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The Impact of ESG Rating Discrepancies on Supply Chain Resilience

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Abstract. Using 2014-2024 data from Chinese A-share listed companies, this research examines how inconsistent ESG ratings affect corporate supply chain resilience. Greater rating disagreement is linked to a notable drop in resilience. Industry competition amplifies this effect: higher concentration makes the negative impact stronger. The eastern region shows the strongest effect, while pollution level does not matter—heavily and lightly polluting firms are similarly affected. The results give fresh insight into ESG rating inconsistency and offer practical direction for regulators pursuing uniform ESG criteria, as well as for firms striving to boost supply chain resilience.

Keywords: ESG rating divergence, supply chain resilience, industry competition

1. Introduction

Global supply chains have recently taken multiple hits: geopolitical tensions, rising trade protectionism and extreme climate events. Blockages, bottlenecks, and disruptions are more frequent, so resilience is now critical for corporate survival and growth [1]. Environmental, social, and governance (ESG) considerations have gained broad global acceptance. ESG ratings—a key sustainability metric—draw increasing attention from investors, regulators, and supply chain partners [2]. Rating agencies differ sharply in indicator frameworks, assessment methods, and data sources [3]; thus, a company often gets inconsistent scores across agencies, called "ESG rating divergence." These inconsistencies send fuzzy signals about a firm's sustainability, worsen information asymmetry, and can hurt financing ability, operational stability, and supply chain relations [4, 5].

Earlier research has looked at how ESG rating divergence affects capital market efficiency, financing costs, and operational risks [6, 7] but few studies link this divergence to supply chain resilience. Supply chain resilience means a firm can run steadily, bounce back quickly, and adjust when external shocks come [8]. Divergent ESG ratings might theoretically hurt trust and cooperation among supply chain partners, lowering resilience [9]; industry competition intensity could moderate that link.

Using 2014–2024 data from Chinese Ashare firms, this study links ESG rating inconsistency to supply chain resilience and makes two main contributions. Unlike past work that stresses ESG performance's positive side, it treats rating disagreements as resilience obstacles, closing a research gap. The negative effect of ESG rating divergence shrinks under intense industry competition but

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expands with higher market concentration, giving new evidence on this relationship's boundary conditions.

2. Theoretical analysis and research hypotheses

2.1. The impact of ESG rating discrepancies on corporate supply chain resilience

Signaling theory suggests firms use ESG ratings to tell the market about their sustainability. Conflicting evaluations across rating agencies blur the signal and create "information noise," so upstream and downstream partners cannot easily see the focal firm's true condition. Rating divergence makes upstream suppliers struggle to assess the focal firm's reliability and credit risk. Growing information asymmetry makes suppliers worry about future cooperation, pushing them to shorten payment cycles, cut supply volumes, or stick to short-term deals—actions that directly threaten raw material supply stability. Downstream customers also worry about product quality and brand reputation because of rating inconsistencies. Customers often use ESG ratings as a sustainability proxy when choosing partners. Rater disagreements prevent customers from forming consistent expectations, possibly leading them to cut long-term orders or switch to other suppliers, which shortens supply chain relationships. Upstream instability combined with downstream demand fluctuations lowers supply-demand matching efficiency and raises coordination costs substantially. External shocks then make this fragile supply chain structure even harder to sustain, lowering enterprise supply chain resilience. Thus this paper proposes:

H1: ESG rating discrepancies significantly and negatively affect corporate supply chain resilience.

2.2. The moderating role of industry competition

Highly monopolistic industries give firms strong market positions and bargaining power, yet they have few supply chain partners. ESG rating disagreements amplify negative signals and make finding alternative suppliers difficult, causing a larger adverse effect on supply chain resilience [10, 11]. When competition is intense, a focal firm can switch more easily from a supplier that shows rating divergence, reducing the harmful influence of such differences. Competitive industries also tend to have more transparent information, so firms care more about reputation management and risk prevention and actively act to reduce uncertainty from rating disagreements.

H2: The weaker the industry competition , the stronger the adverse influence of ESG rating inconsistency on supply chain resilience.

3. Model construction

3.1. Data sources

Major ESG rating agencies, including Huazheng, began issuing ESG scores for A-share listed companies in 2014. Since then, the ratings from six agencies have been reasonably comparable. This study therefore selects Chinese A-share firms from 2014 to 2024 as the initial sample. ESG rating data are obtained from Huazheng, Shangdao Ronglv, Bloomberg, FTSE Russell, Wind, and CNRDS, while other financial data come from the Guotai'an database.

Several exclusion criteria are applied: removal of financial and insurance firms, elimination of ST and ST companies, deletion of observations lacking essential variables. To reduce outlier influence,

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all continuous variables are winsorized at the 1% and 99% levels. Ultimately, 19,967 firmyear observations are retained.

3.2. Variable definitions

3.2.1. Dependent variable: supply chain resilience

Following prior research [12], supply chain resilience is broken down into two components: disturbance resistance and recovery capacity. Resistance refers to the ability to maintain smooth operation despite external disruptions. Two indicators are used for resistance: the log of the accounts receivable to revenue ratio and the proportion of stable customers among the top five clients. A lower value of the first indicator means customers tie up less capital with the supplier; a higher value of the second indicates more stable supply chain relationships.

The ability to recover from external disruptions is captured by the extent to which production volatility deviates from demand volatility. This study uses that deviation as a proxy, expressed as:

$$\text{Matching}_{\text{it}} = \frac{\text{Var(Demand)}_{\text{it}}}{\text{Var(Production)}_{\text{it}}} \tag{1}$$

The variable $'\ \text{Matching}_{\text{it}}'$ captures the extent of supply-demand imbalance. A value exceeding 1 signals pronounced swings between what upstream suppliers provide and what downstream customers require, implying weak resilience in the supply chain. $'\ \text{Production}$ " denotes a firm's output, while "Demand" represents the firm's demand measured in terms of sales volume and cost.

This paper also constructs a fixed-effects model, using the regression residual ε_{it} as a measure of performance deviation; the larger the value, the stronger the supply chain resilience. The expression is:

$$\text{Perform}_{it} = \alpha_1 + \alpha_2\text{Size}_{\text{it}} + \alpha_3\text{Lev}_{\text{it}} + \alpha_4\text{Growth}_{\text{it}} + \alpha_5\text{Age}_{\text{it}} \tag{2}$$

$$+\alpha_6\text{Board}_{\text{it}} + \Sigma\text{Year} + \Sigma\text{Industry} + \varepsilon_{\text{it}}$$

In this context, $\text{"Perform}_{it}'$ refers to a company's economic performance, calculated as earnings before interest and taxes divided by the number of employees.

This study employs an entropy-based aggregation method to combine these four indicators across two dimensions, thereby deriving a single composite score that reflects the overall resilience of the supply chain.

3.2.2. Explanatory variable: ESG rating discrepancies

ESG scores come from six agencies (Huazheng, Shangdao Ronglv, Bloomberg, FTSE Russell, Wind, and CNRDS) following earlier work [13]. Annual ranking and standardization make scores comparable. For each firm year, we compute the standard deviation of standardized scores for every agency pair, giving 15 pairwise rating differences; their average measures ESG rating divergence. A bigger number means raters disagree more on the company's ESG standing.

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3.2.3. Moderating variable: industry competition

Industry competition is gauged by the Herfindahl-Hirschman Index (HHI), calculated as the sum of squared market shares from total industry revenue. A higher HHI signals more concentration and weaker competition; a lower HHI means a fragmented market and stronger rivalry.

3.2.4. Control variables

Following prior work [14, 15], Control variables are as follows: firm size, profitability (ROE), leverage (assettodebt ratio), equity concentration (largest shareholder's stake), shareholding ratio of top ten shareholders, board size, proportion of independent directors, years since listing, and growth rate (revenue growth). Year and industry dummies are further included as fixed effects. Table 1 provides a summary of how each variable is defined and measured.

Table 1. Variable measurement

Variable Type	Variable Name	Variable Symbol	Measurement Method
Dependent Variable	Supply Chain Resilience	SCR	Comprehensive assessment of four indicators of supply chain resilience and recovery using the entropy weighting method
Explanatory Variables	ESG Rating Discrepancy	ESGdif6	Mean of the standardized scores of six institutions, standardized by pairwise standard deviation
Moderator	Industry Competition Level	HHI	Aggregate of squared market shares for firms in the industry
Control variables	Tobin's Q	Tobin's Q	Market Capitalization / Total Assets
	Cash flow	Cash Flow	Ending Cash Balance - Beginning Cash Balance
	Company Size	Size	Natural logarithm of total assets
	Profitability	ROE	Net Income / Net Assets
	Debt-to-Equity Ratio	Lev	Total Debts / Total Assets
	Concentration of Shareholding	Top 1	Largest shareholder's shares/ Total shares outstanding
	Ownership percentage of the ten largest shareholders	Top 10	Top ten shareholders' shares / Total shares outstanding
	Board Size	Board	Natural log of board size
	Proportion of Independent Directors	Indep	Independent directors / Total board members
	Years since listing	Age	Current calendar year – listing year
	Growth	Growth	(Current revenue – Prior revenue) / Prior revenue

3.3. Model construction

To test the impact of ESG rating divergence on supply chain resilience, the following benchmark regression is estimated:

$$SCR_{it} = \beta_1 + \beta_2 ESGdif6_{it} + \gamma_i Controls_{it} + \Sigma Year + \Sigma Industry + \varepsilon_{it} \quad (3)$$

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SCR_{it} represents firm i's supply chain resilience in year t, $ESGdif6_{it}$ represents firm i's ESG rating divergence in year t, $Controls_{it}$represents all control variables, ∑Year and ∑Industry denote annual and firm-specific fixed effects, respectively, and ε_{it} represents the random disturbance term.

To examine the moderating role of industry competition, an interaction term between ESGdif6 and HHI is added:

$$SCR_{it} = \delta_1 + \delta_2 ESGdif6_{it} + \delta_3 HHI_{it} + \delta_4 ESGdif6_{it} \times HHI_{it} \quad (4)$$
$$+\gamma_i Controls_{it} + \Sigma Year + \Sigma Industry + \varepsilon_{it}$$

A "δ_4" would indicate that industry competition intensity moderates the association between discrepancies in ESG ratings and supply chain resilience

4. Empirical analysis

4.1. Descriptive statistics

Table 2 provides descriptive information for the core variables. ESGdif6 has a mean of 1.54 and a standard deviation of 0.65, reflecting some variation in divergence across firms. For the dependent variable SCR, the mean equals 0.43 and the median equals 0.18; the rightskewed nature of its distribution suggests that supply chain resilience is relatively low for a majority of companies.

Table 2. Descriptive statistics

Variable	N	Mean	SD	Min	p50	Max
ESGdif6	19967	1.540	0.650	0.130	1.510	3.420
SCR	19967	0.430	0.370	0.0600	0.180	0.980
HHI	19,967	0.0800	0.0700	0.0100	0.0500	0.330
Lev	19967	0.430	0.200	0.0700	0.420	0.910
ROE	19,967	0.0400	0.140	-0.640	0.0600	0.330
Top 1	19,967	31.50	13.98	7.950	29.51	69.83
Top 10	19,967	54.68	14.66	22.07	54.81	87.92
Age	19,967	12.17	7.390	2	11	29
Growth	19,967	0.120	0.330	-0.540	0.0800	1.700
Board	19,967	2.300	0.220	1.790	2.300	2.890
Size	19,967	22.38	1.250	20.14	22.20	26.24
Indep	19,965	0.380	0.0700	0.250	0.360	0.600
CashFlow	19967	0.0500	0.0600	-0.130	0.0500	0.230
TobinQ	19967	2.010	1.230	0	1,640	7.350

4.2. Benchmark regression analysis

Based on Model (3), the regression analysis shows an ESGdif6 coefficient of -0.133, significant at the 1% level, indicating a clear negative association between ESG rating divergence and supply chain resilience, thus supporting H1. ESG rating differences send negative signals about a firm's

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sustainability uncertainty, worsen information asymmetry, reduce supplier and customer trust, and make supply chain partnerships more short-term and unstable.

4.3. Mechanism testing

The model adds an interaction term (ESG_HHI) to test industry competition's moderating role. Table 3 column (3) reports a coefficient of 0.127 for this term, significant at the 5% level. This positive coefficient means industry competition positively moderates the relationship: more monopoly (larger HHI) strengthens ESG divergence's negative impact; more competition weakens it.

Table 3. Benchmark regression and mechanism tests

	(1)	(2)	(3)
	SCR	SCR	SCR
ESGdif6	-0.133***	-0.133***	-0.143***
	(0.00398)	(0.00398)	(0.00625)
HHI_OR		-0.120	-0.317**
		(0.0880)	(0.132)
Lev	-0.0259	-0.0263	-0.0266
	(0.0162)	(0.0162)	(0.0162)
ROE	0.102***	0.102***	0.101***
	(0.0211)	(0.0211)	(0.0212)
Top 1	-0.000252	-0.000256	-0.000253
	(0.000247)	(0.000247)	(0.000247)
Top 10	0.0000816	0.0000886	0.0000905
	(0.000247)	(0.000247)	(0.000247)
Age	-0.00582***	-0.00581***	-0.00579***
	(0.000438)	(0.000438)	(0.000438)
Growth	-0.0463***	-0.0462***	-0.0461***
	(0.00805)	(0.00805)	(0.00805)
Board	-0.0395***	-0.0396***	-0.0397***
	(0.0123)	(0.0123)	(0.0123)
Size	0.0189***	0.0189***	0.0189***
	(0.00279)	(0.00279)	(0.00279)
Indep	0.0165	0.0167	0.0156
	(0.0391)	(0.0391)	(0.0391)
_cons	0.200***	0.222***	0.240***
	(0.0715)	(0.0733)	(0.0739)
ESG_HHI			0.127**
			(0.0634)
Ind/ Year		Yes	
N	19965	19965	19965
R2	0.116	0.116	0.116

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Table 3. (continued)

adj. R^2	0.111	0.112	0.112

Note: *** p<0.01, ** p<0.05, * p<0.1.

4.4. Robustness tests

To ensure the reliability of the research conclusions, this study conducted the following two robustness tests, with the results shown in Table 4.

Additional controls: cash flow and TobinQ enter the baseline model. Cash flow indicates a firm's liquidity and directly affects its ability to buffer supply chain disruptions; Tobin's Q reflects market value and growth prospects, and high-growth firms may adapt better to supply chain shocks. Regression results in Table 4 column (1) show the ESG rating divergence coefficient remains significantly negative, confirming the baseline findings are statistically significant.

Changing the sample period. The global public health crisis after 2020 caused severe disruptions to supply chains, and the period from 2016 to 2020 marked a phase of rapid development for ESG ratings in China. To avoid the influence of sample period selection on the regression results, this study restricts the sample to the years 2016–2020 and performs the regression analysis again. Column (2) of Table 4 shows that ESG rating divergence continues to negatively affect supply chain resilience, confirming the robustness of our findings.

Table 4. Robustness tests

	Inclusion of Additional Control Variables	Changing the Sample Period (2016–2020)
	(1)	(2)
	SCR	SCR
ESGdif6	-0.133***	-0.112***
	(0.00398)	(0.00547)
CashFlow	0.0236	
	(0.0434)	
TobinQ	-0.00331	
	(0.00241)	
_cons	0.236***	0.302***
	(0.0762)	(0.102)
Controls/ Year/ Ind	Yes	
N	19965	8417
R2	0.116	0.104
adj. R^2	0.111	0.095

Note: *** p<0.01, ** p<0.05, * p<0.1.

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4.5. Heterogeneity analysis

4.5.1. Regional heterogeneity

China's regions differ greatly in economic development and regulatory environments, so the sample is divided into eastern, central, and western areas. Table 5 shows the ESGdif6 coefficient is negative and significant across all three regions. The eastern region has advanced marketization and heavy reliance on ESG ratings by investors and supply chain participants, exhibiting the largest negative effect. The central region undergoes economic transformation and intense restructuring pressure, also showing a strong effect. The western region features a less developed economy and simpler supply chain networks, with a smaller coefficient and lower sensitivity to ESG rating discrepancies. These findings highlight regional heterogeneity.

4.5.2. Heterogeneity in pollution levels

The sample is further split into two groups: heavy-polluting industries and their non-heavy-polluting counterparts. As shown in Table 5, the ESGdif6 coefficient is significantly negative in both groups, and the magnitudes are quite close. Thus, pollution level does not act as a boundary condition: ESG rating divergence harms supply chain resilience regardless of whether a firm is in a highly polluting sector. Even though heavy polluters face stricter environmental scrutiny, the signal confusion from rating disagreements persists; light polluters experience less environmental pressure, but rating differences still trigger market concerns. Therefore, the effect appears universal, and regulators should aim for consistent ESG ratings across all industries.

Table 5. Regional distribution and heterogeneity of pollution levels

	Eastern Region	Central Region	Western Region	Heavy Pollution	Non-Heavily Polluted
	(1)	(2)	(3)	(4)	(5)
	SCR	SCR	SCR	SCR	SCR
ESGdif6	-0.137***	-0.122***	-0.113***	-0.139***	-0.132***
	(0.00479)	(0.00948)	(0.0105)	(0.00822)	(0.00457)
_cons	0.522***	-0.577***	0.106	0.126	0.241***
	(0.0949)	(0.171)	(0.173)	(0.139)	(0.0796)
Controls/ Year/ Ind			Yes		
N	14154	3259	2455	4,393	15,572
R2	0.125	0.166	0.245	0.109	0.119
adj. R^2	0.119	0.146	0.219	0.102	0.115

Note: *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusions and recommendations

Based on A-share listed firm data from 2014 to 2024, this research looks at how ESG rating divergence affects supply chain resilience. The key findings are as follows. ESG rating divergence lowers supply chain resilience, and this negative link holds even after adding more controls or changing the sample period. Industry competition plays a moderating role: the more monopolized the industry, the bigger the harmful effect; under intense competition, the damage gets smaller.

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Geographically the adverse impact is strongest in the east, moderate in the central region, and weakest in the west. Pollution level does not act as a boundary—ESG divergence hurts both heavy and light polluters, so its influence is general.

Policy implications. Governments should cooperate with rating agencies, industry experts, businesses, and NGOs to build a unified ESG rating framework, specify evaluation metrics and data sources, and thus cut the negative effect of rating discrepancies on supply chain resilience. Besides, Regional policies need differentiation. Regulators should strengthen antitrust enforcement to encourage fair competition and reduce supply chain risks in monopolistic industries.

For enterprises. Firms need a full grasp of risks from divergent ESG ratings, early-warning systems, and a complete risk identification framework. Eastern Chinese firms should emphasize ESG disclosure more to strengthen supply chain disruption resistance. Diversify supply chain setups and establish backup supply channels so production stops caused by key supplier problems are avoided. Use big data and blockchain to raise transparency and traceability across the whole supply chain, thus building stronger risk resistance.

For rating agencies. Agencies need to disclose their rating criteria and indicator systems to boost credibility and enhance communication and collaboration among themselves to converge on standardized methods. They should also enforce strict data collection and verification processes, and when issuing composite ESG ratings, provide component scores and uncertainty indicators to help investors and firms better understand the information.

The study has several limitations. It only looks at short-term effects; future research could extend the time horizon. It focuses on industry competition's moderating role without testing mediating pathways; later studies might examine financing constraints, reputational risk, or information transparency. The sample is only A-share listed firms, so whether the results apply to unlisted companies or other emerging markets remains unknown.

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