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Article

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The Effects of Enterprise Risk Management on the Performance and Risk of Vietnamese Listed Firms: Evidence from Abnormal Enterprise Risk Management Index

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ABSTRACT

Purpose: This paper examines the effects of Enterprise Risk Management (ERM), as measured by the Abnormal Enterprise Risk Management Index (ABERMI), on the performance and risk of Vietnamese listed firms.

Design/methodology/approach: The paper employs a combination of three regression methods (Pooled Ordinary Least Squares, Fixed Effect Model and Random Effect Model) to test the effects of Enterprise Risk Management on the performance and risk of Vietnamese listed firms in the period of 2010-2020. In addition, a two-stage regression model is used to calculate the ABERMI.

Findings: The findings show that firms with effective enterprise risk management (ERM), as evidenced by their low abnormal enterprise risk management index, can enhance their business performance measured by Tobin's Q. Furthermore, good ERM helps firms reduce the risk of bankruptcy. However, the research proves that ERM is not associated with return on total assets and systematic risk.

Research limitations/implications: Firm can employ Enterprise Risk Management (ERM) to efficiently and effectively manage risk. Additionally, applying a standard might further enhance the quality of risk management efforts by managers. Authorities can encourage the implementation of ERM to safeguard investor's wealth and indirectly protect the Vietnamese economy.

Originality/value: Through a comprehensive analysis of various methodologies, this paper aims to uncover positive outcomes in exploring the impact of Enterprise Risk Management (ERM) on both risk and performance within the setting of Vietnamese listed firm.

Keywords: Abnormal Enterprise Risk Management Index (ABERMI), Enterprise Risk Management (ERM), firm performance, firm risk, Vietnam

I. Introduction

Risk is a fundamental concept that captures the attention of every business right from its inception. In the dynamic landscape of business operations,

where fluctuations abound, risks invariably accompany a myriad of challenges and opportunities. To navigate this terrain successfully, businesses must thoroughly comprehend, construct, and refine their risk management approach, allowing them to surmount challenges and capitalize on developmental opportunities. Traditionally, risk management was delegated to individual departments based on their specific functions. For instance, the finance department handled

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financial risks, while technical and technological risks were the responsibility of the technical department. However, over time, this approach has revealed several limitations. Risks are not isolated within a single department but can reverberate across the entire business operation system. As a result, businesses have come to recognize the necessity of a comprehensive, strategic, and systemic integrated risk management framework. Hence, integrated risk management entails the identification and assessment of the collective risks that impact firm value, and adopting a comprehensive, firm-wide strategy to effectively oversee these risks (Meulbroek, 2002). This approach goes beyond merely addressing specific risks; it entails evaluating their impacts on the entirety of business operations and aiming to handle all of a firm's risks in a structured and coherent framework. Consequently, a proactive strategy is developed to mitigate risks and curtail their overall influence. An exemplary instance of the transition from traditional risk management to a modern approach was demonstrated by Honeywell in 1997. The company made a pivotal decision to adopt a multi-year contract that encompassed insurance for property and liability risk, along with options to safeguard their overseas operating profit from fluctuation in currency exchange rate (Dickinson, 2001).

In today's world of globalization, companies are presented with unprecedented opportunities for rapid and large-scale development. The globalization process has elevated efficiency and effectiveness to levels never before imagined. However, these opportunities come hand in hand with risks. With more opportunities, businesses face increased exposure to various types and degrees of risks. In an unstable and increasingly risky business environment, firms must prepare for an uncertain future to sustain themselves; otherwise, they will face serious consequences through natural selection. Recently, Enterprise Risk Management (ERM) has gained traction as a means to significantly improve the risk management process. In simple terms, ERM is a systematic, integrated approach to managing all the risks a company face (McShane, 2018). While many

risks may be beyond management's control, ERM systems can prepare them for worst-case scenarios, making them more resilient and agile in the face of external changes. ERM can serve as an indicator of good corporate governance, minimizing or preventing activities that could harm the company and its stakeholders. Research conducted by Hoyt & Liebeberg (2011), McShane et al. (2011), Iswajuni et al. (2018), González et al. (2020) indicates that the presence of ERM items in financial statements positively impacts firm value. This positive market reaction to ERM provides relevant information for anticipating corporate interest. Adopting ERM can also add value to the company, enhancing its competitive advantage and attracting more investor interest. However, it is crucial that ERM measurement tools align with the four objectives of COSO (2004), including strategy, operations, reporting, and compliance (Kimbrough & Compton, 2009). Hence, in the pursuit of Enterprise Risk Management (ERM) objectives, Gordon et al. (2009) employed the COSO framework (2004) to meticulously assess both existing and potential risks. Progressing from the groundwork laid by Gordon et al. (2009) and in alignment with the ethos of COSO (2004), Wang et al. (2018) formulated the concept of the Abnormal Enterprise Risk Management Index (ABERMI). This index serves as a tool to evaluate the effectiveness of an ERM system, with higher ABERMI values indicating poorer enterprise risk management performance. As a result, the ABERMI emerges as a pivotal metric for accurately appraising the enterprise risk management system.

Amid economic downturns, the global economy is prone to major shocks, especially for developing countries, which is highly dependent on world trade (Bertelsmann Stiftung report on Globalization in 2020). This highlights a cautionary signal for their governments that, in the event of a crisis, their countries would encounter the most pronounced ramifications (Sachs et al., 2020). Vietnam, an emerging country experiencing rapid economic growth in recent years and anticipated by experts to become a major player in the global economy, appears to have limited

awareness of the adverse consequences that unpredictable environment can precipitate. In the Vietnamese context, risk management practices are gradually gaining recognition from both business entities and regulatory authorities. Listed firms have implemented stringent internal control system to identify, monitor, and manage inherent operational risks. However, prevailing regulations on risk management practices primarily concentrate on the banking, financial, and insurance sectors, where risk constitutes a significant proportion of their operations. Despite its notable impact on the economy, policymakers continue to undervalue the role of risk management in other industries. Within the Vietnamese context, research conducted by Phan et al. (2020) and Nguyen Thuy Anh & Tran Phuong Hoa (2021) have revealed a robust positive correlation between Enterprise Risk Management (ERM) and firm performance. However, scant attention has been paid to exploring the association between ERM and firm-level risks. Consequently, this study aims to examine the effects of Enterprise Risk Management on the performance and risk profiles of Vietnamese listed companies, with the dual objectives of confirming the existing relationship between ERM and firm performance and investigating the impact of ERM on firm-level risks. Moreover, the research is grounded in an analysis of Vietnamese listed companies to furnish additional empirical evidence in the realm of risk management within the developing market.

This study makes three key contributions to the literature. Firstly, it reinforces the positive association between ERM and firm performance in Vietnam, supporting previous findings (Phan et al., 2020; Nguyen Thuy Anh & Tran Phuong Hoa, 2021). Secondly, it provides new evidence of the link between ERM and firm value in a developing market like Vietnam, indicating that ERM adoption can help reduce the probability of bankruptcy for Vietnamese listed firms. Thirdly, the study introduces a new method to assess the effectiveness of ERM in Vietnam, employing the Abnormal Enterprise Risk Management Index (ABERMI) in the main model and using search engines to find keywords related

to ERM application for robustness testing.

The remainder of this paper is organized as follows. Section 2 reviews the literature and proposes the research hypotheses. Section 3 discusses the research methodology, including data collection and empirical models. Section 4 presents the research results and discussion. Finally, Section 5 summarizes the main findings and offers some recommendations.

II. Literature Review and Hypotheses Development

During the process of empirical research, it has been revealed that the impact of Enterprise Risk Management (ERM) on firm performance does not consistently align with the theoretical perspective, which suggests a positive relationship. While some scholars did not reach definitive conclusions, and a few even found negative effects, a majority of papers concurred that there is evidence supporting a positive relationship between a comprehensive risk management approach and value creation. For example, Kraus & Lehner's (2012) critical review of 25 articles on the connection between ERM and performance revealed that 78% of the papers reported a positive impact on the bottom line, while 17% could not establish a significant link, and 5% even concluded that ERM had a negative effect on operational performance. Beasley et al. (2008) examined the relationship between information conveyed in hiring new Chief Risk Officers and market reaction. They found the relationship to be statistically insignificant for all sample companies but significant for financial sector companies. Furthermore, Yim (2021) indicated that individual blockholders reduced overall corporate risk and long-term risky investment. In a panel data analysis, Hoyt & Liebenberg (2011) reported a considerable and strong relationship between ERM implementation and firm added value. They arrived at this result across a diversified sample, representative of U.S. companies. On the other hand,

Tahir & Razali (2011) focused on performance and ERM interactions in the Malaysian market, and although they reported positive yet insignificant results, they emphasized that an insignificant result does not imply the cost ineffectiveness of implementing ERM. They stressed the need for a longer research period to investigate the impact, considering risk management as a strategic, long-term process. In a study by Farrell & Gallagher (2015), the implementation maturity of ERM programs was investigated for its impact on a firm's market value. The study illustrated that the longer the period of ERM adoption, the more value they created, measured through Tobin's Q ratio. Under Modigliani and Miller's capital structure theory (1958, 1963), it is implied that a firm can integrate additional debt without apprehension regarding the erosion of its market value. Consequently, the financial risk (default risk) associated with this debt becomes irrelevant. Thus, the optimal capital structure for a company would involve complete financing through debt. At this threshold of debt, the firm's theoretical value reaches its peak. However, in the practical market, numerous frictions are present that enable risks associated with debt to impose tangible costs on the company. As a result, effectively managing these firm-specific risks could theoretically stabilize business performance and thereby enhance the firm's value (Canil and Rosser, 2005; McShane, 2018).

Numerous academic articles conducted in the Vietnam setting showed consistent results with research in developed nations, indicating both positive and negative influences of ERM. Trang & Khuong (2017) explored how perceived risk directly affected investment performance in Vietnam. Kommunuri et al. (2016) found that the Vietnamese market's perception of company value was higher for firms using ERM but indicated a statistically significant negative impact of ERM on firm performance as assessed by Return on Assets (ROA). Conversely, Phan et al. (2020) provided further evidence for the favorable relationship between ERM and business value in their analysis of 77 listed firms on the Ho Chi Minh City Stock Exchange. Nguyen Thuy Anh & Tran Phuong Hoa

(2021) demonstrated the beneficial influence on both firm performance and firm value in a Vietnamese listed business. Based on the aforementioned argument, the first hypothesis is proposed regarding the relationship between ERM and firm performance in Vietnam as follows:

Hypothesis 1: Firms with effective ERM, as indicated by a low abnormal enterprise risk management index, positively affect firm performance.

In prior literature, the topic of Enterprise Risk Management (ERM) and its positive impact on companies' risk, particularly financial risk, has been extensively discussed, consistently aligning with theoretical reasoning. Independent studies by Hoyt & Liebenberg (2011) and Farrell & Gallagher (2015) have both concluded, based on empirical evidence, that companies incorporating ERM practices and frameworks into their operations can effectively reduce the likelihood of bankruptcy or financial distress. McShane et al. (2011) also found that companies with evidence of ERM adoption experience lower average costs of accessible capital, leading to reduced financial burdens in terms of interest expenses and a decreased risk of bankruptcy. This empirical evidence supports the theoretical ideas proposed by Stulz (1996), who conjectured that risk management lowers the probabilities of value destruction during financial crises by reducing the cost of capital. The insurance sector has also witnessed positive outcomes from risk management practices, as demonstrated in Nocco & Stulz's (2006) paper. Insurers utilizing ERM have shown access to affordable capital reserves, leading to faster processes and a decreased probability of facing financial problems that could lead to insolvency. Additionally, corporate credit rating agencies have begun incorporating ERM frameworks to assess companies' risk management processes (Hoyt & Liebenberg, 2015). Consequently, companies adopting ERM can significantly reduce the cost of capital and receive higher credit ratings. ERM implementation has also been found to help control expenses at a reasonable level,

reducing fluctuations in enterprise earnings, as indicated by Andersen et al. (2008). This reduction in share price volatility is consistent with the decrease in fluctuations in enterprise bottom-line profits. In contrast, risks can emerge from various sources, including Chief Executive Officer (CEO) incentive compensation (Yang, 2012). Consequently, González et al.'s (2020) research, which examined the impact of ERM on the risk of Spanish listed companies, concluded that ERM adoption is not directly associated with the probability of bankruptcy. In a related study, Wang & Nguyen (2015) presented evidence demonstrating that idiosyncratic risks increase significantly as stock returns rise after a bailout. Considering the volatile context of an emerging market like Vietnam, where the economy is susceptible to unprecedented events such as economic shocks and political chaos, enterprises implementing ERM are expected to effectively identify, evaluate, prevent, and address risks. Therefore, the second hypothesis is developed as follows:

Hypothesis 2: Firms with effective ERM, as indicated by a low abnormal enterprise risk management index, can reduce firm risks.

III. Research Methodology

A. Data

This study started with an initial sample of 760 listed firms in Vietnam, spanning an 11-year period from 2010 to 2020. Among these firms, 171 firms from the financial, banking, and insurance sector were excluded from the sample due to their involvement in complex risk management processes within the

financial sector. Subsequently, the study removed firms with insufficient data for applying the research model, especially for the two-stage regression model to compute the abnormal enterprise risk management index. To minimize the impact of outliers on the model fitting process, the data is winsorized at the 99th and 1st percentiles. As a result, 504 sampled firms met the research data requirement, yielding a total of 5553 observations over the 11-year period (Table 1).

B. Empirical Models and Variable Definitions

In line with González et al. (2020), the study proposes two models to assess the impact of ERM on the performance and risk of Vietnamese listed firms during 2010-2020 and conducts regression analyses for Eq. (1) and (2) as follows:

$$\begin{aligned} \text{Firm Performance}_{it} = & \beta_0 + \beta_1 \text{ABERMI}_{it} + \beta_2 \text{LEV}_{it} \\ & + \beta_3 \text{SIZE}_{it} + \beta_4 \text{LIQ}_{it} + \beta_5 \text{MKB}_{it} + \beta_6 \text{PS}_{it} \\ & + \beta_7 \text{CAPEX}_{it} + \beta_8 \text{AGE}_{it} + \beta_9 \text{STATE}_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{Firm Risk}_{it} = & \beta_0 + \beta_1 \text{ABERMI}_{it} + \beta_2 \text{LEV}_{it} \\ & + \beta_3 \text{SIZE}_{it} + \beta_4 \text{LIQ}_{it} + \beta_5 \text{MKB}_{it} + \beta_6 \text{PS}_{it} \\ & + \beta_7 \text{CAPEX}_{it} + \beta_8 \text{AGE}_{it} + \beta_9 \text{STATE}_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

Where subscript *i* and *t* represent the firm and the year, respectively. Along with firm performance and firm risk, which serve as dependent variables, the study utilizes the abnormal enterprise risk management index (ABERMI) as an indicator to assess the effectiveness of ERM. In addition, several firm-level controlling variables, namely LEV, SIZE, LIQ, MKB, PS, BID4, AGE and STATE are included as described in Table 3.

Table 1. Sample selection

	Number of firms	Number of observations
Initial sample (2010-2020)	760	8253
(1) Excluding banks, investment funds, financial or insurance companies	171	1804
(2) Eliminating missing or invalid values	85	896
Final sample	504	5553

1. Dependent variables - Firm risk

Firm risk is measured by two indicators: the likelihood of bankruptcy and systematic risk, as described in the research of González et al. (2020).

In 1968, Altman introduced the Z-Score formulation for predicting corporate bankruptcy in his renowned article titled "Financial Ratios, Discriminant Analysis and The Prediction of Corporate Bankruptcy". The formula, shown in Eq. (3), was derived after analyzing public manufacturing companies with assets valued above \$1 million:

$$\begin{aligned} \text{Altman Z-Score} = & 1.2 \frac{\text{Working capital}}{\text{Total assets}} \\ & + 1.4 \frac{\text{Retained Earnings}}{\text{Total assets}} \\ & + 3.3 \frac{\text{Earnings before interest and tax}}{\text{Total assets}} \\ & + 0.6 \frac{\text{Market Capitalization}}{\text{Total liabilities}} \\ & + 1.0 \frac{\text{Sales}}{\text{Total assets}} \end{aligned} \quad (3)$$

Altman provides guidance on interpreting the Z-Score: a score above 3.0 indicates safety, signifying the company's ability to meet its obligations with debtors. A score between 1.8 and 3.0 suggests a moderate probability of filing for bankruptcy within two years, while a score below 1.8 indicates critical financial health, raising concerns about the company's ability to repay its debt when it matures.

The concept of Beta, a measure of systematic risk, originates from Sharpe's famous Capital Asset Pricing Model in 1964. This model proposes that the required return of a risky asset is determined by a linear function of beta and the risk premium associated with holding that asset, as opposed to investing in risk-free instruments like government long-term bonds. In the mathematical formula, beta represents the volatility of an asset's return compared to the market return. A beta of 1.0 indicates that the individual stock's return moves in line with the market and to the same extent. A stock with a beta greater than 1.0 is considered riskier, meaning its return changes

correspondingly with market fluctuations. Conversely, a beta less than 1.0 signifies a less risky stock but is associated with a lower return compared to the market. A negative beta suggests that the stock return increases when the market decreases and vice versa. Therefore, the study runs a linear regression on a stock's returns compared to the market using the following Capital Asset Pricing Model (CAMP) model (4) to calculate beta as systemic risk.

$$ER_i = R_f + \beta_i(ER_m - R_f) \quad (4)$$

Where ER_i refers to expected return of investment. R_f is the risk-free rate. $ER_m - R_f$ represents the market risk premium.

2. Independent variable - Abnormal Enterprise Risk Management Index (ABERMI)

Following the approach of Wang et al. (2018) and Kuo et al. (2021), the study employs a two-stage regression method to assess the abnormal ERM index (ABERMI), which serves as a measure of ERM's efficacy. In the first stage, the coefficients are estimated in the following model (5):

$$\begin{aligned} ERM_{it} = & a_0 + a_1 EU_{it} + a_2 IC_{it} + a_3 SIZE_{it} + a_4 FC_{it} \\ & + a_5 BDM_{it} + \varepsilon_{it} \end{aligned} \quad (5)$$

In this model, ERM_{it} represents the comprehensive index of Enterprise Risk Management (ERM), which will be further explained in Eq.(8). EU_{it} represents the level of uncertainty in the environment, IC_{it} denotes the competition within the industry, $SIZE_{it}$ is firm size, FC_{it} represents the complexity of the firm, and BDM_{it} denotes board monitoring. The coefficients are estimated using the Gordon et al. (2009) method, which takes into account five contingency variables from best-practice firms, specifically those with excess market return.

In the second stage, the study conducts a regression analysis using the coefficients acquired from the initial stage, as indicated in Eq. (6):

$$\text{PERMI}_{it} = \hat{\alpha}_0 + \hat{\alpha}_1 \text{EU}_{it} + \hat{\alpha}_2 \text{IC}_{it} + \hat{\alpha}_3 \text{SIZE}_{it} + \hat{\alpha}_4 \text{FC}_{it} + \hat{\alpha}_5 \text{BDM}_{it} \quad (6)$$

Where PERMI_{it} measures the proposed best ERM fit determined by normal levels, while other variables have been defined previously. The absolute value of the abnormal enterprise risk management index (ABERMI) is calculated using the coefficient estimates obtained from the estimation of best-practice firms, as shown in Eq. (7). A higher value of ABERMI indicates weaker ERM system.

$$\text{ABERMI}_{it} = |\text{ERMI}_{it} - \text{PERMI}_{it}| \quad (7)$$

Regarding ERM index (ERMI), the study adopts the approach of Gordon et al. (2009) to measure the effectiveness of a firm's risk management. This index is derived from COSO's (2004) four primary business objectives, which include strategy, operations, reporting, and compliance. ERMI consolidates the accomplishments of these four objectives into a single

metric. To gauge the attainment of each objective, the study employs two indicators. The ERMI is subsequently created by summing the values of all eight indicators related to these four objectives, as described in Eq. (8) below.

$$\text{ERMI} = \sum_{k=1}^2 \text{Strategy}_k + \sum_{k=1}^2 \text{Operation}_k + \sum_{k=1}^2 \text{Reporting}_k + \sum_{k=1}^2 \text{Compliance}_k \quad (8)$$

In which, Strategy denotes competitive advantage, Operation represents operational efficiency, Reporting is report reliability, and Compliance represents compliance with auditing standards. To evaluate these four objectives, the study employs two proxies for each. The definitions for each indicator: Strategy, Operation, Reporting, and Compliance, are provided in Table 2 below:

Along with independent variables, all controlling variables are presented in Table 3.

Table 2. Definitions of the variables in Eq. (8)

Variables	Objectives	Explanations
Strategy	Competitive advantage	$\text{Strategy}_1 = \frac{\text{Sales}_i - \mu_{\text{sales}}}{\sigma_{\text{sales}}}$ <p>where Sales_i is firm i's sales, μ_{sales} represents average sales in the same industry, and σ_{sales} denotes the standard deviation of sales for all firms in the same industry.</p>
		$\text{Strategy}_2 = \frac{\Delta \beta_i - \mu_{\Delta \beta}}{\sigma_{\Delta \beta}}$ <p>Where $\Delta \beta_i$ is the change of firm i's beta coefficient from year t-1 to year t, $\mu_{\Delta \beta}$ denotes average industry beta, and $\sigma_{\Delta \beta}$ represents standard deviation of beta for all firms in the same industry.</p>
Operation	Operational efficiency	$\text{Operation}_1 = \frac{\text{Sales}_{it}}{\text{Total Assets}_{it}}$
		$\text{Operation}_2 = \frac{\text{Log}(\text{Sales})_{it}}{\text{Log}(\text{Total Employees})_{it}}$
Reporting	Report reliability	$\text{Reporting}_1 = \frac{ \text{Normal Accruals} }{ \text{Normal Accruals} + \text{Abnormal Accruals} }$ $\text{Reporting}_2 = (\text{Audit Opinion}) + (\text{Restatement})$ <p>If a firm's financial reporting is rated as unqualified opinion in auditor's report, Audit Opinion is assigned a value of 0, otherwise it is set to -1. A restatement of the firm's financial statement is also seen as a decrease in the firm's reporting reliability. If a firm announces a restatement, Restatement is set to -1, otherwise it is set to 0. Therefore, the range for Reporting_2 is from -2 to 0.</p>

Table 2. Continued

Variables	Objectives	Explanations
Compliance	Compliance with auditing standards	Compliance ₁ is a dummy variable which equals 1 if the firm is audited by a BIG4 company (PwC, Deloitte, E&Y, KPMG), otherwise 0. Compliance ₂ = $\frac{Net\ Profit\ (Loss)}{Total\ Assets}$

Note: Table 2 presents the detailed calculations for each variable identified in Eq. (8)

Table 3. Definitions of the variables in models (1), (2)

Variables	Explanation	Calculation
Dependent variable		
ROA	Return on total assets	$\frac{Net\ profit}{Total\ assets}$
TOBINQ	Tobin's Q	$\frac{Equity\ Market\ Value + Liabilities\ Book\ Value}{Equity\ Book\ Value + Liabilities\ Book\ Value}$
ZSCORE	Bankruptcy index	Calculated in Eq.(3)
BETA	Systematic risk	Calculated in Eq.(4)
Independent variable		
ABERMI	Abnormal Enterprise Risk Management Index	Calculated in Eq.(7)
Firm-level controlling variables		
LEV	Financial leverage	$\frac{Total\ debt}{Total\ equity}$
SIZE	Firm size	Logarithm of total assets
LIQ	Firm liquidity	$\frac{Cash\ and\ cash\ equivalents}{Total\ current\ liabilities}$
MKB	Market to book ratio	$\frac{Market\ capitalization}{Total\ equity}$
PS	Price to sale ratio	$\frac{Market\ capitalization}{Sales}$
CAPEX	Capital expenditure	$\frac{Capital\ expenditure}{Sales}$
AGE	Number of years of establishment	$Log(Number\ of\ years\ of\ establishment)$
STATE	State ownership	$\frac{The\ number\ of\ state-owned\ shares}{The\ number\ of\ outstanding\ shares}$

Note: Table 3 presents the detailed calculations for each variable identified in models (1), (2).

IV. Empirical Results and Discussion

A. Descriptive Statistics and Correlation Matrix

Table 4 presents the descriptive statistics of the sample. Regarding business performance indicators, including Return on Assets (ROA) and Tobin's Q

ratio, the minimum values of ROA and TOBINQ variables are greater than 0, indicating that the businesses in the research sample operate efficiently and are profitable. On the other hand, variables indicating business risk such as bankruptcy risk (ZSCORE) and systemic risk (BETA), have the highest values of 2.345 and 3.340, respectively, implying that all sample firms face these risks. Risk

management activities in the businesses are measured through the variable of the abnormal enterprise risk management index (ABERMI), with an average value of 1.719, ranging from 0.0006 to 48.411, indicating significant differences in risk management efficiency among the businesses. While some businesses exhibit relatively good risk management with low ABERMI values, others have poor risk management and high ABERMI values. This variance can also be explained by the differences in industries and business sectors among the observed businesses.

Concerning control variables related to the characteristics of the businesses, such as financial leverage (LEV), firm size (SIZE), liquidity (LIQ), market-to-book ratio (MKB), price-to-sales ratio (PS), capital expenditure (CAPEX), firm age (AGE), and state ownership ratio (STATE), the research sample still includes businesses with a relatively high state ownership ratio, with the largest value being 89.9%. The firm size is diverse, and the majority of businesses do not face significant issues with financial leverage or short-term liquidity.

Table 5 shows the Pearson correlation relationship among the variables in Eq. (1), (2). It can be observed that all independent variables in models (1) and (2) have correlation coefficients smaller than 0.5,

indicating that the model does not exhibit multicollinearity. In addition, the negative coefficients between ARERMI and the two firm performance including ROA, TOBINQ, along with the positive coefficients between ABERMI and ZSCORE, BETA, also show the expected relationship in the study.

B. The effects of Enterprise Risk Management on Firm Performance of Vietnamese listed Firms

Table 6 presents the results of three regression methods, consisting of Pooled Ordinary Least Squares (Pool OLS), Fixed Effect Model (FEM) and Random Effect Model (REM), applied to Eq. (1) for dependent variables indicating firm performance. The Hausman test results indicate that FEM is suitable for examining the relationship for ROA, whereas REM is preferable for Tobin's Q, with the implementation of ERM measured through ABERMI. Heteroskedasticity in the model is detected after conducting the Wald test. To address the issue, FEM and REM with robust standard errors are employed.

The results from Table 6 indicate a regression coefficient of -0.083 at a significance level of 5%

Table 4. Descriptive statistics for all variables in models (1), (2)

Variable	Observation	Mean	Std	Min	Max
ROA	5553	0.068	1.258	0.988	2.034
TOBINQ	5553	1.416	0.658	0.468	6.597
ZSCORE	5553	0.376	0.242	0.009	2.345
BETA	5553	0.587	0.484	-1.383	3.340
ABERMI	5553	1.719	1.830	0.0006	48.411
LEV	5553	0.438	0.432	0.030	1.682
SIZE	5553	27.214	1.503	23.441	32.814
LIQ	5553	0.880	1.007	0.010	21.327
MKB	5553	1.744	1.149	0.020	18.372
PS	5553	2.775	2.023	0.039	15.938
CAPEX	5553	1.255	1.004	0.685	6.852
AGE	5553	1.393	0.235	0.845	1.785
STATE	5553	0.041	0.112	0	0.899

Note: Table 4 presents descriptive statistics of the variables in models (1), (2).

Table 5. Correlation matrix among variables in models (1), (2)

	ROA	TOBINQ	ZSCORE	BETA	ABERMI	LEV	SIZE	LIQ	MKB	PS	CAPEX	AGE	STATE
ROA	1.0000												
TOBINQ	0.4279*	1.0000											
ZSCORE	0.3893*	0.2031*	1.0000										
BETA	-0.1235*	-0.0167	-0.1235*	1.0000									
ABERMI	-0.0598*	-0.0628*	0.0423*	0.0970*	1.0000								
LEV	-0.3353*	-0.2855*	-0.2583*	-0.0850*	0.2689*	1.0000							
SIZE	-0.0582*	0.0983*	-0.2149*	0.2214*	0.4626*	0.3799*	1.0000						
LIQ	0.0621*	0.0187	0.1001*	-0.0553*	0.1724*	-0.2592*	0.4260*	1.0000					
MKB	0.2951*	0.2951*	0.1786*	0.0516*	0.0023	-0.0295	0.0268	-0.0271	1.0000				
PS	-0.0268	-0.0268	-0.0245	-0.0412*	0.0394	-0.0014	0.0294	0.0075	-0.2566*	1.0000			
CAPEX	0.2214*	-0.0582*	0.0983*	-0.2149*	0.0649*	0.1643*	0.0955*	-0.1615*	0.1615*	-0.2015*	1.0000		
AGE	0.0516*	0.2951*	0.0850	0.1786*	-0.0262	0.1342*	0.0857*	0.0654*	-0.1034*	-0.0658*	0.1790*	1.0000	
STATE	-0.0412*	-0.0268	0.0739*	-0.0245	0.0254	0.0197	0.0053	0.0224	-0.0238	0.0027	-0.0048	0.0795*	1.0000

Notes: Table 5 shows the Pearson correlation among the variables in Eq. (1), (2). The definitions of these variables are provided in Table 3. * indicates significance at 10%.

between the TOBINQ and ABERMI variables, demonstrating that firms effectively manage risk through a low ABERMI index, which promotes an increase in business performance as measured by the Tobin's Q index in listed companies in Vietnam. This supports the first hypothesis regarding the positive relationship between risk management in firms and business performance. These results are also consistent with findings from previous studies of Hoyt & Liebenberg (2011), Farrell & Gallagher (2015), Phan et al. (2020), Nguyen Thuy Anh & Tran Phuong Hoa (2021). However, the study did not find evidence of the impact of ERM on the ROA variable, as suggested by some previous studies in Vietnam including Kommunuri et al. (2016), Nguyen Thuy Anh & Tran Phuong Hoa (2021). This can be explained by the fact that the study uses ABERMI to evaluate the efficacy of ERM by considering external factors such as competition and the business environment, which may have a stronger influence

on business outcomes that take market factors into account, such as Tobin's Q. Meanwhile, previous studies in Vietnam on ERM only focused on internal factors within the company.

Additionally, the study also found evidence of the impact of control variables related to firm characteristics, such as financial leverage (LEV), market-to-book ratio (MKB), price-to-sales ratio (PS), and age of the firm (AGE). Specifically, while MKB, PS, and AGE all have a positive effect on business performance, the LEV variable reduces business efficiency in firms.

C. The Effects of Enterprise Risk Management on Firm Risks of Vietnamese listed Firms

Table 7 shows the regression results of ERM's impact on the bankruptcy risk (Altman Z-Score) and systematic risk (Beta) of listed companies on the

Table 6. Regression results for the effects of ERM on firm performance

	ROA				TOBINQ			
	OLS	FEM	REM	Robust FEM	OLS	FEM	REM	Robust REM
ABERMI	-0.022***	-0.011*	-0.006	-0.011	-0.506***	-0.064*	-0.083**	-0.083**
LEV	-0.018***	-0.004***	-0.007***	-0.004**	-0.146***	0.003	-0.009	-0.009
SIZE	0.001	-0.021***	-0.010***	-0.021***	0.059***	-0.138***	-0.091***	-0.091***
LIQ	-0.010***	-0.021***	0.002	-0.001	-0.022*	-0.005	-0.005	-0.005
MKB	0.018***	-0.009***	0.001	0.372***	0.492***	0.339***	0.372***	0.339***
PS	-0.004***	-0.002	-0.006	0.003	0.002	0.001*	0.003	0.001*
CAPEX	-0.033***	-0.004	-0.010*	-0.004	-0.431***	-0.016	-0.042	-0.042
AGE	-0.001	0.002	-0.001	0.002	0.028	-0.026	-0.031	0.031**
STATE	-0.016	-0.011	-0.017	-0.011	-0.064*	0.034**	0.021	0.034
Cons	0.010***	-0.025***	-0.002***	-0.025***	0.067***	-0.140***	-0.096***	-0.140***
N	5553	5553	5553	5553	5553	5553	5553	5553
R-sq	0.112	0.171	0.115	0.118	0.137	0.246	0.295	0.293
Hausman test	chi2 Pro>chi2	50.90 0.0000	Choose FEM		chi2 Pro>chi2	45.89 0.1284	Choose REM	
Breusch & Pagan test						772.50 0.0000		
Wald test	chi2 Pro>chi2	6222.08 0.0000	The model is heteroskedastic		chi2 Pro>chi2	2300.02 0.0000	The model is heteroskedastic	

Notes: Table 6 shows the OLS, FEM, REM regression results for the effects of ERM on firm performance in Eq. (1). The definitions of these variables are provided in Table 3. *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

Vietnamese stock market.

The regression results from Table 7 show that the ABERMI variable has a positive impact on both risk measures in firms, including ZSCORE and BETA, but only ZSCORE is statistically significant at the 5% level. This means that as the abnormal enterprise risk management index (ABERMI) decreases and risk management practices improve, the likelihood of bankruptcy for the firm also decreases. This result is consistent with findings from previous studies of Hoyt & Liebenberg (2011), McShane et al. (2011), Farrell & Gallagher (2015), thereby supporting the second hypothesis. It is evident that listed companies in Vietnam can build an effective risk management system, which helps them identify risks, develop preventive measures, and cope with risks when they occur, thereby reducing the risk of bankruptcy.

However, concerning systemic risk measured by the BETA variable, the study did not demonstrate the impact of ERM on this risk. This can be fully

explained in a developing market like Vietnam, where external instabilities are still difficult to measure and detect. Consequently, an effective risk management system is not yet sufficient for companies to cope with broad risks such as systemic risk, as found by González et al. (2020).

Other variables related to firm characteristics, such as size, liquidity, market-to-book ratio, firm age, and capital cost, also have certain impacts on the risks within firms.

D. Robustness Test

To test the reliability of the main findings, the study uses a method to change the calculation of the ERM variable by measuring ERM as a binary variable that take the value of 1 if the listed firm adopts one of four cases, including (1) tracking the implementation of ISO 31000 framework; (2) having

Table 7. Regression results for the effect of ERM on firm risks

	ZSCORE				BETA			
	OLS	FEM	REM	Robust FEM	OLS	FEM	REM	Robust REM
ABERMI	0.019	0.031**	0.027*	0.031**	0.049	0.129**	0.084	0.084
LEV	-0.038***	-0.012***	-0.015***	-0.012	0.012*	0.036***	0.014	0.014
SIZE	-0.027***	-0.077***	-0.062***	-0.077***	0.053***	-0.157***	0.076***	0.076***
LIQ	0.002	0.030***	0.024***	0.025***	0.001	-0.005	-0.004	-0.004
MKB	0.043***	-0.005	0.004	-0.005	0.012	0.018	0.029***	0.029***
PS	-0.002***	0.001	0.003	0.001	-0.001*	-0.002**	-0.001***	-0.001***
CAPEX	-0.026	0.015	0.010	0.015	-0.136***	0.020	-0.096*	-0.096*
AGE	-0.006	0.030***	0.024**	-0.030*	0.028	-0.065*	-0.018	-0.018
STATE	-0.014	0.006	0.002	0.006	-0.024	-0.148	-0.206	-0.015
Cons	-0.027***	-0.075***	-0.061***	-0.075***	0.072***	-0.167***	0.047***	-0.167***
N	5553	5553	5553	5553	5553	5553	5553	5553
R-sq	0.197	0.227	0.125	0.218	0.169	0.153	0.134	0.123
Hausman test	chi2 Pro>chi2	78.38 0.0000	Choose FEM		chi2 Pro>chi2	89.85 0.2676	Choose REM	
Breusch & Pagan test						252.54 0.0000		
Wald test	chi2 Pro>chi2	67658.74 0.0000	The model is heteroskedastic		chi2 Pro>chi2	59403.09 0.0000	The model is heteroskedastic	

Notes: Table 7 shows the OLS, FEM, REM regression results for the effects of ERM on firm risks in Eq. (2). The definitions of these variables are provided in Table 3. *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

Table 8. Robustness test results

	ROA	TOBINQ	ZSCORE	BETA
ABERMI	0.010	0.049**	-0.197***	-0.015
LEV	-0.003**	-0.019	-0.033	0.006
SIZE	-0.023***	-0.194**	-0.200***	0.077***
LIQ	0.005	-0.040	0.064*	-0.035
MKB	0.009***	0.265**	-0.036	0.012*
PS	-0.001	0.001	0.001	-0.001*
CAPEX	-0.002	-0.004	0.037	-0.012
AGE	0.001	0.006**	-0.005**	-0.025**
STATE	-0.009	0.338	0.170	-0.005
Cons	-0.001**	-0.012***	-0.003**	-0.001*
N	5553	5553	5553	5553
R-squared	0.135	0.232	0.169	0.167

Note: Table 8 shows the FEM regression results after using Robust standard errors for the models (1) and (2). The definitions of these variables are provided in Table 3 and the explanation above. The symbols *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

the risk committee in the company board; (3) using the risk map to analyze the company's risk situation and (4) appointing a Chief Risk Officer (CRO) in the company; otherwise it is 0.

The robustness test results in Table 8 provide supportive evidence for both Hypotheses 1 and 2, which means that the ERM adoption has a positive impact on firm performance and reduces the likelihood of bankruptcy in Vietnamese listed firms.

V. Conclusion and Recommendations

This study assesses the impact of enterprise risk management (ERM) on the business performance and risk of listed companies in Vietnam. Specifically, it measures the effectiveness of risk management using the abnormal enterprise risk management index (ABERMI) from 2010 to 2020. The results from the multivariate regression models demonstrate a positive influence of ERM on business performance, as measured by the Tobin's Q index, and an inverse effect on the risk of bankruptcy for the firm. These findings align with similar studies conducted by Hoyt &

Liebenberg (2011), McShane et al. (2011), Farrell & Gallagher (2015), and Phan et al. (2020). Our findings extend the literature of the relationship between ERM and firm performance as well as firm risks in the emerging market.

The findings highlight certain barriers in evaluating the quality of ERM practices and systems based on the current disclosure of firm information. Vietnamese listed firms are encouraged to provide more comprehensive information about their risk management processes and governance. Effective risk management involves identifying risks, assessing possibilities and hazards, and prioritizing them for appropriate control to avoid unfavorable outcomes. Business openness at all levels of the firm is essential in this regard. It is suggested that the implementation of risk management standards can enhance the performance of Vietnamese listed firms. These standards not only provide a coherent framework, guidance, and principles for companies to follow but also demonstrate their commitment to safeguarding shareholders' wealth and meeting the needs of other stakeholders. They include information on the risk management approach and offer recommendations on its proper execution. Formalizing the risk management process through these guidelines aims to increase its efficacy, though

it does not guarantee it. Adopting a risk management standard presents practical challenges, such as developing an action plan, designing a specific organizational structure for risk management, integrating risk management into the enterprise culture, identifying all risk categories, and establishing guidelines and metrics to measure risk management effectiveness. Moreover, applying international standards enhances the comparability of Vietnamese firms with their international counterparts, leading to increased information transparency for foreign investors and improving the attractiveness of the Vietnamese stock market.

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