Asia Pacific Science Press

Asia Pacific Economic and Management Review
ISSN(O):3005-9275
ISSN(P):3005-9267
Vol. 3 No.6 (2026)

Supply Chain Disruption Risk and Firm Performance: A Dual-path Mechanism of Financing Constraints and Supply Chain Reconfiguration

Zhihui Xiong[1], Lin Ma[2]*

1. School of Management, Guangzhou College of Commerce, Guangzhou, Guangdong, 511363, China
2. Guangdong-hong Kong-macao Greater Bay Area E-commerce Research Center, Guangzhou College of Commerce, Guangzhou, Guangdong, 511363, China

Corresponding author: Lin Ma, 1500983051@qq.com

Copyright: 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY-NC 4.0), permitting distribution and reproduction in any medium, provided the original author and source are credited, and explicitly prohibiting its use for commercial purposes.

Abstract: Against the backdrop of rising global supply chain risks, this study examines the relationship between supply chain disruption risk and firm performance using a sample of Chinese A-share listed firms from 2013 to 2023. We construct a word-embedding measure of supply chain disruption risk from annual report text and estimate two-way fixed-effects models. We find that supply chain disruption risk is significantly negatively associated with contemporaneous firm performance, and this result is robust to alternative measures, industry and year fixed effects, and two-way clustering. Dynamic tests show that the negative impact is concentrated in the current period, with recovery emerging two to three periods later. Mechanism tests indicate that the risk exacerbates financing constraints and promotes supply chain reconfiguration, both of which reduce subsequent performance. The negative association is significantly weaker during the pandemic. These findings reveal a "contemporaneous damage–subsequent adjustment" pattern and provide implications for building resilient supply chains.

Keywords: Supply Chain Disruption Risk; Firm Performance; Financing Constraints; Supply Chain Reconfiguration; Text Analysis

Published: Nov 26, 2026

DOI: https://doi.org/10.62177/apemr.v3i6.1889

1. Introduction

Global supply chains are shifting from an "efficiency-first" to a "security-first" paradigm. Geopolitical frictions, shortages of critical inputs, extreme weather events, and public health crises have turned supply chain disruptions from sporadic operational incidents into a persistent strategic risk for firms. Supply chain risk may alter firm performance through procurement disruptions, production adjustments, order delays, and deteriorating financing conditions. Consequently, whether supply chain disruption risk is associated with firm performance, and whether this association exhibits cross-period characteristics, has become an important question for academic research.

Existing studies have primarily examined the economic consequences of supply chain risk through four lenses: unexpected event shocks, trade frictions, supply chain network relationships, and organizational resilience, providing an important foundation for understanding this topic. Supply chain disruptions may lead to delivery delays, rising costs, order losses, and even production halts [1-3], potentially prompting firms to adjust their supply chain relationships and resource allocation.

However, disruptions are not always immediately observable as actual production halts or supply cut-offs. Unlike realized disruption events, the supply chain disruption risk disclosed in corporate annual reports better captures management's ex ante exposure to supply continuity, access to critical inputs, and external uncertainty. Nevertheless, research that continuously measures firm-level supply chain disruption risk based on annual report text, and further examines firm performance dynamics along with adjustments in internal financing and external supplier relations, remains limited.To address this gap, this study uses a sample of Chinese A-share listed firms from 2013 to 2023 and adopts the supply chain disruption risk measure constructed by Jiang et al.(2025) to examine the relationship between supply chain disruption risk and firm performance, its cross-period dynamic characteristics, and the pathways of financing constraints and supply chain reconfiguration[4].

This study makes three main contributions.First, it examines the economic consequences of supply chain disruption risk from the perspective of textual risk exposure disclosed in corporate annual reports, thereby complementing prior work that has largely centered on realized disruption events.Second, it distinguishes between the contemporaneous performance association of risk and its subsequent dynamic adjustment patterns, thereby revealing a temporal sequence of “contemporaneous damage followed by subsequent recovery.”Third, it explains the link between disruption risk and subsequent performance through two parallel adjustment pathways: financing constraints and supply chain reconfiguration.

2. Literature Review

2.1 Economic Consequences of Supply Chain Disruption Risk

Research on supply chain disruption risk has developed into a relatively mature body of work. Regarding risk sources, existing studies largely classify supply chain risk into internal and external categories. Internal risk originates within a firm's supply chain and includes operational issues such as supplier performance volatility, insufficient production capacity, inventory imbalance, and information distortion[5]. External risk, by contrast, stems from uncontrollable environmental factors such as natural disasters, geopolitical conflicts, trade policy changes, and macroeconomic fluctuations[6]. Compared with internal risk, external risk tends to impose more severe shocks on firm supply chains because of its sudden and unpredictable nature.

Regarding risk identification and measurement, the literature has evolved from traditional financial indicator analysis to big data and text analytics. Early studies often relied on questionnaire surveys or case studies[7]. In recent years, with the development of text mining and machine learning, word embedding models and other quantitative methods have been increasingly applied to measure supply chain risk[4], effectively addressing the timeliness limitations of traditional approaches[8].

Regarding risk consequences, existing studies generally document the negative economic effects of supply chain disruptions. Nikolopoulos et al.(2021)find that supply chain disruption risk leads to delivery delays, declining operating revenue, and rising production costs, and may even cause a severe contraction in market share[9]. Chen et al.(2023)show that under extreme disruption risk, supply chain disruptions trigger sharp fluctuations in stock prices and weaken investors' willingness to invest and overall market confidence[10]. Baghersad and Zobel(2021)emphasize that the negative effects of supply chain disruptions are not confined to short-term operations but also threaten the long-term supplier relationship networks that firms have built, ultimately exerting persistent adverse effects on firm performance[3].

However, existing studies mostly discuss the negative effects of supply chain disruptions in specific contexts such as natural disasters, pandemics, and trade frictions. Because risk sources differ significantly in duration, scope, and firms' room for response, continuous risk measures are necessary to examine firm-level annual risk exposure and its performance consequences.

2.2 Determinants of Firm Performance

Firm performance has long been a core topic in strategic management research, with existing studies focusing mainly on its determinants and measurement. Scholars generally distinguish between internal and external determinants. At the internal level, research has focused on firms' resource base, organizational capabilities, innovation capacity, and governance structure.

Luo et al.(2023)find that R&D investment has a significant positive effect on the performance of technology-intensive firms[11]. Zhang et al.(2025)further point out that the alignment between strategic resources and organizational resilience capabilities significantly affects firms'technological innovation performance[12]. Yi et al.(2021)show that digital transformation significantly improves firm operating performance[13]. At the external level, the effects of market competition, policies and regulations, and macroeconomic fluctuations on firm performance have received extensive attention. From an innovation ecosystem perspective, Adner and Kapoor(2010)[14] argue that the structural characteristics of technological interdependence affect value creation and firm performance in new technology generations. Du et al.(2015)find a U-shaped relationship between competitor orientation and firm performance, with organizational legitimacy playing a mediating role[15]. At a more macro level, Lü et al.(2024)show that entity list events have a significant negative impact on the performance of Chinese high-end manufacturing firms, although this effect gradually weakens over time[16].

Performance measurement has developed into a comprehensive system combining financial and non-financial indicators. Financial indicators mainly include return on assets (ROA), return on equity (ROE), and Tobin's Q[17-18]. Non-financial indicators cover dimensions such as market performance, innovation capability, social responsibility, and environmental governance[19-20].

Research review. In summary, existing literature provides an important foundation for understanding the relationship between supply chain disruption risk and firm performance, yet three gaps remain. First, most studies focus on the association between risk and contemporaneous performance, with insufficient systematic analysis of cross-period dynamic characteristics. Second, the mechanisms through which supply chain disruption risk affects firm performance require further clarification, and empirical evidence on the two pathways of financing constraints and supply chain reconfiguration remains limited. Third, whether external contexts such as the COVID-19 pandemic alter the risk–performance relationship warrants further examination.

3. Research Hypotheses

3.1 Supply Chain Disruption Risk and Firm Performance

Existing research on the impact of supply chain disruption risk on firm performance has largely focused on two aspects: rising cost pressures and declining operational efficiency. A continuous increase in supply chain disruption risk exposes firms to substantial uncertainty across procurement, production, and delivery. Even when the risk has not yet materialized into an actual disruption, firms may proactively adjust procurement plans, expand inventory buffers, and identify alternative supply channels to prevent supply chain breaks. These measures inevitably increase operating costs and may also lead to resource constraints and misallocation, thereby reducing the efficiency of resource allocation.

Baghersad & Zobel (2021)[3] and Frieske & Stieler (2022)[21] point out that when the supply channels for raw materials and key components are disrupted, firms resort to emergency procurement, temporary substitution, or production rescheduling. These adjustments generate additional costs such as procurement premiums, order delays, and coordination expenses. To guard against potential supply gaps, firms may further increase safety stock, which in turn raises working capital occupation and inventory holding costs. Moreover, rising risk leads management to devote more resources to information search, supplier evaluation, contract negotiation, and internal coordination, while operating decisions face greater uncertainty[22]. These uncertainties may ultimately manifest as lower asset turnover efficiency and compressed profit margins. Existing studies also confirm that external shocks such as supply chain disruptions and trade frictions have a significant negative impact on firm operating performance[10,16]. Accordingly, this study proposes:

H1: Supply chain disruption risk is negatively associated with firm performance.

3.2 Financing Constraint Mechanism

Financing capacity is an important safeguard for firms' long-term sustainable development, and supply chain disruption risk tends to exacerbate financing constraints. This study analyzes this logic from two perspectives: information asymmetry and operational uncertainty.

From the perspective of information asymmetry, rising supply chain disruption risk weakens external investors' expectations

regarding a firm's ability to operate steadily. Because the risk shock exposes future procurement, production, and delivery activities to high uncertainty, firms' cash flow volatility increases[23]. Investors and creditors therefore become more conservative in assessing credit risk, leading to higher risk premiums, tighter credit conditions, or a reduced willingness to supply funds. From the perspective of operational uncertainty, after exposure to supply chain disruption risk, firms often need to invest additional resources in supplier search, qualification certification, and contract negotiation[4], which implies higher costs for supplier relationship restructuring and procurement channel reconstruction. In the short term, these adjustment expenditures crowd out working capital that could otherwise be used for R&D investment and capacity expansion. In addition, when external financing channels are constrained, firms find it difficult to smooth the liquidity needs required for procurement, inventory building, and production adjustments, placing further pressure on firm performance. These arguments suggest that supply chain disruption risk may be associated with intensified financing constraints and subsequent performance decline. Accordingly, this study proposes:

H2: An increase in supply chain disruption risk exacerbates financing constraints and is associated with a decline in subsequent firm performance.

3.3 Supply Chain Reconfiguration Mechanism

Rising supply chain disruption risk undermines the stability and continuity of supply relationships. In this context, firms often adjust their existing supply chain networks—for example, by searching for and screening alternative suppliers, or by changing and integrating supply channels—to prevent risks such as insufficient product supply and delivery delays caused by reliance on a single supply source[24]. From the perspective of resource dependence theory, firms tend to proactively adjust or reconfigure their supply chain network structures to avoid the risk of interrupted access to external resources and to enhance the redundancy and flexibility of their supply systems.

Supply chain reconfiguration, however, involves various transaction and adjustment costs during the short-term adjustment process. First, to respond to supply disruption risk, firms need to spend additional resources on searching, screening, evaluating, and verifying potential suppliers. This process generates high information search and evaluation costs and may also entail misjudgment risks arising from information asymmetry. Second, before a new supply relationship is established, firms must engage in price negotiation, contract bargaining, and the definition of rights and responsibilities, which further increases negotiation and contracting costs. Third, after a new supply relationship is established, firms must re-coordinate production scheduling, logistics distribution, quality control, and information system integration, during which transaction efficiency may decline and production adjustment pressures may arise. This entire reconfiguration process is unlikely to improve firm profitability in the short term; instead, it adds substantial extra costs. Existing studies also show that the switching costs associated with supply chain reconfiguration weaken firms' current profitability[8,25]. Supply chain disruption risk thus prompts firms to undertake supply chain reconfiguration, and the resulting transaction and adjustment costs may drag down subsequent firm performance. Accordingly, this study proposes:

H3: An increase in supply chain disruption risk is associated with a higher degree of supply chain reconfiguration, and supply chain reconfiguration is associated with lower subsequent firm performance through its short-term adjustment pressures.

4. Methods

4.1 Sample Selection and Data Sources

This study uses a sample of Chinese A-share listed firms on the Shanghai and Shenzhen Stock Exchanges from 2013 to 2023. The data were cleaned as follows: first, financial industry firms were excluded; second, firms designated as ST, *ST, and PT were excluded; third, observations with missing values for supply chain disruption risk, firm performance, or key control variables were deleted; fourth, continuous variables were winsorized at the 1st and 99th percentiles to mitigate the influence of extreme values. After these screening procedures, the sample contained 34,330 observations. In the two-way fixed-effects estimations controlling for firm and year effects, singleton groups were automatically dropped, yielding a final effective sample of 33,902 observations from 4,673 firms.

Supply chain disruption risk data were obtained from the measure constructed by Jiang et al.(2025)[4], which is based on the MD&A section of listed firms' annual reports and employs a word embedding model. Firm financial data were sourced

from the Wind and CSMAR databases. Supply chain reconfiguration data were constructed based on the top five suppliers disclosed by listed firms in the CSMAR database. The specific processing steps included standardizing and deduplicating supplier names, performing cross-year matching at the firm–year level, and measuring the degree of supply chain reconfiguration by the extent of change in supplier lists between adjacent years. Suppliers disclosed in anonymous form, such as "Supplier A," that could not be matched across years were excluded from the calculation of the supplier turnover rate. Observations that could not form valid cross-year matches did not participate in the supply chain reconfiguration pathway regressions, but this did not affect the baseline sample or other empirical tests.

4.2 Variable Definitions

4.2.1 Dependent Variable: Firm Performance (Roa)

This Study Measures Firm Performance as Net Profit Divided by Total Assets. A Higher Value Indicates Stronger Asset Profitability.

4.2.2 Core Explanatory Variable: Supply Chain Disruption Risk (Scdrisk)

Following Jiang Et Al.(2025)[4], This Study Uses a Word Embedding Model to Identify Supply Chain Disruption Risk-related Terms in the Md&A Section of Listed Firms' Annual Reports. The Ratio of Risk-related Word Frequency to Total Md&A Word Frequency Is Used to Measure the Degree of Supply Chain Disruption Risk Faced by a Firm, With Scdrisk2 Serving as the Baseline Measure. A Higher Value Indicates a Greater Degree of Supply Chain Disruption Risk Reflected in the Firm's Annual Report Text.

4.2.3 Mechanism Variables

Financing constraints (SA). This study uses the SA index proposed by Hadlock and Pierce(2010)[26] to measure financing constraints and takes the negative of the SA index as the financing constraint measure. A higher value indicates stronger financing constraints. To examine the temporal ordering between supply chain disruption risk, financing constraints, and subsequent firm performance, this study uses the one-period-ahead financing constraint measure (t+1).

Supply chain reconfiguration (SCR). Supply chain reconfiguration refers to the process by which firms adjust their existing supply chain relationships and resource allocation in response to supply chain risk. It typically includes multiple dimensions such as supplier substitution, procurement channel adjustment, logistics layout optimization, and inventory strategy changes. Due to data availability constraints, this study focuses on observable adjustment behavior on the supply side and measures supply chain reconfiguration by the supplier turnover rate.

The supplier turnover rate is constructed based on the top five suppliers disclosed in firms' annual reports. Specifically, the top five supplier information for each firm-year is first standardized, deduplicated, and matched across years. The overlap of supplier lists between adjacent years is then compared. S_{it} denote the set of valid top five suppliers for firm i in year t, and $S_{i,t-1}$ denote the set of valid top five suppliers in the previous year. The degree of Supply chain reconfiguration is defined as:

$$SCR_{it}=1-\frac{|S_{it}\cap S_{i,t-1}|}{|S_{it}|}$$

where $|S_{it}\cap S_{i,t-1}|$ represents the number of suppliers that a firm has in common across two consecutive years, and $|S_{it}|$ represents the number of valid suppliers in the current year. To ensure comparability across years, only observations for which the top five suppliers were fully disclosed in both adjacent years are retained. This indicator ranges from 0 to 1. A higher value indicates that a larger proportion of the previous year's suppliers did not continue into the current period, implying a greater degree of supplier relationship adjustment and more pronounced supply chain reconfiguration.

4.2.4 Control Variables

Firm Growth (Growth) Is Measured by the Revenue Growth Rate; Leverage (Lev) Is Measured by the Ratio of Total Liabilities to Total Assets; Firm Size (Size) Is Measured by the Natural Logarithm of Total Assets at the End of the Period; And Firm Age (Age) Is Measured by the Natural Logarithm of the Number of Days from the Firm's Establishment to the End of the Observation Year. Meanwhile, To Reduce Potential Mechanical Correlations between Contemporaneous Financial Characteristics and Firm Performance, All Control Variables Are Lagged by One Period.

4.3 Research Models

To examine the relationship between supply chain disruption risk and firm performance, its dynamic characteristics, and possible transmission pathways, this study constructs a two-way fixed-effects model with firm and year effects. All regressions control for firm fixed effects and year fixed effects, with standard errors clustered at the firm level. Control variables are lagged by one period, which mitigates reverse causality concerns to some extent and reduces contemporaneous mechanical correlations, thereby enhancing the robustness and reliability of the empirical results.

4.3.1 Baseline Model

To test the effect of supply chain disruption risk on contemporaneous firm performance, a two-way fixed-effects baseline model is constructed as follows:

$$ROA_{it}=\alpha_0+\alpha_1 SCDRisk_{it}+\gamma' Controls_{i,t-1}+\mu_i+\lambda_t+\varepsilon_{it} \quad (2)$$

where ROA_{it} denotes the operating performance of firm i in year t, $SCDRisk_{it}$ is the core indicator of the firm's contemporaneous supply chain disruption risk, $Controls_{i,t-1}$ is the set of control variables lagged by one period, μ_i is the firm fixed effect, λ_t is the year fixed effect, and ε_{it} is the random error term. If the coefficient α_1 is significantly negative, it indicates that supply chain disruption risk has a significant inhibitory effect on the firm's contemporaneous performance.

4.3.2 Dynamic Effect Model

To characterize the cross-period dynamic evolution of the impact of supply chain disruption risk on firm performance, and to overcome the limitation of a single contemporaneous regression, the contemporaneous and three-period-lagged supply chain disruption risk indicators are incorporated into the baseline model. The dynamic effect model is constructed as follows:

$$ROA_{it}=\delta_0+\delta_0^* SCDRisk_{it}+\sum_{k=1}^{3}\delta_k SCDRisk_{i,t-k}+\gamma' Controls_{i,t-1}+\mu_i+\lambda_t+\varepsilon_{it}$$

where δ_0^* represents the impact of supply chain disruption risk on the firm's contemporaneous performance, and δ_k (k=1,2,3) respectively reflect the lagged effects of risk exposure on firm performance from one to three periods after exposure, which are used to identify the dynamic evolution characteristics of the risk effect.

4.3.3 Mechanism Test Model

To further analyze the pathways through which supply chain disruption risk affects firm performance, this study adopts the temporal logic of "risk in period t — mechanism variable in period t+1— performance in period t+2", and specifies M^* as the mechanism variable, representing financing constraints (SA) and Supply chain reconfiguration (SCR), respectively. The following models are constructed:

$$M^*_{i,t+1}=\beta_0+\beta_1 SCDRisk_{it}+\phi' Controls^{M}_{i,t-1}+\mu_i+\lambda_t+\varepsilon_{it} \quad (5)$$

$$ROA_{i,t+2}=\theta_0+\theta_1 SCDRisk_{it}+\theta_2 M^*_{i,t+1}+\rho' Controls_{i,t-1}+\mu_i+\lambda_t+\varepsilon_{it} \quad (6)$$

where $M^*_{i,t+1}$ is the value of the mechanism variable for the firm in the next period. In the financing constraint pathway test, since the SA index is constructed from firm size and firm age, $Controls^{M}_{i,t-1}$ excludes the above constituent variables; the Supply chain reconfiguration pathway test includes all baseline control variables. If both β_1 and θ_2 are significant, it indicates that the mediation pathway is supported.

5. Results

5.1 Descriptive Statistics

Table 1 reports the descriptive statistics for the main variables. The mean value of firm performance is 4.741%, with a standard deviation of 7.380, indicating that although the overall profitability of the sample firms is moderate, there is considerable variation across firms. The mean value of supply chain disruption risk is 0.028, with a standard deviation of 0.011, ranging from 0.009 to 0.062, indicating identifiable variation in the degree of supply chain disruption risk across firms. Among the control variables, the mean value of operating revenue growth (Growth) is 11.692%, with a standard deviation of 32.484, reflecting significant heterogeneity in sample firm growth. The mean value of leverage (Lev) is 42.349%, the mean value of firm size (Size) is 22.303, and the mean value of firm age (Age) is 8.904, all within reasonable ranges.

Table 1 Descriptive statistics

Variable	N	Mean	SD	Min	Max
ROA	34,330	4.741	7.380	-23.988	27.236
SCDRisk	34,330	0.028	0.011	0.009	0.062
Growth	34,330	11.692	32.484	-60.796	157.502
Lev	34,330	42.349	20.481	5.351	91.074
Size	34,330	22.303	1.316	19.681	26.309
Age	34,330	8.904	0.294	7.962	9.533

5.2 Baseline Regression Results

Table 2 reports the baseline regression results. Column (1) controls only for firm and year fixed effects; the coefficient of supply chain disruption risk on firm performance is -42.234, significant at the 1% level. Column (2) adds lagged control variables, and the coefficient is -51.615, also significant at the 1% level. For every 1 percentage point increase in supply chain disruption risk, firm performance declines by approximately 0.516 percentage points on average. Relative to the sample mean of 4.741%, this effect represents approximately 10.9% of the mean, indicating economically non-negligible significance. Column (3) further adopts two-way clustered standard errors at the firm and year levels, and the coefficient remains -51.615, still statistically significant. These results support Hypothesis H1.

Regarding control variables, the coefficient of lagged revenue growth is significantly positive, indicating that firms with higher growth perform better. The coefficient of firm size is significantly negative, possibly reflecting organizational rigidity in large firms. The coefficient of firm age is also significantly negative, indicating that firms with longer listing histories have relatively weaker performance growth momentum.

Table 2 Baseline regression

	(1)	(2)	(3)
SCDRisk	-42.234***	-51.615***	-51.615**
	(8.518)	(8.437)	(15.932)
L1_Growthh		0.035***	0.035***
		(0.002)	(0.002)
L1_Lev		0.005	0.005
		(0.005)	(0.019)
L1_Size		-2.205***	-2.205***
		(0.154)	(0.515)
L1_Age		-5.122***	-5.122***
		(1.262)	(1.340)
_cons	5.926***	99.796***	99.796***
	(0.237)	(11.270)	(18.213)
Firm	Y	Y	Y
Year	Y	Y	Y
N	33,902	33,902	33,902
Adjusted R^2	0.397	0.429	0.429

Note: Standard errors are in parentheses. Columns (1)–(2) report firm-level clustered robust standard errors; Column (3) reports two-way clustered standard errors at the firm and year levels; *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

5.3 Robustness Tests

To test the sensitivity of the baseline results to variable measurement, sample specification, and industry-year common

shocks, this study conducts replacement variable tests, controls for industry × year fixed effects, and examines the pandemic boundary condition.

5.3.1 Replacing the Core Explanatory Variable.

Jiang Et Al.(2025)set Three Similarity Thresholds When Constructing the Supply Chain Disruption Risk Indicator: Scdrisk1 (Threshold 0.5), Scdrisk2 (Threshold 0.6), and Scdrisk3 (Threshold 0.7)4. the Previous Section Used Scdrisk2 as the Baseline Indicator. This Section Further Uses Scdrisk1 and Scdrisk3 for Replacement Tests. The Results Are Shown in Columns (1)–(2) of Table 3. the Regression Coefficients under Both Alternative Indicators Are Significantly Negative at the 1% Level, Indicating That the Core Conclusion Does Not Depend on the Specific Similarity Threshold.

5.3.2 Replacing the Dependent Variable.

Columns (3)–(4) of Table 3 Report the Estimation Results with Alternative Performance Measures. When Using the Net Profit Margin on Total Assets (Alternative Roa) as the Dependent Variable, The Coefficient Is -51.844 ($P < 0.01$); When Using Return on Equity (Roe) as the Dependent Variable, The Coefficient Is -138.520 ($P < 0.01$). These Results Indicate That Regardless of the Performance Measure Used, The Negative Effect of Supply Chain Disruption Risk Remains Significant, Suggesting That the Baseline Conclusion Is Not Sensitive to the Choice of Performance Indicator.

5.3.3 Controlling for Industry and Year Fixed Effects.

Supply Chain Risk and Firm Performance May Be Simultaneously Affected by Industry-year Common Factors Such as Industry Prosperity, Industry Policy Adjustments, Supply-demand Changes, And the Competitive Environment. To Reduce Omitted Variable Bias Caused by Such Common Shocks, This Study Controls for Industry × Year Fixed Effects in the Baseline Model. Column (5) of Table 3 Shows That after Absorbing Industry-year Common Shocks, The Regression Coefficient of Supply Chain Disruption Risk Remains -63.665 and Is Significant at the 1% Level. This Result Indicates That the Negative Association between Supply Chain Disruption Risk and Firm Performance Is Not Entirely Driven by Industry-level Annual Common Changes.

Table 3 Robustness tests

	Replacing the core explanatory variable		**Replacing the dependent variable**		**(5)**
	(1) SCDRisk1	**(2) SCDRisk3**	**(3) Alternative ROA**	**(4)ROE**	**Industry × Year FE**
SCDRisk1	-83.997***				
	(11.717)				
SCDRisk3		-111.144***			
		(21.533)			
SCDRisk			-51.844***	-138.520***	-63.665***
			(7.971)	(21.284)	(8.382)
L1_growth	0.035***	0.035***	0.032***	0.074***	0.031***
	(0.002)	(0.002)	(0.001)	(0.004)	(0.002)
L1_lev	0.005	0.005	-0.021***	-0.068***	0.010**
	(0.005)	(0.005)	(0.005)	(0.015)	(0.005)
L1_size	-2.216***	-2.195***	-1.986***	-3.389***	-2.106***
	(0.155)	(0.154)	(0.148)	(0.398)	(0.149)
L1_age	-5.042***	-5.178***	-5.124***	-3.641	-5.395***
	(1.262)	(1.263)	(1.171)	(2.813)	(1.278)
_cons	99.417***	99.459***	94.727***	117.840***	100.211***
	(11.274)	(11.280)	(10.528)	(25.511)	(11.406)
Firm	Y	Y	Y	Y	Y
Year	Y	Y	Y	Y	—
Industry×Year	N	N	N	N	Y
N	33902	33902	33902	33895	33895
Adjusted R^2	0.430	0.429	0.429	0.284	0.456

Note: Standard errors are in parentheses, firm-level clustered robust standard errors; *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

5.3.4 Pandemic Boundary Condition

Because the COVID-19 pandemic in 2020–2021 caused widespread and profound shocks to global supply chains, the supply chain disruption risk faced by firms may have different impacts before and after the pandemic. This study therefore includes the $\mathrm{SCDRisk}_{it} \times \mathrm{COVID}_{\mathrm{t}}$ interaction term in Equation (1) to test the difference in the impact of supply chain disruption risk on firm performance under the external shock of the pandemic. Because the main effect of the pandemic dummy variable may be absorbed by year fixed effects, this study replaces year fixed effects with industry × year interaction fixed effects for the baseline regression. Table 4 reports the results. In Column (1), the baseline slope (supply chain disruption risk coefficient) is -68.759 ($p < 0.01$), and the interaction term coefficient between risk and pandemic is 63.112 ($p < 0.01$). The interaction term coefficient is significantly positive, indicating that the impact of disruption risk on performance is significantly weakened during the pandemic. In Column (2), the non-pandemic sample (excluding 2020–2021), the supply chain disruption risk coefficient is -66.451 ($p < 0.01$), and its absolute value is larger than the full-sample baseline estimate. This difference may be related to policy support during the pandemic, changes in the financing environment, and strengthened firm risk response. This study does not directly test the specific channels.

Table 4 Pandemic boundary condition test

	(1) Pandemic slope difference	(2) Non-pandemic sample
SCDRisk	-68.759*** (8.637)	-66.451*** (9.408)
SCDRisk × COVID	63.112*** (7.390)	
L1_Growth	0.035*** (0.002)	0.035*** (0.002)
L1_Lev	0.006 (0.005)	-0.009 (0.006)
L1_Size	-2.186*** (0.153)	-1.935*** (0.159)
L1_Age	-5.060*** (1.256)	-4.543*** (1.247)
_cons	98.853*** (11.226)	89.462*** (11.110)
Controls	Y	Y
Year	Y	Y
Industry	Y	Y
N	33902	26278
Adjusted R²	0.431	0.415

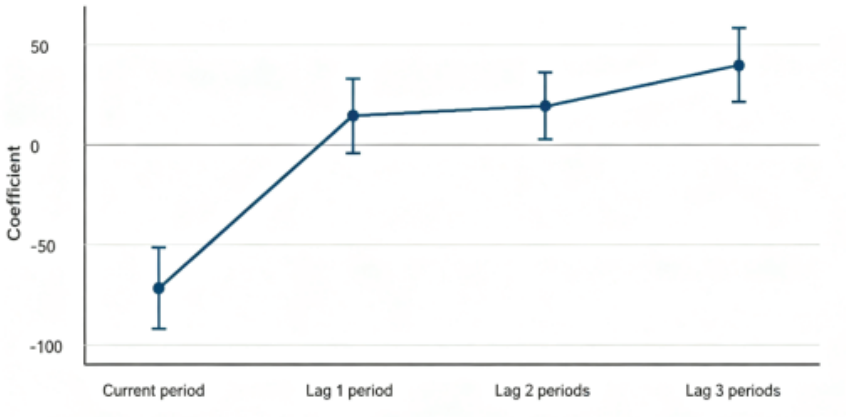
Note: Standard errors are in parentheses, firm-level clustered robust standard errors; *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

5.4 Dynamic Effect Analysis

To investigate the cross-period dynamic characteristics of the impact of supply chain disruption risk on firm performance,

this study uses lagged firm characteristics, controls for firm and year fixed effects, and clusters standard errors at the firm level. Figure 1 presents the results. Supply chain disruption risk has a significant negative effect on contemporaneous firm performance, indicating that supply disruption expectations or actual supply relationship disturbances may lead to procurement disruptions, delivery delays, production adjustments, and rising transaction costs in the short term, thereby reducing firm performance. The first lag term of risk turns positive but does not reach conventional significance levels; the second and third lag terms are significantly positive. These results indicate that the impact of supply chain disruption risk on firm performance exhibits a dynamic pattern of "contemporaneous damage—medium-term recovery." This pattern may arise because firms gradually absorb the shock through financing arrangements, supplier adjustments, and other operating strategies after risk exposure. It should be noted that the supply chain reconfiguration pathway test reveals short-term adjustment pressure during the reconfiguration process, whereas the dynamic regression reflects the overall performance change of firms under the combined effect of multiple adjustments. The two are not contradictory.

Figure 1. Joint dynamic effect of SCDRisk on ROA.



5.5 Mechanism Tests

5.5.1 Financing Constraints

Because the financing constraint index is composed of firm size and firm age, to avoid mechanical correlation, Columns (1) and (2) do not include size and age control variables. Table 5 reports the results. Column (1) uses t+1 period financing constraints as the dependent variable; the regression coefficient of supply chain disruption risk is 0.329, significant at the 1% level, indicating that an increase in supply chain disruption risk significantly exacerbates subsequent financing constraints. Column (2) uses t+2 period firm performance as the dependent variable and simultaneously includes supply chain disruption risk and t+1 period financing constraints. The regression coefficient of financing constraints on t+2 period firm performance is -4.378, significant at the 1% level, indicating that increased financing constraints significantly reduce subsequent firm performance. This result provides evidence consistent with theoretical expectations for the transmission pathway of "risk increase—financing constraint intensification—subsequent performance decline," supporting Hypothesis H2.

5.5.2 Supply Chain Reconfiguration

Column (3) of Table 5 uses t+1 period supply chain reconfiguration as the dependent variable. The regression coefficient of supply chain disruption risk is 0.272, significant at the 1% level, indicating that an increase in supply chain disruption risk significantly increases subsequent supply chain reconfiguration. Column (4) uses t+2 period firm performance as the dependent variable and simultaneously includes contemporaneous supply chain disruption risk and t+1 period supply chain reconfiguration. The regression coefficient of t+1 period supply chain reconfiguration on t+2 period firm performance is -3.986, significant at the 1% level. That is, the higher the degree of supply chain reconfiguration, the worse the subsequent firm performance. This result provides evidence consistent with theoretical expectations for the transmission pathway of "risk increase—supply chain reconfiguration increase—subsequent performance decline," supporting Hypothesis H3.

It should be particularly noted that the positive coefficients of supply chain disruption risk in Columns (2) and (4) of Table 5 are conditional correlation coefficients obtained under different samples, different time settings, and after controlling for mechanism variables. These coefficients are not directly comparable to the total effect in the baseline regression (-51.615),

and it cannot be inferred that supply chain disruption risk improves future performance. Their economic meaning should be understood as the residual association between risk and performance after given financing constraint levels and supply chain reconfiguration degrees. The core focus of this study is the significant negative correlation between mechanism variables (SA and SCR) and subsequent performance, rather than the direction of the second-stage risk coefficient.

Table 5 Mechanism test results

	(1) SA	(2) ROA	(3) SCR	(4) ROA
SCDRisk	0.329*** (0.102)	42.310*** (9.078)	0.272*** (0.063)	31.935*** (8.831)
SA		-4.378*** (1.369)		
SCR				-3.986*** (1.013)
L1_Growth	Y	Y	Y	Y
L1_Lev	Y	Y	Y	Y
L1_Size	N	N	Y	Y
L1_Age	N	N	Y	Y
Firm	Y	Y	Y	Y
Year	Y	Y	Y	Y
N	21,759	21,759	23,854	23,854
Adjusted R²	0.974	0.420	0.974	0.439

Note: Standard errors are in parentheses, firm-level clustered robust standard errors; *, **, and *** denote significance at the 10%, 5%, and 1% levels, respect

6. Conclusions

This study uses a sample of Chinese A-share listed firms from 2013 to 2023 and employs a two-way fixed-effects model with firm and year fixed effects to examine the impact mechanisms and cross-period dynamic characteristics of supply chain disruption risk on firm performance. The main conclusions are as follows.

First, supply chain disruption risk has a significant inhibitory effect on contemporaneous firm performance. Baseline regression results show that for every 1 percentage point increase in supply chain disruption risk, firm performance declines by approximately 0.516 percentage points on average. This conclusion remains robust after replacing the core explanatory and dependent variables and controlling for industry and year fixed effects. Second, there is a cross-period dynamic association between risk shocks and performance. Specifically, the negative impact is strongest in the contemporaneous period, and recovery characteristics appear in periods 2–3 after the shock. Third, intensified financing constraints and increased supply chain reconfiguration may be important transmission channels through which supply chain disruption risk affects subsequent firm performance. Fourth, the negative impact of supply chain disruption risk on performance was significantly weakened during the pandemic.

Based on these conclusions, this study proposes the following policy implications.

First, build a supply chain risk early-warning platform. Relevant departments should jointly build a supply chain disruption risk monitoring system based on big data platforms, promptly identify and issue warnings about supply disruption signals in key components and core technology fields, and provide forward-looking risk warnings and emergency guidance for firms.

Second, broaden firm financing channels to mitigate risk shocks. For firms exposed to supply chain disruption risk, liquidity support with matching maturities and supply chain financial services should be provided to reduce financing constraint pressure during the adjustment period. Financial institutions can explore credit assessment models based on supply chain relationships to provide more convenient financing support for small and medium-sized enterprises.

Third, reduce switching costs in the supply chain reconfiguration process. The government can build public service platforms for supplier certification, quality inspection, and alternative matching to reduce information search and qualification certification costs for firms during supply chain reconfiguration, and to shorten the running-in period for supplier switching.

Fourth, guide firms to build resilient supply chains. Encourage firms to carefully evaluate the costs and benefits of diversified procurement, key input backup, and emergency coordination mechanisms based on their own industry characteristics to shorten the adjustment period after risk shocks. At the same time, digital tools can be used to improve supply chain visibility and risk warning capabilities.

This study has several limitations. First, the textual risk indicator may simultaneously reflect objective risk and disclosure tendency. Second, supply chain reconfiguration is only characterized by the supplier turnover rate and does not yet cover other supply chain adjustment methods such as logistics, inventory, customer relationships, and cross-border procurement. Future research can combine industry input-output linkages, supply chain transaction networks, or exogenous policy shocks to strengthen identification design. Third, although firm fixed effects, year fixed effects, and lagged control variables help reduce the influence of some omitted factors and contemporaneous associations, they cannot completely exclude endogeneity concerns caused by reverse causality, unobserved shocks, and textual disclosure tendency. Therefore, the conclusions of this study mainly reflect the association between the textual representation of supply chain disruption risk and firm performance.

Funding

This work was supported by the National Natural Science Foundation of China General Program “Research on the Cascading Brittleness Mechanism of the Digital–Real Dependency Structure of Strategic Industrial Chains under Asymmetric Science and Technology Regulation and the Evolutionary Governance of Collaborative Anti-Fragility” (Project No. 7267403); the Guangdong Provincial Philosophy and Social Science Planning Project “Research on the Resilience Reshaping Path and Policy Risk Response Mechanism of Manufacturing Digital Twin Supply Chains Facing Global Trade Fluctuations—From the Perspective of Intelligent Manufacturing Digital Resilience Ecology” (Project No. GD26CYJ43); the Guangdong Provincial Philosophy and Social Science Planning Project “Research on the Identification, Impact, and Countermeasures of Supply Chain Interruption Risks in Guangdong's Electronic Information Industry under the Background of U.S. 'Decoupling and Breaking Chains' toward China” (Project No. GD24XGL033); and the Guangdong Provincial Department of Education Discipline Research Capacity Enhancement Project “Research on the Risk Sharing Mechanism and Control of Supply Chain Finance for Micro, Small, and Medium-sized Enterprises Driven by Digital Platforms” (Project No. 2024ZDJS077).

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

Reference

[1] Hendricks, K. B., & Singhal, V. R. (2005a). Association between supply chain glitches and operating performance. Management Science, 51(5), 696-711.

[2] Hendricks, K. B., & Singhal, V. R. (2005b). An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm. Production and Operations Management, 14(1), 35-52.

[3] Baghersad, M., & Zobel, C. W. (2021). Assessing the extended impacts of supply chain disruptions on firms: An empirical study. International Journal of Production Economics, 231, 107862.

[4] Jiang, W., Wang, N., & Cao, S. P. (2025). Measurement and application of supply chain disruption risk: An analysis based on word embedding model. Nankai Business Review, 28, 108-119. [in Chinese]

[5] Ang, E., Iancu, D. A., & Swinney, R. (2017). Disruption risk and optimal sourcing in multitier supply networks. Management Science, 63(8), 2397-2419.

[6] Liu, J. Y. (2022). Supply chain disruption: Causes, consequences, and countermeasures—A literature review from the perspective of supply chain governance. Journal of Zhongnan University of Economics and Law, 130-144. [in Chinese]

[7] Ekanayake, E. M. A. C., Shen, G. Q., & Kumaraswamy, M. M. (2023). A fuzzy synthetic evaluation of capabilities for improving supply chain resilience of industrialised construction: A Hong Kong case study. Production Planning &

Control, 34(7), 623-640.

[8] Wang, H. C., & Zhou, Z. X. (2025). Modeling and simulation of disruption risk propagation trends in complex supply chain networks. Complex Systems and Complexity Science, 22, 56-68. [in Chinese]

[9] Nikolopoulos, K., Punia, S., Schäfers, A., Tsinopoulos, C., & Vasilakis, C. (2021). Forecasting and planning during a pandemic: COVID-19 growth rates, supply chain disruptions, and governmental decisions. European Journal of Operational Research, 290(1), 99-115.

[10] Chen, Y., Zhang, S., & Miao, J. (2023). The negative effects of the US–China trade war on innovation: Evidence from the Chinese ICT industry. Technovation, 123, 102734.

[11] Luo, J. Q., Pan, R. R., & Yang, Z. C. (2023). Manufacturing enterprise servitization, R&D innovation investment and firm performance—An empirical study based on technology-intensive enterprises. Management Review, 35, 116-125. [in Chinese]

[12] Zhang, K. Y., Wang, Q. J., & Shi, R. B. (2025). The impact of path-dependent strategy and organizational resilience capability matching on firm technological innovation performance in the context of digital transformation. Science and Technology Progress and Policy, 42, 112-123. [in Chinese]

[13] Yi, L. X., Wu, F., & Chang, X. (2021). Firm digital transformation process and main business performance—Empirical evidence from textual identification of Chinese listed firms' annual reports. Modern Finance and Economics, 41, 24-38. [in Chinese]

[14] Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. Strategic Management Journal, 31(3), 306-333.

[15] Du, Y. Z., Zhang, Y. L., & Ren, B. (2012). Show or hide competitive advantage: The U-shaped relationship between new venture competitor orientation and performance and the mediating role of organizational legitimacy. Management World, 96-107. [in Chinese]

[16] Lü, Q., Li, B., & Ma, Y. N. (2024). The impact of entity list events on the performance of Chinese high-end manufacturing firms. Studies in Science of Science, 42(6), 1152-1164. [in Chinese]

[17] Baosiqintana, & Qi, E. S. (2018). Construction of performance evaluation system for lean design of manufacturing systems. Statistical Decision, 34, 174-177. [in Chinese]

[18] Xie, K., Wang, T., & Dai, J. (2017). The impact of sustainable supply chain management practices on firm performance: An empirical study based on China. Mathematical Statistics and Management, 36(4), 693-702. [in Chinese]

[19] Orazalin, N., & Baydauletov, M. (2020). Corporate social responsibility strategy and corporate environmental and social performance: The moderating role of board gender diversity. Corporate Social Responsibility and Environmental Management, 27(4), 1664-1676.

[20] Valero-Gil, J., Surroca, J. A., Tribo, J. A., Gutierrez, L., & Montiel, I. (2023). Innovation vs. standardization: The conjoint effects of eco-innovation and environmental management systems on environmental performance. Research Policy, 52(4), 104737.

[21] Frieske, B., & Stieler, S. (2022). The “semiconductor crisis” as a result of the COVID-19 pandemic and impacts on the automotive industry and its supply chains. World Electric Vehicle Journal, 13(10), 189.

[22] Wiedmer, R., Rogers, Z. S., Polyviou, M., Mena, C., & Chae, S. (2021). The dark and bright sides of complexity: A dual perspective on supply network resilience. Journal of Business Logistics, 42(3), 336-359.

[23] Ivanov, D. (2024). Cash flow dynamics in the supply chain during and after disruptions. Transportation Research Part E: Logistics and Transportation Review, 185, 103526.

[24] Jing, Y., Liu, W., Liu, Q. Q., et al. (2025). Research on supply chain response planning for coping with supply interruption under emergent events. Chinese Journal of Management Science, 33, 123-135. [in Chinese]

[25] Chen, W., & Fan, Y. Z. (2024). Firm supply chain risk perception and cooperation relationship stability. Management World, 40, 209-228. [in Chinese]

[26] Hadlock, C. J., & Pierce, J. R. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. Review of Financial Studies, 23(5), 1909-1940.