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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Enterprise risk management and firm performance: Empirical evidence from Ghana equity market

Sylvester Senyo Horvey^{1,2*} and Jacob Ankamah³

Abstract: This paper examines the linear and non-linear relationship between Enterprise Risk Management (ERM) and firm performance while focusing on how operational status (financial and non-financial listed firms' status) affects this relationship in Ghana. Analysis of 30 listed firms on Ghana Stock Exchange between 2010 and 2016 in a robust fixed effect and random effect estimation techniques, presented new insights into ERM literature. We showed that ERM propels firm performance at both the firm level (return on assets and equity) and market level (Tobin Q) performance of listed firms in Ghana. A non-linear inverted U-shape is observed when return on equity is employed as a performance indicator while a non-linear direct U-shape is observed when return on assets and Tobin Q are employed as performance indicators. A non-linear relationship exists between ERM and performance of listed firms in Ghana whether the non-linearity is an inverted U shape or direct U shape depends on the firm performance. This paper recommends that firms should implement fundamental robust measures and dynamic risk management techniques to get better ERM outcome. Enterprise Risk Management should be implemented in both financial firms and non-financial firms because firms which practice ERM are more likely to perform better than Non-ERM counterparts.

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PUBLIC INTEREST STATEMENT

In recent decade particularly between the year 2010 through 2016, there has been a looming financial crisis in Ghana. Most of the financial firms have ran into bankruptcy as result of high debt, risk management strategies that firms fail to consider in the corporate governance system. This study attempts to examine whether there exists a non-linear relationship between Enterprise Risk Management (ERM) and firm performance while considering the role of operational status on Ghana equity market. ERM propels firm performance at both the firm level (return on assets and equity) and market level (Tobin Q) performance of financial and nonfinancial listed firms in Ghana. Little is known about ERM within the African context, particularly Ghana. This paper contributes new empirical evidence by adopting a more detailed measure for ERM with useful findings which are deemed relevant guide for equity market policy implications.

Subjects: Economics; Finance; Business, Management and Accounting

Keywords: Enterprise risk management; Tobin Q; firm performance; Ghana

1. Introduction

Enterprise risk management (ERM) has remained a subject of great interest in this contemporary time (Viscelli et al., 2016). Most businesses stress on the importance of risk management as this determines their survival and business performance (Acharyya, 2009; Hoyt & Liebenberg, 2008). It follows that risk management is an important factor in improving financial performance. ERM implementation is on the ascendancy. However, some organizations are yet to consider implementing ERM programmes (Hoyt & Liebenberg, 2011). Compared to the traditional risk management where firms managed risks in “silos,” ERM supports firms to manage risks in an enterprise-wide system. The holistic way of managing risk in an integrated manner is called Enterprise risk management (Gordon et al., 2009). The ultimate goal of ERM is to ensure that organizations create value (Pagach & Warr, 2010). Risk management was traditionally done in silo's, but the main essence of risk management may not be realized until various silo risk management techniques are managed under one umbrella (Acharyya, 2009).

Most studies on ERM used a discrete metric, thus a dummy variable for ERM identification, thus CRO = 1 when there is a Chief Risk Officer and zero (0) otherwise (Acharyya, 2009; Beasley et al., 2008; Hoyt & Liebenberg, 2008; Liebenberg & Hoyt, 2003; Pagach & Warr, 2010; 2011; Hoyt & Liebenberg, 2011). However, using a single variable may not be a good predictor of ERM adoption. A good measure for ERM should be a continuous metric rather than a discrete metric. This is because ERM is a process that takes place over a continuum and not an event (Lundqvist, 2014; Nii Okai, 2015). Hence, this study fills in the gap with the use of a continuous metric by adopting different features to measure the sophistication of ERM.

Studies conducted in Ghana have focused on risk management practices among the life and non-life insurers (Akotey & Abor, 2013), commercial banks in Ghana (Kumah & Sare, 2013) and the small and medium scale enterprises (Abotsi et al., 2014) without explicitly focusing on how these influence performance. More so, no study seems to address the ERM and performance relationship in the Ghanaian certain. Hence, this study becomes the first to investigate the relationship between ERM and firm performance as well as analyzing its effect on financial and non-financial firms. This study focuses on ERM in the Ghanaian setting because it has just been adapted into the framework of most firms in Ghana. For instance, the National Insurance Commission (NIC) in 2015 issued a new solvency framework and as part of measures put in place, have adopted the Risk-Based approach to Supervision of Insurers. The NIC has also developed a Governance and Risk Management Framework to guide the operational activities of insurers as well as enhance the effective supervision of the Insurance companies. Also, the Bank of Ghana, in its bid to ensure stability of the banking sector and keep pace with global developments and growth in risk management practices, has rolled out the Capital Requirement Directive which requires banks to implement Basel II Pillar 1 risks and Basel III Capital Framework. Hence, this study seeks to analyse how these regulatory policies on risk management affects the listed firms performance.

Most studies on ERM focused only on the financial institutions such as banks and insurance (Acharyya, 2009; Hoyt & Liebenberg, 2008; 2011; McShane et al., 2011; Geessink, 2012; Akotey & Abor, 2013; Omasete, 2014; Nii Okai, 2015; Florio & Leoni, 2017). This is because the activities of financial institutions involve higher risks as compared to the non-financial institutions. However, the Committee of Sponsoring Organisations of the Treadway Commission (COSO) (2004) explained ERM as an activity that should be adopted by all organizations (both financial and non-financial) because business organizations are exposed to diverse kinds of risk from the external and internal

environment. COSO further highlighted that ERM is an activity that provides support to the organization's strategic objectives. It is on this premise that this study examined how ERM affects the performance of financial and non-financial institutions.

There have been inconsistent results on the effect of Enterprise Risk Management on firm Performance. Found an inverse relationship between Enterprise Risk Management and organizations performance. While other studies also found a positive and a significant relationship between ERM and firm performance and hence argue that ERM increases firm value and performance (Baxter et al., 2013; Hoyt & Liebenberg, 2011; McShane et al., 2011; Florio & Leoni, 2017). Markowitz (1952) contends that risk management practices have a negative net present value and ought not to be practised. Other studies state that it is very difficult to quantify the real benefits of adopting enterprise risk management (Acharyya, 2009; Gordon et al., 2009) while Pagach and Warr (2010) and Beasley et al (2008) found an inconclusive result. This study focuses mainly on the listed firms on the Ghanaian equity market and adopted the Generalized Least Square (GLS) estimation technique. Our source of information was mainly from the annual financial reports from the Ghana Stock Exchange (GSE).

This study is organised into five sections. The first section introduces the subject matter and the specific research problems. The second section addresses the literature review of the related concepts and theories that underlies the study while the third section discusses the methodological approaches to the study. The fourth section analyzes and discusses the results. The fifth section summarizes and concludes the results and gives directions for further research.

2. Literature review

2.1. Theoretical review

This section discussed the theoretical underpinnings of the study. Risk management is the theoretical foundation of this study. Sarkis (1998) explained risk management theory as a concept that studies the various ways businesses and individuals raise money and how money is allocated to projects while taking into consideration their associated risk factor.

2.1.1. Agency theory

Smith and Stulz (1985) state that risk management agency theory has proven to have a great impact on the attitudes of managers in risk-taking behavior and hedging. This theory expounds that a possible conflict of interest between shareholders, management including debt holders is due to asymmetries in earning distribution, which can lead the firm in taking too much risk or not engaging in productive ventures (Mayers & Smith, 1987). Agency theory offers support for risk management as an answer to the disparity between incentives by managers and shareholder interests. Smith and Stulz (1985) state that shareholders and managers have unlike interests to the company and their risk management objective differs. While owners may demand high risk to high return on investments, managers desire low risk and return on investment. The agency theory stress the fact that risk management should line up the interest of shareholders and managers so as to increase organizational performance. Considering the motivation of this study in relation to existing literature on agency theory, it is concluded that ERM serves as a governance tool for monitoring managerial actions and decisions thereby reducing the agency cost of risk management; therefore, the agency theory is considered as the underlying theoretical basis of this study.

2.1.2. Portfolio theory

The present day portfolio theory stated by Markowitz (1952) posits that risk management does not create value for stockholders. The reason is that shareholders can without much of stress spread their risk, and hence only the systematic risk is relevant. In view of that, all risk management

practices have a negative net present value and must therefore not be implemented. Beasley et al. (2008) explains that the negative NPV project which happens as a result of firm's reduction of idiosyncratic risk is based on the notion that capital markets work devoid of resistances and deficiencies. When such resistances and deficiencies are introduced, the value creation of ERM emerges. The portfolio theory is incorporated in this study, since it is revealed through related literature that the implementation of ERM is not a waste of resources but helps in the selection and management of organizational portfolio and guiding managerial decisions.

2.2. Empirical review

McShane et al. (2011) using the S&P rating for insurers categorized ERM levels into five thus: weak, adequate, adequate with a positive trend, strong and excellent ERM levels. They revealed a positive relationship between "ERM rating" and firm value as this advances over the first three categories known as increasing levels of TRM but with no extra increase in the value of the firm as the rating goes beyond TRM into the ERM realm.

Hoyt and Liebenberg (2011), who studied the relationship between ERM and firm value for insurance companies used the Chief Risk Officer as an indicator for ERM implementation with the use of Tobin's Q as a proxy of firm value among insurers. They measured firm value as market and book value of equity over its liabilities. From their findings, it was shown that ERM significantly improves firm value, though, its effect on value is small. They found some differences in Tobin's Q for firms that practices ERM and firms who are yet to implement ERM, and again this relationship was significant. This shows that ERM improves firm value in general. This confirms their results in 2008 which discovered a statistically significant and a positive relationship between ERM and firm value.

Pagach and Warr (2010) led a similar study on how ERM affect firm performance. ERM implementation was measured on various firm features which are believed to be influenced by ERM practice. Some factors of the firm include financial factors, risk factors as well as asset and market features of the firm. With a sample of 106 firms spanning from 1992–2004, they found that the impact of ERM adoption on a range of firm variables was small. They again found an insignificant relationship for these variables. They therefore concluded that ERM implementation does not have an influence on performance, for both non-financial and financial firms. Nevertheless, their result differs from that of Hoyt and Liebenberg (2011) who had a significant positive relationship between ERM and performance.

In contradiction to the findings of Hoyt and Liebenberg (2008,2011), other literature found an inverse relationship between ERM and performance. Aebi et al. (2012) realized an insignificant and negative relationship between performance and CEO ownership, board independence and shareholders right. In addition to this, Agustina and Baroroh (2016) explained that ERM has an insignificant influence on firm value in the Indonesian market since banks adopt ERM as a result of compliance to regulatory requirements hence do not take keen interest in proper practices for effectiveness.

Again, Pagach and Warr (2011) stated in their work; thus the various characteristics of organizations that hire CROs, that firms that are large in size and have more risk of financial distress, thus, firms with high unstable operating cash flows have a higher probability of adopting ERM. More so, they found that stock volatility, CEOs with incentive to take risk and banks with a low capital ratio are important determinant of hiring CRO. Using a sample of 138 firms from 1992 to 2000, their result revealed that firms that hire CROs does so in other to be consistent with the expected benefits of ERM.

Beasley et al. (2008) conducted a study on information concerning the hiring announcement of senior executive overseeing enterprise wide risk management processes from 1992–2003 using 120 firms. Using CRO as a proxy for ERM, they concluded that the benefits of ERM are not the same across different firms but depends on their firm-specific characteristics hence, the cost and benefits of ERM are firm- specific.

More so, the work by Gordon et al. (2009) using a sample of 112 US firms, found a positive relationship between ERM and firm performance. However, this relationship was dependent on a proper link between ERM and firm-specific factors. This is in support of the results by Beasley et al. (2008) which revealed that the link between ERM and performance are firm-specific but not equal across firms hence the cost and benefit of ERM are based on individual firm characteristics. Gordon et al. (2009) further explained that there are five factors that are relevant in explaining the proper match between ERM and firm performance. These five factors include: environmental uncertainty, industry competition, size of the firm, complexities, and monitoring by board of directors.

Furthermore, Acharyya (2009) established that majority of insurance companies in Kenya have adopted risk management practices in their operations and that this have a strong effect on their financial performance. Risk identification was found to be the most significant factor in influencing financial performance, followed by risk mitigation, risk management program implementation, and monitoring and risk assessment and measurement, respectively.

Moreover, Omasete (2014) authored a similar study in Kenya on the impact of risk management on financial performance using 49 insurance firms from 2008 to 2012. Their result shows that there exists a positive relationship between risk management and financial performance. This is due to the fact that most companies have adopted risk management practices which have an effect on performance. The result also confirms the findings of Hoyt and Liebenberg (2011) and Florio and Leoni (2017) who had a positive relationship between ERM and financial performance.

2.3. Hypothesis of the study

According to ERM reviewed literature, and other related theoretical assumptions, we postulate the following two main hypotheses for Ghana's Equity market with respect to two main cases.

Case 1: What are the determinants of financial firms' performance in Ghana's Equity market?

Case 2: What are the determinants of non-financial firms' performance in Ghana's Equity market?

An attempt was laid on the effects that some explanatory or control variables have on firm's performance. The study hypothesised the under-listed relationships for both financial and non-financial firms' performance.

H₁: There is a positive association between Enterprise Risk Management Index (ERMI) and firm performance.

H₂: There is a positive association between Size of firm and firm performance.

H₃: There is a positive association between Efficiency (EFF) and firm performance.

H₄: There is a positive association between Ownership (OWN) and firm performance.

H₅: There is a positive association between Age of firm and firm performance.

H₆: There is a positive association between Leverage (LEV) and firm performance.

3. Methods

To study whether there is a linear or non-linear relationship between ERM and firm performance, this study employed a panel regression analysis consisting of 30 firms on Ghana Stock Exchange (GSE) to estimate the relationship from 2010–2016. Secondary data was obtained from GSE on the listed firms. Panel data is deemed effective in detecting and measuring effects that basically cannot be discovered in pure cross-section or pure time series data and therefore enhances empirical analysis. A total of 35 firms were listed on GSE during the period for this study, however the sample was reduced by five (5) because of incomplete data by some firms for the sample period. Non-financial firms were 17 (57%) of our final sample while 13 (43%) were financial firms. The study research design is primarily quantitative with the purpose of providing objective and useful findings for policy implications.

3.1. Estimation technique and discussion of variables

This study employed a Generalized Least Square estimation technique for a number of reasons. Generalized least squares (GLS) is a method for fitting coefficients of explanatory variables that help to predict the outcomes of a dependent random variable. GLS is normally designed to produce an optimal unbiased estimator of β for the situation with heterogeneous variance.

The regression model is stated as:

$$ROE_{it} = \beta_0 + \beta_1 ERMI_{it} + \beta_2 ERM_{it}^2 + \beta_3 SIZ_{it} + \beta_4 EFF_{it} + \beta_5 AGE_{it} + \beta_6 OWN_{it} + \varepsilon_{it} \quad (1)$$

$$ROA_{it} = \beta_0 + \beta_1 ERMI_{it} + \beta_2 ERM_{it}^2 + \beta_3 SIZ_{it} + \beta_4 EFF_{it} + \beta_5 AGE_{it} + \beta_6 OWN_{it} + \varepsilon_{it}. \quad (2)$$

$$TobinQ_{it} = \beta_0 + \beta_1 ERMI_{it} + \beta_2 ERM_{it}^2 + \beta_3 SIZ_{it} + \beta_4 EFF_{it} + \beta_5 AGE_{it} + \beta_6 OWN_{it} + \varepsilon_{it} \quad (3)$$

Where subscripts i denotes individual firms and t denotes the time period (2010–2016), β are the parameters to be estimated $\wedge \varepsilon$ is the error component.

3.2. Dependent variable

3.2.1. Firm performance

We employed three measures of performance which include:

3.2.1.1. *Return on Asset (ROA)*. Return on Asset is calculated as the net profit after tax divided by average total assets. This indicates how effectively a firm is managing its assets to generate income. We expect a positive relation between ROA and ERM (Hoyt & Liebenberg, 2011).

3.2.1.2. *Return on Equity (ROE)*. Return on equity (ROE) is a measure of financial performance calculated by dividing net income by shareholders' equity. Because shareholders' equity is equal to a company's assets minus its debt.

3.2.1.3. *Tobin Q*. This study adopts Tobin's Q as a proxy for firm performance because it is primarily used to measure the value of firms on stock exchanges. It is measured as the market

value of a firm over the asset value of a firm. This gives a better measure of firm performance because, it reflects investors' expectations about the future and is also free from managerial manipulations (Hoyt & Liebenberg, 2008; McShane et al., 2011). Lang et al. (1996) explains that Tobin's Q is preferred over other measures because it does not require risk adjustment as compared to other measures. It is also a performance indicator that tells you the value of the firm at the market level.

3.3. Independent variables

3.3.1. Enterprise risk management Index (ERMI)

Our main variable of interest is the use of ERMI as a proxy for ERM. To measure ERM in the various firms, an index was created based on the following features: title of the risk manager, ERM adoption, Risk management committee, risk department, BOD independence, Auditor type and risk plan. Data on ERM features were gathered from the corporate governance reports and publicly declared information by the companies. A binary approach was used in constructing the index. If the answer to any of these questions is yes, it was assigned a value of one (1) and zero otherwise. The index was constructed by taking the average of these variables (Florio & Leoni, 2017; Paape & Speklè, 2012; Beasley et al., 2008; Hoyt & Liebenberg, 2011).

3.4. Control variables

3.4.1. Firm Size (SIZE)

Logically, when a company increases in size, the nature of happenings affecting it will be different as well. Also, large organizations have the ability to exploit greater resources for implementation. It is evidenced that larger organizations are likely to perform better (Beasley et al., 2008). It is therefore essential to control for firm size in this study. It is calculated as the natural log of total assets.

3.4.2. Efficiency (EFF)

The study also control for efficiency in our analysis because it influences firm performance (Omasete, 2014). A good operating efficiency occurs when there is more output for a given level of input or a smaller amount of input for a given level of output. Operating efficiency with a high value should reduce the firm's overall risk of failing, and should increase its performance. Efficiency is measured as operating expenses over total assets (Cummins & Weiss, 1998; Geessink, 2012). We expect a positive relationship with firm performance.

3.4.3. Ownership (OWN)

We also control for ownership in this study as it also determines firm performance. Ownership is the identity of equity owners. This has a major importance in corporate governance as it determines the motivations of managers and thus the economic efficiency of the organizations they manage (Azzam et al., 2013). Bernard et al. (1995) showed that companies owned by foreigners in the U.S. are more productive compared to local-owned companies. Foreign ownership significantly improves the financial performance of companies (Boardman et al., 1997; Goethals & Ooghe, 1997).

3.4.4. Age

Age make firms become more effective and efficient and productive as firms realize what they are good at and study how to operate in a better way (Jovanovic, 1982; Kenneth, 1962; Pakes & Ericson, 1998). Hence, more experienced organizations exhibit superior value. However, old age can make knowledge, skills, and abilities outdated and lead to organizational decline (Agarwal &

Gort, 1996; 2002). The study control for age because it can have an adverse or positive influence on firm performance. Age is measured as the number of years a firm has been listed on a stock exchange.

3.4.5. Leverage (LEV)

To control for the relation between ERM and firm performance, we include a leverage variable that is equal to the ratio of the book value of liabilities to the market value of equity. The predicted sign on this variable is ambiguous. Financial leverage enhances firm value to the extent that it reduces free cash flow that might otherwise have been invested by self-interested managers in sub-optimal projects (Jensen, 1986). On the other hand, excessive leverage can increase the probability of bankruptcy and cause the firm's owners to bear financial distress costs. Firms engaging in ERM may have lower financial leverage if they have decided to lower their probability of financial distress by decreasing financial risk.

4. Results and discussions

4.1. Summary statistics

The mean score for the return on assets (ROE) which is a measure of firm performance and a dependent variable is 1.33, it has a variation of 14.244 and the minimum and maximum values are 0.033 and 206.672, respectively as presented in Table 1. ROA had an average of 1.332 and the minimum value was 0.007 with the maximum being 12.931.

Tobin Q which measures the performance of the firms recorded an average score of 0.716. The minimum value and maximum value were 0.001 and 20.667, respectively, with a standard deviation of 2.537. The ERMI which serves as a proxy for ERM has an average score of 0.451. This indicates that the programme (ERMI) reveals a good risk control system but may still lack a well-built procedure for making an organized risk decision that are useful for effective strategic risk management. It also has a variation shown by the standard deviation as 0.567 with the minimum and maximum values of 0.000 and 0.964, respectively.

Efficiency (EFF) has an average score of 0.61. The degree of variation is explained by the standard deviation with a score of 2.213. The minimum and maximum values were 0.0016 and 23.716 respectively. A lower efficiency ratio is better because when a firm's expenses are decreasing, its assets/revenues are increasing.

Table 1. Summary statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
ROE	210	1.37	14.244	0.033	206.672
ROA	210	1.332	1.829	0.007	12.931
TOBINQ	210	0.716	2.537	0.001	20.667
ERMI	210	0.873	0.367	0.000	0.964
SIZE	210	8.946	21.402	15.345	292.755
EFF	210	0.610	2.213	0.001	21.716
OWN	210	0.567	0.504	0	1
AGE	210	5.647	7.017	2.000	23.000
LEV	210	0.772	0.371	0.023	11.435

Source: Authors Computations

The average age (AGE) of the firms was 5.647. The minimum and maximum values were 2 and 23 respectively with a variation of 7.017. While the average ownership (OWN) for the firm was 0.5667. This indicates that 56% of the firms were foreign-owned. They had a minimum value of 0 and maximum value of 1. The standard deviation of 0.5040 explains the variation among them. Lev also had an average value of 0.772 with a variation of 0.371.

4.2. Correlation matrix and diagnostic tests

The correlation matrix presented in Table 2 reveals that there are no high correlations among the independent variables, which explain no presence of multicollinearity. Therefore, the variables considered fit to be used in the regression model as evidenced by the variance inflation factor (VIF) in Table 9 such that the correlation between independent variables and the strength of that correlation with the empirics having VIFs between 1 and 2 with overall Mean VIF = 1.417 suggesting that there is a moderate correlation, but it is not sufficient to warrant corrective measures. To ensure the consistency, reliability, and validity of the data set, the study examined the data set using various test such as Heteroscedasticity, Autocorrelation, Hausman's test (as presented in Table 10) and robustness checks. Quantile regressions were also analyzed to prove the consistency of the panel results.

4.3. Regression results for the period 2010-2016

4.3.1. Regression analysis for financial firms and non-financial firms

To determine the influence of ERM on both financial and non-financial firm's performance, a regression analysis was run separately for the financial and non-financial firms. Using ERMI as a proxy for ERM, this study further analyzed the results for both financial and non-financial firms in order to indicate if there is any similarity or difference on the relationship between ERM and firm performance. The results are shown in Tables 3 and 4 accordingly.

The study adopted three performance indicators which are Return on Asset (ROA), Tobin Q and Return on Equity (ROE). We applied two estimation techniques for each of the dependent variables, which are Random Effect (RE) and Fixed Effect (FE). Table 3 presents on Fixed Effect, while Table 4 presents on Random Effect. Tables 3 and 4 analyzed its results on both financial and non-financial firms using the three performance indicators. This study discusses fixed effect results in Table 3 because the Hausman's test justifies the reason to use fixed effect over the random effect (Ho: difference in coefficients not systematic) as specified in Table 10 of Hausman's test objectively justifies (since $\text{Prob} > \chi^2 = 0.0001$) the reason to use fixed effect model in the discussions.

From the regression analysis in Table 3, presented on Fixed effect was found that ERM is statistically significant on the performance of both financial firms and non-financial firms as captured in the hypothesis. The coefficients showed a positive result indicating a positive relationship with ROA, Tobin Q and ROE. The results indicate that ERM improves firm-level and market-level performance for both financial and non-financial firms. Hence, ERM should not only be implemented in the financial firms but also the non-financial firms. Therefore, firms which implement ERM stand a better chance of performing better in both sectors. The Fixed effect result is consistent with the Random Effect result in Table 4.

In Table 3, Firm size and Efficiency had a negative relationship with the performance of financial firms and non-financial firms. Firm size was also statistically significant on ROE and Tobin Q. Efficiency was statistically insignificant. Ownership had a positive relationship with both financial and non-financial performance with a statistical significance using ROE. Age had a positive and statistical significance on ROE but was statistically insignificant on ROA. Leverage had an inverse

Table 2. Correlation matrix

Variables	ROE	ROA	TobinQ	ERMI	SIZE	EFF	OWN	AGE	LEV
ROE	1.000								
ROA	-0.041	1.000							
TOBIN Q	0.547	0.021	1.000						
ERMI	0.026	-0.484	-0.054	1.000					
SIZE	0.920	0.156	0.527	-0.336	1.000				
EFF	0.013	-0.034	-0.013	-0.090	0.031	1.000			
OWN	0.148	-0.457	0.027	0.409	-0.194	-0.028	1.000		
AGE	-0.042	0.387	-0.036	-0.399	0.286	0.173	-0.698	1.000	
LEV	-0.150	-0.445	-0.027	0.084	-0.184	0.075	0.161	-0.163	1.000

Source: Authors Computations

Table 3. Regression analysis for financial firms and non-financial firms using fixed effect

Variables	Financial firms			Non-financial firms		
	ROA	TOBIN Q	ROE	ROA	TOBIN Q	ROE
Fixed Effect						
ERMI	10.63*** (3.187)	3.622*** (0.854)	0.223 (0.542)	10.38*** (3.223)	4.363 (6.769)	0.524** (0.634)
SIZE	0.425 (0.262)	-0.353*** (0.070)	-0.093** (0.036)	-0.302 (0.203)	0.173 (0.427)	-0.197*** (0.040)
EFF	0.052 (0.067)	-0.025 (0.018)	0.703*** (0.001)	-0.003 (0.0665)	0.0222 (0.140)	-0.023* (0.013)
OWN	0.023 (2.126)	0.310 (0.192)	0.326*** (0.116)	3.432 (1.631)	1.990** (0.798)	0.171* (0.099)
AGE	-0.069 (0.076)	0.041** (0.020)	0.022** (0.010)	0.062 (0.064)	-0.116 (0.134)	0.045*** (0.0125)
LEV	0.877 (1.580)	0.152 (0.423)	-0.179 (0.219)	0.675 (1.394)	-0.512 (2.928)	-0.309 (0.274)
Constant	-9.143** (4.507)	3.706*** (1.208)	1.694** (0.674)	1.797 (3.693)	-2.676 (7.755)	3.188*** (0.726)
Observations	91	91	91	119	119	119
R-squared	0.169	0.390	0.543	0.131	0.120	0.234
Prob > F	0.001	0.001	0.000	0.000	0.000	0.000
Number of id	13	13	13	17	17	17

Source: Results in Data Analysis in Stata 13 Significance level: * (10%), ** (5%), *** (1%). Values in parenthesis are the standard errors.

Table 4. Regression analysis for financial firms and non-financial firms using random effect

Variables	Financial firms			Non-financial firms		
	ROA	TOBIN Q	ROE	ROA	TOBIN Q	ROE
Random Effect						
ERMI	7.804*** (3.000)	2.037*** (0.613)	0.062* (0.389)	7.810*** (2.833)	-3.628* (1.957)	0.388 (0.385)
SIZE	0.354 (0.252)	-0.209*** (0.053)	-0.065** (0.029)	-0.272 (0.195)	-0.098 (0.176)	-0.120*** (0.031)
EFF	0.0292 (0.070)	-0.022 (0.018)	0.703*** (0.009)	-0.020 (0.068)	-0.006 (0.099)	-0.019 (0.012)
OWN	-0.474 (2.197)	-0.151 (0.322)	0.051 (0.190)	0.529 (1.862)	1.946** (0.853)	0.147 (0.180)
AGE	-0.050 (0.0732)	0.0251 (0.0163)	0.013 (0.009)	0.044 (0.062)	-0.167*** (0.063)	0.026*** (0.010)
LEV	-0.899 (1.398)	0.505* (0.264)	-0.179 (0.156)	-0.576 (1.212)	-0.232 (0.831)	-0.227 (0.162)
Constant	-5.531 (4.331)	2.138** (0.903)	1.392*** (0.524)	3.481 (3.487)	5.798** (2.832)	2.096*** (0.507)
Observations	91	91	91	119	119	119
R-squared	0.392	0.410	0.532	0.315	0.278	0.345
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Number of id	13	13	13	17	17	17

Source: Results in Data Analysis in Stata 13 Significance level: * (10%), ** (5%), *** (1%). Values in parenthesis are the standard errors.

relationship with Tobin Q and ROE and a positive relationship with ROA, but leverage was statistically insignificant.

4.3.2. Regression analysis of the non-linear relationship

Table 5 provides the results for the panel regression on the non-linear relationship between ERM and firm performance. $ERMI^2$ is the quadratic term for ERM which reveals the non-linear relationship. As a rule of thumb, the values for the point of inflection is minimum (U-shaped relationship) if it has a negative value, and maximum (inverted U-shaped relationship) if it has a positive value.

Table 5 examines the linear ($ERMI^1$) and non-linear ($ERMI^2$) relationship between ERM and firm performance. The three measures of performance which are Return on Equity (ROE), Return on Asset (ROA) and Tobin Q were adopted to examine the non-linear relationship. From the table, model (1) and (2) presents performance using ROE, model (3) and (4) presents performance using (ROA), and model (5) and (6) presents performance using TOBIN Q. In each of the dependent variables, two different estimations were used for the analysis. These are Random effect (RE) and Fixed Effect (FE). Models (1), (3) and (5) presented on Random effect. Models (2), (4) and (6) presented on Fixed effect.

The main variable of interest in the study was ERM. From the regression analysis, it was found that ERM has a highly significant relationship with firms' performance. However, the effect of ERM on firm performance is based on the performance indicator used. According to Table 5, using ROE, the effect of the ERM coefficient value on performance was positive at the initial stages and

Table 5. Regression results

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	RE 1	FE 1	RE 2	FE 2	RE 3	FE 3
	ROE		ROA		TOBIN Q	
ERMI	0.709** (0.338)	0.222 (0.266)	-0.283** (0.124)	-0.267** (0.113)	-0.171 (0.125)	-0.212* (0.117)
ERMI²	-0.0301** (0.0133)	-0.0115 (0.0172)	0.0153** (0.00706)	0.0198** (0.00788)	0.00822* (0.00475)	0.0115* (0.00586)
SIZE	0.695*** (0.00603)	0.700*** (0.00743)	-0.00119 (0.00287)	0.00186 (0.00332)	0.0705*** (0.00153)	0.0730*** (0.00209)
EFF	0.0615** (0.0271)	0.0362 (0.0238)	-0.0459*** (0.00753)	-0.0420*** (0.00855)	-0.00342 (0.0166)	-0.0107 (0.0116)
OWN	0.257*** (0.0988)	0.107 (0.105)	-0.0762* (0.0394)	-0.0853* (0.0447)	0.00583 (0.0236)	-0.0595 (0.0458)
AGE	-0.245*** (0.0937)	-0.106 (0.0663)	0.00851 (0.0651)	-0.0133 (0.0817)	-0.0965** (0.0479)	-0.0926 (0.131)
LEV	-0.586 (0.729)	-5.165** (2.299)	-1.124 (0.768)	1.107* (0.646)	0.391 (0.307)	0.421 (1.424)
Constant	-7.166*** (2.289)	-1.535 (2.263)	3.206** (1.515)	0.913 (0.912)	0.716 (0.960)	1.042 (1.136)
Inflection	1.70**	0.54	1.81**	2.36**	1.37*	1.81**
Observations	210	210	210	210	210	210
R-squared	0.979	0.997	0.461	0.062	0.337	0.339
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Number of id	30	30	30	30	30	30

Source: Results in Data Analysis in Stata 13; Significance level: * (10%), ** (5%), *** (1%). Values in parenthesis are the standard errors.

negative at the extreme case. This means that ERM at its initial stages increases performance but decreases as ERM advances. The inflection is significant telling us that the relationship is not linear but non-linear which takes the form of an inverted U. This is confirmed by the trends in our quantile regression in Tables 6 and 7 accordingly, indicating that even as different estimations are used, similar patterns are found across the dependent variables.

However, we see a sharp contrast between ROE and the other measures of performance (ROA and Tobin Q) in Table 5. With ROA and Tobin Q, the effect was negative at the initial stages and positive as it increases. This reveals that ERM reduces firm performance at the initial stages, but increases firm value as it increases. This reveals that ERM and Performance relationship is not monotonous but has a non-linear relationship which takes the form of a U-shape. We find similar trends in our quantile regressions in Tables 6-8 confirming similar patterns across the dependent variables. This means that ERM may not always have a positive relationship with performance but also leads to an inverse relationship as a company progresses.

Our results in Table 5 further revealed that firm size had a positive relationship with ROE and Tobin Q. The relationships were found to be statistically significant at 1% significance level, the empirical results obtained in this study confirm existing underlying theoretical relationship in

Table 6. Quantile regression using ROE

	(1)	(2)	(3)	(4)	(5)
Variables	.20	.40	.60	.80	.95
ERMI	0.282*** (0.0406)	1.700*** (0.0989)	1.557*** (0.0950)	1.168*** (0.106)	0.202 (0.317)
ERMI ²	-0.00923*** (0.00207)	-0.0564*** (0.00505)	-0.0513*** (0.00485)	-0.0401*** (0.00540)	-0.00718 (0.0162)
SIZE	0.112*** (0.00240)	0.704*** (0.00584)	0.704*** (0.00561)	0.700*** (0.00624)	0.690*** (0.0187)
EFF	0.0205 (0.0218)	0.137** (0.0531)	0.109** (0.0510)	0.137** (0.0568)	0.0381 (0.170)
OWN	0.00497 (0.0119)	0.0278 (0.0291)	0.0477* (0.0279)	0.0687** (0.0311)	0.217** (0.0932)
AGE	0.00138 (0.0119)	-0.0436 (0.0289)	-0.0616** (0.0278)	-0.197*** (0.0309)	-0.432*** (0.0926)
LEV	-0.148 (0.133)	-0.531 (0.325)	-0.387 (0.312)	-0.756** (0.347)	-1.454 (1.040)
Constant	-1.987*** (0.213)	-12.53*** (0.519)	-11.70*** (0.498)	-8.010*** (0.555)	-1.133 (1.662)
Observations	210	210	210	210	210
Inflection	0.037	0.167	0.376	0.596	0.846
Pseudo R ²	1.79**	4.67***	4.32***	3.45***	0.23

Source: Results in Data Analysis in Stata 13 Significance level: * (10%), ** (5%), *** (1%). Values in parenthesis are the standard errors.

respect of ROE and Tobin Q. This indicates that firm size has a statistically significant influence on firm performance. The positive relationship shows that firms that increase in size are more likely to perform better than smaller firms. However, firm size had an inverse direction with ROA, which indicates that smaller firms perform better than bigger firms.

Firm efficiency, which studies the input-output relationship of firms, was also found to have a statistically significant effect on performance. It had a positive relationship with ROE. The positive relationship indicates that firms that are more efficient perform better than less efficient firms. There was a negative relationship with ROA and Tobin Q.

Age of the firm which explains the number of years of being listed was also found to be insignificant and have a negative relationship with performance. The negative relationship reveals that firms that are old are not able to perform well as compared to newly listed firms. Our measure of ownership was significantly related to performance. The coefficient for ownership showed a positive relationship with ROE and Tobin Q, which shows that firms that are owned by foreigners are able to perform better than local-owned firms. However, its effect on performance is insignificant on ROA and Tobin Q. Ownership had a significant relationship with ROE.

The results also reveal that the relationship between firm leverage and performance was negative and statistically significant across all measures of profitability except for Tobin Q, which had a positive relationship. The positive relationship reveals that highly leveraged firms are more likely to perform better.

Table 7. Quantile regression using ROA

	(1)	(2)	(3)	(4)	(5)
Variables	.20	.40	.60	.80	.95
ERMI	0.214*** (0.0168)	0.150*** (0.0184)	0.0931*** (0.0319)	-0.117 (0.105)	-0.555 (0.940)
ERMI ²	-0.00705*** (0.000860)	-0.00403*** (0.000941)	-0.00183 (0.00163)	0.00757 (0.00536)	0.0260 (0.0480)
SIZE	0.0704*** (0.000994)	0.0697*** (0.00109)	0.0688*** (0.00188)	0.0686*** (0.00620)	0.0702 (0.0555)
EFF	0.0244*** (0.00904)	0.0219** (0.00990)	0.0192 (0.0171)	0.0230 (0.0564)	-0.0485 (0.505)
OWN	0.00438 (0.00495)	0.0121** (0.00542)	0.0239** (0.00938)	0.0243 (0.0309)	-0.0120 (0.277)
AGE	0.00227 (0.00492)	-0.00746 (0.00539)	-0.0209** (0.00932)	-0.0663** (0.0307)	-0.168 (0.275)
LEV	0.131** (0.0553)	0.0546 (0.0605)	-0.0279 (0.105)	-0.0609 (0.345)	0.0352 (3.087)
Constant	-1.605*** (0.0883)	-1.250*** (0.0967)	-0.847*** (0.167)	0.403 (0.551)	3.482 (4.932)
Observations	210	210	210	210	210
Inflection	3.37***	0.39		1.11	0.45
Pseudo R ²	0.098	0.155	0.170	0.201	0.320

Source: Results in Data Analysis in Stata 13 Significance level: * (10%), ** (5%), *** (1%). Values in parenthesis are the standard errors.

4.3.3. Discussions of empirical findings

4.3.3.1. *Discussions on financial and non-financial firms.* From the regression results in Tables 3 and 4, it was shown that ERM is statistically significant and have a positive relationship with firm performance for both financial firms and non-financial firms. This indicates that ERM influences firm performance when implemented in both sectors. This confirms the findings of Bertinetti et al. (2013) who found that ERM increases the value of the firm, irrespective of the type of industry the firm belongs to, whether financial or non-financial firm. Also, Florio and Leoni (2017) supported this argument and found a positive relationship between ERM and performance for both financial and non-financial firms among Italian-listed firms. However, this conflicts with the results of Pagach and Warr (2010) who concluded that ERM implementation has no significant influence on either financial and or non-financial performance. In Ghana, the enforcement shows that ERM is implemented only in financial firms because of regulatory issues, but the results show that ERM when implemented in non-financial firms, will also have a significant impact. It is therefore prudent that non-financial firms practice ERM.

4.3.3.2. *Discussion of non-linear relationship.* The result of the regression analysis in Table 5 indicates that ERM has a statistically significant effect on firm performance. However, it has a non-linear relationship with performance which reveals itself in the form a U-shape or an inverted U. The result indicates that the ERM and performance relationship is not stable in the long run. This may be because firms may take a bigger risk as ERM advances or that firms may be using an obsolete approach in managing their risks. This relationship arises when ERM is unable to identify a

Table 8. Quantile regression using TOBIN Q

	(1)	(2)	(3)	(4)	(5)
Variables	.20	.40	.60	.80	.95
ERMI	-0.132*** (0.0362)	-0.212*** (0.0406)	-0.269*** (0.0544)	-0.590*** (0.205)	-1.350*** (0.224)
ERMI²	0.00451** (0.00185)	0.00750*** (0.00207)	0.0100*** (0.00278)	0.0239** (0.0104)	0.0502*** (0.0114)
SIZE	-0.00256 (0.00214)	-0.00517** (0.00239)	-0.00659** (0.00321)	-0.00905 (0.0121)	-0.0124 (0.0132)
EFF	-0.0221 (0.0194)	-0.0133 (0.0218)	-0.0262 (0.0292)	-0.0634 (0.110)	-0.192 (0.120)
OWN	0.00451 (0.0106)	0.00692 (0.0119)	0.00570 (0.0160)	0.0158 (0.0602)	0.0385 (0.0659)
AGE	0.0295*** (0.0106)	0.0147 (0.0119)	0.0188 (0.0159)	-0.0343 (0.0598)	-0.167** (0.0655)
LEV	-0.662*** (0.119)	-1.380*** (0.133)	-1.822*** (0.179)	-2.489*** (0.672)	-3.094*** (0.736)
Constant	1.580*** (0.190)	2.824*** (0.213)	3.591*** (0.286)	6.040*** (1.073)	12.08*** (1.176)
Observations	210	210	210	210	210
Inflection	1.12	1.83**	2.08**	1.52*	2.49***
Pseudo R²	0.312	0.440	0.430	0.373	0.571

Source: Results in Data Analysis in Stata 13 Significance level: * (10%), ** (5%), *** (1%). Values in parenthesis are the standard errors.

risk that must be eliminated in a firm's risk portfolio. More so, when owners fail to provide resources required for good risk management, it affects the implementation and impact of ERM. Hence, firms must implement fundamental measures and robust and dynamic risk management techniques to always get the best out of ERM. This finding is confirmed by McShane et al. (2011) and Priem and Butler (2001) who said that environmental conditions might affect the core capabilities of firm that may influence the implementation of ERM to be inefficient or irrelevant. Gordon et al. (2009) supports the argument and explained that the relationship is dependent on a proper link between ERM and performance. McShane et al. (2011) further highlighted that there is a significant positive relationship with shareholder value, but only at the increasing level of silo-based risk management, however moving from the traditional system to an advanced ERM system does not additionally add anything to shareholder value as considered in the sample of insurers.

This is supported by Pagach and Warr (2010) who indicated that ERM does not have any influence on firm value. The difference in results may be due to their measure for ERM. The insignificant results indicate that ERM adds no value to firm performance. Beasley et al. (2008) concluded that the relevance of ERM are not the same for all firms but depends on certain firm-specific characteristics hence, the cost and benefit of ERM are firm-specific. They explain that ERM increases firm cost and reduces shareholder value. However, their argument is based on the assumption that the market operates without deficiencies and resistances (Beasley et al., 2008; Viscelli et al., 2016). Moreover, Agustina and Baroroh (2016) said ERM does not significantly affect firm value because banks comply as a result of regulatory requirements.

Table 9. Variance inflation factor		
	VIF	1/VIF
Own	2.074	0.482
Age	1.708	0.586
Leverage	1.283	0.780
Ermd	1.239	0.807
Firmsize	1.161	0.861
Efficiency	1.038	0.964
Mean VIF	1.417	.

Table 10. Hausman's test				
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fixed	Random	Difference	S.E.
ermd	0.0901451	0.3848651	-0.2947199	0.0100928
firmsize	0.7054952	0.7102039	-0.0047087	
efficiency	0.7054952	0.7102039	-0.0047087	
age	-0.0152985	-0.0331299	0.0178314	
liquidity1	-6.241431	-1.112774	-5.128656	0.4037448

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg
 Test: Ho: difference in coefficients not systematic
 $\chi^2(6) = (b-B)'[(V_b-V_B)^{-1}](b-B)$
 = 263.91
 Prob>chi2 = 0.0000
 (V_b-V_B is not positive definite)

The findings of this study is in sharp contrast with other studies which found that ERM has a direct relationship with performance.

The results from the study revealed that ERM propels firm performance at both the firm level (return on assets and equity) and market level (Tobin Q) performance of financial and non-financial listed firms in Ghana. Second, we further show that a non-linear relationship may exist between ERM and performance. Thus, a non-linear inverted U-shape is observed when return on equity is employed as performance indicator while a non-linear direct U-shape is observed when return on assets and Tobin Q are employed as performance indicators. Hoyt and Liebenberg (2008); (2011)) assert that firms which adopt ERM perform better than those who do not practice ERM. This argument is supported by several literature (Acharyya, 2009; Gordon et al., 2009; McShane et al., 2011; Omasete, 2014) which indicate that there exists a positive relationship between ERM and firm value.

Firm size was positive and statistically significant with ROE and TOBIN Q at a 1% level of significance. This means the size of the firm is significant in influencing performance. The positive relationship reveals that large firms have the ability to improve their performance. This result is supported by Beasley et al. (2008) findings that, large organizations have the ability to exploit greater resources for implementation. The findings of this study further support contemporary

reports on the moderating role of firm size on financial performance of firms in equity markets particularly in emerging economies around the world (Hussain et al., 2019; Kijkasiwat & Phuensane, 2020; Santosa, 2020).

There is evidence that large organizations are likely to perform better. Also, Klapper and Love (2004) are of the opinion that large firms could lead to significant growth opportunities. Hence, positively influence performance. However, contrary to the arguments, Willmore (1986) found that larger firms have higher negotiation power thereby reducing financial cost.

However, size had an inverse relationship with ROA. This inverse relationship indicates that smaller firms perform better than bigger firms. This argument appears to be consistent with Conheady et al. (2015) position that large firms create significant fights between managers and shareholders and this leads to resourceful managerial behaviours which will adversely influence firm performance. More so, Cooley and Quadrini (2001) support the assertion that performance is adversely related to firm size.

The positive results support the assertion that high operating efficiency reduces the firm's overall risk of failing, and hence increases its performance (Cummins & Weiss, 1998; Geessink, 2012; McShane et al., 2011). The insignificant positive result for efficiency shows that efficiency has the potential of influencing performance. Efficiency had a significant effect on performance.

Age had an inverse relationship with ROE, ROA and TOBIN Q. It means that the age of a firm is not relevant in influencing the performance of a firm in Ghana. The reason is that managers rely more on past experience than on new signals (Katz, 1982). This makes it very difficult to design, accept, and implement policy changes. Moreover, the issue of complacency and seniority is a factor that can adversely affect performance with firms that are old. Knowledge, abilities, and skills of old firms become outdated and lead to organizational decay (Agarwal & Gort, 1996, 2002). One possible reason is that good performance influences firms to organize their approach through institutions and processes, a regulation that can become vessel for improved strategies over a given period. Age had a statistically significant impact on performance. However, age was found to be statistically insignificant with ROA which shows that age does not have any significant impact on performance. The inverse relationship conflict other findings which revealed that age assists firms to become very efficient and effective over time as firms are able to discover their strengths and learn how to operate better (Jovanovic, 1982; Kenneth, 1962; Pakes & Ericson, 1998).

Firm ownership had a positive relationship with performance and had a statistical significance, showing that foreign-owned firms perform better than domestically owned firms. This argument is supported by Boardman et al. (1997) who analyzed the profitability differences between locally owned firms and foreign firms in Canada and found that foreign subsidiaries perform better than their domestic counterparts. This is agreed by Blomström and Sjöholm (1999) as well as Bernard et al. (1995) who found a positive relationship, which shows that foreign-owned firms are more industrious as compared to domestically-owned companies.

Leverage which was measured as the ratio of total debt to total assets, exhibited a negative relationship with ROE and ROA and was statistically significant. This actually means that an increase in leverage ratio will cause a decrease in profitability. Mahakud and Misra (2009) explained that the increase in leverage ratio of the firms listed in Indian stock exchange results in an increase in resource cost, therefore firm profitability decreases. This in relation to the underlying theories indicate that, ERM index in line of a firm's leverage, serves as a governance

tool for monitoring managerial actions and decisions thereby reducing the agency cost of risk management.

5. Conclusions and recommendations

Risk management has become an important concept in these contemporary days. This is as a result of the complexities and uncertainties that businesses face. Firms have switched from the traditional risk management system to enterprise risk management (ERM) where risks are managed holistically. Empirical work on the relation between ERM and performance has had conflicting results while most of these studies were on financial firms. The purpose of this study was to examine whether there exists a linear or non-linear relationship between ERM and firm performance as well as its impact on the financial and non-financial firm's performance.

Using a panel regression analysis and a sample of 30 listed firms, the findings suggest that the relationship between ERM and firm performance is not monotonous, but there exists a non-linear relationship between them ERM and firm performance. That is, the effect of ERM changes as it advances. This relationship is revealed in the form of a U shape or an inverted U. The result indicates that, the ERM and performance relationship is not stable over time because ERM may take an extended period of time to reap its benefits or external conditions may render ERM implementation irrelevant. Hence, firms must implement fundamental measures and robust and dynamic risk management techniques to always get the best out of ERM. Also, it was revealed that ERM has a statistically significant and positive relationship with both financial and non-financial firms. Therefore, ERM should not only be implemented in the financial firms but also in the non-financial firms as this will help them perform better. This study suggests that ERM should be given keen attention and practised in the non-financial firms as it is likely to improve firms' performance. The reason being that implementation of ERM is not a waste of resources but helps in the selection and management of organization and guiding managerial decisions as supported by the portfolio and agency theories. ERM indicators and firms characteristics such as; firm size, firm ownership, and efficiency should be well considered in the management and decision making process of equity firms since the characteristics especially, operating efficiency with a high value reduces firm's overall risk of failing, therefore increases firms performance.

Despite its contribution to empirical work, this study has some limitations which provide reasons for further research. First, the study is limited to firms listed on Ghana Stock Exchange hence, cannot be generalized for all firms because some industries are not well represented on the equity market. More so, the factors used to construct the ERM index are not exhaustive as there may be other factors that could influence ERM adoption. This index was limited because of data availability. Further studies can proxy for ERM using other features depending on resources available and the context of reference. Specific features such as the presence of Chief Risk Officers (CRO) on the executive board, quality of risk oversight, and other operational mechanisms could be considered in future studies.

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