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Financial distress early warning for Chinese listed firms from a crash risk exposure perspective

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Abstract

In the face of increasingly volatile global capital markets, merely understanding the causes of stock price crash risk is insufficient; it is also essential to fully grasp the economic consequences of such risks to better respond to black swan events. Based on financial data of 11,336 A-share listed manufacturing firms from 2014 to 2023, this paper employs a logit regression model to explore the impact of crash risk exposure on corporate financial distress two years later, with a particular focus on the transmission roles of the firm itself, creditors, and institutional shareholders. The findings indicate that increased crash risk exposure significantly promotes the occurrence of financial distress. Mechanism analysis further reveals that heightened crash risk exposure deteriorates firms financing conditions by intensifying financing constraints, increasing debt financing costs, and reducing institutional ownership, thereby exacerbating financial distress. A heterogeneity analysis shows that the effect of increased crash risk exposure on financial distress is more pronounced in large firms and in the post-2018 period. This study enriches research on corporate risk management and provides new insights for effectively preventing financial distress and enhancing firm competitiveness.

Keywords: *Crash risk, Financial distress, Financing, Manufacturing industry*

JEL Classification: C23, G32, G33

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1 INTRODUCTION

The stability of listed companies stock prices is a crucial pillar supporting corporate financial health. However, stock price crashes have become increasingly common. A crash not only severely undermines shareholder interests and investor confidence but also, in a highly interconnected financial system, can trigger systemic risks through cross-contagion mechanisms, as a single stock price plummet may spread across the market (Acemoglu et al., 2015). Stock price crashes arise from the concentrated release of previously concealed bad news. According to Hong and Stein (2003), short-sale constraints prevent investors with negative market outlooks from expressing their views, leading to information suppression. When market conditions decline, the accumulation of hidden negative information is unleashed, causing a crash. Jin and Myers (2006), using agency theory, constructed an informational model to explain the causes of stock price crashes. They argue that corporate insiders have both the motivation and ability to conceal adverse information; once the accumulation surpasses a critical threshold, the concentrated release of negative information results in a stock price crash. Following the global stock market collapse during the 2008 financial

crisis, academic interest in crash risk research surged. Scholars have examined crash risk determinants from various angles, including insiders motivations to hide bad news (Kothari et al., 2009), how markets may detect hidden bad news in advance (Li et al., 2020), and mechanisms to curb insiders ability to conceal information (Ali et al., 2023). In terms of internal corporate governance, existing literature finds that factors such as corporate tax avoidance (Kim et al., 2011a), share pledging by controlling shareholders (Zhou et al., 2021), separation of control and ownership rights (Al Mamun et al., 2020), independence of independent directors (Jin et al., 2022), excessive perks (Xu et al., 2014), and internal control information disclosure (Kim et al., 2019) all influence crash risk. Regarding external governance, institutional investors (Xiang et al., 2020), analyst research (Xu et al., 2017), auditor industry expertise (Robin & Zhang, 2015), social trust (Li et al., 2017), and religious beliefs (Callen & Fang, 2015) have also been shown to impact crash risk.

Current academic research on crash risk primarily focuses on the mechanisms of its formation. However, studies on the impact of crash risk on interactions between the firm itself and external stakeholders remain relatively scarce (Harper et al., 2020). Since the stock market crash in China in 2015, the domestic stock market has experienced several precipitous declines, with listed firms facing increasing risks of financial distress and frequent debt defaults. On one hand, the number of credit bond defaulters, the scale of defaults, and the debt default rate have risen significantly (Su et al., 2021). On the other hand, financial distress events—such as bank loan default lawsuits, trust product defaults, leasing defaults, and private bond defaults—have also increased markedly (Ma et al., 2021). Data disclosed by the China Banking Regulatory Commission shows that the non-performing loan ratio of commercial banks rose from 1.1% in 2010 to 1.73% in 2021. However, among the initial defaulters between 2018 and 2020, credit ratings were often downgraded only after a default crisis had already occurred, highlighting the lagged response of rating adjustments compared to the ratings at the time of bond issuance, indicating insufficient early warning effectiveness of existing financial distress forecasting methods. Thus, is there an intrinsic link between crash risk and financial distress? If crash risk significantly promotes the occurrence of financial distress, what are the underlying mechanisms involved? Current discussions on whether crash risk triggers financial distress largely remain speculative. Therefore, this paper quantitatively analyzes the impact of crash risk exposure on corporate financial distress and explores the transmission mechanisms from a stakeholder perspective. This has important academic value and practical significance for preventing corporate financial distress and fostering a stable, long-term capital market.

The potential contributions of this paper compared to existing literature are as follows: (1) This paper confirms a significant positive correlation between crash risk exposure and corporate financial distress. (2) From the perspectives of the firm itself and external stakeholders, this study reveals that crash risk exposure promotes financial distress by affecting corporate financing constraints, debt financing costs, and institutional ownership. (3) Through a heterogeneity analysis, this paper compares the impact of crash risk exposure on financial distress across firms with different intrinsic characteristics and external environmental factors, providing empirical evidence for various types of firms to prevent financial distress by managing crash risk. The

remainder of the paper is organized as follows: section 2 reviews the relevant literature on crash risk and corporate financial distress and presents the hypotheses to be empirically tested; section 3 outlines the model design and explains the variables; section 4 presents the empirical analysis results of crash risk exposure and corporate financial distress; and section 5 provides research conclusions and implications.

2 THEORETICAL BACKGROUND

2.1 Theoretical analysis

2.1.1 Stock price crash risk

Stock price crash risk refers to the risk of a listed firm stock price plummeting sharply without any prior informational signals. Research on crash risk dates back to the 1980s, when foreign scholars first developed theoretical models to explore the causes of stock price crashes. Within the framework of an incomplete information rational expectations equilibrium, the theory of stock price crashes suggests that such crashes result from the concentrated release of private information by informed traders and the subsequent actions of uninformed traders. The crash risk theory based on behavioral finance, on the other hand, primarily interprets stock price crashes from perspectives such as investor sentiment and heterogeneous beliefs (Hong & Stein, 2003). Unlike the earlier frameworks of rational expectations equilibrium and behavioral finance, Hutton et al. (2009) developed simplified information structure models. These models assume homogeneous investor beliefs and expectations and focus on information asymmetry between corporate management, who release information, and investors, who receive it, to explain the mechanism behind stock price crashes. This shift in perspective from the market level to the firm level laid the groundwork for firm-level research on crash risk. Subsequent studies on the formation and evolution of crash risk have predominantly focused on the dimensions of agency problems and information transparency.

On one hand, agency issues are a major driver of crash risk, primarily reflected in the opportunistic behaviors of management and controlling shareholders. Research suggests that management, aiming to increase personal compensation or build a corporate empire, often conceals negative information while releasing positive news, which leads to an overvaluation of the firm and heightens future crash risk (Kim et al., 2011b). This is especially true for state-owned enterprises, where management may engage in on-the-job consumption and power manipulation to conceal unfavorable information, thereby increasing crash risk (Xu et al., 2014). In addition, controlling shareholders may obscure their expropriation activities through equity pledging and earnings management, significantly raising crash risk (Francis et al., 2016). On the other hand, a lack of information transparency also plays a crucial role in the formation of crash risk. Information asymmetry between informed and uninformed parties makes investors prone to panic when negative information suddenly surfaces, leading to collective sell-offs and triggering stock price crashes (Marin & Olivier, 2008). The opacity of corporate financial information and a lack of accounting conservatism further amplify this risk (Kim & Zhang, 2016). Although China has introduced policies to enhance information disclosure quality, overall market transparency remains

low and ineffective in curbing crash risk (Piotroski & Wong, 2012). Meanwhile, frequent media coverage and strong internal control disclosures can help improve transparency and reduce crash risk for firms (An et al., 2020).

2.1.2 Corporate financial distress

Beaver (1966) identified financial distress as the state in which a firm is unable to meet its debt obligations, defining it to include situations like bankruptcy, bond default, bank overdrafts, or failure to pay preferred dividends. Carmichael (1972) broadened the scope of financial distress, proposing that a firm falls into financial distress when it is financially unable to fulfill its debt obligations on time. This includes manifestations such as debt default, cash flow interruptions, negative net assets, and insufficient working capital. In empirical research, for the convenience of sample selection, most Western scholars equate bankrupt firms with financially distressed firms. However, Altman and Hotchkiss (1993) distinguished between bankruptcy and related concepts like business failure, insolvency, liquidation, and loan default, arguing that bankruptcy emphasizes the legal significance of financial distress, thus underemphasizing its economic implications. In China A-share market, special treatment (ST) stocks are those of firms that have incurred losses for two consecutive years and are therefore flagged for special treatment. These firms typically exhibit abnormal financial conditions, or they may already be in distress, facing cash flow issues and difficulties in repaying debts. For ease of data collection, most domestic scholars use firms that have reported losses for two consecutive years and been flagged as ST by the China Securities Regulatory Commission as sample firms for financial distress (Geng et al., 2015). The introduction of this "two consecutive years" dynamic criterion frames financial distress as an ongoing developmental process.

In the field of financial distress prediction research, early scholars indeed treated financial distress as a financial issue, primarily seeking causes from a financial perspective and building models using financial accounting indicators. Beaver (1966) suggested that cash flow to debt ratio, return on assets, debt-to-asset ratio, and asset safety ratio are the best indicators for predicting corporate financial distress. Altman (1968) selected five financial indicators from the dimensions of liquidity, profitability, solvency, and sales to serve as explanatory variables in the *Z*-score model. Numerous subsequent studies adopted variables from the *Z*-score model and expanded on them, selecting several high-explanatory indicators from dimensions such as debt repayment ability, profitability, market value, operational efficiency, growth potential, and cash flow (Altman et al., 2017), to construct new explanatory variable models. However, many scholars argue that financial factors are only one cause of corporate financial distress. Thus, some researchers have introduced non-financial variables into the predictive models for financial distress (Mare, 2015). In recent years, a large body of academic and practical literature has incorporated various non-financial warning indicators related to corporate operations and repayment, which can be categorized into types such as external environment, external stakeholders, internal characteristics, and signaling (Ciampi, 2015). Non-financial warning indicators can supplement financial indicators by expanding data and informational inputs, substantially broadening the research scope of financial distress prediction from a statistical perspective. If the concentrated release of hidden bad news is the antecedent of increased crash risk exposure, then corporate financial distress is likely a

consequence of this heightened exposure. Therefore, quantifying the relationship between crash risk exposure and corporate financial distress and analyzing the transmission mechanism between the two through the intermediary role of stakeholders is both necessary and urgent.

2.2 Research hypotheses

The expansion of crash risk exposure is often seen as a direct reflection of declining investor confidence in the stock market (Jin & Myers, 2006). When a firm crash risk exposure increases, its market value typically experiences a significant decline, intensifying financial pressures and making equity financing more challenging. Additionally, increased crash risk exposure undermines the robustness of a firm debt-to-asset structure (Hakkio & Keeton, 2009), potentially leading to credit rating downgrades, which in turn restricts the firm borrowing capacity (Jorion et al., 2009). Furthermore, heightened crash risk exposure impacts a firm resource allocation and operational decision-making. In response to market uncertainty and financial strain, firms may be compelled to cut investments, reduce costs, or even liquidate assets to relieve financial pressure. However, these short-term measures can erode the firm long-term competitiveness and profitability, creating a vicious cycle that exacerbates financial distress (Dallas, 2011). At the same time, as crash risk exposure increases, market trust in the firm management declines significantly, and investors begin to question the decision-making abilities and corporate governance standards of the management team (Habib et al., 2018). This erosion of trust not only depresses stock prices and market value but also leads investors to demand higher returns (Gennaioli & Shleifer, 2018), further driving up the firm cost of capital. Moreover, after an increase in crash risk exposure, firms often face stricter regulatory scrutiny and higher compliance costs (Leuz & Wysocki, 2016), adding to their financial burden. These adverse factors intertwine, heightening the risk of survival in a volatile market. Based on this analysis, this paper proposes the following hypothesis:

H1: The greater the crash risk exposure, the higher the likelihood of a firm experiencing financial distress.

According to the pecking order theory, firms prioritize internal funds when financing, followed by debt financing, and only resort to equity financing as a last option (Frank & Goyal, 2003). When facing heightened crash risk, firms often adopt conservative financial strategies, such as reducing or suspending cash dividend payments (Chay & Suh, 2009), to retain more funds. However, this approach further weakens stock market investor confidence, compelling firms to rely more on internal funds to sustain daily operations. As internal funds gradually deplete, firms experience cash flow volatility, which forces them to depend on high-cost debt financing to address short-term liquidity pressures (Diamond & He, 2014). Additionally, stock price crashes are often triggered by the concentrated release of long-accumulated negative information. Persistent negative news not only damages the firm's market image (Elliott et al., 2018) but can also lead to a loss of market share, thereby weakening the firm competitive position. These adverse effects exacerbate financing constraints, gradually narrowing access to external funding channels. As financing constraints intensify, the firm financial flexibility diminishes, making it more challenging to effectively respond to cash shortages or operational disruptions, significantly increasing the risk of financial distress (Le et al., 2024). Based on this analysis, this paper proposes the following hypothesis:

H2: The increase in crash risk exposure intensifies a firm's financing constraints, thereby promoting the occurrence of financial distress.

In China's corporate financing sources, debt financing occupies an important position (Qian & Yeung, 2015). When a firm faces higher crash risk exposure, it often indicates that the management may be concealing substantial negative information, leading creditors to question the reliability of the firm's disclosed information. As a result, creditors typically increase financing rates to obtain a risk premium (Andrade et al., 2014; Xu et al., 2024). Research by Gu et al. (2019) shows a positive correlation between crash risk exposure and bank loan interest rates, with banks using crash risk exposure as an important evaluation criterion; the greater the crash risk exposure, the higher the loan interest rates. Furthermore, higher crash risk exposure suggests that the firm management may engage in more opportunistic behavior, increasing the legal risks for the firm and its executives (Srinivasan, 2005). In emerging market countries like China, lower judicial efficiency further raises the cost for creditors to protect their rights, forcing them to increase financing costs to address potential risks (Lin & Milhaupt, 2017). In addition, higher crash risk exposure also reflects instability in the firm's fundamentals (Meng et al., 2023), intensifying creditors concerns about default risk. Especially during economic downturns, creditors tolerance for high-risk firms decreases, which may prompt them to recall loans early or shorten loan terms, thereby increasing the financial pressure on the firm. Based on this analysis, this paper proposes the third hypothesis:

H3: The increase in crash risk exposure raises debt financing costs, thereby promoting the occurrence of financial distress in firms.

Institutional investors, as an important external force, can play a supervisory role to some extent and improve corporate governance. Compared to retail investors, institutional investors, with their capital and informational advantages, can encourage management to improve the quality of information disclosure (Almazan et al., 2005), and are more effective in curbing managerial self-interested behavior (Ramalingegowda et al., 2021). In addition, institutional ownership can attract analysts attention, uncover more valuable information, and reduce both internal and external information asymmetry (Lin & Fu, 2017). Studies have shown that the higher the institutional ownership, the better the quality of corporate information disclosure (Boone & White, 2015). Furthermore, according to the efficient market hypothesis, when market bubbles increase, rational institutional investors, as arbitrageurs, often find that the optimal strategy is to quickly short-sell stocks to bring prices back to equilibrium levels (Woo et al., 2020). Therefore, when crash risk exposure gradually increases, institutional investors tend to reduce their holdings. This behavior weakens their supervisory role in corporate governance, thereby diminishing the constraints on management. This weakening increases uncertainty in corporate strategic decisions and long-term planning. At the same time, institutional investors typically exhibit herding behavior (Crane et al., 2019), meaning there is a degree of behavioral consistency. When one institutional investor begins to reduce its holdings, this behavior may be transmitted to other institutions, creating a downward pressure on the stock price. Poor stock performance not only affects the corporate image but also makes it more difficult to raise new funds through stock issuance, thereby exacerbating the firm's

financial pressure (Qureshi et al., 2017). Based on this analysis, this paper proposes the fourth hypothesis:

H4. The increase in crash risk exposure reduces institutional ownership, thereby promoting the occurrence of corporate financial distress.

Figure 1 illustrates the theoretical mechanism through which crash risk exposure affects corporate financial distress.

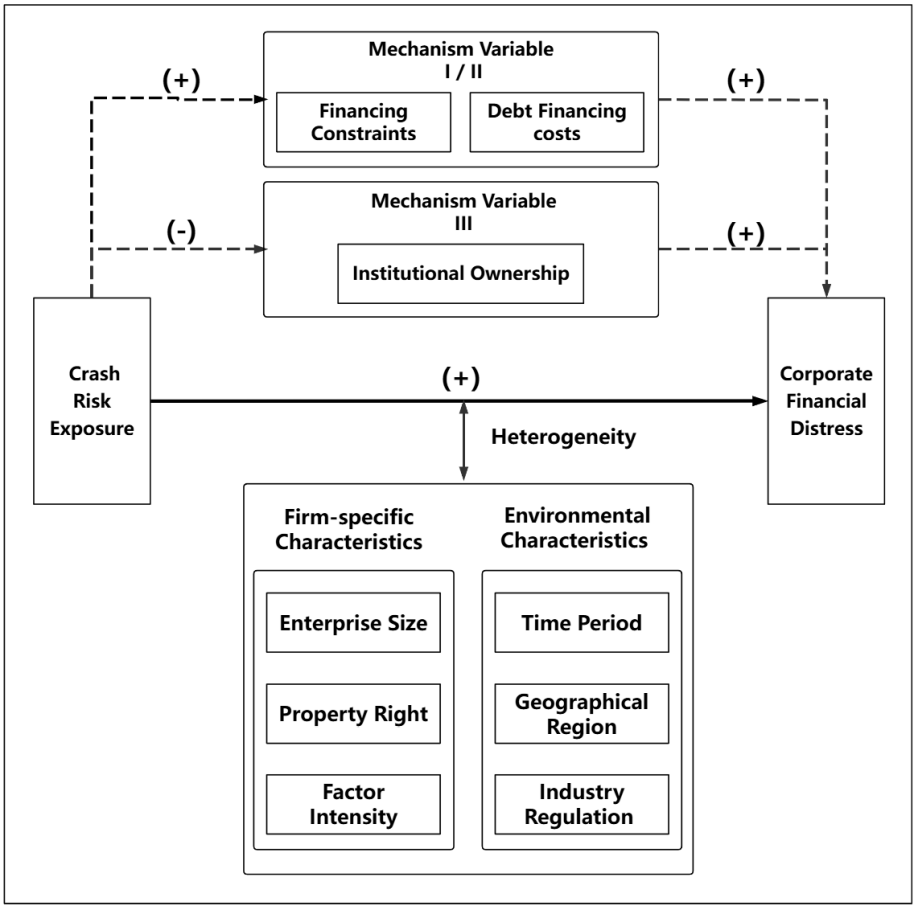

Fig. 1 - Theoretical mechanism framework

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

3.1 Sample selection and data source

3.1.1 Data source

Based on the content of this study and the availability of data, this paper selects the financial statement data of manufacturing firms listed on the A-share market from 2014 to 2023, with the following data processing steps: (1) exclusion of samples with significant missing indicators; (2) application of Winsorization to reduce the effect of extreme values. A final dataset of 11,336 sample observations is obtained. The data used in this study is sourced from the CSMAR database and the Wind database.

3.2 Model design

To test hypothesis H1, this study constructed the following regression model (1):

$$FD_{i,t} = \left(1+\exp\left(-\left(\alpha_0 + \alpha_1 CrashRisk_{i,t-2} + \sum Control_{i,t-2} + \sum Year + \varepsilon_{i,t}\right)\right)\right)^{-1} \quad (1)$$

In model (1), $FD_{i,t}$ represents the financial distress of firm i in year t; $CrashRisk_{i,t-2}$ is the core explanatory variable of this study, representing crash risk exposure of the firm in year $t-2$; $Control_{i,t-2}$ represents the control variables in year $t-2$; $Year$ represents year fixed effects; ε is the random disturbance term.

To test research hypotheses H2, H3, and H4, this study constructed a mediation model (2):

$$\begin{aligned} Med_{i,t} &= \beta_0 + \beta_1 CrashRisk_{i,t} + \sum Control_{i,t} + \sum Year + \varepsilon_{i,t} \\ FD_{i,t} &= \left(1+\exp\left(-\left(\gamma_0 + \gamma_1 CrashRisk_{i,t-2} + \gamma_2 Med_{i,t-2} + \sum Control_{i,t-2} + \sum Year + \varepsilon_{i,t}\right)\right)\right)^{-1} \end{aligned} \quad (2)$$

In model (2), Med serves as the mediator variable. According to the research hypotheses H2, H3, and H4, respectively, the variables of the firm's financing constraints, debt financing cost, and institutional ownership will be employed as mediator variables.

3.3 Variable description

3.3.1 Explained variable

The explained variable in this study is corporate financial distress (*FD*). Corporate financial distress is classified based on whether a firm has been listed as special treatment (ST) by the China Securities Regulatory Commission due to two consecutive years of losses. Specifically, if the firm is under Special Treatment, $FD = 1$; otherwise, $FD = 0$.

3.3.2. Explanatory variable

This paper employs *DUVOL* as the primary explanatory variable to measure corporate crash risk exposure. In robustness checks, *NCSKEW* and *CRASH* are used as alternative explanatory variables. The calculation process is as follows:

First, the weekly returns of stock i are regressed as follows:

$$r_{i,k} = \alpha + \beta_{1,i} * r_{m,k-2} + \beta_{2,i} * r_{m,k-1} + \beta_{3,i} * r_{m,k} + \beta_{4,i} * r_{m,k+1} + \beta_{5,i} * r_{m,k+2} + \varepsilon_{i,k} \quad (3)$$

Where $r_{i,k}$ represents the return of stock i in week k for each year, and $r_{m,k}$ denotes the value-weighted average market return of all A-share stocks in week k. This study incorporates lagged and leading terms of market returns into the above equation to adjust for the impact of non-synchronous trading of stocks.

Taking the residuals $\varepsilon_{i,k}$ from the above regression, calculate the specific return $w_{i,k}$ of stock i in week k as follows:

$$w_{i,k} = \ln(1+\varepsilon_{i,k}) \quad (4)$$

Next, based on $w_{i,k}$, construct the following indicator:

(1) *DUVOL*.

$$DUVOL_{i,t} = \ln\left\{\left[(n_u-1)\sum_{Down} w_{i,k}^2\right]\Big/\left[(n_d-1)\sum_{Up} w_{i,k}^2\right]\right\} \quad (5)$$

Where $Down$ (Up) represents the set of weekly specific returns of stock i when $w_{i,k}$ is less than (greater than) the annual average return; n_u (n_d) is the number of weeks where $w_{i,k}$ is greater than (less than) the annual average return. A higher *DUVOL* indicates a more left-skewed distribution of returns, signifying a greater crash risk exposure.

(2) *NCSKEW*.

$$NCSKEW_{i,t} = -\left[n(n-1)^{\frac{3}{2}}\sum w_{i,k}^3\right]\Big/\left[(n-1)(n-2)\left(\sum w_{i,k}^2\right)^{3/2}\right] \quad (6)$$

Among them, n is the number of trading weeks for stock i in a given year. The larger the *NCSKEW*, the more severe the negative skewness, indicating a higher crash risk exposure.

(3) *CRASH*.

The study defines crash weeks in a given fiscal year for a given firm as those weeks during which the firm experiences firm-specific weekly returns 3.2 standard deviations below the mean firm-specific weekly returns over the entire fiscal year, with 3.2 chosen to generate a frequency of 0.1% in the normal distribution. *CRASH* is an indicator variable that equals 1 for a firm-year that experiences one or more crash weeks during the fiscal year period, and 0 otherwise.

3.3.3. Mechanism variable

Based on research hypotheses H2, H3, and H4, this paper uses financing constraints, debt financing costs, and institutional ownership as mediating variables. Specifically, financing constraints are measured using the *WW* index, with a higher *WW* indicating greater financing constraints. Debt financing cost (*DFC*) is measured by the ratio of interest expenses from financial costs to the subtotal of operating cash inflows.

The expression for the *WW* is as follows:

$$WW = -0.091*CF - 0.06*DivPos + 0.01*Lev - 0.044*Size + 0.10*ISG - 0.03*SG \quad (7)$$

Where CF represents the ratio of cash flow to total assets; $DivPos$ is a dummy variable for cash dividend payments, taking the value of 1 if cash dividends are paid in the current period and 0 otherwise; Lev denotes the ratio of long-term debt to assets; $Size$ is the natural logarithm of total assets; ISG is the industry average sales growth rate; and SG represents the sales growth rate.

3.3.4. Control variables

Based on existing literature (Kliestik et al., 2020; Wang & Liang, 2024), this paper selects a total of 30 financial indicators from the aspects of solvency, operational efficiency, profitability, growth potential, and risk level, as detailed in Table 1. Solvency assesses a firm's ability to meet its long-term obligations, with poor solvency potentially worsening financial distress. Operational efficiency evaluates how effectively a firm uses its resources, as inefficiencies can lead to financial

strain. Profitability measures a firm's capacity to generate earnings, which is crucial for navigating and mitigating financial distress. Growth potential reflects the firm's future prospects and its ability to recover from financial difficulties. Risk level measures the firm's exposure to financial and operational risks, with indicators like financial leverage and operating leverage amplifying the effects of crash risk exposure on financial distress. Given the advantages of composite indicators in terms of predictive ability and robustness, following the approach of Wang and Liang (2024), principal component analysis is used to extract the effective information from the financial indicators. Using an 80% cumulative variance contribution rate as the extraction criterion, six principal components are selected from the financial indicators, denoted as APC1, APC2, APC3, APC4, APC5, and APC6.

4 RESULTS

4.1 Descriptive statistics

Table 2 presents the descriptive statistics for each variable. The maximum value of *DUVOL* is 1.7572, the minimum value is -1.8819, the mean is -0.1965, and the standard deviation is 0.492. The significant difference between the minimum and maximum values, along with the relatively large standard deviation, indicates substantial variation in crash risk exposure among different firms. The statistical results of the other variables are also within a reasonable range, satisfying the necessary conditions for the study.

Figure 2 shows the number and proportion of manufacturing firms listed on the A-share market experiencing financial distress. From 2018 to 2021, the proportion of financially distressed firms showed a clear upward trend, increasing from 2.20% in 2018 to 4.15% in 2021. However, after 2021, the proportion of financially distressed firms gradually declined, with 3.09% in 2022 and 2.34% in 2023. Furthermore, as shown in Figure 3, the crash risk exposures of manufacturing industry were at high levels in 2015, 2017, 2018, and 2022. Among these, the highest crash risk exposure occurred in 2017.

Tab. 1 - Original financial indicators of control variables. Source: own research

Primary Indicator	Secondary Indicator	Description
Solvency	Current Ratio	Current Assets / Current Liabilities
	Quick Ratio	(Current Assets - Inventory) / Current Liabilities
	Equity Multiplier	Total Assets / Total Equity
	Debt-to-Asset Ratio	Total Liabilities / Total Assets
	Long-term Debt to Total Assets Ratio	Long-term Borrowings / Total Assets
	Cash Ratio	Ending Cash and Cash Equivalents Balance / Current Liabilities
	Working Capital to Debt Ratio	(Total Current Assets - Total Current Liabilities) / (Short-term Borrowings + Long-term Borrowings)
	Interest Coverage Ratio	Net Cash Flow from Operating Activities / Financial Expenses
	Long-term Debt to Working Capital Ratio	Total Non-current Liabilities / (Total Current Assets - Total Current Liabilities)
Operational capability	Accounts Receivable Turnover Ratio	Revenue / Ending Accounts Receivable Balance
	Inventory Turnover Ratio	Cost of Goods Sold / Ending Inventory Balance
	Accounts Payable Turnover Ratio	Cost of Goods Sold / Ending Accounts Payable Balance
	Current Assets Turnover Ratio	Revenue / Ending Current Assets Balance
	Non-current Assets Turnover Ratio	Revenue / Ending Non-current Assets Balance
	Total Asset Turnover	Revenue / Ending Balance of Total Assets
Profitability	Return on Assets ROA)	(Net Profit + Financial Expenses) / Total Assets
	Net Profit Margin on Current Assets	Net Profit / Current Assets Balance
	Net Profit Margin on Fixed Assets	Net Profit / Fixed Assets Balance
	Operating Profit Margin	Net Profit / Operating Revenue

	Return on Equity ROE)	Net Profit / Shareholders' Equity Balance
	Return on Invested Capital ROIC)	(Net Profit + Financial Expenses) / (Total Assets - Current Liabilities + Notes Payable + Short-term Borrowings + Non-current Liabilities due within one year)
Growth potential	Fixed Assets Growth Rate	(Ending Net Fixed Assets - Beginning Net Fixed Assets) / Beginning Net Fixed Assets
	Revenue Growth Rate	(Current Period Revenue - Previous Period Revenue) / Previous Period Revenue
	Earnings per Share Growth Rate	(Ending Earnings per Share - Beginning Earnings per Share) / Beginning Earnings per Share
	Return on Equity Growth Rate	(Current Period Return on Equity - Previous Period Return on Equity) / Previous Period Return on Equity
	Net Profit Growth Rate	(Current Year Current Period Net Profit - Previous Period Net Profit) / Previous Period Net Profit
	Total Assets Growth Rate	(Ending Total Assets - Beginning Total Assets) / Beginning Total Assets
	Sustainable Growth Rate	((Net Profit / Total Owners' Equity Ending Balance) * (1 - Dividends per Share before Tax / (Current Period Net Profit / Paid-in Capital Ending Balance))) / (1 – ((Net Profit / Total Owners' Equity Ending Balance) * (1 - Dividends per Share before Tax / (Current Period Net Profit / Paid-in Capital Ending Balance))))
Risk level	Financial Leverage	(Net Profit + Income Tax Expense + Financial Expenses) / (Net Profit + Income Tax Expense)
	Operating Leverage	(Net Profit + Income Tax Expense + Financial Expenses + Depreciation of Fixed Assets + Depletion of Oil and Gas Assets + Depreciation of Productive Biological Assets + Amortization of Intangible Assets + Amortization of Long-term Deferred Expenses) / (Net Profit + Income Tax Expense + Financial Expenses)

Tab. 2 - Descriptive statistics of variables. Source: own research

Variable	Name	Symbol	Size	Median	Mean	Std	Min	Max
Explained variable	Corporate financial distress	FD	11336	0	0.0441	0.205	0	1
Explanatory variable	Crash risk exposure	DUVOL	11336	-0.1935	-0.1965	0.492	-1.8819	1.7572
		NCSKEW	11336	-0.2540	-0.2962	0.748	-3.4754	3.1317
		CRASH	11336	0	0.0861	0.281	0	1
Mechanism variables	Financing constraints	WW	11336	-1.0212	-1.0253	0.082	-2.1994	-0.7840
	Debt financing costs	DFC	11336	0.0124	0.0211	0.030	-0.0048	0.3357
	Institutional ownership	IO	11336	0.4341	0.4175	0.239	0.0000	0.9498
Control variables	Corporate financial indicators	APC1	11336	-0.0440	-0.0451	0.182	-0.6639	0.6680
	(Principal components of	APC2	11336	-0.0453	-0.0263	0.106	-0.2600	0.7521
	solvency, operational	APC3	11336	-0.0274	-0.0038	0.110	-0.2186	0.6563
	capability, profitability,	APC4	11336	0.0064	-0.0006	0.080	-0.5731	0.4006
	growth potential, and risk level)	APC5	11336	-0.0147	-0.0040	0.069	-0.1697	0.7107
		APC6	11336	-0.0080	-0.0065	0.040	-0.2257	0.5983

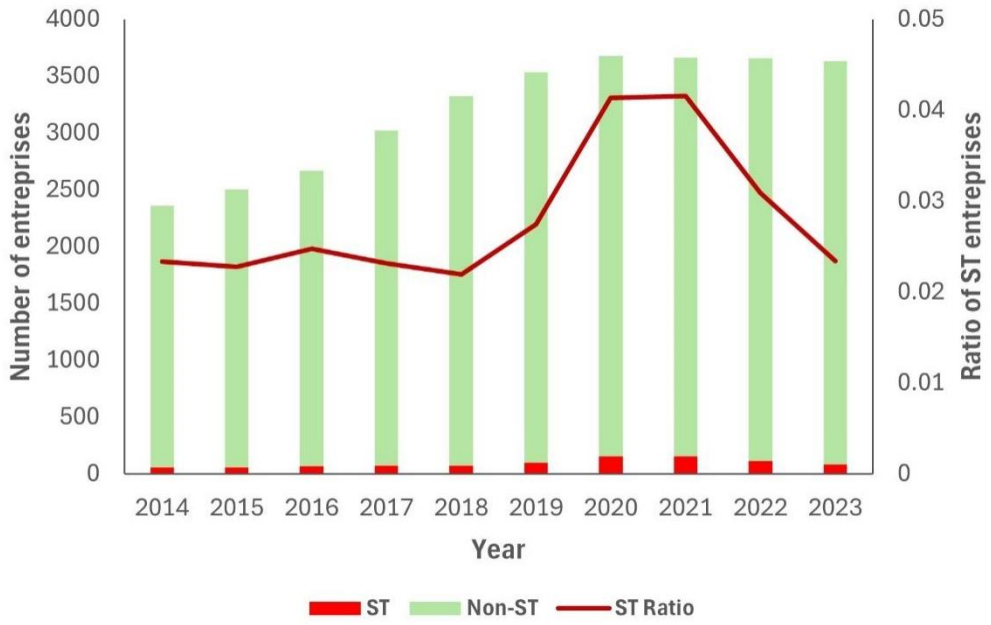

Fig. 2 - Proportion of manufacturing firms subject to special treatment in A-share market. Source: own research

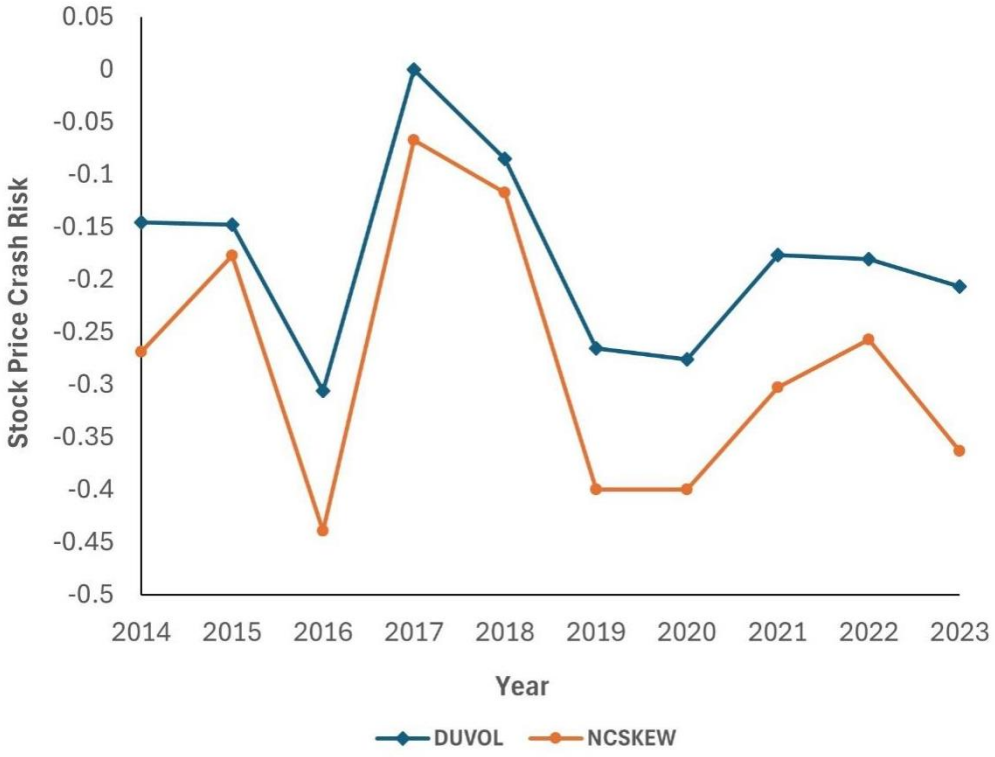

Fig. 3 - Crash risk exposure of manufacturing industry. Source: own research

4.2 Benchmark regression

Table 3 shows the results of the benchmark regression. Column (1) presents the direct regression results between the explanatory variables and the explained variable; columns (2) and (3) respectively present the regression results after controlling for year fixed effects and adding control variables; column (4) shows the results after simultaneously controlling for fixed effects and adding control variables. From the results, it is evident that the *DUVOL* coefficient remains positive at the 1% significance level before and after adding control variables and fixed effects, indicating that crash risk exposure has a significant positive impact on corporate financial distress, thus supporting hypothesis H1. According to the estimation results in column (4), ceteris paribus, a 1% increase in crash risk exposure corresponds to an average increase of 0.6713% in the log-odds ratio of corporate financial distress.

Tab. 3 - Benchmark regression. Source: own research

Variables	(1)	(2)	(3)	(4)
DUVOL	0.6643***	0.6516***	0.6991***	0.6713***
	(0.093)	(0.094)	(0.093)	(0.097)
APC1			-1.9803***	-1.5906***
			(0.248)	(0.266)
APC2			-5.0614***	-5.7541***
			(0.611)	(0.645)
APC3			0.0108	-0.0261
			(0.420)	(0.443)
APC4			3.7365***	3.2194***
			(0.800)	(0.850)
APC5			7.4194***	8.5207***
			(0.668)	(0.757)
APC6			-3.9712**	-4.8806**
			(1.786)	(2.137)
Constant	-2.9930***	-3.8270***	-3.5944***	-4.5145***
	(0.046)	(0.198)	(0.074)	(0.213)
Fixed Effects	NO	YES	NO	YES
Observations	11336	11336	11336	11336
Pseudo R^2	0.0124	0.0470	0.1185	0.1522

Note: *, **, *** represent significance levels of 10%, 5%, and 1%, respectively. Standard errors are reported in parentheses throughout. The same convention applies to subsequent instances.

4.3 Robustness analysis

4.3.1 Substitution of explanatory variable

This study uses *NCSKEW* and *CRASH* as alternative explanatory variables *I* and *II* to measure the crash risk exposure of firms. As shown in columns (1) and (2) of Table 4, the coefficients of *NCSKEW* and *CRASH* are both positive at the 1% significance level. This indicates that, even after substituting explanatory variables *I* or *II*, an increase in crash risk exposure promotes the occurrence of corporate financial distress, thereby providing preliminary validation for hypothesis H1.

4.3.2 Substitution of explained variable

The *Z*-score has been widely used to measure the financial risk of listed firms. Its calculation formula is

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5 \quad (8)$$

Where

$$X1 = \frac{Working\ Capital}{Total\ Assets}$$
$$X2 = \frac{Retained\ Earnings}{Total\ Assets}$$
$$X3 = \frac{EBIT}{Total\ Assets} \quad (9)$$
$$X4 = \frac{Market\ Value\ of\ Equity}{Book\ Value\ of\ Total\ Liabilities}$$
$$X5 = \frac{Sales}{Total\ Assets}$$

When $Z > 2.67$, the financial condition is good, and the probability of bankruptcy is low, whereas $Z < 1.81$ indicates financial distress, implying an imminent bankruptcy crisis. Therefore, this study identifies firms with a *Z*-score less than 1.81 as those experiencing financial distress, using this as alternative explained variable *I* and performing regression using model (1). Additionally, since listed firms are subject to special treatment only after two consecutive years of losses, to ensure consistency in identifying financial distress, firms with *Z*-scores less than 1.81 for two consecutive years are identified as experiencing financial distress, used as alternative explained variable *II*. As shown in columns (3) and (4) of Table 4, the *DUVOL* coefficients are significantly positive, indicating that even after substituting explained variables *I* or *II*, an increase in crash risk exposure still promotes the occurrence of corporate financial distress, thereby further validating hypothesis H1.

Tab. 4 - Robustness test: Substitution of explanatory variable, substitution of explained variable. Source: own research

Variables	Substitution of explanatory variable		Substitution of explained variable	
	(1) I	(2) II	(3) I	(4) II
NCSKEW	0.4202***			

	(0.063)			
CRASH		0.6526***		
		(0.132)		
DUVOL			0.1143**	0.1066*
			(0.058)	(0.062)
APC1	-1.6521***	-1.4917***	-12.9050***	-12.3517***
	(0.257)	(0.265)	(0.512)	(0.564)
APC2	-5.2723***	-5.6929***	-7.9387***	-7.0566***
	(0.625)	(0.645)	(0.449)	(0.483)
APC3	-0.0706	0.0741	-5.1608***	-4.9339***
	(0.433)	(0.442)	(0.507)	(0.549)
APC4	3.5145***	3.3192***	3.3780***	4.0500***
	(0.815)	(0.847)	(0.494)	(0.533)
APC5	8.3435***	8.5046***	-9.2531***	-7.8713***
	(0.680)	(0.757)	(1.334)	(1.449)
APC6	-2.9302*	-4.8076**	1.0911	3.5242**
	(1.779)	(2.136)	(1.448)	(1.501)
Constant	-4.4750***	-4.6527***	-3.8432***	-4.0963***
	(0.213)	(0.214)	(0.125)	(0.136)
Fixed effects	YES	YES	YES	YES
Observations	11336	11336	11336	11336
Pseudo R^2	0.1506	0.1459	0.3507	0.3250

4.3.3 Exclusion of anomalous factors

(a) Exclusion of anomalous years.

During the sample period, the COVID-19 pandemic post-2020 exerts a substantial impact on firms' development. To minimize the uncertainty in research results due to anomalous years, data from 2020-2023 are excluded, and regression is re-run.

(b) Exclusion of anomalous cities.

In China, provincial capitals and municipalities possess unique economic characteristics. To reduce the impact of these cities on the research results, sample firms from these locations are excluded, and regression is re-run.

(c) Exclusion of extreme data.

To avoid the influence of extreme outliers on estimation results, this study trims the explanatory and control variables at the 1% level, and regression is re-run.

From the regression results in Table 5, the *DUVOL* coefficients are consistently positive at the 1% significance level, indicating that, even after excluding various anomalous factors, the positive effect of crash risk exposure on corporate financial distress remains robust. These results support the validity of hypothesis H1.

Tab. 5 - Robustness test: Exclusion of anomalous factors. Source: own research

Variables	Exclusion of anomalous years	Exclusion of anomalous cities	Exclusion of extreme data
DUVOL	0.5419***	0.6385***	0.6702***
	(0.128)	(0.118)	(0.098)
APC1	-2.1456***	-2.1091***	-1.5336***
	(0.350)	(0.325)	(0.274)
APC2	-5.0668***	-6.5318***	-6.1256***
	(0.864)	(0.793)	(0.660)
APC3	-0.2184	-0.0971	-0.0021
	(0.584)	(0.516)	(0.455)
APC4	2.7457***	2.7980***	2.9358***
	(1.064)	(1.007)	(0.876)
APC5	8.2806***	8.1608***	8.6049***
	(0.836)	(0.856)	(0.825)
APC6	0.4923	-5.3757**	-6.5000***
	(1.540)	(2.374)	(2.343)
Constant	-4.4873***	-4.4768***	-4.5317***
	(0.221)	(0.254)	(0.213)
Fixed effects	YES	YES	YES
Observations	6354	7193	11336
Pseudo R^2	0.1505	0.1720	0.1509

4.3.4 Endogeneity test

Considering the potential endogeneity issue, this study selects instrumental variables and uses the two-stage least squares (2SLS) method for endogeneity testing. Regarding the selection of instrumental variables, the first method is to use the *DUVOL* lagged by two periods (i.e., the crash risk exposure from four years ago) as an instrumental variable. According to the China Securities Regulatory Commission's ST system, whether a firm is classified as ST in year t is solely based on the financial performance of the previous two accounting years (i.e., year $t-2$ and year $t-1$).

Therefore, the crash risk exposure from year $t-4$ does not have a direct causal relationship with the firm's financial distress in year t, thus satisfying the exogeneity condition for an instrumental variable, meaning it is not directly related to the current financial distress state and can be considered an exogenous instrumental variable. The second method is to use the average crash risk exposure of firms in the same region and industry as the instrumental variable. Since firms in the same region and industry are typically subject to similar external shocks (e.g., regional economic policies, industry cyclical fluctuations), and these common factors can affect the crash risk exposure of individual firms through information spillover effects. However, a firm's financial distress is mainly influenced by its own financial performance and operational decisions, and the crash risk exposure of other firms in the same region and industry does not directly impact its financial distress. Therefore, the industry-region average crash risk exposure can serve as an effective instrumental variable, satisfying the exogeneity condition.

First, from the first-stage regression results in Table 6, the coefficients of the selected instrumental variables are positive at the 1% significance level, and the *F*-statistics are 37.0 and 245.1, well above the critical value of 10 for weak instruments, indicating that the selected instrumental variables are valid and not weak instruments. Furthermore, from the second-stage regression results, the *DUVOL* coefficients are positive at the 1% significance level, suggesting that, after considering the endogeneity issue, the conclusion that the expansion of crash risk exposure significantly promotes the occurrence of corporate financial distress still holds true. This confirms the validity of hypothesis H1 once again.

Tab. 6 - Endogeneity test. Source: own research

Variables	DUVOL lagged two periods		Mean of DUVOL by city	
	(1) DUVOL	(2) FD	(3) DUVOL	(4) FD
DUVOL		8.2925***		1.0570***
		(3.113)		(0.215)
Instrumental	0.0363***		1.0242***	
	(0.012)		(0.019)	
Constant	-0.3598***	-1.3550	0.0096	-4.4332***
	(0.017)	(1.158)	(0.013)	(0.215)
Control	YES	YES	YES	YES
Fixed effects	YES	YES	YES	YES
Observations	6655	6655	11336	11336
F test	37.0***		245.1***	
Adjusted R^2	0.061		0.232	
Pseudo R^2		0.1257		0.1454

4.3.5 Placebo test

To ensure the validity of the empirical results, this study conducts a placebo test by randomly assigning the crash risk exposure variable to the selected sample firms and re-running the regression 1,000 times using the matched data for model (1). If the positive correlation between crash risk exposure and corporate financial distress is due to omitted variables, the matched results will remain significantly positive. However, if the *DUVOL* coefficient is no longer significant, it indicates that the increase in crash risk exposure increases the likelihood of corporate financial distress.

After 1,000 regressions, this study obtains a kernel density plot of the *DUVOL* coefficients and a plot of *p*-values against *DUVOL* coefficients (Figure 4). The kernel density plot of the *DUVOL* coefficients shows that most values are distributed around 0, significantly different from the *DUVOL* coefficient of 0.6713 in the baseline regression in column (4); from the plot of *p*-values against *DUVOL* coefficients (Figure 5), it can be seen that most *p*-values are above the dashed line at p=0.1, indicating that most of the estimated *DUVOL* coefficients are not significant, demonstrating that the effect of crash risk exposure on corporate financial distress is not driven by omitted variables, thus confirming the robustness of hypothesis H1.

4.4 Mechanism analysis

4.4.1 Financing constraints

Columns (1) and (2) of Table 7 present the results of the mediation effect test for financing constraints. From column (1), it is evident that the *DUVOL* coefficient is positive at the 1% significance level, indicating that an increase in crash risk exposure indeed increases corporate financing constraints. The results in column (2) show that the *DUVOL* coefficient is positive at the 1% significance level, and the *WW* coefficient is also positive at the 1% significance level, confirming the presence of the *WW* mediation effect. Similarly, the Sobel test's *p*-value is 0.0000, below the critical value of 0.05, and the 95% confidence interval of the bootstrap test is [0.1030, 0.1841], which does not include zero. These results from the Sobel and bootstrap tests verify that *WW* plays a mediating role, thus supporting hypothesis H2: An increase in crash
risk exposure intensifies a firm's financing constraints, thereby promoting the occurrence of financial distress.

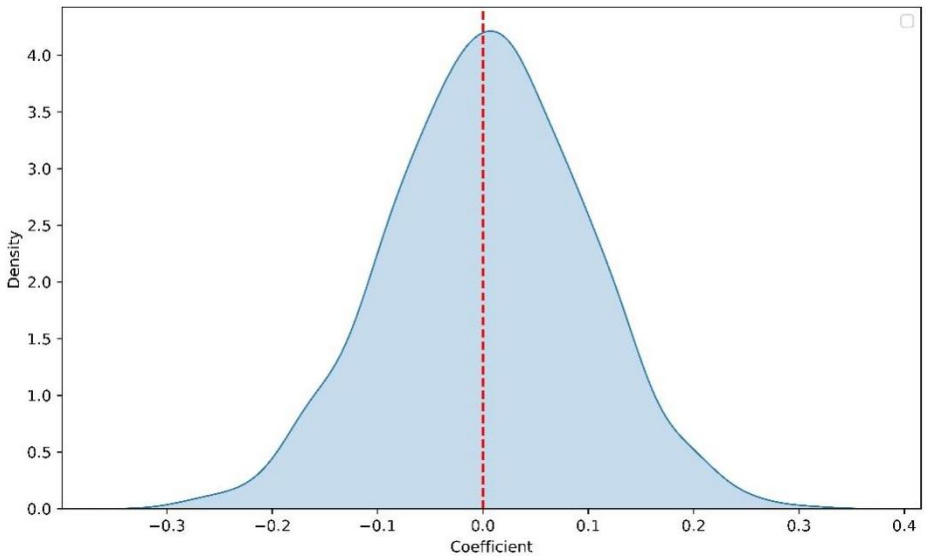

Fig. 4 - Kernel density plot of *DUVOL* coefficients. Source: own research

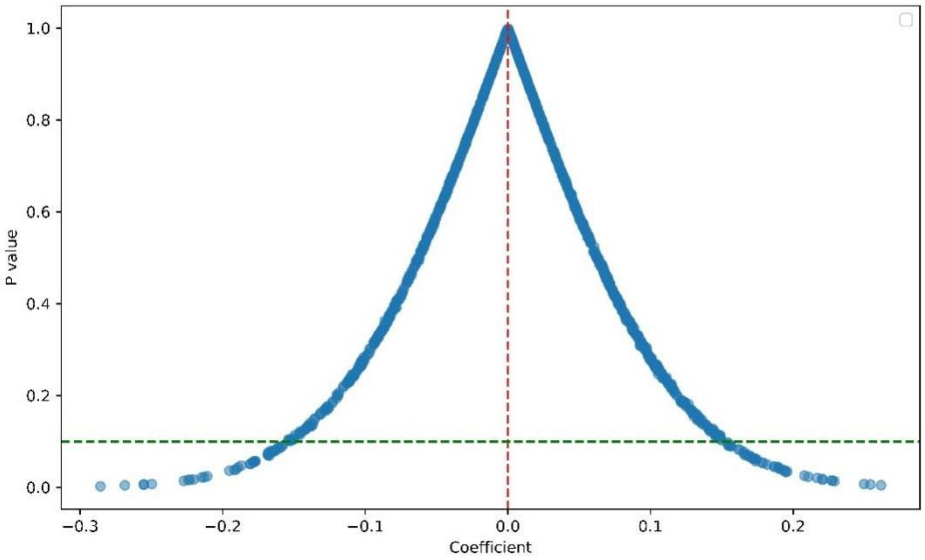

Fig. 5 - Relationship between *p*-values and *DUVOL* coefficients. Source: own research

4.4.2 Debt financing costs

Columns (3) and (4) of Table 7 present the results of the mediation effect test for debt financing costs. From column (3), it is evident that the *DUVOL* coefficient is positive at the 1% significance level, indicating that an increase in crash risk exposure indeed raises the cost of debt financing. The results in column (4) show that the *DUVOL* coefficient is positive at the 1% significance level, and the *DFC* coefficient is also positive at the 1% significance level, confirming the presence of the *DFC* mediation effect. Similarly, the Sobel test *p*-value is 0.0035, and the 95% confidence interval of the bootstrap test is [0.0088, 0.0424]. The results of both the Sobel and bootstrap tests confirm that *DFC* acts as a mediator, thus validating Hypothesis H3 of this study. This implies that the increase in crash risk exposure significantly raises debt financing costs of firm, which in turn promotes the occurrence of financial distress.

4.4.3 Institutional ownership

Columns (5) and (6) of Table 7 present the results of the mediation effect test for institutional ownership. From column (5), it is evident that the *DUVOL* coefficient is negative at the 1% significance level, indicating that an increase in crash risk exposure indeed reduces institutional ownership. The results in column (6) show that the *DUVOL* coefficient is positive at the 1% significance level, and the *IO* coefficient is negative at the 1% significance level, confirming the presence of the *IO* mediation effect. Similarly, the Sobel test *p*-value is 0.0011, and the 95% confidence interval of the bootstrap test is [0.0107, 0.0357]. Both the Sobel and bootstrap tests confirm that *IO* acts as a mediator, thereby supporting Hypothesis H4 of this study. This suggests that the increase in crash risk exposure decreases the institutional ownership, thereby promoting the occurrence of corporate financial distress.

Tab. 7 - Mechanism analysis. Source: own research

Variables	Financing Constraints		Debt Financing Costs		Institutional Ownership	
	(1) WW	(2) FD	(3) DFC	(4) FD	(5) IO	(6) FD
DUVOL	0.0086***	0.5349***	0.0013***	0.6453***	-0.0205***	0.6477***
	(0.001)	(0.099)	(0.000)	(0.099)	(0.005)	(0.096)
Med		16.7682***		18.8535***		-1.0403***
		(0.895)		(1.284)		(0.216)
Constant	-1.0232***	12.1634***	0.0209***	-5.0334***	0.4232***	-4.0893***
	(0.002)	(0.890)	(0.001)	(0.227)	(0.007)	(0.226)
Control	YES	YES	YES	YES	YES	YES
Fixed effects	YES	YES	YES	YES	YES	YES
Observations	11336	11336	11336	11336	11336	11336
Adjusted R^2	0.188		0.333		0.056	
Pseudo R^2		0.2549		0.2018		0.1575
Sobel Test	(Z=6.7544, p=0.0000)		(Z=2.9177, p=0.0035)		(Z=3.2726, p=0.0011)	
Bootstrap Test	[0.1030, 0.1841]		[0.0088, 0.0424]		[0.0103, 0.0357]	

4.5 Heterogeneity analysis

4.5.1 Heterogeneity in firms' intrinsic characteristics

To explore the impact of firms intrinsic characteristics on the research conclusions, this study categorizes the sample firms as follows: (1) based on property right, firms are divided into SOEs (*PR=1*) and non-SOEs (*PR=0*); (2) based on factor intensity, firms are divided into capital-intensive firms (*FI=1*) and non-capital-intensive firms (*FI=0*); (3) based on firm size, firms are divided into large firms (*FS=1*) and SMEs (*FS=0*).

The regression results in Table 8 indicate that, for firms with different property rights and factor intensity, the DUVOL coefficients remain positive and statistically significant at the 1% level. However, the interaction terms (*DUVOL*PR* and *DUVOL*FI*) are not significant, suggesting that variations in property rights and factor intensity do not alter the relationship between crash risk exposure and financial distress. This implies that regardless of these intrinsic characteristics, an increase in crash risk exposure consistently raises the likelihood of financial distress. In contrast, firm size exhibits a different pattern. The *DUVOL* coefficient remains positive and significant at the 1% level, and the interaction term (*DUVOL*FS*) is also significantly positive. This finding indicates that, compared to SMEs, large firms are more vulnerable to financial distress when exposed to crash risk. In other words, crash risk exposure has a stronger exacerbating effect on financial distress for large firms than for SMEs. This is because large firms often rely more on external financing, making them more susceptible to sudden increases in funding costs or tightening credit conditions when facing high crash risk exposure. Additionally, large firms have higher market influence and visibility, so a significant drop in stock prices may trigger broader and more profound market negative sentiments, exacerbating their financial distress. Moreover, large firms typically have more complex and highly structured financial operations, including sophisticated financial derivatives or cross-border capital flows, which may make their financial distress more severe and harder to rectify when facing high crash risk exposure. Therefore, large firms are more sensitive to crash risk exposure compared to SMEs.

Tab. 8 - Heterogeneity analysis: Property right, factor intensity, firm size.
Source: own research

Variables	Property right	Factor intensity	Firm size
DUVOL	0.6408***	0.7299***	0.4057***
	(0.109)	(0.117)	(0.140)
Interaction	-0.0342	-0.1828	0.4209**
	(0.223)	(0.197)	(0.196)
Constant	-4.3497***	-4.7283***	-3.4507***
	(0.214)	(0.218)	(0.225)
Control	YES	YES	YES
Fixed effects	YES	YES	YES
Observations	11336	11336	11336
Pseudo R^2	0.1610	0.1636	0.2290

Note: Capital-intensive industries include the manufacturing of alcoholic beverages and refined tea, tobacco products, paper and paper products, petroleum processing, coking, and nuclear fuel processing, manufacturing of chemical raw

materials and chemical products, manufacturing of chemical fibers, smelting and pressing of ferrous metals, smelting and pressing of non-ferrous metals, and manufacturing of general-purpose machinery.

4.5.2 Heterogeneity in external environmental characteristics

To investigate the impact of external environmental characteristics on the research conclusions, this study categorizes the sample firms as follows: (1) based on whether they belong to regulated industries, firms are divided into regulated industry firms (*IR=1*) and non-regulated industry firms (*IR=0*); (2) based on geographical regions, firms are divided into eastern region firms (*GR=1*) and central and western region firms (*GR=0*); (3) based on different time periods, firms are divided into those before 2018 (*TP=1*) and those after 2018 (*TP=0*).

From the regression results shown in Table 9, the *DUVOL* coefficients remain positive and statistically significant at the 1% level. when interaction terms (*DUVOL*IR* and *DUVOL*GR*) are added to the model, the coefficients of the interaction terms are not significant, indicating that for firms with different levels of regulation or in different geographical regions, an increase in crash risk exposure significantly increases the likelihood of financial distress. When the interaction term (*DUVOL*TP*) is added to the model, the coefficient of the interaction term is significantly negative, indicating that after 2018, an increase in crash risk exposure more easily induces financial distress. This is because after 2018, the global economy and financial markets faced multiple uncertainties, such as trade wars, geopolitical tensions, and disruptions in global supply chains, which collectively led to significant increases in market volatility. This increased market volatility meant that firms facing large fluctuations in stock prices experienced greater shocks to the stability of their capital structures, thereby increasing the risk of financial distress. Additionally, after 2018, Chinese capital markets placed greater emphasis on firms financial performance and risk management capabilities, with investors focusing more on short-term profitability and financial health. This increased market scrutiny meant that when firms faced high crash risk exposure, investor confidence could rapidly decline, further exacerbating financial distress.

Tab. 9 - Heterogeneity analysis: Industry regulation, geographical regional, time period. Source: own research

Variables	Industry regulation	Geographical region	Time period
DUVOL	0.6982***	0.6739***	0.7597***
	(0.104)	(0.128)	(0.107)
Interaction	-0.1705	0.0022	-0.4258*
	(0.263)	(0.190)	(0.237)
Constant	-4.4808***	-3.9506***	-4.5253***
	(0.213)	(0.217)	(0.215)
Control	YES	YES	YES
Fixed effects	YES	YES	YES
Observations	11336	11336	11336
Pseudo R^2	0.1519	0.1763	0.1526

Note: (1) According to the 2012 industry classification rules of the China Securities Regulatory Commission, industries with the following codes: B, C25, C31, C32, C36, C37, D, E48, G53, G54, G55, G56, I63, I64, K, and R are considered regulated industries. Therefore, in this study, the manufacturing industries with industry codes C25, C31, C32, C36, and C37 are classified as regulated industries. (2) The eastern region comprises Beijing, Tianjin, Shanghai, Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan provinces.

5 DISCUSSION

5.1 Theoretical development

This study conducts an empirical analysis of the relationship between stock price crash risk exposure and corporate financial distress. It utilizes data from publicly listed manufacturing firms (classified under industry code C in the National Economic Industry Classification) from 2014 to 2023 and adopts a longitudinal approach to examine the impact of crash risk exposure on financial distress two years later.

The empirical analysis is conducted using a logit regression model, which includes all relevant control variables and undergoes robustness and heterogeneity tests. This study provides theoretical support for the relationship between crash risk exposure and corporate financial distress, offering a new and effective early warning indicator for financial distress. The findings of this study have significant practical implications for investors, corporate management, and financial regulators. Specifically, investors can use stock price crash risk exposure as a warning tool to optimize their portfolios and reduce potential losses; corporate management can optimize financing structures, enhance financial transparency, and improve governance to strengthen risk resilience; and financial regulators can establish monitoring mechanisms and improve early warning systems to protect investor interests and maintain financial market stability.

In the existing literature, most studies focus on the impact of single risk factors on financial distress, such as financial leverage (Ugur et al., 2022) and market volatility (Vuong et al., 2024), while there is insufficient exploration of the impact of stock price crash risk as a comprehensive risk exposure on corporate financial distress. Stock price crash risk refers to the risk of a sharp decline in stock prices following the collapse of a market bubble, and stock price crashes are common occurrences in the stock market. Current perspectives mainly explain this phenomenon from the financial market theory of irrational investors and the agency theory based on corporate finance (Jia et al., 2024; Andreou et al., 2023). As a special type of systemic risk, stock price crash risk can trigger significant fluctuations in the capital market within a short period, affecting the stability of corporate operations (Zheng et al., 2022). Therefore, this study systematically explores the mechanism through which crash risk exposure affects corporate financial distress, enriching the theoretical framework regarding the relationship between crash risk and corporate financial health.

Especially in the context of increasing macroeconomic fluctuations and uncertainty in the capital market environment, stock price crash risk has gradually become a market risk factor that cannot be ignored. Existing literature mainly focuses on predictive models for stock price crash risk and short-term analyses of capital market responses (Sun et al., 2024; Alp et al., 2022), with little discussion from both internal and external perspectives on how this risk exacerbates corporate financial distress two years later, such as in terms of corporate financing constraints and capital market reactions. This study empirically tests the long-term link between stock price crash risk

and corporate financial distress, using data from a longer time span (2014-2023), thereby filling the gap in previous research regarding the depth of time analysis.

5.2 Theoretical implications

The main contribution of this study lies in establishing the theoretical link between stock price crash risk exposure and corporate financial distress. First, through extensive empirical analysis, this paper reveals a significant positive correlation between crash risk exposure and corporate financial distress. Specifically, the financing constraints, increased debt costs, and decreased institutional ownership resulting from crash risk exposure further exacerbate corporate financial distress, validating the impact mechanism of crash risk as a potential threat to firms. Similar conclusions have also been found in the studies of other scholars (Vuong et al., 2024). This finding provides a new perspective for existing research on financial distress and broadens the theoretical framework in the field of risk management.

Second, this study is the first to approach the issue from both internal and external perspectives, offering a detailed analysis of how crash risk exposure affects corporate financing conditions. It proposes a theoretical model that combines financing constraint theory and market reaction theory. From the internal perspective, corporate financing constraints are quantified using the WW financing constraint index, which reflects the financing difficulties firms face when exposed to stock price crash risks. From the external perspective, the study examines the market's response to firms crash risk exposure through two factors: debt financing costs and institutional ownership ratios, revealing the profound impact of crash risk on capital market reactions. Previous research (Wu et al., 2024; Cao et al., 2024) has also used similar indicators to explore the factors influencing financial distress, further validating the theoretical model of this study.

Theoretically, this study enriches the existing stock price crash risk theory by incorporating factors such as internal and external corporate financing conditions and market response mechanisms. It fills gaps in current literature and provides a new theoretical framework and direction for future research. The study also outlines the specific pathway through which crash risk exposure exacerbates financial distress by influencing corporate financing conditions and market reactions.

5.3 Practical implications

In terms of practical significance, this study provides effective decision-making guidance for various stakeholders, particularly in the areas of investment, corporate management, and financial regulation.

For investors, crash risk exposure serves as an important forward-looking risk management tool. By monitoring firms exposure to crash risk, investors can identify companies that may face financial distress, enabling them to optimize their portfolios and reduce investment losses. Especially during periods of high market volatility, crash risk exposure can help investors adjust their strategies in a timely manner to avoid potential risks. Specifically, investors can treat crash

risk exposure as a market signal, especially during times of market bubble bursts or increased economic uncertainty, prompting them to adopt more cautious investment strategies. To manage risk, investors can monitor stock price volatility, assess a firm's debt burden and financing conditions, track industry and market trends, and implement diversified asset allocation. By employing these measures, investors can dynamically adjust their portfolios, reduce reliance on high-risk assets, and increase investment in low-risk assets, thereby enhancing the portfolio resilience. Furthermore, investors can collaborate with industry research institutions, financial information platforms, and professional analysis teams, utilizing modern data analysis tools and AI technologies to monitor real-time risk changes in firms and markets. This enables quick responses and adjustments to investment strategies, maximizing loss reduction.

For corporate managers, this study reveals the negative impact of crash risk exposure on financing constraints, debt costs, and institutional ownership. Corporate management must fully recognize that since 2018, crash risk exposure has increasingly contributed to the triggering of corporate financial distress. This effect is particularly pronounced in large firms, where increased crash risk exposure significantly raises the probability of financial distress. Therefore, corporate management should adopt targeted decision-making and response measures based on their own characteristics, industry heterogeneity, and the external environment. To effectively cope with crash risk exposure, corporate management can focus on optimizing financing structures, enhancing financial transparency, managing cash flow, and strengthening corporate governance. In terms of optimizing financing structures, firms can reduce reliance on a single financing method by diversifying funding sources, thereby decreasing dependence on bank loans and capital markets, especially in regions with looser or unstable regulations. Additionally, firms should improve financial information disclosure to increase transparency, particularly during periods of sharp stock price fluctuations or market uncertainty, by promptly communicating the firm’s financial health and future development plans. This helps boost investor confidence and reduce panic selling caused by information asymmetry. In terms of cash flow management, firms should establish emergency cash reserves and regularly forecast cash flows to identify potential financial pressures early, allowing them to develop response plans and ensure sufficient liquidity to deal with unexpected financial distress during market turmoil. Finally, strengthening corporate governance entails establishing a sound risk management system, especially for financial, investment, and operational areas, to effectively supervise and ensure the firm can make quick and effective decisions in a complex market environment.

From the perspective of financial regulation, the findings of this study provide targeted policy recommendations for financial regulatory authorities, particularly in terms of managing and preventing corporate financial distress. Regulatory agencies should enhance monitoring of abnormal stock market fluctuations and take measures to prevent the exacerbation of financial distress in firms due to crash risk exposure. Specifically, regulators should establish a monitoring mechanism for crash risk exposure, regularly publish relevant indicators of crash risk exposure, and utilize data analysis tools for real-time market monitoring. This will help identify signals that may trigger market crashes and corporate financial distress, issuing early warnings to assist investors and corporate management in risk prevention. Furthermore, regulators should improve

early warning systems and intervention mechanisms. In times of market bubbles or high economic uncertainty, they should increase monitoring of market volatility and take timely intervention measures to prevent systemic financial risks, mitigating the financial distress that may arise from crash risk exposure. To enhance the monitoring and response to corporate financial distress, regulatory authorities should encourage firms to improve risk management, especially for high-leverage and high-risk firms, by adopting appropriate debt restructuring measures and promoting the optimization of financing structures to reduce the occurrence of financial distress. Additionally, financial regulators should strengthen investor protection mechanisms, particularly for ordinary investors, enhancing their ability to identify risks and establishing robust investor protection systems to safeguard their legal rights during market crashes. Finally, regulatory authorities can draw on successful international experiences in stock market crash risk management to further improve China's financial regulatory system, ensuring market stability and preventing the occurrence of systemic financial risks.

5.4 Limitations and future research directions

Although this study provides empirical support for the relationship between crash risk exposure and corporate financial distress, several limitations exist. First, the study primarily relies on data from China's A-share market. While this market is representative on a global scale, differences in financial market conditions, legal regulations, corporate governance structures, and investor behaviors across countries and regions may limit the generalizability of the findings. In other countries or regions, the impact of stock price crash risk may follow different paths and degrees. For example, in more developed markets, institutional investors may have a more significant regulatory role, and market mechanisms may have stronger risk-mitigating capabilities. As such, the impact path and degree of crash risk exposure on financial distress in these markets may not fully align with the conclusions of this study. Future research could extend this framework to other countries and regions to validate the generalizability of the findings and conduct comparative analyses of the effects of stock price crash risk on financial distress across different market environments.

Second, this study focuses on the impact of crash risk exposure on corporate financial distress but does not delve deeply into other types of market risks. For instance, macroeconomic factors such as interest rate risk and exchange rate risk may also affect corporate financial conditions. Future research could expand to examine other types of market risks, explore their interactions with stock price crash risk, and assess their joint impact on corporate financial distress.

Finally, this study does not explore specific policy measures or management strategies in depth. Future research could take a more practical approach by investigating how policy interventions, optimization of market mechanisms, and adjustments in corporate internal management can mitigate the impact of crash risk exposure on financial distress. For example, research could explore how regulatory frameworks and information disclosure systems in the capital market can reduce the negative effects of crash risk exposure, and how companies can alleviate financial distress by optimizing capital structures and strengthening internal controls.

6 CONCLUSION

Since the 2008 global financial crisis and the 2015 Chinese stock market crash, issues related to stock price crash risk have become a focal point in academic research. Using financial data from A-share listed manufacturing firms from 2014 to 2023, this paper examines how crash risk exposure impacts corporate financial distress two years later. The findings indicate that increased crash risk exposure significantly promotes the occurrence of financial distress, and this conclusion holds after a series of robustness checks. The transmission mechanism analysis reveals that higher crash risk exposure worsens firms financing conditions by intensifying financing constraints, increasing debt financing costs, and reducing institutional ownership, thereby exacerbating financial distress. Specifically, from an internal perspective, heightened crash risk exposure intensifies firms financing constraints, limiting their access to external financing and thereby worsening financial distress. From an external perspective, it increases corporate debt financing costs and reduces institutional ownership, signaling a deterioration in actual financing conditions, which further exacerbates financial distress. Heterogeneity analysis of firm-specific characteristics shows that an increase in crash risk exposure raises the likelihood of financial distress across firms with different ownership structures or factor intensities; notably, the impact on financial distress is more pronounced in large firms. Heterogeneity analysis of external environmental characteristics demonstrates that heightened crash risk exposure increases the likelihood of financial distress across firms operating under varying regulatory regimes or in different geographic regions. Additionally, the effect of increased crash risk exposure is more likely to induce financial distress in firms after 2018.

This study fills a gap in the research on stock price crash risk by establishing a link between crash risk exposure and corporate financial distress, providing a new and effective early warning indicator for financial distress. From an investor's perspective, the crash risk exposure indicator serves as a forward-looking risk management tool, helping investors identify firms facing potential financial distress, optimize asset allocation, and mitigate investment losses. For corporate management, recognizing that an increase in crash risk exposure may lead to heightened financing constraints, rising debt costs, and a reduction in institutional ownership can prompt management to implement measures to enhance financial stability. From the perspective of capital market regulation, regulatory authorities should strengthen monitoring and early warning systems for abnormal stock market fluctuations to prevent systemic financial risks and maintain the stability and soundness of capital markets.

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REFERENCES

1. Acemoglu, D., Ozdaglar, A., & Tahbaz-Salehi, A. (2015). Systemic risk and stability in

financial networks. *American Economic Review*, *105*(2), 564-608. https://www.aeaweb.org/articles?id=10.1257/aer.20130456

2. Al Mamun, M., Balachandran, B., & Duong, H. N. (2020). Powerful CEOs and stock price crash risk. *Journal of Corporate Finance*, *62*, 101582. https://doi.org/10.1016/j.jcorpfin.2020.101582
3. Ali, S., et al. (2023). Does board diversity reduce the likelihood of financial distress in the presence of a powerful Chinese CEO? *Management Decision*, *61*(6), 1798-1815. https://doi.org/10.1108/MD-01-2022-0007
4. Almazan, A., Hartzell, J. C., & Starks, L. T. (2005). Active institutional shareholders and costs of monitoring: Evidence from executive compensation. *Financial Management*, *34*(4), 5-34. https://doi.org/10.1111/j.1755-053X.2005.tb00116.x
5. Alp, O. S., Canbaloglu, B., & Gurgun, G. (2022). Stock liquidity, stock price crash risk, and foreign ownership. *Borsa Istanbul Review*, *22*(3), 477-486. https://doi.org/10.1016/j.bir.2021.06.012
6. Altman, E. I., & Hotchkiss, E. (1993). *Corporate financial distress and bankruptcy*. John Wiley & Sons. http://ndl.ethernet.edu.et/bitstream/123456789/27600/2/68.pdf.pdf
7. Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-score model. *Journal of International Financial Management & Accounting*, *28*(2), 131-171. https://doi.org/10.1111/jifm.12053
8. An, Z., Chen, C., Naiker, V., & Wang, J. (2020). Does media coverage deter firms from withholding bad news? Evidence from stock price crash risk. *Journal of Corporate Finance*, *64*, 101664. https://doi.org/10.1016/j.jcorpfin.2020.101664
9. Andrade, S. C., Bernile, G., & Hood III, F. M. (2014). SOX, corporate transparency, and the cost of debt. *Journal of Banking & Finance*, *38*, 145-165. https://doi.org/10.1016/j.jbankfin.2013.10.001
10. Andreou, P. C., Lambertides, N., & Magidou, M. (2023). A critique of the agency theory viewpoint of stock price crash risk: The opacity and overinvestment channels. *British Journal of Management*, *34*(4), 2158-2185. https://doi.org/10.1111/1467-8551.12693
11. Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of Accounting Research*, *4*, 71-111. https://doi.org/10.2307/2490171
12. Boone, A. L., & White, J. T. (2015). The effect of institutional ownership on firm transparency and information production. *Journal of Financial Economics*, *117*(3), 508-533. https://doi.org/10.1016/j.jfineco.2015.05.008
13. Cao, J., Dong, D., & Yue, S. (2024). Institutional investors' site visits and firms' financial distress. *Research in International Business and Finance*, *67*, 102150. https://doi.org/10.1016/j.ribaf.2023.102150
14. Carmichael, D. R. (1972). *The auditor's reporting obligation: The meaning and implementation of the fourth standard of reporting.* American Institute of Certified Public Accountants. https://lccn.loc.gov/72171020
15. Chay, J. B., & Suh, J. (2009). Payout policy and cash-flow uncertainty. *Journal of Financial Economics*, *93*(1), 88-107. https://doi.org/10.1016/j.jfineco.2008.12.001

16. Ciampi, F. (2015). Corporate governance characteristics and default prediction modeling for small enterprises: An empirical analysis of Italian firms. *Journal of Business Research*, *68*(5), 1012-1025. https://doi.org/10.1016/j.jbusres.2014.10.003
17. Crane, A. D., Koch, A., & Michenaud, S. (2019). Institutional investor cliques and governance. *Journal of Financial Economics*, *133*(1), 175-197. https://doi.org/10.1016/j.jfineco.2018.11.012
18. Dallas, L. L. (2011). Short-termism, the financial crisis, and corporate governance. *Journal of Corporation Law*, *37*, 265. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2006556
19. Diamond, D. W., & He, Z. (2014). A theory of debt maturity: The long and short of debt overhang. *Journal of Finance*, *69*(2), 719-762. https://doi.org/10.1111/jofi.12118
20. Elliott, W. B., Grant, S. M., & Hodge, F. D. (2018). Negative news and investor trust: The role of $Firm and #CEO Twitter use. *Journal of Accounting Research*, *56*(5), 1483-1519. https://doi.org/10.1111/1475-679X.12217
21. Francis, B., Hasan, I., & Li, L. (2016). Abnormal real operations, real earnings management, and subsequent crashes in stock prices. *Review of Quantitative Finance and Accounting*, *46*, 217-260. https://doi.org/10.1007/s11156-014-0468-y
22. Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of Financial Economics*, *67*(2), 217-248. https://doi.org/10.1016/S0304-405X(02)00252-0
23. Geng, R., Bose, I., & Chen, X. (2015). Prediction of financial distress: An empirical study of listed Chinese companies using data mining. *European Journal of Operational Research*, *241*(1), 236-247. https://doi.org/10.1016/j.ejor.2014.08.016
24. Gennaioli, N., & Shleifer, A. (2018). *A crisis of beliefs: Investor psychology and financial fragility*. Princeton University Press. https://www.torrossa.com/en/resources/an/5559644?digital=true
25. Habib, A., Hasan, M. M., & Jiang, H. (2018). Stock price crash risk: Review of the empirical literature. *Accounting & Finance*, *58*, 211-251. https://doi.org/10.1111/acfi.12278
26. Hakkio, C. S., & Keeton, W. R. (2009). Financial stress: What is it, how can it be measured, and why does it matter. *Economic Review*, *94*(2), 5-50.
27. Harper, J., Johnson, G., & Sun, L. (2020). Stock price crash risk and CEO power: Firm-level analysis. *Research in International Business and Finance*, *51*, 101094. https://doi.org/10.1016/j.ribaf.2019.101094
28. Hong, H., & Stein, J. C. (2003). Differences of opinion, short-sales constraints, and market crashes. *Review of Financial Studies*, *16*(2), 487-525. https://doi.org/10.1093/rfs/hhg006
29. Hutton, A. P., Marcus, A. J., & Tehranian, H. (2009). Opaque financial reports, R2, and crash risk. *Journal of financial Economics*, *94*(1), 67-86. https://doi.org/10.1016/j.jfineco.2008.10.003
30. Jia, H., Zhu, Y., & Chen, X. (2024). Stock repurchase and stock price crash risk. *Finance Research Letters*, *60*, 104879. https://doi.org/10.1016/j.frl.2023.104879
31. Jin, H. M., Su, Z. Q., Wang, L., & Xiao, Z. (2022). Do academic independent directors matter? Evidence from stock price crash risk. *Journal of Business Research*, *144*, 1129-1148. https://doi.org/10.1016/j.jbusres.2022.02.054

32. Jorion, P., Shi, C., & Zhang, S. (2009). Tightening credit standards: The role of accounting quality. *Review of Accounting Studies, 14*, 123-160. https://doi.org/10.1007/s11142-007-9054-z
33. Kim, J. B., Li, Y., & Zhang, L. (2011a). Corporate tax avoidance and stock price crash risk: Firm-level analysis. *Journal of Financial Economics*, *100*(3), 639-662. https://doi.org/10.1016/j.jfineco.2010.07.007
34. Kim, J. B., Li, Y., & Zhang, L. (2011b). CFOs versus CEOs: Equity incentives and crashes. *Journal of Financial Economics*, *101*(3), 713-730. https://doi.org/10.1016/j.jfineco.2011.03.013
35. Kim, J. B., Yeung, I., & Zhou, J. (2019). Stock price crash risk and internal control weakness: Presence vs. disclosure effect. *Accounting & Finance*, *59*(2), 1197-1233. https://doi.org/10.1111/acfi.12273
36. Kim, J. B., & Zhang, L. (2016). Accounting conservatism and stock price crash risk: Firm-level evidence. *Contemporary Accounting Research*, *33*(1), 412-441. https://doi.org/10.1016/j.jfineco.2011.03.013
37. Kliestik, T., et al. (2020). Remaining financially healthy and competitive: The role of financial predictors. *Journal of Competitiveness*, *12*(1). https://doi.org/10.7441/joc.2020.01.05
38. Kothari, S. P., Shu, S., & Wysocki, P. D. (2009). Do managers withhold bad news? *Journal of Accounting Research*, *47*(1), 241-276. https://doi.org/10.1111/j.1475-679X.2008.00318.x
39. Le, H. T. M., Cheng-Po, L., Phan, V. H., & Pham, V. T. (2024). Financial reporting quality and investment efficiency in manufacturing firms: The role of firm characteristics in an emerging market. *Journal of Competitiveness*, *16*(1), 62-78. https://doi.org/10.7441/joc.2024.01.04
40. Leuz, C., & Wysocki, P. D. (2016). The economics of disclosure and financial reporting regulation: Evidence and suggestions for future research. *Journal of Accounting Research*, *54*(2), 525-622. https://doi.org/10.1111/1475-679X.12115
41. Li, T., Xiang, C., Liu, Z., & Cai, W. (2020). Annual report disclosure timing and stock price crash risk. *Pacific-Basin Finance Journal*, *62*, 101392. https://doi.org/10.1016/j.pacfin.2020.101392
42. Li, X., Wang, S. S., & Wang, X. (2017). Trust and stock price crash risk: Evidence from China. *Journal of Banking & Finance*, *76*, 74-91. https://doi.org/10.1016/j.jbankfin.2016.12.003
43. Lin, L. W., & Milhaupt, C. J. (2017). Bonded to the state: A network perspective on China's corporate debt market. *Journal of Financial Regulation*, *3*(1), 1-39. https://doi.org/10.1093/jfr/fjw016
44. Lin, Y. R., & Fu, X. M. (2017). Does institutional ownership influence firm performance? Evidence from China. *International Review of Economics & Finance*, *49*, 17-57. https://doi.org/10.1016/j.iref.2017.01.021
45. Ma, Z., Liu, Y., & Gao, Y. (2021). Research on the impact of COVID-19 on Chinese small and medium-sized enterprises: Evidence from Beijing. *PLoS One*, *16*(12), e0257036. https://doi.org/10.1371/journal.pone.0257036
46. Mare, D. S. (2015). Contribution of macroeconomic factors to the prediction of small bank failures. *Journal of International Financial Markets, Institutions and Money*, *39*, 25-39.

https://doi.org/10.1016/j.intfin.2015.05.005
47. Marin, J. M., & Olivier, J. P. (2008). The dog that did not bark: Insider trading and crashes. *Journal of Finance*, *63*(5), 2429-2476. https://doi.org/10.1111/j.1540-6261.2008.01401.x
48. Meng, Y., Shen, D., & Xiong, X. (2023). When stock price crash risk meets fundamentals. *Research in International Business and Finance*, *65*, 101975. https://doi.org/10.1016/j.ribaf.2023.101975
49. Piotroski, J. D., & Wong, T. J. (2012). Institutions and information environment of Chinese listed firms. *Capitalizing China*, *2*, 201-242. https://doi.org/10.7208/9780226237268-007
50. Qian, M., & Yeung, B. Y. (2015). Bank financing and corporate governance. *Journal of Corporate Finance*, *32*, 258-270. https://doi.org/10.1016/j.jcorpfin.2014.10.006
51. Qureshi, F., Kutan, A. M., Ismail, I., & Gee, C. S. (2017). Mutual funds and stock market volatility: An empirical analysis of Asian emerging markets. *Emerging Markets Review*, *31*, 176-192. https://doi.org/10.1016/j.ememar.2017.05.005
52. Ramalingegowda, S., Utke, S., & Yu, Y. (2021). Common institutional ownership and earnings management. *Contemporary Accounting Research*, *38*(1), 208-241. https://doi.org/10.1111/1911-3846.12628
53. Robin, A. J., & Zhang, H. (2015). Do industry-specialist auditors influence stock price crash risk? *Auditing: A Journal of Practice & Theory*, *34*(3), 47-79. https://doi.org/10.2308/ajpt-50950
54. Srinivasan, S. (2005). Consequences of financial reporting failure for outside directors: Evidence from accounting restatements and audit committee members. *Journal of Accounting Research*, *43*(2), 291-334. https://doi.org/10.1111/j.1475-679x.2005.00172.x
55. Su, C. W., et al. (2021). Can bank credit withstand falling house price in China? *International Review of Economics & Finance*, *71*, 257-267. https://doi.org/10.1016/j.iref.2020.09.013
56. Sun, G., Wang, J., & Ai, Y. (2024). The impact of government green subsidies on stock price crash risk. *Energy Economics*, *134*, 107573. https://doi.org/10.1016/j.eneco.2024.107573
57. Ugur, M., Solomon, E., & Zeynalov, A. (2022). Leverage, competition and financial distress hazard: Implications for capital structure in the presence of agency costs. *Economic Modelling*, *108*, 105740. https://doi.org/10.1016/j.econmod.2021.105740
58. Vuong, G. T. H., Van Nguyen, P., Barky, W., & Nguyen, M. H. (2024). Stock return volatility and financial distress: Moderating roles of ownership structure, managerial ability, and financial constraints. *International Review of Economics & Finance*, *91*, 634-652. https://doi.org/10.1016/j.iref.2024.01.054
59. Wang, W., & Liang, Z. (2024). Financial distress early warning for Chinese enterprises from a systemic risk perspective: Based on the adaptive weighted XGBoost-bagging Model. *Systems*, *12*(2), 65. https://doi.org/10.3390/systems12020065
60. Woo, K. Y., Mai, C., McAleer, M., & Wong, W. K. (2020). Review on efficiency and anomalies in stock markets. *Economies*, *8*(1), 20. https://doi.org/10.3390/economies8010020
61. Wu, W., Zhang, S., Fan, Y., & Shi, Y. (2024). Financial flexibility, firm performance, and financial distress: A comparative study of China and the US during pandemics. *International*

Review of Financial Analysis, *96*, 103706. https://doi.org/10.1016/j.irfa.2024.103706
62. Xiang, C., Chen, F., & Wang, Q. (2020). Institutional investor inattention and stock price crash risk. *Finance Research Letters*, *33*, 101184. https://doi.org/10.1016/j.frl.2019.05.002
63. Xu, N., Jiang, X., Chan, K. C., & Wu, S. (2017). Analyst herding and stock price crash risk: Evidence from China. *Journal of International Financial Management & Accounting*, *28*(3), 308-348. https://doi.org/10.1111/jifm.12062
64. Xu, N., Li, X., Yuan, Q., & Chan, K. C. (2014). Excess perks and stock price crash risk: Evidence from China. *Journal of Corporate Finance*, *25*, 419-434. https://doi.org/10.1016/j.jcorpfin.2014.01.006
65. Xu, S., et al. (2024). Sustainable competitiveness through ESG performance: An empirical study on corporate resilience. *Journal of Competitiveness*, *16*(3), 53-72. https://doi.org/10.7441/joc.2024.03.03
66. Zheng, Y., Peng, J., Wei, X., & Zhang, J. (2022). Low-carbon transition of enterprises and financial market stability: From the perspective of stock price crash risk. *Emerging Markets Finance and Trade*, *58*(15), 4361-4374. https://doi.org/10.1080/1540496X.2022.2103403
67. Zhou, J., Li, W., Yan, Z., & Lyu, H. (2021). Controlling shareholder share pledging and stock price crash risk: Evidence from China. *International Review of Financial Analysis*, *77*, 101839. https://doi.org/10.1016/j.irfa.2021.101839

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