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The Impact of Supply Chain Concentration on a Company's Risk-Taking Capacity

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Abstract: A supply chain is a network structure formed by linking various stakeholders in modern production processes. How, then, does the distribution relationship between upstream and downstream segments of the supply chain affect the enterprise itself? Based on resource dependence theory, this study examines the mechanism through which supply chain concentration influences a firm's risk-taking level using a sample of Chinese A-share listed companies from 2008 to 2023. The results indicate that supply chain concentration enhances a firm's risk-taking level, a conclusion that remains valid after robustness tests. Mechanism tests reveal that supply chain concentration enhances risk-taking levels by reducing the firm's own information transparency. Heterogeneity analysis indicates that the effect of supply chain concentration on increasing risk-taking is more pronounced in state-owned enterprises and firms not audited by the Big Four. These findings provide micro-level evidence at the firm level for theoretical research in supply chain-related fields and offer practical guidance for risk investment and the management of related business operations.

1. Introduction

Supply chains play a foundational and connecting core role in modern markets. Ensuring the stability and security of supply chains is an objective requirement of our times and a key measure for maintaining the resilience of the economic system and enhancing the stability of economic operations. Therefore, exploring the relationships between upstream and downstream entities within the supply chain is of great significance for enterprises to allocate resources rationally, reduce efficiency losses, and mitigate related risks. Among Chinese enterprises, a large number of transactions take place within networks of connected stakeholders rather than through open markets; these transactions are based on mutual trust and dependence (Li Zengquan, 2017)[1]. Consequently, relational transactions may lead to firms becoming dependent on long-term suppliers and customers, while also generating a large amount of proprietary information that is difficult to share or disclose to the outside world. However, within the supply chain, relational transactions can facilitate effective information exchange when firms select customers or suppliers with whom they have strategic partnerships or mutual familiarity (Chang Yuxuan et al., 2025) [2].

The degree of supply chain concentration represents the strength of interconnections among related firms within the chain, including customer concentration and supplier concentration. It reflects the relative power of upstream and downstream firms in the supply chain, the ease of accessing resources,

and the number and distribution of collaborative relationships (Fu et al., 2024) [3]. Existing literature has noted the dual effects of supply chain concentration on firms. Previous research has primarily focused on the impacts of chain concentration on firms. On the one hand, as the degree of supply chain concentration increases, firms not only enhance their innovation levels but also become more inclined to engage in breakthrough innovation (Jiang et al., 2024; Jiang Wei et al., 2019) [4] [5]; simultaneously, it helps reduce audit expenses to facilitate integration within the supply chain; On the other hand, supply chain concentration can also undermine corporate independence, sustainable profitability, and risk resilience, and may even compromise the authenticity of relevant data (Sun Yi et al., 2023) [6]; furthermore, it significantly increases the risk of a stock price crash (Gao Zhennan et al., 2023) [7].

Risk refers to the impact that events likely to occur under conditions of uncertainty may have on an organization. In the course of business operations, risk is ever-present. A firm's risk-taking reflects its selection of investment projects during the investment process; it indicates the extent to which the firm is willing to assume greater risk in pursuit of higher returns, while also measuring the volatility of cash flows and the uncertainty of expectations associated with the investment (Acharya VV et al., 2011) [8]. In practice, the concept of net present value (NPV) is commonly used to assess whether an investment project is efficient and reasonable. In fact, both the costs incurred in procurement and the revenues generated from product sales constitute the core components of a company's daily cash flow. The stability and availability of cash inflows and outflows determine the feasibility of an investment. Therefore, in academic research, a higher level of risk-taking implies that managers are less likely to reject high-risk investment projects with a positive expected NPV (Li Wengui et al., 2012) [9]. so ideally, managers should select all investment projects with positive expected NPV to increase capital inflows. However, in practice, investment decisions are often influenced by a combination of factors. For instance, the richness of a CEO's personal and professional background can elevate a firm's risk-taking level (He Ying et al., 2019) [10]. Scholars have also found that state-owned enterprises exhibit significantly lower risk-taking levels than non-state-owned enterprises (Yu Minggui et al., 2013) [11]. corporate social networks in the market, a symmetric value-added tax system, and increased social media attention can all positively promote risk-taking levels (Zhang Min et al., 2015; Wu Yili et al., 2022; Shen Danlin et al., 2025) [12] [13] [14]. The findings of the aforementioned studies all illustrate the constraints faced by firms in selecting appropriate investment projects.

To validate the above analysis, we conducted an empirical study using A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2008 to 2023 to examine the impact of supply chain concentration on firms' risk-taking levels. This study makes the following contributions: First, it reveals the mechanism through which supply chain concentration influences risk-taking levels from a supply chain perspective, thereby enriching research on the determinants of risk-taking levels, expanding the theoretical scope of stakeholders in relational transactions, and supplementing existing literature; Second, by examining the channel of information transparency, this study elucidates its mediating role between supply chain concentration and corporate risk-taking.

2. Theoretical Analysis and Research hypotheses

2.1 Supply Chain Concentration and Corporate Risk-Taking Levels

Resource dependence theory posits that no organization is self-sufficient; all organizations engage in mutual exchange with their environment. Suppliers and customers along the supply chain possess resources that complement those of the firm, making them the primary targets for the firm's external sourcing of resources. When relationships within the supply chain become more concentrated, "resource dependence" arises—that is, the higher the concentration, the closer the relationships between upstream and downstream partners and the firm.

Within the "supplier–enterprise–customer" relationship chain, a more concentrated supplier base offers advantages such as lower transaction costs, reduced collaboration risks, and increased bargaining power for the enterprise, which helps mitigate the risk of supply chain disruptions. For customers, enterprises must fully understand their preferences to secure long-term funding sources, thereby generating surplus capital for investment activities. Enterprises with a higher risk-taking tolerance inevitably face a certain degree of financial and operational risk when making investments; however, this also increases their operating profits and shareholder wealth, thereby strengthening their long-term competitive advantage. Although supply chain concentration significantly reduces investment efficiency—an effect manifested in both overinvestment and underinvestment (Zhang Zhaohui et al., 2022) [15]—venture capital can also elevate a firm's risk-taking capacity (Shan Zhicheng et al., 2022; Liu E-ping et al., 2021) [16] [17]. When facing a high degree of environmental uncertainty, firms will engage more actively with existing suppliers and customers to maintain stable cooperative relationships. Through information exchange and close collaboration, this to some extent increases the firm's supply chain concentration, thereby raising its risk-taking level (Dai Shusong et al., 2020) [18]. On the other hand, a more concentrated supply chain indicates that the firm has a sustained incentive to establish close relationships with suppliers or customers, which serves as a positive signal to stakeholders that the firm is in a healthy operational state. From this perspective, managers may seize high-risk, high-return investment opportunities with positive net present value, which is more conducive to obtaining useful information from customers and thereby improving corporate performance. Consequently, there is a greater tendency to pursue high-risk, high-return investment decisions (Bao Xiaolan et al., 2020) [19]. Existing research on the indirect pathways influencing corporate risk-taking levels indicates that an increase in supply chain concentration can significantly enhance this phenomenon (Sun et al., 2024) [20].

Therefore, based on the above analysis, the following research hypothesis is proposed:

H1: Supply chain concentration can increase a firm's risk-taking level.

2.2 The Mechanism of Information Transparency

The bullwhip effect in supply chains refers to the phenomenon where fluctuations in demand from firms at downstream nodes lead to decisions made by upstream firms based on miscommunication, resulting in fluctuations that deviate significantly from actual conditions. The root cause of this risk is information risk (Xie Kefan et al., 2003) [21]; that is, this phenomenon arises from distortions in the transmission of information within the supply chain. If a firm establishes relatively concentrated relationships with its upstream and downstream partners in the supply chain, there is reason to believe that the firm will have a reduced incentive to disclose information to the outside world. In other words, to a certain extent, the firm no longer needs to fully disclose its information to potential stakeholders beyond its regular suppliers and customers, as it already possesses relatively stable procurement and sales channels.

According to prior literature, the higher the supply chain concentration, the more likely a firm is to face negative consequences from non-compliance with information disclosure and transfer regulations. This is because the exchange of private information within these relationships reduces both the firm's incentive to disclose information publicly and the consequences of non-compliance with public disclosure requirements (Chen Xichan et al., 2021) [22]. If information disclosure is not conducted in a reasonable and compliant manner, it is difficult to ensure accuracy and transparency. Therefore, we predict a negative correlation between supply chain concentration and corporate information transparency. Companies possess a wide variety of information. Transparent financial reporting and information disclosure provide the market with richer and more accurate information about corporate characteristics, which helps investors predict future events (Xin Qingquan et al., 2014)

[23]. Consequently, the impact of information transparency on risk-taking can be demonstrated from the perspectives of accounting information comparability, analyst coverage, and investor information interaction. The lower the comparability of accounting information, the greater the number of analysts covering the firm, and the less investor information interaction there is, the greater the impact on the firm's risk-taking level, resulting in higher risk-taking (Dong Zhu et al., 2021; Yang Daoguang et al., 2019; Chen Shuai et al., 2024) [24] [25] [26]. Information opacity prevents supply chain members from fully understanding what is occurring in other segments of the supply chain. Due to the inability to share information, inaccuracies in information flow upstream along the supply chain, artificially increasing risks throughout the entire supply chain (Ma Zujun et al., 2003) [27]. To address this issue, implementing information sharing across the entire supply chain process and creating a transparent supply chain environment not only achieves information transparency but also facilitates effective coordination among participants, which is also the key to the efficient operation of supply chain management (Zhang Wenyan, 2009) [28]. Therefore, there is a negative correlation between predictive information transparency and a firm's risk-taking level. In summary, the following research hypothesis is proposed:

H2: Supply chain centralization increases a firm's risk-taking level by reducing information transparency.

3. Research design

3.1 Sample Selection

This study uses data from A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2008 to 2023 as its research sample. The relevant variable data were processed as follows: companies with ST or PT status and those with missing data were excluded; companies that went public or were delisted during the year were excluded; and companies in the financial and real estate sectors were excluded. Ultimately, this study obtained 27,319 firm-level annual observations from 4,666 listed companies. To mitigate the impact of outliers, the relevant continuous variables were trimmed at the top and bottom 1%. Firm-level data, as well as data on upstream and downstream suppliers and customers of listed companies, were sourced from Guotai An (CSMAR). The standard errors used in the analysis were clustered at the firm level.

3.2 Model Development

Independent Variable: Supply Chain Concentration (Supply/Customer). This study measures supply chain concentration using supplier concentration and customer concentration. Customer concentration is calculated as the proportion of sales to the top five customers relative to total annual sales. Subsequently, we use the respective proportions of the largest procurement amount and the largest sales amount for each of these top five customers as alternative explanatory variables for supply chain concentration to conduct robustness tests.

Dependent Variable: Firm Risk-Taking Level (Risk). Referring to the research by He Ying et al. (2019) [10], we calculate Adj_Roa by subtracting the annual industry average from the company's ROA to mitigate the effects of industry and business cycles. Since the average tenure of Chinese executives is three years, we use a three-year observation period (from year t to year t+2) to calculate the standard deviation of the industry-adjusted ROA (Adj_Roa), denoted as Risk, on a rolling basis. Subsequently, we conduct robustness regression tests using the standard deviation calculated over a five-year rolling period as a substitute for the dependent variable.

$$Adj\_Roa_{i,t} = \frac{EBIT_{i,t}}{ASSET_{i,t}} - \frac{1}{X}\sum_{k=1}^{X}\frac{EBIT_{i,t}}{ASSET_{i,t}} \quad (1)$$

$$Risk_{i,t} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(Adj\_Roa_{i,t} - \frac{1}{T}\sum_{t=1}^{T}Adj\_Roa_{i,t}\right)^2}, T = 3 \quad (2)$$

Moderating variable: Information transparency (TRANS). Based on the research by Xin Qingquan (2014) [23], five relevant indicators were selected: (1) the earnings quality indicator calculated using the adjusted model; (2) the disclosure evaluation scores assigned by the Shenzhen Stock Exchange to listed companies on the Shenzhen market for each year; (3) the number of analysts covering the company; ④ the accuracy of analysts' earnings forecasts; ⑤ whether the company engaged one of the Big Four international firms as its auditor for the annual report in the given year. The composite indicator TRANS, constructed on this basis, is the average of the percentile ranks of these five variables. A higher TRANS value indicates greater corporate information transparency.

Control Variables: Based on relevant research, the following firm-level variables were selected as controls: firm size (Size), ownership type (SOE), return on assets (ROA), accounts receivable ratio (Rec), debt-to-equity ratio (Lev), revenue growth rate (Growth), largest shareholder's ownership stake (Top1), board size (Board), dual-role arrangement (Dual), Tobin's Q (TobinQ), and years since establishment (FirmAge). Industry fixed effects and year fixed effects were also included. The sources and definitions of the relevant variables are shown in Table 1.

Table 1. Variable Definitions and Measurement Methods

Variable Type	Variable Name	Variable Symbol	Measurement Method
Dependent Variable	Corporate Risk-Taking	Risk	Standard deviation of ROA calculated using a rolling window of three years per observation period.
Independent Variables	Supply Chain Concentration	Customer	Proportion of sales revenue from the top five customers to total annual sales revenue.
		Supply	Proportion of procurement amount from top five suppliers to total annual procurement amount.
Mediating Variable	Information Transparency	TRANS	Information transparency index constructed from five relevant variables.
Control Variables	Firm Size	Size	Natural logarithm of total assets for the year.
	Ownership Type	SOE	Takes the value of 1 for state-owned enterprises, and 0 otherwise.
	Return on Assets	ROA	Net profit for the year divided by the average balance of total assets.
	Leverage	Lev	Year-end total liabilities divided by year-end total assets.
	Revenue Growth Rate	Growth	Current year's operating revenue divided by previous year's operating revenue minus 1.
	Largest Shareholder Ratio	Top1	Number of shares held by the largest shareholder divided by total number of shares.
	Board Size	Board	Natural logarithm of the number of directors on the board.
	CEO Duality	Dual	Takes the value of 1 if the Chairman and General Manager are the same person, and 0 otherwise.
	Tobin's Q	TobinQ	(Market value of outstanding shares + Number of non-tradable shares × Net assets per share + Book value of liabilities) / Total assets.
	Firm Age	FirmAge	Natural logarithm of (current year - year of incorporation + 1).

This paper primarily examines the impact of supply chain concentration on a firm's risk-taking

level. To test the hypotheses, the following model is established for regression analysis:

$$Risk_{i,t} = \beta_0 + \beta_1 \times Supply / Customer_{i,t} + \beta_2 \times Controls + Industry + Year + \varepsilon_{i,t} \quad (3)$$

In this model, the subscripts i and t denote the firm and the year, respectively; Risk represents the firm's risk-taking level; Supply/Customer represents the degree of concentration among suppliers and customers; Controls denotes the set of control variables; Industry and Year represent industry fixed effects and year fixed effects, respectively; and ε is the random error term. If the β1 coefficient in this model is significantly positive, it confirms that supply chain concentration can effectively increase the firm's risk-taking level.

4. Empirical analysis

4.1 Descriptive stats

This paper conducts a descriptive statistical analysis of the key variables in the model under consideration. The results are shown in Table 2 below. The maximum value of corporate risk-taking (Risk) is 0.233, the minimum is 0.0017, the mean is 0.0316, and the standard deviation is 0.0387, indicating that there are significant variations in the risk-taking levels of China's listed companies at present; From a supply chain perspective, the maximum concentration ratio for customers is 0.987, while the minimum is only 0.013; the maximum concentration ratio for suppliers reaches 0.952, and the minimum is only 0.0514. Both values are far removed from the mean and standard deviation, indicating that, overall, the concentration of supply chains among listed companies exhibits a pronounced degree of polarization.

Table 2. Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Max	Min
Risk	27319	0.0316	0.0387	0.2330	0.0017
Customer	27319	0.3190	0.2250	0.9870	0.0130
Supply	27319	0.3470	0.1980	0.9520	0.0514
Size	27319	22.1500	1.2750	26.4500	19.4100
SOE	27319	0.3440	0.4750	1.0000	0.0000
Lev	27319	0.4060	0.2000	0.9270	0.0274
ROA	27319	0.0473	0.0634	0.2550	-0.3750
Growth	27319	0.1830	0.3860	3.8080	-0.6540
Dual	27319	0.3030	0.4590	1.0000	0.0000
Top1	27319	0.3420	0.1470	0.7580	0.0802
Board	27319	2.1170	0.1960	2.7080	1.6090
TobinQ	27319	2.0480	1.3390	16.6500	0.8040
FirmAge	27319	2.8920	0.3410	3.6110	1.0990

4.2 Baseline Regression

Columns (1) and (3) of Table 3 present the empirical results regarding the relationship between a firm's risk-taking level and supply chain concentration under a two-way fixed-effects model without control variables. Columns (2) and (4) present the regression results after incorporating control variables. The results indicate that, without controlling for covariates, the level of risk-taking is significant at the 1% level. After controlling for covariates, both supplier concentration and customer concentration are significant at the 1% level in relation to the firm's risk-taking level, with regression

coefficients of 0.004 and 0.006, respectively. This suggests that supply chain concentration promotes an increase in the firm's risk-taking level, thereby providing firms with greater motivation to engage in investment activities, which confirms Hypothesis H1.

Table 3. Benchmark Regression

Variable	(1)	(2)	(3)	(4)
Customer	0.009***	0.004**		
	(5.03)	(2.47)		
Supply		-0.000	0.011***	0.006***
		(-1.33)	(5.88)	(3.45)
Controls	NO	YES	NO	YES
_ cons	0.029***	0.067***	0.029***	0.057***
	(43.82)	(8.28)	(35.31)	(5.84)
Industry/Year	YES	YES	YES	YES
Obs	27319.000	27319.000	27319.000	27319.000
Adjusted R^2	0.065	0.162	0.066	0.163

4.3 Robustness Tests

4.3.1 Substitution of core explanatory variables

We selected the proportion of the largest supplier's procurement value and the proportion of the largest customer's sales value as alternative explanatory variables for supply chain concentration and reran the regression. The results are shown in columns (1) and (2) of Table 4. After substituting these measures, the regression results remain consistent with the baseline regression results presented earlier.

4.3.2 Replacing the core dependent variable

To enhance the reliability of the research conclusions, following the approach of Hong Jinming et al. (2023) [29], the risk-taking metric was replaced with the standard deviation of the return on total assets over a five-year period (from t-2 to t+2), and the regression was rerun. The results are shown in Table 4. The regression results remain consistent with the baseline results presented earlier in this paper; therefore, the conclusions are robust.

Table 4. Results of Robustness Tests

Variable	(1) Alternative Independent Variable		(2) Alternative Dependent Variable	
Customer1	0.007**			
	(2.09)			
Supply1		0.008**		
		(2.12)		
Customer			0.013***	
			(4.44)	
Supply				0.008***
				(2.83)
Controls	YES	YES	YES	YES
_ cons	0.075***	0.074***	0.036***	0.098***
	(6.25)	(6.13)	(32.77)	(7.36)
Industry/Year	yes	yes	yes	yes
Obs	15532.000	15532.000	15532.000	15532.000
Adjusted R^2	0.194	0.194	0.100	0.219

4.4 Endogeneity Tests

4.4.1 Instrumental Variables Method

To mitigate potential reverse causality and endogeneity issues in this study, following the approach of Zhang Nan et al. (2025) [30], we selected one-period lagged supplier concentration and customer concentration as instrumental variables and conducted a regression using the 2SLS method. The results are shown in Table 5. As shown in the table, in the first-stage regression results presented in columns (1) and (3), the impact of the instrumental variables on the endogenous variables is significant, satisfying the correlation assumption. The second-stage regression results in columns (2) and (4) indicate that the level of risk-taking by firms is significant at both the 1% and 5% significance levels, with positive regression coefficients. This suggests that even after accounting for endogeneity, the concentration relationships among firms in the supply chain still significantly increase the level of risk-taking, and the conclusions of this study remain robust.

Table 5. Results of the instrumental variables test

Variable	(1) Customer	(2) Risk	(3) Supply	(4) Risk
iv1	0.879***			
	(0.004)			
iv2			0.814***	
			(0.006)	
Customer		0.004**		
		(0.002)		
Supply				0.005**
				(0.003)
Obs	26895	26895	21493	21493
R^2		0.102		0.118
F	43183.818	60.984	18585.539	63.228
CD Wald F	102494.810		44230.417	
SW S stat.	5.951		4.358	

4.4.2 Propensity Score Matching

This paper also uses the set of control variables identified earlier as matching variables. A propensity score matching test was conducted using a Logit model, and a 1:3 nearest-neighbor matching method was employed for sample matching. Table 6 presents the results of the PSM robustness test. The results show that, after controlling for both firm and year fixed effects, the regression coefficients are significant at the 1% level, consistent with the results of the baseline regression in this paper.

Table 6. Propensity Score Matching Results

Variable	(1) Risk	(2) Risk	(3) Risk	(4) Risk
Customer	0.007***	0.005***		
	(4.82)	(3.54)		
Supply			0.009***	0.006***
			(4.83)	(3.13)
Controls	NO	YES	NO	YES
_ cons	0.028***	0.056***	0.028***	0.062***
	(45.83)	(7.42)	(37.20)	(7.38)
Industry/Year	yes	yes	yes	yes
Obs	28862.000	28862.000	24276.000	24276.000

Adjusted R^2	0.069	0.153	0.067	0.161

4.5 Testing the Mechanism of Action

This paper examines the mechanism through which the concentration of buyers and sellers in the supply chain affects a firm's risk-taking level, based on the channel mechanism of corporate information transparency. Drawing on the methodology of Wen Zhonglin and Ye Baojuan (2014) [31], (4) and (5) are developed based on (3).

$$TRANS_{i,t} = \alpha_0 + \alpha_1 \times Supply / Customer_{i.t} + \alpha_2 \times Controls + Industry + Year + \varepsilon_{i,t} \quad (4)$$

$$Risk_{i,t} = \gamma_0 + \gamma_1 \times Supply / Customer_{i,t} + \gamma_2 \times TRANS + \gamma_3 \times Controls + Industry + Year + \varepsilon_{i,t} \quad (5)$$

(4) is used to examine the effect of supply chain concentration on information transparency, while (5) is used to examine the effects of information transparency and supply chain concentration on a firm's risk-taking level. The results are shown in Table 7. In columns (1) and (3), the regression coefficients for customer concentration and supplier concentration on information transparency are -0.04 and -0.052, respectively, both of which are significant at the 1% level. Therefore, supply chain concentration has a negative impact on information transparency. In columns (2) and (4), the regression coefficients for information transparency are -0.019 and -0.02, respectively, and are significant at the 1% level. In summary, supply chain concentration increases a firm's risk-taking level by reducing information transparency.

Table 7. Analysis of Mechanism Verification

Variable	(1) TRANS	(2) Risk	(3) TRANS	(4) Risk
Customer	-0.040***	0.009***		
	(-5.46)	(5.52)		
TRANS		-0.019***		-0.020***
		(-10.40)		(-10.26)
Supply			-0.052***	0.007***
			(-6.77)	(3.81)
Controls	YES	YES	YES	YES
_ cons	-1.636***	0.021**	-1.647***	0.017*
	(-33.75)	(2.27)	(-34.37)	(1.70)
Industry/Year	YES	YES	YES	YES
Obs	34664.000	34664.000	28872.000	28872.000
Adjusted R^2	0.426	0.205	0.425	0.210

5. Further Analysis

5.1 Testing for Moderating Effects

To examine the impact of supply chain concentration on corporate risk-taking levels under different corporate governance scenarios, we introduced the internal control index provided by Shenzhen Dibo Enterprise Risk Management Technology Co., Ltd. into the baseline regression model to measure the level of internal control (Score). We also measured executive team stability (Stmt) using the number of executives who remained in office throughout the sample period. We then conducted regression analyses of the interaction terms between these variables and supply chain concentration, respectively, and corporate risk-taking levels. The specific regression results are shown in Table 8. Columns (1) and (2) present the moderation effects of internal control levels, while columns (3) and (4) present the moderation effects of management team stability.

The results show that the regression coefficients for the interaction term between customer concentration and the internal control index (Customer×Score) and the interaction term between supplier concentration and the internal control index (Supply×Score) are -0.043 and -0.040, respectively, both of which are statistically significant at the 1% level. This indicates that internal control levels play a significant negative moderating role in the relationship between supply chain concentration and a firm's risk-taking level; that is, as internal control levels improve, the positive impact of supply chain concentration on a firm's risk-taking level weakens.

Regarding the moderating effect of team stability, the regression coefficients for the interaction terms between customer concentration and team stability (Customer×Stmt) and between supplier concentration and team stability (Supply×Stmt) were -0.034 and -0.037, respectively, both significant at the 1% level. A stable executive team can mitigate the positive effect of supply chain concentration on corporate risk-taking. This can be explained by the fact that the stability of a company's management team reflects the synergy in the division of labor and collaboration among personnel. In day-to-day operations, this reduces unnecessary communication costs and stabilizes the various departments' understanding of risks and contingency plans. Essentially, it leverages human factors to stabilize the business environment, thereby leading to more cautious and secure investment decisions.

Table 8. Analysis of Moderating Effects

Variable	(1)	(2)	(3)	(4)
Customer	0.032***		0.034***	
	(5.55)		(6.42)	
Supply		0.032***		0.040***
		(5.82)		(6.27)
Customer×Score	-0.043***			
	(-5.32)			
Supply×Score		-0.040***		
		(-5.20)		
Customer×Stmt			-0.034***	
			(-6.16)	
Supply×Stmt				-0.037***
				(-6.00)
Controls	YES	YES	YES	YES
_ cons	0.065***	0.062***	0.070***	0.067***
	(7.39)	(7.03)	(7.93)	(7.63)
Industry/Year	YES	YES	YES	YES
Obs	24839.000	24839.000	24839.000	24839.000
Adjusted R^2	0.174	0.174	0.173	0.174

5.2 Heterogeneity Analysis

5.2.1 Test of Heterogeneity in Corporate Ownership

Supply chain concentration may have different effects on the risk-taking levels of firms with different ownership structures. Therefore, the sample data were grouped by ownership type for regression analysis, with the results shown in Table 9.

Regarding customer concentration, the regression coefficients for state-controlled enterprises and non-state-controlled enterprises are 0.006 and 0.002, respectively. In the sample data for state-controlled enterprises, the regression coefficient is significant at the 1% level. State-owned enterprises have a wide business coverage area; even when dealing with a single customer, they do not need to worry about default risks, thereby possessing a stronger risk-bearing capacity. The regression coefficient for supplier concentration in state-controlled enterprises is significantly higher than that of other enterprises and is significant at the 1% level. This may be because state-controlled

enterprises often undertake strategic missions; consequently, in certain situations, they rely on large suppliers to ensure operational stability and execution efficiency, exhibiting a tendency to proactively assume higher risks.

Table 9. Analysis of Heterogeneity in Property Rights

Variable	(1) SOE=1	(2) SOE=0	(3) SOE=1	(4) SOE=0
Customer	0.006***	0.002		
	(2.59)	(0.73)		
Supply			0.009***	0.004*
			(3.46)	(1.74)
Controls	YES	YES	YES	YES
_ cons	0.072***	0.060***	0.068***	0.057***
	(6.51)	(5.11)	(6.04)	(4.99)
Industry/Year	YES	YES	YES	YES
Obs	9409.000	17910.000	9409.000	17910.000
Adjusted R^2	0.158	0.159	0.160	0.159

5.2.2 Testing for Audit Heterogeneity among the Big Four Accounting Firms

Compared to other accounting firms, the "Big Four" are generally regarded as being larger in scale, employing more professionals, and capable of providing higher-quality audit services. De Fond and Jiambalvo (1993) [32] found that, compared to companies audited by non-international "Big Four" firms, those audited by the "international" Big Four exhibited higher-quality financial reporting and a lower probability of adverse events such as violations and fraud. Pan Lin et al. (2019) [33] point out that compared to "small firms," "large firms" have more robust quality control mechanisms and have generally established more comprehensive employee training systems. This helps enhance the professional competence of certified public accountants, thereby improving audit quality.

Therefore, a regression analysis was conducted using sample data categorized by whether the company was audited by the Big Four. The results revealed a significant difference in the impact of supply chain concentration on risk-taking levels depending on whether the company was audited by the Big Four. The regression results are shown in Table 10.

The results indicate that the promotional effect of client concentration on a firm's risk-taking level is not significant when the firm is audited by the Big Four, whereas this effect remains significant when the firm is audited by a non-Big Four firm. This result may stem from the fact that audits by the Big Four provide higher-quality financial reports, reducing information asymmetry and the risk of "price gouging" by major clients. Consequently, managers are more inclined to prioritize cash flow stability, thereby mitigating risks arising from client concentration. Meanwhile, the impact of supplier concentration on risk-taking is significant at the 10% and 1% significance levels, respectively. Companies may adjust their risk preferences in a timely manner due to the pressure of effective auditor oversight, thereby reducing uncertainty in their collaborations with suppliers.

Table 10. Results of the Heterogeneity Test for the Four Major Audits

Variable	(1) Big Four Audit Firms	(2) Non-Big Four Audit Firms	(3) Big Four Audit Firms	(4) Non-Big Four Audit Firms
Customer	0.006	0.004**		
	(1.19)	(2.42)		
Supply			0.012*	0.006***
			(1.93)	(3.11)
Controls	YES	YES	YES	YES
_ cons	0.065**	0.065***	0.060**	0.063***

	(2.48)	(7.22)	(2.41)	(7.05)
Industry/Year	YES	YES	YES	YES
Obs	1476.000	25843.000	1476.000	25843.000
Adjusted R^2	0.158	0.163	0.163	0.164

6. Conclusions

Based on resource dependence theory and the supply chain bullwhip effect, this study conducts an empirical regression analysis using data from Chinese listed companies from 2008 to 2023, confirming the impact of supply chain concentration on firms' risk-taking levels. The main conclusions are as follows: (1) The degree of supply chain concentration positively influences firms' risk-taking levels, increasing the probability of firms engaging in risky investments. (2) The closer the relationships within the supply chain and the lower the firm's external information transparency, the higher the level of risk-taking. (3) Firms with higher levels of internal control and more stable executive teams are better able to identify and assess their own risks, thereby mitigating the positive effect of supply chain concentration on risk-taking. (4) Heterogeneity analysis reveals that, compared to non-state-owned enterprises, customer concentration has a more significant impact on the risk-taking level of state-owned enterprises, while supplier concentration exhibits even greater significance; the impact of both supplier and customer concentration on risk is weaker when the firm is audited by one of the Big Four.

Based on the above discussion, this paper draws the following insights: First, in the course of operations, enterprises should pay attention to their interdependence with suppliers and customers, seeking appropriate relational transactions to control the appropriate proportion of sales and purchases with these parties in actual operations. From the perspective of the internal corporate environment, this requires managers to maintain flexibility when formulating strategies and controlling risks; externally, the role of independent reviews by third-party institutions should not be overlooked. Second, enterprises should emphasize the role of channel mechanisms in ensuring information transparency and consider appropriately reducing information asymmetry between the enterprise and the outside world when disclosing information. With the development of the information age, supply chain digitization is an inevitable trend. This also demonstrates that supply chain transaction data will become increasingly tamper-resistant in the future, which to some extent compels enterprises to disclose information. Third, companies should conduct daily operations based on a customer selection strategy tailored to their specific characteristics. By evaluating the overall stability of the management team, they can determine whether to adopt a concentrated or diversified customer strategy, thereby reducing overall supply chain operational risks and fostering a virtuous cycle within the supply chain.

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