 0 otherwise. The ERM variable is defined as follows:

$$\Pr\left(\mathrm{ERM}_{\mathrm{it}}\right) = 1\left(\overset{*}{}_{\mathrm{it}} \geq 0\right) = \begin{cases} 1 \text{ if } \mathrm{ERM}_{\mathrm{it}}^{*} \geq 0 \\ 0 \text{ if otherwise} \end{cases} \tag{1}$$

Such that:

$$\Pr\left(\mathrm{ERM}_{\mathrm{it}} = \frac{1}{X_{it}} = \Pr\left(X_{\mathrm{it}}\beta + \varepsilon_{\mathrm{it}}\right)\right) \tag{2}$$

Equation (2) signifies the probability of ERM adoption, taking into account the covariates X_{it} which includes a vector of predictor variables (determinants). The error term ε_{it} is assumed to follow a normal distribution with a mean of zero, where i and t denote the individual firm and time period, respectively.

The panel logistic regression was used in the study to analyse the data, and the maximum likelihood approach was used to estimate the model parameters. Panel logistic regression works well with longitudinal data and is well-suited for analysing dichotomous dependent variables. Panel data facilitate the tracking of missing variables and firm-specific effects, enabling the analysis of both short-term and long-term effects. This approach overcomes the limitations associated with time series and cross-sectional methods [45]. This paper shows that the random effects model is suitable due to minimal within-variation across insurers, a conclusion further supported by the Hausman test. In particular, the null hypothesis was not rejected by the Hausman test, indicating no systematic differences in the coefficients. This suggests that the unobserved heterogeneity issue is not a significant concern. The study consults previous studies to determine

Table 2 Description of variables

Variable	Abbreviation	Measurement	Source
Enterprise risk management	ERM	Dummy variable which is equal to 1 if firm has adopted ERM, and 0 otherwise	Hoyt and Liebenberg [23]
Firm size	Size	Natural logarithm of total assets	Horvey and Ankamah [21],Abbas et al. [1]
Industrial diversification	IND_DIV	Dummy variable is equal to 1 if the firm is industrially diversified and 0 otherwise	Farrell and Gallagher [13],Lechner and Gatzert [26]
Return on assets	ROA	Net profit divided by total assets	Oyewo [34]; Horvey et al. [20]
Big four auditing company	Big4	Dummy variable if the firm is audited by one of the big four audit companies (i.e. KPMG, Deloitte, Ernest and Young, PriceWaterhouseCoopers) and 0 otherwise	Lechner and Gatzert [26],Horvey et al. [20]
Industry type	Life	Dummy variable that takes the value of 1 if the firm is life insurance and 0 otherwise	Golshan and Rashid [15]; Lechner and Gatzert [26]
Financial leverage	LEV	Ratio of total debt/liabilities to asset capital	Lechner and Gatzert [26]
Institutional ownership	OWN	Dummy variable that takes the value of 1 if owned by foreigners and 0 otherwise	Golshan and Rashid [15], Syrová and Spička [43]

the appropriate specification of the drivers. Therefore, the general model is specified as follows:

$$\mathrm{ERM}_{\mathrm{it}} = \mathrm{f}\left(\mathrm{IND_DIV}, \mathrm{Size}, \mathrm{Big4}, \mathrm{Own}, \mathrm{ROA}, \mathrm{Life}, \mathrm{Lev}\right)_{it} \quad (3)$$

The logistic quantile regression

Several factors motivate the selection of the logistic quantile regression. First, Bottai et al. [9] narrate that it offers a more comprehensive insight than methods that focus on one summary metric. Second, it is particularly useful in addressing challenges associated with small sample sizes and mitigating the impact of outliers. Third, Orsini and Bottai [33] add that, it serves as a strong econometric approach for examining several aspects of the result distribution across varying covariate patterns, offering a more thorough analysis than focussing solely on the mean [33]. Hence, this technique is specified as:

$$\mathrm{Q}_{\mathrm{h}(\mathrm{yit})}(\mathrm{p}) = \mathrm{Q}_{\log \mathrm{it}(\mathrm{yit})}(\mathrm{p}) = x_{\mathrm{it}}^{\mathrm{T}}\beta_{\mathrm{p}} \quad (4)$$

The study assumes that for any quantile p, there exists a fixed set of parameters β_p and a known nondecreasing function h across the interval (y_{min}, y_{max}). X_{it} =($x_{it,1}^{T}$,..... $x_{it,p}^{T}$)^{T} is a vector of independent variables.

Definition of variables

The study also incorporates key determinants, as discussed in Sect. "Literature Review". Firm size is measured as the natural logarithm of total assets [19]. Financial leverage is measured as the ratio of debt to the asset capital [26]. The type of auditor is indicated by a dummy variable, where 1 denotes firms audited by one of the Big4 and 0 otherwise [7, 35]. The study further considers industrial diversification, which refers to the number of business segments held by the insurance company. This is measured as a dummy variable, assigned a value of 1 if the company is diversified across multiple segments, and 0 otherwise [15]. Return on assets is measured as net profit divided by total assets [20]. Additionally, the study evaluates whether insurers in the life insurance sector are more prone to implement ERM given the long-term nature of their operations. This variable is treated as a dummy, where 1 represents life insurance companies, and 0 indicates other sectors. The study posits that insurers in the life insurance industry are more likely to adopt ERM due to the long-term nature of their operations, which requires a more structured approach to risk management [23]. It is widely believed that foreign investors have a greater interest in achieving quick returns and are therefore more prone to embrace ERM. This variable is also treated as a dummy variable, where 1 represents foreign-owned firms and 0 represents non-foreign-owned firms [15]. Table 2 provides further information on the variables.

Results

Summary statistics

The summary statistics for the regression variables are presented in Table 3. Regarding ERM adoption, South Africa has the highest mean at 76%, while Ghana has a mean of 59%. This indicates that more insurers in South Africa have adopted ERM systems than the industry in Ghana. This difference is not surprising, as the South African insurance industry is well-established and advanced, with greater appeal to the international market, boasting the highest insurance penetration rate in Africa, whereas Ghana is one of the emerging insurance

Table 3 Descriptive Statistics

Variable	Obs	Mean	SD	Min	Max
South Africa					
ERM	252	0.758	0.429	0.000	1.000
Ind_Div	252	0.952	0.214	0.000	1.000
Size	252	35,346	11,135	2,220.00	653,435
Big4	252	0.921	0.271	0.000	1.000
Own	252	0.270	0.445	0.000	1.000
ROA	252	0.417	0.372	0.000	2.897
Life	252	0.444	0.498	0.000	1.000
Lev	252	0.647	0.675	−2.574	9.948
Ghana					
ERM	132	0.594	0.492	0.000	1.000
Ind_Div	132	0.765	0.426	0.000	1.000
Size	132	117,231	17,120	2,537.5	1,180,032
Big4	132	0.758	0.431	0.000	1.000
Own	132	0.697	0.461	0.000	1.000
ROA	132	0.091	0.132	0.010	1.310
Life	132	0.455	0.521	0.000	1.000
Lev	132	0.910	1.264	−0.452	12.512

ERM represent enterprise risk management adoption; Ind_Div represents industrial diversification; Size represents the firm size, Big4 represents the big four auditing company; OWN represents ownership, ROA represents return on assets; Life represents insurers that belong to the life insurance industry and LEV represents financial leverage

markets in the region. In terms of the determinants, the South African insurance industry has an average total asset value of 35,300 billion South African Rand, with 95% of insurers diversifying across various business segments. Around 92% of the companies are audited by one of the Big4 firms, and 27% are foreign-owned. On average, 42% of insurers' earnings are derived from their assets, as shown by the return on assets. Moreover, 44% of firms operate in the life insurance sector, with the average financial leverage at 65%, suggesting that insurers' assets surpass their liabilities.

In the case of Ghana, the sampled insurers have total assets averaging 117,231 million cedis. The findings indicate a mean return on assets of 9%, suggesting that the South African insurance industry generates more income from its assets compared to the Ghanaian industry. Seventy-six per cent of the insurance companies are audited by one of the Big4 audit firms, while 70% are owned by foreigners, indicating that most insurers are subject to audits by top global firms and have foreign ownership. Additionally, 46% of insurers offer life insurance products, and the average leverage in Ghana stands at 91%, which is higher than South Africa's leverage, highlighting that insurers in Ghana are more reliant on debt to fund their operations.

Table 4 Correlation Coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
South Africa								
(1) ERM	1.000							
(2) Ind_Div	0.221***	1.000						
(3) Size	0.194***	0.040	1.000					
(4) Big4	0.245***	−0.066	0.322***	1.000				
(5) Own	0.197***	0.137**	−0.107*	0.046	1.000			
(6) ROA	−0.155**	−0.047	−0.481***	0.018	−0.022	1.000		
(7) Life	−0.091	0.202***	0.345***	−0.210***	0.032	−0.293***	1.000	
(8) Lev	0.034	0.088	0.265***	0.088	0.164***	0.032	0.240***	1.000
Ghana								
(1) ERM	1.000							
(2) Ind_Div	0.385***	1.000						
(3) Size	0.214**	0.206**	1.000					
(4) Big4	0.294***	0.062	0.165*	1.000				
(5) Own	0.133	0.140	0.0377	0.089	1.000			
(6) ROA	−0.123	0.065	−0.390***	−0.019	0.176**	1.000		
(7) Life	−0.003	−0.111	−0.039	−0.090	−0.205**	0.152*	1.000	
(8) Lev	0.105	−0.005	0.046	0.011	0.021	−0.113	0.151*	1.000

***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively

Table 5 Univariate Difference Across ERM Status

	ERM = 1		ERM = 0		Difference	
Variable	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
South Africa						
Ind_Div	0.979	1.000	0.869	1.000	0.110***	0.000***
Size	14.822	14.573	13.761	12.815	1.061***	1.758***
Big4	0.958	1.000	0.803	1.000	0.155***	0.000***
Own	0.320	0.000	0.115	0.000	0.205***	0.000***
ROA	0.385	0.329	0.519	0.390	−0.134***	−0.061
Life	0.419	0.000	0.524	1.000	−0.105	−1.000
Lev	0.660	0.616	0.606	0.609	0.054	0.007
Obs	191	61				
Ghana						
Ind_Div	0.898	1.000	0.566	1.000	0.332***	0.000***
Size	18.066	18.158	17.454	17.499	0.612***	0.659***
Big4	0.861	1.000	0.604	1.000	0.257***	0.000***
Own	0.747	0.000	0.623	0.000	0.124	0.000
ROA	0.077	0.062	0.111	0.071	−0.034	−0.009
Life	0.456	1.000	0.453	1.000	0.033	0.000
Lev	1.019	0.752	0.749	0.694	0.272	0.058
Obs	79	53				

***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively

The correlation analysis for both countries is presented in Table 4. Additionally, variance inflation factors (VIFs) were calculated to assess multicollinearity. The VIF results are shown in Table 7, and the results are significantly lower than the 10-point critical threshold, suggesting that multicollinearity is not an issue. Therefore, the variables considered are deemed appropriate for inclusion in the regression model.

Univariate analysis

The study begins by examining the differences between ERM-adopting firms (ERM = 1) and non-ERM firms (ERM = 0), as displayed in Table 5. The descriptive analysis reveals that 76% of the South African insurers and 59% of the Ghanaian insurers have implemented ERM. This difference is expected, considering that there are more insurers in South Africa than in Ghana. The study calculates the mean and median for both ERM and non-ERM insurers and examines the differences between the two categories.

A two-sample t-test was employed to assess the mean difference and the nonparametric Wilcoxon rank-sum test was used to explore the median difference. Overall, the average means of ERM firms are higher than those of non-ERM firms, with the exception of ROA and life insurers. For example, the mean firm size for ERM-adopting companies is slightly higher (14.922 and 18.066) than that of non-ERM firms (13.761 and 17.454) in South Africa and Ghana, respectively. The result was statistically significant for both countries, indicating that, on average, ERM firms are larger in size than non-ERM firms. This supports the hypothesis that larger firms encounter more complexities and risks, prompting them to adopt ERM to address these challenges. Additionally, the mean values for Ind_Div, Big4, and Own are higher for ERM firms in both Ghana and South Africa, though their median values remain the same. All of these variables, except for ownership, are statistically significant. The univariate analysis results support the idea that insurers with diversified business segments and those frequently audited by one of the Big4 firms are more inclined to adopt an ERM system. This aligns with the view that audit firms prioritise robust risk management and transparency in accounting, thereby encouraging their clients to adopt ERM. Furthermore, firms with diversified business segments are exposed to group risks, which are likely to drive their decision to implement ERM. Regarding ownership, foreign-owned firms tend to adopt ERM more frequently than non-ERM firms, although this was statistically insignificant in the Ghanaian context.

Regarding profitability, the mean difference in ROA for South African insurers was negative and statistically significant in both samples. The comparison also reveals an insignificant negative difference in the median for both countries. The significant negative

mean difference contradicts the hypothesis that more profitable firms are more likely to adopt ERM. This outcome could suggest that less profitable firms adopt ERM as a strategy to mitigate potential financial distress that may affect their returns. For the other variables (Life and Lev), no statistically significant differences were found in the means and medians for both countries. The mean difference for life insurers yielded inconclusive results.

Sensitivity analysis

The study also performs a sensitivity analysis to verify the robustness of the covariates, using seven different regressions. The determining factors are incorporated progressively into the regression model to assess the stability of each covariate. In the first model, one explanatory variable is introduced, with additional variables added in the subsequent models. The final model represents the comprehensive model. Table 6 presents the coefficient estimates from the sensitivity analysis using the panel logistic regression method, with the dependent variable held constant. Notably, the results remain consistent across all specifications, confirming the robustness of each determinant in relation to ERM adoption. This suggests that individual determinants and ERM adoption are strongly associated, regardless of the inclusion of other variables. Furthermore, the statistical significance discovered for the majority of determinants across the models validates their influence and dependability, even as the regression framework's complexity increases. This stability increases confidence in the validity of the results by indicating that the relationships are not affected by changes to the model specification. The analysis validates that the determinants are essential factors behind the adoption of ERM by showing consistency in the effects of these factors. Their practical value for researchers and decision-makers seeking to comprehend or improve ERM processes in corporate contexts is highlighted by their robustness. Firm size is only significant in models 3 and 4 for the South African case, while it shows insignificant and positive results in the other models. A possible explanation could be that firm size is more nuanced and intertwined with other factors that gain more prominence in more comprehensive specifications.

Presentation of empirical findings and discussions

Linear regression analysis

This study investigates the firm characteristics that influence ERM adoption in South Africa and Ghana. A panel logistic regression was employed to estimate the results of the determinants. The study presents that the random effect model is appropriate, as confirmed by the Hausman test. Additionally, the data was found to be suitable for simple pooled OLS analysis. The empirical findings are presented in Table 7, where the first column lists the determinants, the second column reports the VIF, and the third, fourth, and fifth columns present the estimated parameters of the Random Effects (RE), Marginal Effects (ME), and Pooled OLS (POLS) models, respectively.

The empirical findings reveal that while the parameter estimates are consistent across both countries, the statistical significance varies in several aspects. Specifically, five out of the seven determinants from the South African sample significantly explain ERM adoption, whereas only two factors were significant in the Ghanaian sample. These differences in significance may be attributed to the sample size, as well as the higher proportion of insurers without ERM adoption in Ghana compared to South Africa. This finding aligns with Hoyt and Liebenberg [22] and Horvey et al. [20], who observed numerous insignificant results in their regression models, attributing this to the prevalence of non-ERM firms within their samples.

The estimated results indicate that industrial diversification (Ind_Div) has a positive effect on ERM adoption. This relationship is statistically significant at the 1% level for both South Africa and Ghana, supporting the hypothesis that insurers with more diversified business operations are more inclined to implement ERM. This is because insurance companies with other business segments face complexities and high levels of risk, which requires a strong risk management system. By implementing ERM, insurers may ensure a more informed and flexible approach to decision-making by better matching their risk management plans with the complexities brought about by diversification [20]. This finding is consistent with the literature [5, 26]. On the contrary, Farrell and Gallagher [13] reveal an inverse relationship, but this may be due to their sample size and data type. Given this finding, the study posits that implementing ERM helps mitigate the complexities linked to diversification, thereby improving insurance performance [1]. Hence, industrially diversified insurance companies are encouraged to implement ERM. By implementing ERM, insurers can improve their operational resilience and financial stability by thoroughly identifying, evaluating, and mitigating risks across their diverse portfolios.

Regarding firm size, the result shows that size positively drives insurers' decisions to adopt ERM, which is in line with the literature [13]. The positive relationship could be explained by the fact that bigger insurance companies typically deal with a broader range of interconnected

Table 6 Sensitivity analysis regarding the determinants of ERM adoption

Variables	**ERM Adoption (South Africa)**						
	ERM1	**ERM2**	**ERM3**	**ERM4**	**ERM5**	**ERM6**	**ERM7**
Ind_Div	14.660***	17.060***	17.320***	16.240***	14.850**	19.890***	18.980***
	(3.396)	(3.450)	(3.527)	(3.606)	(7.535)	(4.724)	(5.315)
Size		0.694	0.830**	1.385***	0.382	0.690	0.864
		(0.515)	(0.409)	(0.441)	(0.532)	(0.566)	(0.577)
Big4			14.300***	12.130***	17.140***	15.020***	10.150***
			(2.866)	(2.971)	(5.125)	(4.008)	(3.859)
Own				6.508**	5.704**	5.835*	6.389**
				(2.794)	(2.763)	(3.134)	(2.646)
ROA					−7.013**	−8.029***	−8.024***
					(2.842)	(2.508)	(2.798)
Life						−6.070**	−7.150**
						(2.708)	(2.928)
Lev							0.814
							(0.747)
Constant	−3.643	−14.08*	−31.94***	−37.89***	−23.72**	−27.88***	−25.57***
	(2.625)	(8.509)	(5.895)	(6.411)	(9.926)	(8.852)	(8.657)
Observations	250	250	250	250	250	250	250
Number of id	63	63	63	63	63	63	63
LR Test	150.26***	143.10***	137.68***	130.83***	132.79***	128.62***	127.98***
Wald Test of Ind Eq	18.64***	24.53***	66.17***	66.44***	30.54***	44.19***	55.82***
Variables	**ERM Adoption (Ghana)**						
	ERM1	**ERM2**	**ERM3**	**ERM4**	**ERM5**	**ERM6**	**ERM7**
Ind_Div	2.644***	2.503***	2.414***	2.354***	2.518***	2.543***	2.589***
	(0.848)	(0.886)	(0.776)	(0.782)	(0.807)	(0.810)	(0.743)
Size		0.344	0.269	0.265	0.154	0.152	0.076
		(0.274)	(0.243)	(0.239)	(0.266)	(0.260)	(0.263)
Big4			1.804**	1.762**	1.869**	1.912**	1.898**
			(0.774)	(0.761)	(0.785)	(0.776)	(0.776)
Own				0.348	0.186	0.267	0.193
				(0.603)	(0.646)	(0.698)	(0.699)
ROA					−3.060	−2.820	−4.742
					(2.610)	(2.639)	(3.590)
Life						−0.350	−0.090
						(0.677)	(0.683)
Lev							0.612
							(0.392)
Constant	−1.466**	−7.461	−7.479	−7.556*	−5.404	−5.343	−4.421
	(0.653)	(5.100)	(4.562)	(4.546)	(5.020)	(4.893)	(4.927)
Observations	132	132	132	132	132	132	132
Number of id	33	33	33	33	33	33	33
LR Test	7.20***	7.05***	3.58**	3.31**	3.52**	3.34***	2.33*
Wald Test of ind eq	9.72***	8.39***	12.33***	12.51**	13.09**	13.39**	17.01**

***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively

Table 7 Panel logistic regression results

	South Africa				Ghana			
Variables	**VIF**	**RE**	**ME**	**POLS**	**VIF**	**RE**	**ME**	**POLS**
Ind_Div	1.063	18.981***	0.187**	0.473***	1.362	2.589***	0.379***	0.428***
		(5.315)	(0.093)	(0.119)		(0.743)	(0.057)	(0.094)
Size	1.818	0.864	0.005	0.031**	1.329	0.077	0.011	0.010
		(0.577)	(0.008)	(0.015)		(0.263)	(0.038)	(0.029)
Big4	1.346	10.150***	0.179**	0.255**	1.139	1.898**	0.278***	0.306***
		(2.859)	(0.093)	(0.106)		(0.776)	(0.093)	(0.092)
Own	1.059	6.389**	0.055**	0.179***	1.135	0.193	0.028	0.037
		(2.646)	(0.030)	(0.059)		(0.699)	(0.103)	(0.092)
ROA	1.385	−8.024***	−0.116*	−0.138*	1.109	−4.742	−0.695	−0.532**
		(2.798)	(0.092)	(0.081)		(3.590)	(0.500)	(0.234)
Life	1.375	−7.150**	−0.082	−0.168***	1.065	−0.090	−0.013	−0.029
		(2.928)	(0.064)	(0.059)		(0.683)	(0.100)	(0.079)
Lev	1.220	0.814	0.013	−0.015	1.052	0.612	0.090	0.044*
		(0.747)	(0.021)	(0.041)		(0.392)	(0.058)	(0.026)
Constant		25.57***		−0.280		−4.421		−0.150
		(8.657)		(0.233)		(4.927)		(0.535)
Obs		250	252	250		132	132	132
R-squared				0.196				0.261
Prob > F				0.000				0.000
No. of id		63	63			33	33	
LR Test		127.98***				2.330*		
Wald Test		55.82***				17.01**		

Standard errors in parentheses; where ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. RE is Random Effect; ME is Marginal Effect; POLS is Pooled OLS; VIF is Variance Inflation Factor; LR Test is Likelihood-ratio test

risks than smaller firms, which may require the presence of ERM to help manage their intrinsic operational complexity. This argument is supported by Lechner and Gatzert [26], who state that a proportional increase in firm size results in a higher number of risks, which drives firms to adopt ERM. Horvey et al. [20] add that, as a firm grows, so does the scope and complexity of its operations. This complexity exposes the company to more risks and affects the type, timing, and size of the risks it faces. This makes the implementation of ERM imperative since it allows firms to systematically identify and manage risks across the whole operation. However, this relationship was statistically insignificant for both countries. This is expected, as ERM is still gaining traction in these regions, and many insurers are in the early stages of adopting ERM. The insignificance could also be a reflection of market-specific dynamics. To level the playing field and ensure that both big and small insurers follow the same risk management guidelines, the regulatory frameworks in these countries, for instance, may mandate the implementation of ERM regardless of firm size.

As hypothesised, the findings show that insurers audited by one of the Big4 audit firms are more prone to embrace ERM, as evidenced by the significant positive results for both countries. This affirms the findings from the literature [7, 5, 39]. The empirical findings can be explained by these auditing firms' desire to maintain their reputation [39]. In this process, they make sure that audited insurers comply with risk management regulations and generally accepted accounting principles [26]. Additionally, it is the responsibility of external auditors to guarantee that the internal controls and financial systems of the companies they audit adhere to generally accepted accounting standards and principles [20]. This is true for the Ghanaian and South African insurance industry, which have a regulatory mandate to implement a robust risk management system, such as ERM. The results lend credence to the theoretical claim that implementing ERM is feasible in a regulated setting.

The paper also shows that foreign-owned insurers and ERM are positively related in both contexts. The literature posits that shareholder pressure is one of the primary reasons affecting the adoption of ERM. Scholars argue that shareholders benefit from integrated risk management as it enables companies to make better risk-adjusted decisions and enhance corporate value [1].

Therefore, with all things being constant, foreign-owned companies are more likely to adopt ERM. Pagach and Warr [36] support this finding. The sample for South Africa presents a significant relationship at 5%, suggesting that foreign investors in the South African market seek higher returns in a shorter timeframe, motivating firms to implement robust risk management systems. On the other hand, the result for Ghana demonstrates an insignificant relationship. The differences could be due to contextual differences. For instance, the South African insurance market is the biggest industry in Africa, and it has a strong regulatory environment and appeals to the global financial market [38]. This increases the pressure on foreign-owned firms to adopt ERM in order to align with international standards and investors' expectations. In the case of Ghana, the insurance sector is smaller and less developed, and there may be less pressure on companies to follow international ERM standards or less regulatory enforcement. Additionally, Ghanaian foreign-owned insurers may encounter obstacles such as a lack of local resources or expertise to properly practice ERM.

In terms of ROA, the empirical evidence for South Africa suggests that profitable insures are less prone to embrace ERM. The same trend was observed in Ghana. While this is unexpected, a possible explanation could be that highly profitable insurers might not see the urgent need for ERM. These businesses may believe that their solid financial results offer a sufficient hedge against possible risks, which would cause them to place less importance on implementing ERM. The negative results for profitability support Lechner and Gatzert's [26] findings. Ahmad Jaber and Mohammed Shah [2] confirm this relationship and narrate that highly profitable firms may be less inclined to implement ERM due to the associated costs, such as appointing a Chief Risk Officer (CRO), setting up a risk committee, and allocating the necessary human and financial resources for implementing ERM. This confirms the theoretical and empirical findings, which argue that firms that have recently experienced poor performance and are at higher risk of default are more likely to implement an ERM strategy [25]. Other scholars suggest that less profitable insurers are more inclined to adopt ERM in order to mitigate any costs that could impact their profits [26]. Despite the negative results, it is essential to highlight that while the implementation of ERM may incur costs, its potential to enhance value should not be underestimated. Moreover, while the adoption of ERM can be costly, its profitability is anticipated to be realised gradually over time [26]. Therefore, profitable firms must not desist from implementing ERM.

Surprisingly, the empirical results in both contexts illustrate that the life insurance inversely influence the adoption of ERM. The negative relationship can be explained by the small number of life insurers in the sample, as well as the long-term nature of the life insurance business; they are more likely to prioritise other investments over ERM [3]. However, in order to better manage new risks, including environmental risks, regulatory changes, and systemic shocks, life insurers are still urged to implement ERM [14]. This ensures they stay competitive and compliant in a risk environment that is becoming more complex while strengthening their resilience, aligning with global best practices, and changing regulatory standards.

When examining the influence of leverage, it is evident that leverage positively correlates with ERM adoption, showing consistency for both contexts. This positive relationship aligns with the findings of [25, 40]. The positive could stem from the fact that insurance companies with high levels of debt are more prone to embrace ERM due to their high risks and a great chance of going bankrupt [20]. It should be mentioned that in a heavily leveraged corporation, the risk of insolvency shifts from owners to creditors. To put it another way, creditors can continue to control the business without making any investments because they are not allowed to vote at the annual general meeting. As a result, these dynamics might also be related to the pressure on heavily indebted businesses to adopt ERM. Abbas et al., [1] support this argument and narrate that leverage increases a company's reliance on external parties or creditors and raises the possibility that it will have trouble fulfilling its financial commitments and interests [1]. Given this, the study suggests that insurance companies with high leverage should adopt ERM to manage their financial distress.

Results from the quantile regression

The use of this technique provides additional insights into the behaviour of the determinants according to the different levels of the distribution. The results are presented in Tables 8 and 9. For the continuous variables (thus, leverage, return on assets, and size), their quadratic terms were taken to capture their nonlinear relationships. The findings are reported in Models (1) to (3) and the quantile regression results are reported in Models (4) to (7) for both samples. In both samples, the paper presents quantiles at 0.20, 0.40, 0.60, and 0.80. The bootstrap approach with 100 replications was used to obtain the standard errors of the coefficient estimates.

Regarding the sample from South Africa, the results from the quantile regression indicate that firm size positively influences ERM adoption at lower levels and negatively drives ERM adoption at higher levels, implying an inverted U-shaped relationship but mostly insignificant.

Table 8 Quantile regression results (South Africa)

South Africa	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Quantile regression			
Variables	RE	RE	RE	Q.20	Q.40	Q.60	Q.80
Size	−0.473	0.848*	1.135*	0.853***	0.00858	0.00984	0.00011***
	(4.212)	(0.630)	(0.635)	(0.232)	(0.00914)	(0.0124)	(0.00002)
$Size^2$	0.0328			−0.0266***	−0.000148	−0.000137	−0.000213
	(0.141)			(0.00756)	(0.000296)	(0.000395)	(0.00345)
ROA	−8.924***	−14.05***	−13.57***	0.244	0.278***	0.228***	0.000034**
	(3.185)	(5.348)	(4.458)	(0.332)	(0.0125)	(0.0176)	(0.00021)
ROA^2		3.822*		−0.09871	−0.349***	−0.334***	−0.0003***
		(2.166)		(0.12001)	(0.00459)	(0.00604)	(0.00001)
LEV	1.158	0.618	−14.250	−0.476***	−0.0524***	−0.0845***	−0.00010
	(0.943)	(0.758)	(15.081)	(0.125)	(0.00610)	(0.00972)	(0.0012)
LEV^2			4.022	0.0440***	0.0119***	0.0150***	0.00003***
			(11.682)	(0.0119)	(0.000579)	(0.000918)	(0.00001)
Ind_Div	19.05***	18.95***	19.224***	0.639***	2.076***	2.047***	0.00017**
	(4.245)	(5.853)	(5.847)	(0.227)	(0.00877)	(0.0109)	(0.00005)
Big4aud	8.266**	10.262**	15.451***	0.08762	2.158***	1.124***	0.000023*
	(3.450)	(4.628)	(4.808)	(0.190)	(0.00772)	(0.0112)	(0.00016)
Own	4.834**	6.276**	6.921**	1.638***	0.0173***	0.0274***	0.00001***
	(2.345)	(2.872)	(3.048)	(0.12032)	(0.00437)	(0.00565)	(0.00000)
Life	−6.208**	−7.595**	−6.666**	−0.0289	−0.00204	−0.00078	0.00013***
	(2.535)	(3.216)	(2.952)	(0.12721)	(0.00520)	(0.00604)	(0.00001)
Constant	−10.103	−23.242**	−24.910**	−7.784***	−3.256***	−2.172***	1.099***
	(31.632)	(9.342)	(10.760)	(1.73410)	(0.07101)	(0.09501)	(0.02311)
Observations	252	252	252	252	252	252	252
Number of id	63	63	63				
LR Test	125.55***	129.06***	121.43***				
Wald Test	43.16***	47.10***	47.28***				

On the other hand, the Ghanaian sample demonstrates a direct U-shaped relationship, showing statistical significance. This relationship suggests that smaller firms are less likely to adopt ERM compared to larger firms. Bohnert et al. [8] suggest that larger firms are more susceptible to financial distress, which drives them to implement ERM. This is because ERM assists in managing the increasing complexities associated with firm growth [20]. This confirms Abbas et al.'s [1] explanation that, as a business expands, so does the scope and complexity of its operations. They are more susceptible to risks due to their complexity, which can affect the kind, timing, and extent of the firm's risks. In light of this, ERM is crucial for insurers, as it enables them to systematically manage their risks across the entire operation [20].

More so, return on assets presents an inverted U-shaped nexus for both countries and is statistically significant across quantiles. This implies that insurers with low profitability are more prone to implement ERM in order to robustly manage risks to propel their performance, while large insurers are less likely to ensure ERM adoption. This is explained by Lechner and Gatzert [26], who contend that the high resource requirements for ERM implementation deter more profitable firms from implementing ERM. For financial leverage, the study found a direct U-shaped relationship for all quantile levels in South Africa. This suggests that leverage has a negative effect on ERM adoption in the early stages but a positive impact at more advanced stages. This affirms the argument that the tendency to implement ERM is greater in firms with high leverage [1]. Khan et al. [25] indicate that high-leverage firms, with their increased risk and greater likelihood of bankruptcy, implement ERM to mitigate the cost of financial distress. This helps them to manage their costs of debts for higher returns [37]. Given this, insurers are more likely to consider ERM implementation. Contrarily, the Ghanaian sample shows an inverted U-shaped relationship. Unlike the South African insurance industry, which is the largest in Africa, the Ghanaian industry

Table 9 Quantile regression results (Ghana)

Ghana	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Quantile regression			
Variables	RE	RE	RE	Q.20	Q.40	Q.60	Q.80
Size	−7.730**	0.063	0.130	−3.90432***	−0.01001	−0.02051**	−0.00871
	(3.863)	(0.272)	(0.270)	(0.42612)	(0.06900)	(0.00795)	(0.00865)
$Size^2$	0.231**			0.117***	0.00031*	0.00055**	0.00024
	(0.116)			(0.01323)	(0.00022)	(0.00023)	(0.00026)
ROA	−5.315	0.298	−4.727	−0.24421	0.14823***	0.22845***	0.29712***
	(3.550)	(8.419)	(3.605)	(1.34812)	(0.01650)	(0.01864)	(0.02686)
ROA^2		−13.613		−0.23021	−1.39123***	−1.45794***	−1.50575***
		(17.264)		(0.93432)	(0.01145)	(0.01283)	(0.01934)
LEV	0.610	0.587	−1.723	−0.00038	0.00753***	0.00159	0.00089
	(0.413)	(0.408)	(1.215)	(0.10231)	(0.00147)	(0.00183)	(0.00287)
LEV^2			0.854*	0.01105	−0.00055***	−0.00013	−0.00012
			(0.485)	(0.07670)	(0.00011)	(0.00014)	(0.00021)
Ind_Div	2.474***	2.626***	2.564***	0.32534**	2.19033***	2.19267***	0.00860***
	(0.824)	(0.765)	(0.684)	(0.15503)	(0.00213)	(0.00238)	(0.00114)
Big4aud	1.645**	1.930**	2.158***	0.12834	0.01156***	0.00342	0.00414
	(0.792)	(0.792)	(0.797)	(0.13902)	(0.00207)	(0.00294)	(0.00331)
Own	0.550	0.157	0.133	0.18332	−0.00111	0.00143	0.00073
	(0.786)	(0.727)	(0.708)	(0.13501)	(0.00194)	(0.00221)	(0.00309)
Life	−0.409	−0.0768	−0.068	0.00964	−0.00019	0.00200	0.00135
	(0.794)	(0.702)	(0.713)	(0.13625)	(0.00172)	(0.00204)	(0.00288)
Constant	61.232*	−4.433	−4.524	30.94276***	−1.03243***	−0.91615***	1.15623***
	(32.231)	(5.139)	(5.008)	(3.61681)	(0.05731)	(0.06836)	(0.07231)
Observations	132	132	132	132	132	132	132
Number of id	33	33	33				
LR Test	2.94**	2.41**	2.33**				
Wald Test	18.42***	16.71***	20.25***				

is still growing and does not have sufficient resources; hence most insurers rely on debt to fund their business. As a result, higher leverage necessitates the need for a strong risk management system such as ERM to manage the cost of financial distress. It is also important to highlight that insurers who rely excessively on leverage may face financial constraints, which could limit their ability to invest and effectively implement ERM, which might be the cause of the inverted U-shaped relationship. Nevertheless, the relationship is statistically insignificant.

The analysis also shows that industrial diversification, ownership, and the Big4 audit firms are positively related to ERM adoption at various distribution levels, with significant coefficient estimates observed across all quantile distribution levels for the two samples. The findings illustrate that insurers that are industrially diversified, foreign-owned, and audited by one of the Big4 audit firms are more prone to embrace ERM. Foreign-owned firms may be subjected to strict governance mechanisms and international best practices which stimulate ERM adoption while industrially diversified insurers are often exposed to diverse risks. This supports the literature's argument that firms with diversified business segments encounter numerous complexities, thereby encouraging ERM adoption [20]. Additionally, the Big4 auditors aim to maintain reliability and transparency and are more inclined to suggest ERM implementation to their clients as part of their audit and advisory services [26]. Life insurers showed a negative relationship across quantiles but demonstrates a significant positive impact in the 80th quantile, as seen in the South African sample. The implication is that at lower quantile levels, life insurers are less likely to adopt ERM due to a more conservative risk profile. However, as life insurers become large, more established, and advanced, the decision to implement ERM strategies becomes necessary. The Ghanaian sample was mostly positive across all quantiles but insignificant. Ownership illustrates a significant positive relationship in the case of South Africa. Proponents argue that foreign

shareholders benefit from integrated risk management because it enables companies to make more informed, risk-adjusted decisions and increase corporate value [35].

Conclusion and recommendations

Conclusion

This paper adds to the body of knowledge by examining the factors driving ERM adoption, in the context of emerging markets in Africa, an area that has been underexplored to the best of the researcher's knowledge. Specifically, the study investigates the factors influencing ERM adoption among insurers in Ghana and South Africa from 2015 to 2018. Additionally, the study employs a novel quantile regression approach, in contrast to the traditional linear methods used in previous research, to assess the drivers of ERM adoption. This approach provides a comprehensive overview of the factors influencing ERM adoption at different levels. Using a panel logistic regression approach, the empirical results reveal that industrial diversification and the type of audit firm are significantly and positively associated with ERM adoption among insurers in Ghana and South Africa. This is because insurers engaged in other business segments adopt ERM to mitigate the complexities associated with diversification. Furthermore, the Big4 audit firms mostly advocate for their clients to implement ERM to ensure compliance with generally accepted accounting practices and other regulatory risk management policies. The study also reveals a positive relationship between ownership and ERM adoption, which is statistically significant for South African insurers. Regarding financial leverage, the results show a positive but insignificant effect on ERM adoption. This positive relationship suggests that firms relying on loans for financing embrace ERM to mitigate financial distress. Regarding firm size, the findings indicate a positive relationship with ERM adoption; however, the insignificant results suggest that firm size does not significantly influence insurers' decision to implement an ERM system in Ghana and South Africa. Interestingly, life insurers and profitability show negative relationships with ERM adoption. These relationships were statistically significant for South Africa but insignificant for Ghana. The negative results imply that firms with lower profitability are more likely to adopt ERM.

The findings from the quantile regression further suggest that initial levels of size and profitability leverage advances ERM adoption in the South African case, while significant increases in these factors weakens ERM adoption. This indicates an inverted U-shaped relationship. These relationships were significant across all quantiles. In contrast, leverage exhibits a U-shaped relationship. More so, the study reveals an inverted U-shaped relationship for return on assets and leverage in the Ghanaian sample, beginning from the 40th quantile. Additionally, a significant positive relationship is found for industrial diversification, Big4 audit firms, and ownership across all quantiles. Furthermore, life insurers positively influence ERM adoption only at higher levels.

Theoretical contributions

The study's findings provide a nuanced understanding that supports and expands on the concepts of contingency and institutional theories. The results demonstrate that internal organisational factors such as size, leverage, profitability, and industrial diversification stimulate ERM adoption, with varying effects according to the level of implementation. This aligns with the principles of contingency theory and underscores how important it is to align ERM practices with firm-specific operational contexts. More so, the evidence that external factors such as the Big4 audit companies and ownership structure contribute to ERM adoption supports the institutional theory. The study further challenges conventional knowledge that the strength of institutional factors is not uniform but depends on the level of market dynamics and regulatory maturity, as observed in Ghana and South Africa. By capturing the heterogeneity in these influences, the results support the theoretical insights of how these factors contribute to shaping ERM adoption in different contexts.

Policy implications

Given the findings above, this paper recommends that insurers consider implementing ERM to effectively manage the factors contributing to its adoption. It is essential to understand that these factors do not operate in isolation; therefore, a holistic evaluation may provide valuable insights for their management. Furthermore, insurers reliant on debt financing should prioritise ERM adoption to mitigate the costs associated with financial distress. Further, insurance companies could leverage the expertise of the Big4 audit companies to enhance their ERM frameworks. These companies have the expertise and resources to guide the implementation and compliance of effective ERM practices, which align with international standards. The study provides a basis for regulatory bodies to refine policies and frameworks that encourage ERM practices. In South Africa, where the insurance industry is more advanced, regulators might help insurers compare their ERM implementation to industry best practices using benchmarking tools. Also, the study suggests that the FSCA should ensure that poorly performing insurers consider adopting ERM to enhance profitability and better manage the complexities

and costs associated with financial distress, especially in relation to diversification, leverage, and growth in the insurance business. For Ghana, it was discovered that most insurance companies have not yet adopted ERM, which may explain the numerous insignificant results in the study. Therefore, this paper suggests that the NIC monitors insurers' activities. Insurers that are large in size and aim to increase their profitability and leverage should promote ERM adoption, as it helps manage the complexities associated with these factors. More so, Ghana's regulatory policies should focus on increasing awareness and investing in capacity building to enhance knowledge and skills for ERM systems through training and other regulatory support.

From a managerial perspective, the study highlights how important it is for businesses to cultivate a risk-aware culture. Managers should consider ERM as a strategic tool rather than merely a compliance requirement and integrate risk considerations into their daily activities. Training programs at different levels of the organisation could help employees better understand and align with ERM goals. Additionally, by employing reward systems to encourage risk-aligned performance, proactive risk management strategies can be encouraged. The results are extremely pertinent to other developing economies that face similar challenges, including resource constraints, market volatility, and regulatory development. ERM enforcement in these markets can be implemented gradually by policymakers using a combination of mandated regulations, technical guidance, and facilitating capacity-building programs. By prioritising governance reforms and utilising external knowledge to create strong ERM frameworks, insurers in these areas can also learn from the study. Establishing regional partnerships to exchange best practices and standardise regulatory requirements might help emerging markets even more by creating an atmosphere that is conducive to the implementation of ERM.

Limitations and future research

Despite the contributions made in this paper, there are some constraints that offer opportunities for further studies. First, the study's sample was limited to only a few determinants. However, other factors influencing ERM adoption could provide a more comprehensive understanding of the determinants. Given this, scholars could consider other determining factors such as board characteristics, existing risk management function structure, economic characteristics, and firm culture. Additionally, the approach to measuring industrial diversification can be improved by considering the number of business segments a firm operates in. Furthermore, this research focussed solely on the Ghanaian and South African insurance industry, which limits the generalisability of the findings. This paper encourages future research to explore these concepts in other emerging economies to offer a comprehensive evaluation of the factors driving firms to adopt ERM. Additionally, further investigation is required to understand the nonlinear relationship and identify the threshold levels at which these factors impact ERM. Due to the absence of ERM disclosure, a binary approach was employed in this study. Future research could focus on developing a more robust method for identifying ERM adoption. The use of quantile regression in ERM research presents new avenues for investigation, particularly when market conditions or firm characteristics vary significantly. Hence, scholars could explore the sectoral variations, firm-specific variables, or cross-sectional disparities in the adoption of ERM at different stages using this technique. Additionally, future studies could look at state-of-the-art techniques like machine learning or structural equation modelling to closely examine these relationships.

Abbreviations

CRO	Chief risk officer
ERM	Enterprise risk management
FCSA	Financial sector conduct authority
LEV	Leverage
NIC	National insurance commission
PwC	PricewaterhouseCoopers
ROA	Return on assets
SAM	Solvency assessment and management framework
SSA	Sub-Saharan Africa
VIF	Variance inflation factor

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