International Review of Economics and Finance 106 (2026) 105006

Contents lists available at ScienceDirect

International Review of Economics and Finance

journal homepage: www.elsevier.com/locate/iref

Financial distress and firm performance: Evidence from Vietnam☆

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ARTICLE INFO

JEL classification:
B41
G01
G32
G33

Keywords:
Financial distress
Firm performance
Multiple discriminant analysis
Vietnam

ABSTRACT

How financial status impacts firms' operations has long been a central question in management. This study examines that relationship in the context of Vietnam, an emerging market where financing constraints, debt structures, and macroeconomic conditions differ substantially from those in developed economies. For listed manufacturing and commercial firms, we first construct a financial distress prediction model employing multiple discriminant analysis, achieving correct classification rates of 71.5% for distressed firms and 96.3% for sound firms. We then investigate the link between financial distress and firm performance, and regression analyses consistently reveal that alleviated financial distress is significantly associated with improved firm performance, controlling for leverage, firm size, foreign exchange risk, price level, and economic growth. Further robustness is confirmed across alternative leverage decompositions, subsample tests separating distressed and sound firms, and for the Covid-19 period. While consistent with the literature, these emerging market findings are noteworthy for their geographical and sectoral uniqueness. Managerial and policy implications are also discussed.

1. Introduction

"In times of great stress or adversity, it's always best to keep busy, to plow your anger and your energy into something positive …"[2]

The financial health of a firm plays a pivotal role in shaping its strategic decisions, operational efficiency, and long-term sustainability. In management, understanding how financial status influences firm performance has remained a central question. Financial distress, in particular, can significantly hinder a firm's ability to compete, innovate, and grow, especially in emerging

☆ We are grateful for the research support from Chung-Ang University, Ewha Womans University, The State University of New York, Korea and Stony Brook University.

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[1] We thank Feng Eric He, Xuguang Simon Sheng, Andrew Urquhart (the Editors), Arman Eshraghi, Brian Lucey, Shweta Sharma, and the anonymous referees. The authors contributed equally to this work. Standard disclaimer rules apply, and all errors are our own.

[2] See Lee Iacocca's (Iaccoa and Novak, 2011, p.16) quote.

https://doi.org/10.1016/j.iref.2026.105006
Received 1 October 2025; Received in revised form 22 January 2026; Accepted 9 February 2026
Available online 12 February 2026
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markets where economic volatility and institutional constraints are more pronounced.

Over the decades, the literature finds various models to predict financial distress and bankruptcy. Altman's (1968) seminal Z-score model utilizes financial ratios and multiple discriminant analysis (MDA) to assess the likelihood of corporate failure (Altman & Hotchkiss, 1993). Ohlson (1980) later introduced a probabilistic approach using logistic regression, while subsequent studies have tested the generalizability and robustness of these models across different contexts (Anjum, 2012; Grice & Ingram, 2001). Despite these advancements, there remains a need to adapt and validate such models in specific national and sectoral contexts, particularly in rapidly developing economies like Vietnam.

Vietnam's strategic role in global supply chains makes it an ideal setting to study financial distress and firm performance (Stevenson & Ngo, 2025). As manufacturing relocates from China due to trade tensions, Vietnam attracts investment but faces operational pressures, especially for firms dependent on Chinese inputs. Rising U.S. exports increase scrutiny over transshipment and supply chain authenticity, adding financial and regulatory risks. Small and medium enterprises (SMEs) dominate the economy and remain vulnerable to liquidity constraints despite efforts in digital transformation, which are hindered by skills gaps and weak infrastructure (Economist, 2023a; 2023b). With a young workforce and active trade agreements, Vietnam offers a dynamic context to explore how mitigating financial distress through liquidity, governance, and strategic investment can enhance firm performance.

Vietnam's manufacturing and commercial sectors have experienced substantial growth in recent years, yet they remain vulnerable to financial shocks and macroeconomic fluctuations. Prior research has shown that capital structure and macroeconomic variables—such as leverage, exchange rates, and inflation—can significantly influence firm performance (Abor, 2005; Hussain et al., 2021; Myers & Majluf, 1984; Zeitun & Tian, 2007). Our study contributes to the literature, which is sparse in linking financial status and operational outcomes (e.g., Tran et al., 2023b). However, few studies have systematically examined the predictive power of financial distress models, such as MDA, in Vietnam or explored how distress correlates with firm-level performance outcomes.

In response to increasing financial uncertainties and operational contingencies, it is imperative for Vietnamese enterprises to identify robust forecasting frameworks to anticipate and mitigate the risk of financial distress. Such models aim to estimate the likelihood of distress and assess bankruptcy risk through a quantifiable distress index. Understanding the implications of elevated bankruptcy risk on firm performance has become essential, prompting a deeper investigation into the financial determinants of distress. Accordingly, this study seeks to develop a predictive model for financial distress while simultaneously examining the influence of key explanatory factors on firm performance.

Our study addresses these gaps by developing a financial distress prediction model using MDA for listed firms in Vietnam's manufacturing and commercial sectors. The model achieves the classification accuracy proportions of 71.5% and 96.3% for the financially distressed and sound groups, respectively, offering a reliable tool for early warning. Furthermore, we investigate the relationship between financial distress and firm performance using multiple regression methods, controlling for key financial and macroeconomic variables. This is deemed a valuable country study along with previous recent regional studies on Indonesia (Andriani et al., 2025), the Philippines (Delfin & Ferrer, 2024; Rago et al., 2023), Malaysia (Hashim et al., 2024; Kamaruzzaman et al., 2025), and the ASEAN region (Yunisa and Santi, 2023).

Financial distress weakens a firm's ability to operate effectively because managers become preoccupied with short-term survival, investment is delayed, and stakeholders lose confidence. When firms relieve this pressure—by improving cash flow, restructuring debt, or strengthening liquidity—they regain flexibility to make better decisions, invest in productive activities, and stabilize relationships with creditors, suppliers, and employees. Reduced distress therefore not only prevents failure but also enables smoother operations and stronger performance. Accordingly, we empirically find that alleviated financial distress is associated with enhanced business performance in Vietnam among commercial and manufacturing sectors.

By linking predictive analytics with performance outcomes, this research provides actionable insights for managers, investors, and policymakers aiming to enhance corporate resilience and strategic planning in an emerging market economy. The remainder of our study proceeds as follows: Section Two reviews the relevant literature and formulates this study's research question. Section Three presents an economic model for the distress-performance framework, identifies variables and the empirical experiment design, including the estimation and regression models, and describes the data. The preliminary and main empirical results, along with robustness checks and further discussions, including managerial and policy implications, are presented in Section Four. Finally, Section Five concludes the study and suggests directions for future research.

2. The literature and hypothesis development

Financial distress has traditionally been viewed as a precursor to bankruptcy and organizational failure. Altman & Hotchkiss (1993) define financial distress as a period of severe financial difficulty, often marked by an inability to meet debt obligations. Beaver (1966) similarly characterizes it as the incapability to fulfill financial commitments, frequently leading to insolvency. A substantial body of existing research in the literature finds that alleviating financial distress and reducing financial risk are strongly associated with enhanced firm operations. Building on this foundational understanding, it is essential to examine how distress affects the internal

functioning of firms and why its resolution matters for operational efficiency.

Financial distress impairs a firm's ability to operate efficiently by disrupting internal decision-making, reducing access to capital, and weakening stakeholder confidence. Wruck (1990) argues that distress leads to organizational inefficiencies, which can be reversed through financial restructuring. Similarly, Gilson et al. (1990) show that private debt reorganizations often restore firm value and operational capacity, suggesting that alleviation of distress directly contributes to performance recovery. This operational perspective naturally connects to the role of capital structure, as the way firms manage debt and equity can either mitigate or exacerbate distress.

Jensen (1986) posits from an agency-theoretic perspective that while debt can discipline managers, excessive leverage leads to financial distress and managerial inefficiency. Berger & Bonaccorsi di Patti (2006) empirically confirm that firms with optimized capital structures—balancing debt and equity—exhibit superior performance, as reduced agency costs improve governance and strategic alignment. However, capital structure alone cannot fully shield firms from shocks; liquidity emerges as another critical determinant of resilience during periods of uncertainty.

Liquidity plays a critical role in operational continuity. Almeida et al. (2004) demonstrate that financially unconstrained firms are better able to invest during downturns, highlighting the importance of liquidity in sustaining operations. Hartman-Glaser et al. (2025) extend this insight through a dynamic contracting model, showing that cash flow-based financing and distress resolution mechanisms, e.g., bankruptcy protection, preserve firm operations and enhance resilience. Beyond internal resources, financial health also shapes external perceptions, influencing how stakeholders respond to a firm's condition.

Sound financial status influences stakeholder behavior via signaling mechanisms. Myers & Majluf (1984) argue that firms facing distress are penalized in capital markets due to adverse selection, while financially healthy firms attract investment and trust. Graham & Harvey (2001) find that managers are acutely aware of market signals when making financing decisions, indicating that perceived financial stability enhances stakeholder engagement and operational momentum. This interplay between financial health and strategic decision-making aligns closely with broader theories of dynamic capabilities, which emphasize adaptability in turbulent environments.

Additionally, the dynamic capabilities framework emphasizes the strategic flexibility afforded by financial health. Teece et al. (1997) argue that firms must be able to sense, seize, and transform resources to adapt to changing environments. Campello et al. (2010) show that financially distressed firms cut back on innovation and strategic investments during crises, underscoring the importance of financial stability for long-term operational success. In sum, the alleviation of financial distress and reduction of financial risk are not merely survival mechanisms—they are strategic enablers of enhanced firm operations. Accordingly, we propose the following research question:

H1. *Alleviated financial distress is associated with enhanced business performance.*

Vietnam's increasing integration into global supply chains, particularly as a key destination for manufacturing relocation amid U.S.–China trade tensions, has introduced both significant opportunities and operational challenges for domestic firms, including heightened financial and regulatory risks associated with transshipment scrutiny (Stevenson & Ngo, 2025). The economy, characterized by a predominance of SMEs, faces persistent liquidity constraints and infrastructural limitations; however, firms are progressively adopting digital technologies to enhance resilience and operational efficiency (Economist, 2023a; 2023b).

Coupled with a youthful labor force and active participation in multiple trade agreements, these structural and institutional conditions position Vietnam as an appropriate context for investigating how mitigating financial distress—through improved liquidity, governance mechanisms, and strategic investment—can strengthen firm performance. Since these overall parameters pose both financial risks and operational opportunities to the real side of the Vietnamese economy, we specifically finetune the above raised hypothesis to the manufacturing and commercial sectors in Vietnam as follows:

H1a. *Mitigated financial distress is correlated with improved firm performance in the Vietnamese manufacturing and commercial sectors.*

3. Research design

3.1. The models and variables

3.1.1. The distress-performance framework

In the previous section, the four channels depicted in the literature survey—organizational inefficiency, financing costs and leverage, liquidity and resilience, dynamic feedback from financial health to operations—lead to the main hypothesis. In this regard, we provide a simple and intuitive economic model to formulate the distress-performance framework.

The firm's operating profit is given by

$$\Pi_t = f(I_t, e_t) - c(s_t) - r(s_t)B_t, \tag{1}$$

where $f(\cdot,\cdot)$ is the production function (sales revenue), $I_t \geq 0$ is investment, e_t is managerial and operational effort, $s_t \in \{0,1\}$ denotes financial distress (1 = distressed), $c(\cdot)$ is operating cost with $c(1) > c(0)$, B_t is outstanding debt and $r(s_t)$ is the effective cost of debt with $r(1) > r(0)$. In other words, financial distress lowers performance by increasing organizational friction and financing costs.

Liquidity L_t evolves as

$$L_{t+1} = L_t + \Pi_t - I_t, \tag{2}$$

and the probability of remaining distressed satisfies

$$\mathbb{P}(s_{t+1}=1)=\pi(L_{t+1}) \tag{3}$$

such that $\pi'(L)<0$, i.e., higher liquidity reduces future distress risk.

The firm makes an investment decision I_t maximize the discounted operating profits:

$$\max_{I_t} \ \Pi_t+\beta\mathbb{E}_t(\Pi_{t+1}) \tag{4}$$

whose first-order condition implies

$$f_I(I_t,e_t)=1+r(s_t)+\text{distress premium}. \tag{5}$$

Higher distress, thus, raises the marginal cost of investment and reduces optimal investment. Since financial distress raises inefficiency $c(s_t)$, financing costs $r(s_t)$, and future distress risk, alleviating distress ($s_t: 1\to 0$) leads to higher investment I_t, improved operations $f(\cdot,\cdot\cdot)$, and higher firm performance Π_t.

3.1.2. Multiple discriminant analysis method

As a financial-distress predictive methodology, MDA has been widely applied across fields for model identification for a categorical dependent variable, e.g., financially distressed vs. sound for bankruptcy prediction (Altman, 1968). In its simplest form, MDA constructs a linear relationship based on those characteristics to maximize the distinction between groups (Fisher, 1936). MDA calculates discriminant coefficients and converts the individual variable values into a single *Z*-score for classification ranking whose discriminant function is

$$Z=\zeta_1X_1+\zeta_2X_2+\cdots+\zeta_nX_n, \tag{6}$$

where $\{X_i\}_{i=1}^n$ and $\{\zeta_i\}_{i=1}^n$ are the independent variables and their discriminant weights, respectively.

MDA analyzes multiple variables of an object simultaneously rather than examining them sequentially. In this study, MDA considers the entire set of common characteristics among the evaluated companies, as well as their interactions. As the *Z*-score model was originally developed for the corporate environment in the U.S., it is an empirical question whether it can still be applied to the business conditions in Vietnam. We accordingly adopt five variables from the *Z*-score model (Altman, 1968) and augment a financial leverage variable to construct a financial distress estimation model as follows:

$$Distress=\delta_1 WorkingCapital+\delta_2 RetainedEarnings+\delta_3 EBIT+\delta_4 EquityDebt+\delta_5 Sales+\delta_6 DebtEquity. \tag{7}$$

First, *WorkingCapital* is calculated as working capital divided by total assets and serves as a widely accepted measure of liquidity in corporate finance. Among various liquidity ratios, Altman (1968) identified this ratio as the most significant predictor of financial distress. Second, *RetainedEarnings*, defined as retained earnings divided by total assets, reflects the portion of net income reinvested in the business rather than distributed as dividends. A higher ratio indicates stronger internal financing and lower reliance on debt, signaling financial resilience (Altman, 1968). Third, *EBIT* is earnings before interest and taxes divided by total assets. This ratio measures a firm's ability to generate profits from its assets, independent of tax and interest effects. Altman (1968) emphasized its usefulness in evaluating operational efficiency and investment effectiveness. Fourth, *EquityDebt* represents the market value of equity divided by the book value of debt. It reflects a firm's financial stability by indicating how much its market value can decline before liabilities exceed assets (Altman, 1968). Fifth, *Sales*, or total asset turnover, is calculated as total sales revenue divided by total assets. This ratio assesses how efficiently a firm utilizes its assets to generate revenue. It is a key indicator of operational effectiveness and is particularly relevant for investment decisions (Altman, 1968).

As our addition to the *Z*-score model, *DebtEquity*, the ratio of total debt to total equity, measures financial leverage. It indicates the extent to which a firm relies on debt financing. A higher ratio suggests increased financial risk and potential distress (Beaver, 1966; Ding et al., 2023; Opler & Titman, 1994).

The group centroids are calculated as

1. *Perform discriminant analysis.* Apply MDA to the sample computing discriminant functions that best separate the groups.
2. *Compute discriminant (financial distress) scores.* For each observation, calculate its score on each discriminant function, representing the projection of the data onto the discriminant axes.
3. *Group the scores by class.* Organize the discriminant scores by financially distressed versus sound.
4. *Calculate the centroid for each group.* For each group, compute the mean (centroid) of the discriminant scores.

As a result, for each group, the centroid ($\mathbb{C}_G$) is estimated as

$$\mathbb{C}_G=\frac{1}{|G|}\sum \mathbb{D}_G, \tag{8}$$

where $\mathbb{D}_G$ is the financial distress score (*Distress*) for each group ($G\in\{D,S\}$), financially distressed (D) versus sound (S) with total observations $n=|D|+|S|$. The implied threshold ($\underline{\mathbb{Z}}$) is

$$\underline{\mathbb{Z}} = (|S| \cdot \mathbb{C}_D + |D| \cdot \mathbb{C}_S)/_n \tag{9}$$

which provides the following classification criteria:

$$Distress \begin{Bmatrix} < \\ \geq \end{Bmatrix} \underline{\mathbb{Z}} \Longrightarrow \begin{cases} \text{financially distressed} \\ \text{financially sound.} \end{cases}$$

Put another way, the financial distress score herein is an inverse measure of financial distress.

3.1.3. Variables and the empirical model

As a proxy for firm performance, Opler and Titman's (1994) model includes the return on assets (ROA), the return on equity (ROE), return on sales, Tobin's (1969) Q, earnings per share, the operating ratio, and the price-to-book ratio as the basket of objective dependent variables. From various analytical perspectives, these indicators effectively describe and evaluate firm performance. This study adopts ROA, ROE, and Tobin's Q (*TobinQ*) as effective measures of firm profitability, vetted in Ghana (Abor, 2005), the U.K. (Pacini et al., 2017), and Malaysia (Salim & Yadav, 2012) as respectively defined as

$$ROA \equiv Earnings/_{Assets},$$

$$ROE \equiv Earnings/_{Equity},$$

$$TobinQ \equiv Price\ of\ stock \times \#\{shares\ outstanding\} + Liabilities/_{Assets}.$$

As explanatory variables, financial risk is assessed using the Vietnam financial distress score (*Distress*) while controlling for financial leverage, the short- and long-term debt ratios, firm size, the USD-VND exchange rate, the interest rate of government bonds, and the consumer price index (CPI).

Financial leverage (*Leverage*) is empirically shown to evaluate a firm's financial autonomy and risk around the world (Abor, 2005; Gill et al., 2011; Salim & Yadav, 2012; Zeitun & Tian, 2007). According to the pecking order theory, raising debt capital mobilization is considered a more favorable signal than raising equity capital, highlighting the positive aspect of financial leverage (Myers & Majluf, 1984). Firms can benefit from using debt due to the tax shield effect of interest expenses. However, this index is also considered a risk factor that can potentially lead to financial distress and negatively impact future performance. The short- (*ShortDebt*) and long-term debt (*LongDebt*) ratios are debts due within and after more than one year, respectively, divided by the total assets. Additionally, firm size (*Size*)—the natural logarithmic value of the market capitalization of the company—is a common covariate for firm performance.

We control for macroeconomic risks faced by the firm: First, the exchange rate (*VND*)—defined as the natural logarithmic value of the Vietnamese dong per US dollar exchange rate—fluctuations pose a financial risk, as they directly impact import-export operations and currency exchange. An appreciation (depreciation) in the Vietnamese dong will aggravate (enhance) the price competitiveness of export goods in the foreign market. Yet, the exports will be exchanged at higher (lower) proceeds. The impact of exchange rates on profitability is deemed an empirical issue. Second, government bond interest rates (*RiskFree*) are an effective indicator of market interest rates, such as bank lending rates and corporate bond rates (Cieslak & Povala, 2015; Duffee, 1998). These rates affect capital costs and, ultimately, firm performance. Third, the CPI (*Price*) is the change in the average cost of consumer goods and services affecting both the sales revenue and expenses of the sample firms. Rising inflation increases input costs of production and business operations, thereby reducing firm performance. Lastly, the growth rate of gross domestic products (*GDP*) proxies for economic growth which influences corporate investment decisions *ex ante* and the aggregate demand or firms' sales revenues *ex post*.

Accordingly, the empirical model can be constructed as

$$Performance_{i,t} = \beta_0 + \beta_D \cdot Distress_{i,t} + \beta_F \cdot Financials_{i,t} + \beta_C \cdot Controls_{i,t} + e_{i,t}, \tag{10}$$

where the financial distress score (*Distress*) is estimated per the procedure described in the previous section, and

$$Performance = \{ROE, ROA, TobinQ\},$$

$$Financials = [Leverage, ShortDebt, LongDebt, Size]^T,$$

$$Controls = [VND, RiskFree, Price, GDP]^T$$

for firm i in year t.

3.2. Data

This study utilizes secondary data from 374 listed manufacturing and commercial enterprises in Vietnam from 2010 to 2022 which includes the Covid-19 pandemic period (World Health Organization, 2020; 2023). Specifically, the dataset encompasses enterprises that meet the following criteria: (1) they must have complete financial reports for the research period; and (2) the financial reports must be transparent, accurate, and audited by an independent auditing organization to ensure integrity and compliance with accounting principles in accordance with current accounting standards. Accordingly, all accounting and financial data used for

estimating the financial distress score and implementing regression analysis are procured from the FiinPro database which has been a proven data source for recent capital markets research on Vietnam (Tran et al., 2023a; Huynh, 2025; Vuong et al., 2025). A sample firm is categorized as financially distressed if, based on the previous four-year moving average, (1) the after-tax profit is negative (i.e., a loss), (2) the debt-to-assets ratio exceeds 70 percent, and (3) the current liquidity ratio is less than one. Financially sound firms are those not identified as distressed.

4. Empirics

4.1. Financial distress

Discriminant coefficient estimates are used for estimating the financial distress score. The greater the absolute value of a coefficient estimate, the more it contributes to the discriminant ability of the function. The discriminant score is determined by the weighted sum of the identified determinants (Panel A of Table 1) with the discriminant coefficients as weights with an eclectic constant shift.

In this research, the MDA method herein searches for the optimal discriminant function per stepwise procedure (Poulsen & French, 2008). As a result, Model 3 with the intercept is identified as follows, given the overall highest Wilks' (1932) lambda, eigenvalue, and canonical correlation (Panel B of Table 1):

$$\begin{aligned} Distress = &-1.006 + 3.106 \times WorkingCapital + 0.284 \times RetainedEarnings + 4.295 \times EBIT - 0.003 \times EquityDebt + 0.013 \times Sales \\ &- 0.082 \times DebtEquity \end{aligned} \tag{11}$$

The coefficients in the discriminant function are considered partial coefficients because they reflect the independent contribution of each variable when classifying the dependent variable. The results show that *WorkingCapital*, *RetainedEarnings*, and *EBIT* positively and significantly influence the overall population.

Based on the identified discriminant function (Model 3 in Panel B of Table 1), the financial distress score (*Distress*) is provided with 4,862 firm-year estimates across 374 Vietnamese manufacturing and commercial firms from 2010 until 2022 (Panel A of Table 2). The centroids (mean scores) of financially "distressed" (D) versus "sound" (S) groups are 0.173 ($= \mathbb{C}_D$) and 1.294 ($= \mathbb{C}_S$), respectively, seemingly different from the mean score of 1.033 (Panel A). Because the number of observations in each group is unequal ($|D| = 1,048 < |S| = 3,918$), the cut-off threshold ($\mathbb{Z}$) is estimated (Panel B of Table 2) as

$$\mathbb{Z} = (|S| \cdot \mathbb{C}_D + |D| \cdot \mathbb{C}_S)/n = 0.410, \tag{12}$$

where n ($= |D| + |S|$) is the total number of firm-year distress score estimates. An average Vietnamese firm in the sample appears to be

Table 1
Multiple discriminant analysis results
In Panel A, as the determinants of the financial distress score (Distress), WorkingCapital is working capital divided by total assets. RetainedEarnings is retained earnings divided by total assets. EBIT is earnings before interest and taxes divided by total assets. EquityDebt is the market value of equity divided by the book value of debt. Sales is total sales revenue divided by total assets. DebtEquity is total debt divided by total equity. Distress is the financial distress score implied from the multiple discriminant analysis method. Panel B shows the results from the multiple discriminant analysis method in a step-wise optimization procedure based on the overall criterion of Wilks' (1932) lambda, eigenvalue and canonical correlation. Through Models 1 and 2, Model 3 shows the canonical discriminant function including the intercept as the final output.

Panel A. Determinants of the financial distress score

Variable	Mean	Std. dev.	*p*-value	Minimum	Median	Maximum	No. obs.
WorkingCapital	0.229	0.234	0.000	−0.674	0.206	0.984	4,966
RetarinedEarnings	0.109	0.129	0.000	−0.946	0.085	1.518	4,966
EBIT	0.088	0.100	0.000	−1.009	0.071	0.994	4,966
EquityDebt	2.136	6.308	0.000	0.000	0.591	126.189	4,966
Sales	1.339	1.139	0.000	0.001	1.095	13.839	4,966
DebtEquity	1.471	3.742	0.000	−19.373	0.854	140.033	4,966

Panel B. Discriminant functions

Variable	Model 1	Model 2	Model 3
WorkingCapital	0.671	0.841	3.106
RetainedEarnings	0.036	0.647	0.284
EBIT	0.410	0.673	4.295
EquityDebt	−0.030	0.303	−0.003
Sales	0.015	0.059	0.013
DebtEquity	−0.300	−0.493	−0.082
Constant			−1.006
Wilks' lambda			0.806
Eigenvalue			0.241
Canonical correlation			0.441

Table 2
Financial distress score and classification results
Panel A shows the distribution of the financial distress score (Distress) implied from the multiple discriminant analysis method. Specifically, Distress is determined by linear combinations of WorkingCapital, RetainedEarnings, EBIT, EquityDebt, Sales. and DebtEquity whose definifitions are found in Table 1. In Panel B, the threshold for the classification of financial status of sample firms is estimated as $(|S| \times C_D + |D| \times C_S)/(|D|+|S|)$, where $|D|$ and $|S|$ are the counts of financially distressed (D) and sound (S) firms, and C_D and C_S are the centroids of the D and S groups, respectively. Panel C exhibits the classification results based on the original and cross-validated samples. Cross-validation leaves out one observation at a time and implement the model on the excluded observation.

Panel A. Financial distress score

Variable	Mean	Std. dev.	*p*-value	Minimum	Median	Maximum	No. obs.
Distress	1.033	1.063	0.000	−12.188	0.961	6.454	4,862

Panel B. Group centroids and threshold

Group	Distressed	Sound	Threshold
Centroid	0.173	1.294	0.410
Count	1,048	3,918	4,966

Panel C. Classification results

Sample	Group	Predicted		Total
		Distressed	Sound	
Original	Distressed	911	363	1,274
	Proportion	0.715	0.285	1.000
	Sound	137	3,555	3,692
	Proportion	0.037	0.963	1.000
Cross-validated	Distressed	912	362	1,274
	Proportion	0.716	0.284	1.000
	Sound	138	3,554	3,692
	Proportion	0.037	0.963	1.000

financially sound given its mean score (1.033) exceeding the threshold (0.410).

If the distress score (*Distress*) is (no) less than 0.410, the business is financially distressed (sound). Out of 4966 firm-year distress score estimates in the original sample of financially distressed and sound firms, 911 and 3555 were correctly classified into the financially distressed and sound groups, representing 71.5% and 96.3% "hit" ratios, respectively (Panel C of Table 2). The remaining 363 and 137 were incorrectly predicted as financially sound (type I error) and distressed (type II error), accounting for 28.5% and 3.7%, respectively. To get a more accurate evaluation of the MDA model's performance, "jack-knife" cross-validation leaves out one observation at a time and implement the model on the excluded observation. Even after cross-validation, either financial status group exhibited minimal fluctuation.

4.2. Financial distress and firm performance

4.2.1. Preliminary results

Panel A of Table 3 summarizes the descriptive statistics from 4,862 firm-year estimates of firm-level variables across 374 Vietnamese manufacturing and commercial companies from 2010 until 2022. Each macroeconomic control variable has 13 yearly estimates.

For the firm performance proxies identified in this study, Tobin's Q is more volatile (higher in standard deviation) than ROE and ROA given its market equity composition. Although an average sample firm is not heavily geared with a less than 50% leverage ratio (*Leverage*), a wide range of 0.3%-116.8% reflects a diverse spectrum of the indebtedness in the cross-section of Vietnamese economy. A significantly dwarfed portion of the long-term (8.9%) as opposed to the short-term debt ratio (36.2%) reveals that the debt market therein is more bank-based than the debt capital market. The market capitalization of sample firms (*Size*) is, on average, very volatile (67.8%). The local currency (*VND*) appears relatively stable against the U.S dollar suggesting the managed foreign exchange regime that relieves the firms from currency hedging risks to a certain extent. An overall high rise in consumers' invoice (*Price*) may occasionally trigger the central bank's intervention. The economy-wide opportunity cost (*RiskFree*) stands relatively affordable (5.8% per annum) providing a feasible benchmark for financial investing and capital raising in Vietnam. The real growth of the Vietnamese economy (*GDP*) is, on average, high (5.9%), and predictable ($SD = 1.5\%$).[3]

Panel B shows that the independent variables show, overall, a low pair-wise correlation. The variance inflation factor (VIF) values are all below 4, indicating no serious multicollinearity concerns. With a firm-year panel dataset constructed accordingly, pooled ordinary least squares (OLS), fixed effects, and random effects models will be implemented to conduct regression analysis. Furthermore,

[3] Separating the sample period into the pre-Covid (2010-2019) and Covid (2020-2022) subperiods yielded representative statistics outputs qualitatively equivalent to Panel A of Table 3. We believe this robustness provides us sufficient ground for the reliability of the financial distress score's classification results shown in Table 2. These biproducts are unreported and, however, are available upon request.

Table 3
Preliminary results
Over the sample period from 2010 until 2022, Distress is the financial distress score implied from the multiple discriminant analysis method. Specifically, Distress is determined by linear combinations of WorkingCapital, RetainedEarnings, EBIT, EquityDebt, Sales. and DebtEquity whose definifitions are found in Table 1. Additionally, ROA is the net profits divided by the total assets. ROE is the net profits divided by the total shareholders' equities. TobinQ is Tobin's (1969) Q ratio defined as the sum of the market capitalization of equities and total liabilities divided by the total assets. Leverage is the financial leverage ratio. ShortDebt is the short-term debt ratio. LongDebt is the long-term debt ratio. Size is the natural logarithmic value of the market capitalization of the company. VND is the natural logarithmic value of the Vietnamese dong per US dollar exchange rate. RiskFree is the interest rate of government bonds. Price is the consumer price index. GDP is the gross domestic products. All sample-firm estimates are based on firm-year observations for 374 firms. All macroeconomic estimates (VND, Price, RiskFree, and GDP) are yearly observations.

Panel A. Sample statistics

Variable	Mean	Std. dev.	*p*-value	Minimum	Median	Maximum	No. obs.
ROA	0.073	0.082	0.000	−0.469	0.058	0.784	4,862
ROE	0.123	0.392	0.000	−25.331	0.120	1.017	4,862
TobinQ	1.268	1.157	0.000	0.034	0.933	17.816	4,862
Leverage	0.451	0.215	0.000	0.003	0.455	1.168	4,862
ShortDebt	0.362	0.202	0.000	0.003	0.342	0.968	4,862
LongDebt	0.089	0.132	0.000	0.000	0.026	0.787	4,862
Size	11.797	0.678	0.000	10.132	11.748	14.251	4,862
VND	9.996	0.057	0.000	9.863	10.015	10.061	13
Price	1.256	0.216	0.000	1.032	1.164	1.595	13
RiskFree	0.058	0.028	0.000	0.022	0.052	0.112	13
GDP	0.059	0.015	0.000	0.026	0.062	0.080	13

Panel B. Correlation coefficients

	Distress	Leverage	ShortDebt	LongDebt	Size	VND	Price	RiskFree	GDP	VIF
Distress	1.000									3.590
Leverage	−0.701	1.000								3.280
ShortDebt	−0.499	0.802	1.000							2.930
LongDebt	−0.379	0.402	−0.224	1.000						2.370
Size	−0.262	0.324	0.126	0.335	1.000					2.280
VND	−0.016	−0.066	−0.026	−0.069	0.168	1.000				1.520
Price	−0.004	0.039	0.017	0.038	−0.109	−0.523	1.000			1.410
RiskFree	0.02	0.065	0.027	0.065	−0.162	−0.931	0.514	1.000		1.490
GDP	0.026	0.005	−0.001	0.009	−0.018	−0.074	0.092	0.289	1.000	1.710

considering firm-specific characteristics and time-period effects, the redundancy test, the likelihood ratio test, and the Hausman (1978) test will be carried out. To additionally address heteroscedasticity concerns, the generalized least squares (GLS) method will be implemented.

4.2.2. Main results

The first-cut regression results per OLS method are out in Table 4. Measured in terms of ROA, ROE, and Tobin's Q (Models 1, 2, and 3, respectively), firm performance is regressed onto the financial distress score (*Distress*) controlling for the financial and macroeconomics covariates aforementioned in the previous section. Statistically and economically speaking, alleviated financial distress (higher score) is significantly and positively associated with superior operational results.

To further control for firm-level characteristics, we conduct panel regressions with fixed effects for the identical bucket of firm performance proxies (Models 4, 5, and 6). With this in mind, the inference from the pooled OLS method continues to hold in the fixed effects models. As a buttress check, statistically significant redundancy test statistics ($p-\text{value}=0$) hint that the fixed effects models are better identified than their OLS counterpart.

Additionally, assuming uncorrelated firm-level characteristics, panel regressions with random effects (Models 7, 8, and 9) do not compromise the main thesis of this study. Yet, the insignificant Hausman test statistics ($p-\text{value}=1$) suggest that the null hypothesis of "no correlation" between firm-level traits and the independent variables are favored and, thus, the random effects models are better identified than their fixed effects alternatives.

As this study involves two sets of original and cross-validated data, the results delivered herein may not be free from heteroskedasticity which is neither addressed by the fixed effects nor the random effects models. The likelihood ratio test statistics are shown to be uniformly significant ($p-\text{value}=0$) across all regression methods for all firm performance measures (Models 1 through 9) thereby rejecting the null hypothesis of "constant variances of the error term" in favor of the alternative hypothesis of heteroskedasticity in the regression models.

Consequently, the GLS method (Models 10, 11, and 12) is called for to confirm that the earlier inference from the pooled OLS

Table 4

Financial distress and firm performance

As the dependent variable, the return on assets (ROA) is the net profits divided by the total assets; the return on equity (ROE) is the net profits divided by the total shareholders' equities; and TobinQ is Tobin's (1969) Q ratio defined as the sum of the market capitalization of equities and total liabilities divided by the total assets. The independent variables are as follows: Distress is the financial distress score implied from the multiple discriminant analysis method. Specifically, Distress is determined by linear combinations of WorkingCapital, RetainedEarnings, EBIT, EquityDebt, Sales. and DebtEquity whose definifitions are found in Table 1. Additionally, Leverage is the financial leverage ratio. Size is the natural logarithmic value of the market capitalization of the company. VND is the natural logarithmic value of the Vietnamese dong per US dollar exchange rate. RiskFree is the interest rate of government bonds. Price is the consumer price index. GDP is the growth rate of the gross domestic products. ***,**,* denote significance at the 1%, 5%, 10% significance level, respectively.

Variable}	Model 1}	Model 2}	Model 3}	Model 4}	Model 5}	Model 6}	Model 7}	Model 8}	Model 9}	Model 10}	Model 11}	Model 12}	Model 13}
Distress	0.063***	0.207***	0.339***	0.071***	0.337***	0.183**	0.070***	0.665***	0.212***	0.058***	0.142***	0.201***	0.452***
Leverage	0.046***	0.568***	−0.225**	0.092***	0.976***	−0.089	0.083***	−0.376***	−0.123	0.030***	0.377***	−0.022	−2.828***
Size	0.019***	0.024***	0.403***	0.018***	0.029	0.650***	0.019***	0.669***	0.494***	0.021***	0.034***	0.256***	−0.186
VND	−0.161***	−0.393	2.470***	−0.153***	−0.310	2.084***	−0.154***	−0.291	2.303***	−0.136***	−0.387***	1.135***	4.012***
RiskFree	−0.025	−0.259	−4.101**	−0.042	−0.398	−3.880***	−0.039	0.011	−4.036***	−0.021	−0.172	−3.696***	−0.537
Price	−0.001	0.008	−0.528***	0.000	0.019	−0.522***	−0.001	0.027	−0.533***	0.001	0.000	−0.355***	0.014
GDP	0.097	0.709*	−3.142***	0.091*	0.535	−2.905***	0.091*	2.983*	−2.923***	0.086**	0.242***	−1.623***	−5.498***
Constant	1.365***	3.263	−27.328***	1.266	2.061	−26.332***	1.283***	0.665	−26.662***	1.101***	3.274***	−12.683***	
ROA	Yes			Yes			Yes			Yes			
ROE		Yes			Yes			Yes			Yes		
TobinQ			Yes			Yes			Yes			Yes	Yes
Ordinary least-squares	Yes	Yes	Yes										
Fixed effects				Yes	Yes	Yes							
Random effects							Yes	Yes	Yes				
Generalized least-squares										Yes	Yes	Yes	
Generalized method of moment													Yes
No. obs.	4862	4862	4862	4862	4862	4862	4862	4862	4862	4862	4862	4862	4114
Adj. R2	0.535	0.166	0.233	0.766	0.255	0.613	0.515	0.176	0.250	0.679	0.599	37.300	
F-statistic	797.200	148.810	212.310	42.830	5.372	21.240	738.980	149.620	232.370	1468.570	1038.900	414.190	152.182
Redundancy test	0.000	0.000	0.000	0.000	0.000	0.000							
Hausman test				1.000	1.000	1.000	1.000	1.000	1.000				
Heteroskedasticity test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000				

Table 5
Robustness tests with short and long-term debt variables
As the dependent variable, the return on assets (ROA) is the net profits divided by the total assets; the return on equity (ROE) is the net profits divided by the total shareholders' equities; and TobinQ is Tobin's (1969) Q ratio defined as the sum of the market capitalization of equities and total liabilities divided by the total assets. The independent variables are as follows: Distress is the financial distress score implied from the multiple discriminant analysis method. Specifically, Distress is determined by linear combinations of WorkingCapital, RetainedEarnings, EBIT, EquityDebt, Sales. and DebtEquity whose definifitions are found in Table 1. Additionally, ShortDebt is the short-term debt ratio. LongDebt is the long-term debt ratio. Size is the natural logarithmic value of the market capitalization of the company. VND is the natural logarithmic value of the Vietnamese dong per US dollar exchange rate. RiskFree is the interest rate of government bonds. Price is the consumer price index. GDP is the growth rate of the gross domestic products. ***,**,* denote significance at the 1%, 5%, 10% significance level, respectively.

Variable	Model 1	Model 2	Model 3
Distress	0.058***	0.143***	0.1950***
ShortDebt	0.031***	0.371***	−0.019
LongDebt	0.030***	0.416***	−0.147
Size	0.021***	0.032***	0.264***
VND	−0.135	−0.376*	1.109
RiskFree	−0.019	−0.164	−3.676
Price	0.001	−0.001	−0.356***
GDP	0.086	0.225*	−1.582
Constant	1.096	3.190	−12.499
ROA	Yes		
ROE		Yes	
TobinQ			Yes
No. obs.	4862	4862	4862
Adj. R2	0.678	0.597	0.374
F-statistic	1282.020	901.600	363.830

method is finally confirmed: Enhanced financial status is associated with boosted firm performance. Accounting for potential endogeneity in the models, the Wu-Hausman (Hausman, 1978; Wu, 1973, 1974) and Dubin & McFadden (1984) test statistics for the independent variables *RiskFree* and *Price* in Models 10 and 11 are statistically insignificant, thus failing to reject the null hypothesis (H_0) of no endogeneity, while the *Leverage* variable in Model 12 is significant which calls for a further examination for endogeneity.[4] In this regard, Model 13 fitted with the generalized method of moment (Hansen, 1982) method continues to hold the main thesis of this study: Numerically and economically, a one-unit increment, in the financial distress score (*Distress*)—an improvement in financial status—is associated with a 45.2-point rise in Tobin's *Q*, a "rerating" in firm valuation.

Whether financial leverage is separated into the short-term (*ShortDebt*) and long-term (*LongDebt*) components (Table 5) or the sample firms are alternated from the financially distressed group to the financially sound peers (Table 6), the main research question continues to be robustly answered. Additionally, augmenting a binary "Covid-19" dummy during the Covid pandemic (sub)period (2020-2023) to Models 1, 2 and 3 of Table 4 shows that the base-case implication of the main regression results is largely unaffected by arbitrary choice of a sample period (Table 7).

4.3. Discussions

4.3.1. Managerial and policy implications

The empirical results shown herein shed light on numerous managerial and policy implications. Managers should institutionalize financial distress prediction tools within their risk management frameworks. Early identification of vulnerability enables proactive restructuring and liquidity management, reducing performance deterioration. Excessive leverage heightens agency costs and managerial inefficiency (Jensen, 1986), while optimized capital structures improve governance and performance (Berger & Bonaccorsi di Patti, 2006). Thus, firms should adopt leverage policies that balance debt discipline with flexibility to avoid distress.

Additionally, managers must focus on liquidity buffers and dynamic capability investments to sustain competitiveness during uncertainty. Cash reserves enhance investment continuity when external finance is costly (Almeida et al., 2004), while financial health enables resource reconfiguration and innovation (Teece et al., 1997). Distressed firms cut back on R&D and strategic investments, underscoring the importance of liquidity and capability-building for long-term success (Campello et al., 2010). By aligning capital structure optimization, liquidity management, and dynamic capability development, managers can mitigate distress and enhance firm performance.

From an administrative policy perspective, regulators in emerging markets are advised to effectively exploit early-warning systems, e.g., the MDA framework discussed herein, for financial oversight to identify firms at risk of operational failure. Such regulatory procedures can help prevent systemic shocks in sectors critical to Vietnam's economy, such as manufacturing and trade. Timely

[4] These unreported test statistics and their *p*-values are available upon request.

Table 6
Robustness check with financially distressed versus sound
As the dependent variable, the return on assets (ROA) is the net profits divided by the total assets; the return on equity (ROE) is the net profits divided by the total shareholders' equities; and TobinQ is Tobin's (1969) Q ratio defined as the sum of the market capitalization of equities and total liabilities divided by the total assets. The independent variables are as follows: Distress is the financial distress score implied from the multiple discriminant analysis method. Specifically, Distress is determined by linear combinations of WorkingCapital, RetainedEarnings, EBIT, EquityDebt, Sales. and DebtEquity whose definifitions are found in Table 1. Additionally, Leverage is the financial leverage ratio. Size is the natural logarithmic value of the market capitalization of the company. VND is the natural logarithmic value of the Vietnamese dong per US dollar exchange rate. RiskFree is the interest rate of government bonds. Price is the consumer price index. GDP is the growth rate of the gross domestic products. ***,**,* denote significance at the 1%, 5%, 10% significance level, respectively.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Distress	0.066***	0.287***	0.031***	0.074***	0.116***	0.152***
Leverage	0.117***	0.693***	0.158**	0.110***	0.363***	−0.098
Size	0.013***	0.023	0.262***	0.011***	0.000	0.811***
VND	−0.139***	−0.550***	−0.447*	−0.086***	−0.172***	0.982***
RiskFree	−0.132**	−0.934***	−2.515***	0.071	0.088	−3.773***
Price	−0.005*	−0.020	−0.134***	0.001	−0.006*	−0.386***
GDP	0.071	−0.106	−0.370	0.032	0.062	−2.173***
Constant	1.178***	4.879***	2.637***	0.670***	1.559	−17.346
ROA	Yes			Yes		
ROE		Yes			Yes	
TobinQ			Yes			Yes
Distressed	Yes	Yes	Yes			
Sound				Yes	Yes	Yes
No. obs.	1235	1235	1235	3627	3627	3627
Adj. R2	0.733	0.563	0.578	0.844	0.846	0.668
F-statistic	34.470	16.730	17.280	75.500	70.880	26.640

Table 7
Robustness tests with a Covid-19 subperiod dummy variable.
As the dependent variable, the return on assets (ROA) is the net profits divided by the total assets; the return on equity (ROE) is the net profits divided by the total shareholders' equities; and TobinQ is Tobin's (1969) Q ratio defined as the sum of the market capitalization of equities and total liabilities divided by the total assets. The independent variables are as follows: Distress is the financial distress score implied from the multiple discriminant analysis method. Specifically, Distress is determined by linear combinations of WorkingCapital, RetainedEarnings, EBIT, EquityDebt, Sales. and DebtEquity whose definifitions are found in Table 1. Additionally, Leverage is the financial leverage ratio. Size is the natural logarithmic value of the market capitalization of the company. VND is the natural logarithmic value of the Vietnamese dong per US dollar exchange rate. RiskFree is the interest rate of government bonds. Price is the consumer price index. GDP is the growth rate of the gross domestic products. A binary "Covid-19" dummy (Covid) equals one during the Covid pandemic subperiod (2020-2023) and zero otherwise. ***,**,* denote significance at the 1%, 5%, 10% significance level, respectively.

Variable	Model 1	Model 2	Model 3
Distress	0.068***	0.189***	0.135***
Leverage	0.098***	0.573***	−0.043
Size	0.017***	0.026***	0.588***
VND	−0.005	−0.086*	−1.113***
RiskFree	0.169***	0.218**	−6.299***
Price	−0.007***	−0.020***	−0.166***
GDP	−0.189***	−0.501***	2.949***
Covid	−0.014***	−0.035***	0.312***
Constant	−0.185***	0.267	5.666**
ROA	Yes		
ROE		Yes	
TobinQ			Yes
No. obs.	4862	4862	4862
Adj. R2	0.862	0.747	0.668
F-statistic	80.733	38.726	26.765

restructuring can restore organizational efficiency and firm value, reinforcing the need for proactive monitoring (Gilson et al., 1990; Wruck, 1990). Additionally, liquidity support programs for SMEs are essential, as financially unconstrained firms maintain investment during downturns, reducing the severity of distress (Almeida et al., 2004).

Moreover, macroprudential authorities should implement stabilization measures to mitigate external shocks that amplify distress. Exchange rate volatility, inflation, and interest rate fluctuations have been shown to significantly influence firm performance (Graham

& Harvey, 2001; Myers & Majluf, 1984). Policies that maintain market liquidity and reduce fire-sale externalities during crises can improve recovery prospects (Hartman-Glaser et al., 2025). Furthermore, insolvency reforms should prioritize out-of-court workouts and going-concern sales to preserve organizational capital (Campello et al., 2010; Gilson et al., 1990).

4.3.2. Implications for Vietnam

Vietnamese manufacturing and commercial firms continue to face tightening financing conditions and heightened operational uncertainty, which intensify the distress–performance dynamics identified in our study. The 2024 corporate-bond rebound illustrates this reality: manufacturing issuers were "nearly absent," limiting access to long-term capital and constraining working-capital needs (Viet Nam News, 2025). With banks dominating new issuance after the 2022–2023 liquidity strains, firms remain dependent on narrow funding channels, making any deterioration in financial health more likely to translate into weaker performance.

External shocks further compound these vulnerabilities. U.S. tariff actions and supply-chain re-routing have tightened margins and reduced orders for Vietnam-based manufacturers, especially in furniture, apparel, and consumer goods (Wall Street Journal, 2025). Such disruptions compress cash flow and increase short-term financing needs, pushing firms into the types of distress indicators captured by our model—an important point given our model's 71.5% accuracy in identifying distressed firms.

Global competitive pressures add to this strain. Intensified overcapacity and falling prices across Asian manufacturing hubs are reshaping regional factory economics and eroding profitability for firms operating on thin spreads (New York Times, 2024; 2025). In Vietnam, where external financing remains scarce, reduced pricing power directly weakens internal funds and heightens reliance on debt—conditions consistent with our robustness findings that firms with higher leverage or external exposure experience sharper performance declines when distress rises.

Regional monitoring underscores the broader macro-financial backdrop. Elevated leverage and weak interest-coverage ratios among Vietnamese construction and manufacturing firms in the post-pandemic period signal persistent vulnerability and slower productivity recovery (AMRO, 2024). Taken together, both our empirical evidence and contemporary press reports point to a shared mechanism: Tightening credit conditions and volatile external markets continue to restrict operational performance in Vietnam's real economy (Tran et al., 2023b; Viet Nam News, 2025).

4.3.3. Financial distress and entrepreneurial activation

Financial risk—the potential for loss due to market volatility and debt servicing challenges—intensifies under distress, prompting more disciplined financial management (Heckmann et al., 2015). Specifically, financial risk arises from fluctuations in net cash flow, capital structure, interest rates, exchange rates, and asset prices, all of which can exacerbate distress but also incentivize strategic recalibration to stabilize operations (Gabriel & Baker, 1980; Li, 2003). While this study reasoned that alleviation of financial distress is associated with enhancement in business performance, there might be additional perspectives.

Around the world, when a company encounters financial distress, managers typically seek strategies to navigate this challenging period. Distressed companies often have no choice but to raise capital through equity issuance in the U.S., a strategy that can lower financial costs and improve operational efficiency (Myers & Majluf, 1984; Opler & Titman, 1994). Similarly, operational restructuring is an effective response to financial distress, contributing to enhanced efficiency in Australia (Routledge & Gadenne, 2000). The initial response to signs of financial distress should involve cost-cutting measures aimed at boosting efficiency and mitigating the risk of further deterioration in Indonesia (Widarwati & Sartika, 2019).

In addition, financial distress can act as a catalyst for entrepreneurial behavior aimed at improving firm performance. This activation is driven by the urgency to survive, pressure from stakeholders, and the need to preserve firm value. Firms under distress often engage in aggressive resource reallocation and operational restructuring to mitigate risk and maintain liquidity (Campbell et al., 2008). Further, distress compels firms to shift from passive value capture to proactive value creation, thereby enhancing strategic agility (Verdin & Tackx, 2015).

This so-called "entrepreneurial activation" is not solely an internal response; it is also shaped by external pressures. The outcome of entrepreneurial activation under distress is reflected in firm performance in terms of profitability, solvency, and operational efficiency. Measures such as ROA, ROE, and market capitalization can represent overall firm success (Hult et al., 2008; Richard et al., 2009). When entrepreneurs respond effectively to distress, these metrics can improve, suggesting that distress—when managed strategically—can lead to enhanced performance.

5. Concluding remarks

How financial status is related to firms' operations has long been an imperative question in the management literature. In this study, we forecast financial distress and investigated its relationship with firm performance among listed companies in Vietnam's manufacturing and commercial sectors. First, we applied MDA to construct an estimation model for financial distress, reporting a high level of classification accuracy. Next, various regression methods reveal a strong association between reduced financial distress and improved firm performance, controlling for leverage, firm size, foreign exchange risk, price levels, and economic growth. While we sought to shed light on a specific geographical and sectoral dimension within the distress-performance framework, there are numerous uncharted territories for the readers.

Methodologically, future research should complement MDA with advanced techniques such as machine learning models—random forests, gradient boosting, and neural networks—to capture nonlinearities and interactions missed by linear approaches, offering out-of-sample gains (Gu et al., 2020). Discrete-time hazard models also improve forecasting by incorporating time-varying predictors (Shumway, 2001). Benchmarking these approaches against traditional ratio-based models will help evaluate predictive accuracy and

interpretability (Altman, 1968; Ohlson, 1980). Such comparisons can clarify whether modern algorithms provide meaningful improvements over established methods in predicting distress and its performance implications.

Governance and sustainability dimensions warrant deeper exploration. Indicators such as board independence, ownership concentration, audit quality, and investor protection may mitigate the performance penalty of distress, as stronger shareholder protections correlate with higher valuations (La Porta et al., 1998, 2002). Extending analysis to environmental, societal, and governance-related (ESG) factors could reveal additional moderating effects, given evidence that sustainable assets enhance resilience under financial strain (Pástor et al., 2021). These factors may not only influence firm-level outcomes but also shape investor perceptions and capital allocation, making them critical for understanding long-term strategic responses to distress.

Finally, embedding firm-level data in macro frameworks with credit frictions can explain persistence in distress–performance dynamics. Financial accelerator and collateral constraint models illustrate how shocks to net worth and borrowing limits affect investment and output (Bernanke et al., 1999; Kiyotaki & Moore, 1997). Sectoral heterogeneity should also be modeled by interacting distress forecasts with industry attributes such as competition, R&D intensity, and trade exposure, while incorporating FX and commodity risk to link external shocks to profitability (Adler & Dumas, 1984; Opler & Titman, 1994). Robustness can be strengthened through rolling-window tests, multi-horizon forecasts, and multi-country samples, with policy implications for bankruptcy codes and creditor rights reforms.

Data availability

Data will be made available on request.

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