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ORIGINAL ARTICLE

How ESG Performance Enhances Corporate Resilience: Evidence From Trade Credit Mechanisms in Chinese Listed Firms

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Abstract

Purpose – This study investigates how Environmental, Social, and Governance (ESG) performance enhances corporate resilience through trade credit mechanisms, considering variations in supplier concentration and industry pollution intensity.

Theoretical framework – Drawing on stakeholder theory, the study presents the pathway "ESG → Trade Credit → Resilience," showing how responsible governance strengthens stakeholder ties and supports resilience via supply chain financing.

Design/methodology/approach – Using panel data from 4,375 Chinese A-share listed firms from 2014 to 2023, the study builds a resilience index through entropy weighting. Two-way fixed effects and mediation models are employed to test the mechanisms.

Findings – ESG performance significantly improves resilience. Trade credit acquisition, provision, and net financing mediate this relationship. The effects are stronger for non-heavy-polluting firms and those with lower supplier concentration.

Practical & social implications of research – The study highlights trade credit as a financial channel linking ESG to resilience, offering insights for firms, regulators, and investors seeking resilience strategies under uncertainty.

Originality/value – By integrating ESG, trade credit, and resilience, this research extends resilience and stakeholder theory and introduces a novel heterogeneity perspective.

Keywords: Corporate resilience, ESG performance, supply chain financing, trade credit.

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1 Introduction

Over the past several years, various factors have disrupted the global supply chain and increased operational variability. These include trade friction between China and the United States, escalating geopolitical tensions among nations, and the impact of COVID-19 (Golgeci et al., 2025). Corporate resilience (CR) – the ability to withstand external forces and recover quickly – is now one of the most critical factors in a firm's sustainable development (Rai et al., 2021). Concurrently, there has been a marked increase in academic scrutiny regarding the influence of environmental, social, and governance (ESG) practices on enterprises' adaptive competencies. Firms with strong ESG performance signal responsible governance and build stakeholder trust, which facilitates access to trade credit during crises and eases liquidity constraints (Lins et al., 2017). As a result, trade credit can be viewed as a strategic alternative to traditional financing channels. Engaging in ESG practices can allow corporations to build stronger relationships within their supply chains, therefore promoting the sustainability of their own operations and improving resilience against risk (Luo et al., 2023). These observations give rise to the core inquiry of this study: How does ESG performance enhance organizational resilience through the use of trade credit?

Corporate resilience has been examined from two perspectives. First, the internal perspective considers strategic flexibility, dynamic capabilities, and sustainability-oriented leadership as the main drivers of resilience (Duchek, 2020; Ortiz-de-Mandojana & Bansal, 2016). Second, the external perspective considers stakeholder trust and social responsibility as means for businesses to recover, collaborate, and ultimately provide long-term value to their stakeholders (Williams et al., 2017; Deng, 2025). While these results underscore the importance of both internal competencies and external involvement, the role of ESG performance as a strategic source of resilience remains underexplored.

Current studies investigating ESG performance have predominantly centered on economic consequences, such as corporate worth, monetary performance, tax avoidance, and production efficiency (Biju et al., 2025; Narula et al., 2025; Nerantzidis et al., 2024; Arsenopoulou et al., 2025). However, the relationship between ESG performance and organizational resilience, particularly the mediating mechanisms that connect them, remains underexplored. Previous research indicates that robust ESG implementation can enhance access to official funding sources by reducing the cost of capital (Koutoupis et al., 2026; Ferrando & Mulier, 2013). Yet, relatively little attention has been given to the role of ESG in facilitating informal financing within supply chains. In particular, ESG performance may strengthen supplier trust and improve firms' capacity to secure trade credit, enabling them to adapt to turbulent environments (Luo et al., 2023).

We conducted an empirical investigation to analyze how ESG performance affects trade credit as a financing avenue for enterprises and organizational resilience. Firms often turn to suppliers for trade credit when they lack sufficient traditional financing due to limited access (Moretto et al., 2019). Trade credit consists of three dimensions: receiving, extending, and net financing. It serves an essential function for all stakeholders by optimizing working capital to maintain corporate stakeholder relations and provide resilience (Petersen & Rajan, 1997). Firms' credit practices during crisis events are closely correlated with their ESG performance, thereby influencing their ability to survive within the supply chain (Chava & Roberts, 2008). Strong ESG performance can create a competitive advantage by enhancing a company's reputation and relational capital, enabling it to obtain better payment terms and increased credit support, which in turn leads to greater operational stability (Fisman & Love, 2003). Furthermore, extending trade credit demonstrates a firm's intent to stabilize market channels and maintain operations by modifying credit terms for customers (Dong et al., 2023). Firms with stronger ESG performance tend to have greater capacity for trade credit financing, which aids in resilience in uncertain environments (Huang et al., 2023).

This study analyzes the impact of ESG on organizational resilience through trade credit, as well as the effect of supplier concentration and industry pollution intensity as moderators. Data from 4,375 Chinese A-share listed enterprises from 2014 to 2023 were analyzed empirically using fixed effects models, mediation models, and multiple endogeneity and robustness tests (Supplementary Material, Supplementary Data 1 – Dataset).

This research yields three major contributions. First, we developed a conceptual model of trade credit as an individual financing source, which is divided into three components: acquisition, provision, and net financing. We reveal how ESG performance affects organizational resilience through supply chain finance, thereby broadening the understanding of ESG and organizational resilience in the supply chain finance literature. Second, previous studies often assume that stock price volatility is an appropriate measure of resilience (Hou et al., 2023; Sajko et al., 2021).

However, this primarily measures what the capital markets expect to happen to the firm and cannot account for the extent to which the firm will recover operationally. We establish an organizational resilience measure based on operational recovery and survival, creating a comprehensive post-shock recovery measure using entropy weighting. This provides a greater degree of usefulness in terms of post-shock recovery. Third, we investigate the heterogeneous nature of the ESG-resilience relationship through supplier concentration and the specific traits of heavily polluting firms. Our findings show that the impact of ESG on resilience is influenced by various supply chain and regulatory conditions that determine the effectiveness of ESG.

This paper is structured as follows: introduction, literature review and hypotheses, research design, empirical analysis, heterogeneity analysis, discussion, and conclusion.

2 Literature review and research hypotheses

2.1 ESG and corporate resilience

According to stakeholder theory (Freeman, 1984), corporations create value for their shareholders by engaging with various stakeholders over time. ESG practices enhance trust and collaboration with key stakeholders, improve corporate reputation, and encourage stakeholders to financially support and maintain cooperative relationships with firms during periods of uncertainty (Lins et al., 2017). Therefore, ESG is an important means for firms to build stakeholder trust and align with broader societal expectations. Emerging evidence suggests that ESG fosters organizational resilience by enabling firms to anticipate risks, maintain operational flexibility, and mobilize external support during crises (Wang et al., 2024a; Li et al., 2025). Effective environmental practices can mitigate regulatory and reputational risks (Garcia et al., 2017; Xu et al., 2024a); proactive social commitment can foster goodwill and cooperation (Lins et al., 2017; Deng et al., 2013); and effective governance practices can bolster internal controls and decision-making capabilities during uncertain times (Duchek, 2020; Brandão & Crisóstomo, 2024). Together, these dimensions enable firms to withstand external shocks, adapt to changes in their operational environment, and recover successfully (Duchek, 2020; Ortiz-de-Mandojana & Bansal, 2016). Although the body of research supporting ESG is growing, most studies focus on general operational or financial outcomes and fail to consider the relational and supply chain finance channels through which ESG can enhance organizational resilience.

2.1.1 *ESG and operational recovery*

High-quality and low-risk ESG business activities and production practices provide a higher potential for operational recovery. Environmental practices stabilize the supply chain of raw materials and energy, decrease the risk of regulatory or legal action, and increase energy efficiency (Eccles et al., 2014; Guo & Tan, 2024). Socially responsible corporate practices, such as community and customer engagement and employee protection, promote customer loyalty and trust, thus reducing the likelihood of operational interruption. Operational governance can minimize potential conflicts of interest, thereby providing additional operational stability. Furthermore, adopting sustainable supply chain procedures and integrating ESG into corporate strategy can enhance firms' operational effectiveness, digitalization capabilities, and smart manufacturing capabilities (Arsenopoulou et al., 2025; Wang et al., 2024b). These structural and process improvements collectively strengthen firms' ability to maintain operations in times of uncertainty.

2.1.2 *ESG and recovery and survival*

A firm's ability to utilize external resources through its stakeholder networks is critical to its resilience. Companies with solid ESG programs build relational capital, enabling them to develop financial resources, become eligible for preferential payment terms, and build reputational or policy buffers. This reduces their risk of bankruptcy and supports their recovery and survival (Lins et al., 2017; Gao & Geng, 2024; Korzeb et al., 2025). In addition, companies focused on ESG develop superior capabilities in restructuring cost structures and allocating assets. These capabilities allow ESG companies to continue operating under stress and provide them with superior access to low-cost credit (Wang et al., 2024a; Ren et al., 2025). During the pandemic, high ESG companies experienced fewer cash shortages than their peers and recovered more quickly due to faster stakeholder mobilization and greater strategic agility (Albuquerque et al., 2020; Lins et al., 2017). These mechanisms have direct implications for the recovery-survival dimension of our resilience framework.

H1: Firms with higher ESG performance exhibit greater resilience.

2.2 ESG, trade credit, and corporate resilience

ESG factors may influence organizational resilience through various channels, including firm performance (Lins et al., 2017; Eccles et al., 2014; Barnett & Salomon, 2012), financing constraints (Cheng et al., 2014; Raimo et al., 2021), and supply chain governance (Luo et al., 2023; Huang et al., 2023; Han & Wu, 2024). Past research has typically looked at these channels in isolation, lacking an integrated view. Trade credit, an informal form of finance within the supplier-customer relationship, represents a possible micro-level route by which ESG impacts resilience. Trade credit not only eases financial limitations, but also fosters cooperation between firms in the supply chain, helping them cope with shocks (Petersen & Rajan, 1997; Cuñat, 2007). During a crisis, a firm's access to trade credit and the terms offered are indicative of its perceived reliability and credibility as a counterparty (Levine et al., 2018). A firm's history of proven sustainability can instill confidence in its counterparties, thus aiding trade credit flow and improving inflow, outflow, and net liquidity (Eccles et al., 2014; Lins et al., 2017; Han & Wu, 2024; Yang et al., 2025). This enhances resilience (Bastos & Pindado, 2013; Levine et al., 2018).

2.2.1 *Trade credit acquisition*

Trade credit is funding received from suppliers (Petersen & Rajan, 1997). Trust-based supplier relationships are based on suppliers' consistent ESG practices. Environmental initiatives provide lower regulatory risk; social responsibility fosters collaboration; and transparency in governance enhances supplier creditworthiness (Huang et al., 2023; Lins et al., 2017; Oino, 2019). Firms with higher ESG ratings are more likely to agree to longer payment periods and/or negotiate flexible contract terms. This will reduce firms' reliance on external financing (Raimo et al., 2021; Baraibar-Diez & Sotorrío, 2018). Firms experiencing financial constraints can access trade credit as a source of short-term financial stability.

> **H2a:** Trade credit acquisition partially mediates the correlation between ESG performance and organizational resilience.

2.2.2 *Trade credit provision*

Trade credit provision reflects a firm's ability to offer customers deferred payment terms (Petersen & Rajan, 1997). ESG-oriented firms build trust through transparency and social responsibility. This enables them to offer flexible terms that support buyer liquidity and strengthen customer loyalty (Fabbri & Klapper, 2016; Zhe, 2023). Firms with strong governance and healthy cash positions have an increased ability to extend credit. A positive reputation with regard to ESG reports may also enhance the likelihood of timely repayment and increase cash turnover (An et al., 2023; Mathath & Kumar, 2024). During difficult times, firms can strategically delay collections to help stabilize supply chains and conserve liquidity.

> **H2b:** Trade credit provision partially mediates the correlation between ESG performance and organizational resilience.

2.2.3 *Trade credit financing*

Trade credit financing is the net amount of credit offered by suppliers that has not been paid for, plus what customers have paid for it. This allows firms to reduce their cash-constrained position (Luo et al., 2023). A net credit position that exceeds the amount offered by customers indicates strong bargaining power and positively affects cash flow, flexibility, and adaptability (Baños-Caballero et al., 2016). ESG performance can promote trade credit financing by expanding supplier credit access and decreasing the credit risk of having many customers who do not pay on time or at all, thus improving overall credit availability. Companies with high reputational and relational capital have substantial bargaining power and can negotiate terms with their suppliers that extend the payment cycle without offering equal terms to customers. Thus, they will reap the benefits of trade credit financing. High ESG firms earn greater trust with customers and regulatory bodies, strengthening their counterparties' willingness to provide financing. Furthermore, during financial crises, these firms are better able to successfully operate payment and collection cycles, manage and organize their cash structures optimally, and build resilience (Giese et al., 2019). Due to insufficient access to bank funding, trade credit financing becomes an alternative capital strategy that stabilizes cash flow and minimizes bankruptcy risk (Bastos & Pindado, 2013).

> **H2c:** Trade credit financing partially mediates the correlation between ESG performance and organizational resilience.

3 Methodology

3.1 Sample selection and data sources

This study examines Chinese A-share listed firms from 2014 to 2023. The starting year reflects the

State Council's policy that transformed Corporate Social Responsibility (CSR) from a voluntary practice into an institutional requirement, thereby shaping the impact of ESG on resilience. The data come from CSMAR, Wind, Sina Finance, and manual collection. After removing ST firms, financial firms, and observations with missing data, the final sample comprises 4,375 firms and 31,478 firm-year observations.

3.2 Dependent variable

Corporate resilience is defined as a firm's capacity to withstand disruptions and rebound swiftly. To capture its multidimensional nature, we followed Wang et al. (2024a) and constructed a composite resilience index using the entropy weighting method, incorporating two dimensions: operational performance and recovery capacity.

The operational performance dimension is gauged by the ratio of economic value added (rEVA). As a residual income indicator, EVA measures the value a firm creates beyond its cost of capital. Although EVA is sensitive to accounting adjustments and capital structure (Hiraoka, 2006), factors that may overlap with ESG-related financial policies, its key advantage is its focus on the value generated by firms' operating activities (Lin & Zhilin, 2009; Zheng et al., 2020). Furthermore, Delegkos et al. (2025) contend that, under the integrated reporting framework, combining financial and non-financial information strengthens the value relevance of accounting information. This provides theoretical support for using EVA as a metric of firms' long-term value creation capability. The recovery capacity dimension uses bankruptcy risk to measure the likelihood that a firm will experience financial distress. This metric is computed using the Ohlson (1980) O-score model. The O-score captures downside risk and solvency buffers, complementing the focus of EVA on value creation (Fullana et al. 2021). The calculation formula is as follows (Equations 1 and 2):

$$RC = e^{Score} \Big/ \left(1 + e^{Score}\right) \tag{1}$$

$$Score = -1.32 - 0.407Si + 6.03Le - 1.43Wc + 0.0757Cl - 2.37NI - 1.83Fu + 0.285In - 1.720En - 0.521Ch \tag{2}$$

where:

$$\text{Wc} = \text{Working Capital} \Big/ \text{Total Assets};$$

$$\text{Cl} = \text{Current Liabilities} \Big/ \text{Current Assets};$$

$$\text{NI} = \text{Net Income} \Big/ \text{Total Assets};$$

$$\text{Fu} = \text{Operating Net Cash Flow} \Big/ \text{Total Liabilities};$$

In = 1 if the firm incurred losses in both of the past two years, otherwise it is 0;

En = 1 when total liabilities exceed total assets, otherwise it is 0;

$\text{Ch} = \left(NIt - NIt-1\right) \Big/ \left(\left|NIt\right| + \left|NIt-1\right|\right)$, where NI denotes net income;

Refer to Table 1 for other variables.

3.3 Independent variable

Following Wang et al. (2024b), this study selects the Huazheng ESG ratings as the independent variable, assigning numerical values from C to AAA to construct the explanatory variable. Specifically, a company rated C is assigned a value of 1, and so on in ascending order.

3.4 Control variables

In line with previous studies, this study includes five control variables: cash ratio, firm size, leverage ratio, Tobin's Q, and ownership concentration (e.g., Wang et al., 2024a; Xu et al., 2024b; Zhang et al., 2024; Hou et al., 2023; Nerantzidis et al., 2022). These variables capture key firm-level characteristics that influence organizational resilience.

3.5 Mediating variables

Following the methodology of Xu et al. (2025) and Liu and Wang (2023), three mediating variables are constructed to capture different dimensions of trade credit: trade credit acquisition, trade credit provision, and trade credit financing. The specific formulas are as follows (Equations 3, 4 and 5):

$$\text{UC} = \frac{Accounts\ Payable + Notes\ Payable + Advances\ from\ Customers}{Total\ Assets} \tag{3}$$

Table 1
Definitions and Descriptions of Key Variables

Variable Type	Variable Symbol	Variable Name	Variable Definition
Dependent Variable	CR	Corporate Resilience	Composite index calculated via entropy method based on EVA ratio and bankruptcy risk score
Independent Variable	ESG	ESG Score	Huazheng ESG score
Control Variables	Cr	Cash Ratio	Ratio of cash assets to current liabilities
	Si	Firm Size	Natural logarithm of total assets at year-end
	Le	Leverage	Total liabilities divided by total assets at year-end
	TQ	Tobin's Q	Ratio of corporate market value to total assets
	Top1	Ownership Concentration	Shareholding ratio of the largest shareholder
	Year	Year Fixed Effect	Year fixed effect
	Code	Firm Fixed Effect	Firm fixed effect
Mediating Variable	UC	Trade Credit Acquisition	Ratio of trade credit obtained from suppliers to total assets
	DC	Trade Credit Provision	Ratio of trade credit extended to customers to total assets
	NC	Trade Credit Financing	UC – DC

$$\mathbf{UC} = \frac{Accounts\ Receivable + Notes\ Receivable + Prepayments}{Total\ Assets} \quad (4)$$

$$NC = UC - DC \quad (5)$$

Here, UC represents trade credit acquisition, DC denotes trade credit provision, and NC indicates trade credit financing.

3.6 Model specification

Model (6) is constructed to test the promoting effect of ESG performance on organizational resilience (Hypothesis H1). Since the dataset consists of firm-level panel data spanning multiple years, a two-way fixed effects model is employed to control for unobserved firm heterogeneity and time-specific shocks. This method (Equation 6) has been widely used in research on firm-level panel data (e.g., Su et al., 2024; Gao & Geng, 2024; Xu et al., 2024b).

$$CR_{i,t} = a_0 + a_1 ESG_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (6)$$

where α_0 is the constant term; $\varepsilon_{i,t}$ is the disturbance term; i denotes the firm, t denotes the year, and CodeFE and YearFE represent firm fixed and year fixed effects, respectively.

To examine the mediating effect of trade credit acquisition (Hypothesis H2a), the following models are estimated (Equations 7 and 8):

$$UC_{i,t} = b_0 + b_1 ESG_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (7)$$

$$CR_{i,t} = c_0 + c_1 ESG_{i,t} + c_2 UC_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (8)$$

To examine the mediating role of trade credit provision and verify Hypothesis H2b, the following models are constructed (Equations 9 and 10):

$$DC_{i,t} = b_0 + b_1 ESG_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (9)$$

$$CR_{i,t} = c_0 + c_1 ESG_{i,t} + c_2 DC_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (10)$$

To further explore the joint effects of trade credit acquisition and provision, and to test the mediating role of trade credit financing (Hypothesis H2c), the following models are specified (Equations 11 and 12):

$$NC_{i,t} = b_0 + b_1 ESG_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (11)$$

$$CR_{i,t} = c_0 + c_1 ESG_{i,t} + c_2 NC_{i,t} + \sum Controls + CodeFE + YearFE + \varepsilon_{i,t} \quad (12)$$

4 Results

4.1 Descriptive statistics

This paper employs a panel dataset of 31,478 firm-year observations covering 4,375 listed firms from 2014 to 2023. The statistical analyses were conducted using Stata software (Supplementary Data 2 – Stata script).

Table 2
Descriptive statistics

VARIABLES	(1)	(2)	(3)	(4)	(5)
	N	mean	SD	min	max
CR	31,478	0.764	0.126	0.310	1.000
ESG	31,478	4.180	0.883	1	8
Cr	31,478	0.779	0.898	0.0583	3.756
Si	31,478	22.27	1.201	20.36	24.96
Le	31,478	0.404	0.193	0.0943	0.790
TQ	31,478	1.959	1.009	0.940	5.082
Top1	31,478	33.71	14.69	8.430	74.09
UC	31,478	0.146	0.107	0.00545	0.488
DC	31,478	0.164	0.117	0.00309	0.525
NC	31,478	-0.0177	0.121	-0.342	0.340

To mitigate the impact of outliers on the estimation results, all continuous firm-level variables are winsorized at the 1% upper and lower levels.

As shown in Table 2, the mean organizational resilience (CR) score is 0.764, with a standard deviation of 0.126, showing substantial variation in firms' resilience levels. The average ESG score is 4.180 (on a scale of 1–8), with a standard deviation of 0.883, suggesting considerable heterogeneity in ESG performance. The mean value of trade credit acquisition (UC) is 0.146, ranging from 0.00545 to 0.488, with a standard deviation of 0.107, reflecting significant differences in firms' access to upstream credit. The maximum trade credit provision (DC) is 0.525. The difference between the maximum and mean (0.164) demonstrates that some firms are exposed to significant customer default risk. Trade credit financing (NC) has a standard deviation of 0.121, indicating that firms employ diverse and distinct supply chain financing strategies.

4.2 Baseline regression

Table 3 shows that ESG has a favorable and meaningful direct impact on CR, as calculated using an entropy weighting method based on operational and recovery performance measures. The estimated coefficient of ESG is 0.002 (t = 2.872) and is significant at the 1% level, thus offering statistical support for H1. Further decomposition reveals that ESG performance is positively linked to rEVA, significant at the 5% level, illustrating that firms with superior ESG scores are more likely to improve operational efficiency. On the other hand, at the 10% level of significance, an inverse correlation exists between the bankruptcy risk index (RC) and ESG performance. This suggests that companies with superior ESG implementation experience lower levels of financial distress risk than their less sustainable peers. Overall, the results support the positive impact of ESG on corporate resilience through two mechanisms: improved operational competence and a diminished likelihood of financial failure.

Table 3
Baseline Regression

	(1)	(2)	(3)
	CR	rEVA	RC
ESG	0.002***	0.001**	-0.000*
	(2.872)	(2.429)	(-1.778)
Cr	-0.000	0.002***	0.000***
	(-0.376)	(4.935)	(18.512)
Si	0.058***	0.020***	-0.001***
	(34.541)	(27.612)	(-38.002)
Le	-0.399***	-0.103***	0.007***
	(-58.435)	(-35.712)	(102.779)
TQ	0.021***	0.010***	-0.000
	(24.206)	(27.033)	(-1.138)
Top1	0.002***	0.001***	-0.000***
	(14.572)	(13.326)	(-10.789)
_cons	-0.479***	-0.436***	0.012***
	(-12.810)	(-27.580)	(33.216)
Code	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	31478	31478	31478
r2_a	0.543	0.509	0.59

t statistics in parentheses; *p<0.1; **p<0.05; ***p<0.01.

4.3 Endogeneity tests

4.3.1 *Propensity Score Matching (PSM)*

Su et al. (2024) proposed the nearest-neighbor PSM method used in this study. In order to support

Table 4
Endogeneity Tests

VARIABLES	PSM	First	2SLS
	(1)	(2)	(3)
	CR	ESG	CR
IV		**-2,621.088*** **	
		(5.066)	
ESG	**0.00596****		**0.004*****
	(0.00271)		**(0.001)**
Control variables	**Control**	**Control**	**Control**
Kleibergen-Paap rk LM		14000***	
Cragg-Donald Wald F		98000(16.38)	
Observations	16,233	31,478	31,478
R-squared	0.156	0.954	0.954
Code	Yes	Yes	Yes
Year	Yes	Yes	Yes

t statistics in parentheses; **p<0.05; ***p<0.01.

commonality between the treated and control groups, only matched observations from the overlapping portion of the distributions were kept. Based on median ESG scores, firms were classified as either high or low performers. Firms above the median received a score of 1, while those below the median received a score of 0.

Using three key covariates in the matching process – leverage ratio, firm size, and ownership stake of the largest shareholder – the matched sample diagnostics demonstrated that the standardized mean differences for all covariates were less than 10%, indicating that the matched groups are well-balanced and meet the required standards of comparability based on these covariates. This reduces bias from an unmatched sample. As shown in Table 4, after excluding unmatched observations, the baseline regression was rerun, and ESG remained statistically significant at $p < 0.05$, confirming a positive association between good ESG performance and organizational resilience. These results provide consistent support for Hypothesis H1 after controlling for selection bias.

4.3.2 *Instrumental variable approach*

This work adopts the instrumental variable (IV) approach of Yu and Xiao (2022). A firm's annual ESG performance correlates with the annual average ESG score of its industry peers, while the industry average is unlikely to directly affect the firm's individual resilience. Thus, we use the annual average ESG score of peer firms in the same industry as the instrumental variable. We use the Kleibergen-Paap rk LM test to assess under-identification, and the rk Wald F statistic is used to evaluate instrument strength. Both diagnostic tests confirm the validity of the instrument. The IV is significantly associated with ESG at the 1% level, and the second-stage results continue to demonstrate a favorable effect of ESG on resilience, thereby supporting Hypothesis H1.

4.4 Robustness checks

4.4.1 *Controlling for omitted variables*

Recent research suggests that the administrative expense ratio is an important predictor of firm resilience. This ratio reflects a firm's spending on management, operational oversight, and organizational coordination, all of which are closely related to governance capability, resource allocation efficiency, and risk resistance, and may therefore influence resilience outcomes. Following Liang and Li (2023), this study includes an additional control variable, the administrative expense ratio, to test the robustness of the baseline findings. This variable was collected from the CSMAR database. After controlling for this variable, ESG has a coefficient of 0.002, indicating that it remains statistically significant at the 1% level. The results further support Hypothesis H1. The addition of a potential omitted variable reinforces the reliability of the conclusions derived from the baseline analysis.

4.4.2 *Replacing key variables*

In the baseline model, rEVA is calculated using "Specification I" (accounting-based) from the CSMAR database.

For robustness testing, we replace this with "Specification II" (finance-based) and recalculate the composite firm resilience index (ET1) using the entropy weighting method. The primary distinction between these two specifications is the adjustment method applied to the numerator (EVA) and denominator (capital investment). As shown in Table 5, when ET1 is used as the dependent variable, ESG remains significantly and positively associated with organizational resilience at the 10% significance level. These results further confirm Hypothesis H1 and demonstrate that the key results remain consistent under different variable definitions.

5 Further analysis

5.1 Mechanism analysis

ESG engagement is typically regarded as a strategic corporate policy that shapes a firm's reputation, transparency, and stakeholder relationships (Lins et al., 2017). Through these channels, stronger ESG performance may enhance the level of trust that suppliers and customers place in a firm (Xu et al., 2024b). Since trade credit arrangements depend on counterparties' perceptions of reliability and long-term sustainability (Cuñat, 2007), improvements in ESG performance may initially impact supply chain relationships and the availability of trade credit (Luo et al., 2023). Trade credit can then provide the liquidity and operational flexibility necessary for firms to cope with external shocks (Bastos & Pindado, 2013), thereby strengthening organizational resilience.

Table 5
Robustness test

VARIABLES	(1)	(2)
	CR	ET1
ESG	0.002*** (2.873)	0.001* (1.648)
GL	0.000* (1.916)	
Control variables	Control	Control
Code	Yes	Yes
Year	Yes	Yes
N	31478	31478
r2_a	0.543	0.505

t statistics in parentheses; *p<0.1; ***p<0.01.

5.1.1 *Trade credit acquisition*

The mediation regression analyses for the trade credit variables are presented in Table 6. The first analysis in Column (1) indicates that ESG has a positive relationship with UC (coefficient = 0.003, significant at the 1% level). The subsequent analysis in Column (2), which includes additional controls, shows that UC significantly and positively affects CR (coefficient = 0.207, significant at the 5% level), while ESG remains significant (coefficient = 0.002, significant at the 1% level). These results support Hypothesis H2a, suggesting that trade credit acquisition mediates the relationship between ESG performance and organizational resilience. In line with stakeholder theory principles, firms with higher ESG scores may foster greater credibility and trust in supply chain relationships, encouraging suppliers to offer trade credit or flexible payment terms (Xu et al., 2024a).

Table 6
Mediation Effect Regression

	(1)	(2)	(3)	(4)	(5)	(6)
	UC	CR	DC	CR	NC	CR
ESG	0.003***	0.002**	0.001***	0.002***	0.001*	0.002***
	(6.126)	(2.179)	(3.066)	(2.628)	(1.871)	(2.834)
UC		0.207***				
		0.142***				
DC				0.142***		
				(13.610)		
NC						0.028***
						(3.377)
Control variables	Control	Control	Control	Control	Control	Control
Code	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	31478	31478	31478	31478	31478	31478
r2_a	0.804	0.549	0.822	0.546	0.739	0.543

t statistics in parentheses; *p<0.1; **p<0.05; *** p<0.01.

Therefore, acquiring trade credit provides potential financial buffers and temporal flexibility, which may increase organizational resilience.

5.1.2 *Trade credit provision*

Table 6 shows a statistically significant relationship between a company's ESG performance and its provision of trade credit (Column 3). Specifically, the ESG coefficient in Column (3) ($\beta = 0.001$, $p < 0.01$) indicates a significant positive association between ESG performance and trade credit provision (DC). Furthermore, Column (4) shows that DC has a significant impact on ET ($\beta = 0.142$, $p < 0.01$), while ESG has a direct positive effect at the 1% level. These results validate our hypothesis that the supply of trade credit is an intermediary channel linking ESG performance to organizational resilience, thereby supporting Hypothesis H2b. In addition, this mechanism suggests that firms with superior ESG performance maintain steadier connections with their customers and suppliers. For example, trade credit provided by firms can stabilize customer demand and support supply chain continuity during disruptions. Reduced sales volatility associated with extending trade credit to customers and alleviated cash flow pressure would enhance firms' ability to rebound from external disruptions.

5.1.3 *Trade credit financing*

As shown in Column (5) of Table 6, ESG performance is significantly and positively associated with net trade credit financing (NC) (coefficient = 0.001, $p < 0.10$). Column (6) indicates that NC has a statistically significant positive influence on CR (coefficient = 0.028, $p < 0.01$). Additionally, Column (6) demonstrates that ESG performance has a statistically significant positive influence on CR (coefficient = 0.002, $p < 0.01$). Thus, these results provide evidence that trade credit financing is likely the mechanism through which ESG performance impacts organizational resilience, thereby supporting Hypothesis H2c. Firms with solid ESG performance typically have a better chance of accessing trade credit from upstream suppliers while maintaining a balanced amount of credit exposure to their downstream customers, thus improving their overall position regarding net trade credit. This increased capacity to obtain indirect financing may allow firms to stabilize their cash flows and maintain uninterrupted operations, indicating a higher degree of resilience during uncertain times.

Overall, the results suggest that trade credit may be an important channel through which ESG performance influences organizational resilience. Of the three channels, trade credit acquisition has the most substantial mediating effect ($\beta = 0.207$, $t = 19.105$), suggesting that ESG primarily enhances resilience by building trust with upstream suppliers and securing greater accounts payable-based financing. While the downstream credit effect also contributes positively as well, net trade credit (NC) continues to show a significant positive association with resilience. These results align with the perspective that ESG operates as a multidimensional relational mechanism that facilitates the coordination of resource allocation across suppliers, customers, and financial stakeholders, thereby supporting firms' capacity to cope with external shocks.

5.2 Heterogeneity analysis

5.2.1 *Supplier concentration*

Following Li et al. (2025), supplier concentration is defined as the percentage of total purchases made from the top five suppliers out of all purchases made during the year. Companies are then separated into high- and low-concentration groups using the median concentration value as a cutoff. Regression analysis indicates that the positive relationship between ESG performance and organizational resilience is stronger for firms with low supplier concentration ($\beta = 0.004$) than for firms with a high concentration of suppliers ($\beta = 0.001$). This finding is consistent with stakeholder theory's power-dependence construct, as greater supplier concentration leads to higher power asymmetry within the supply chain, whereby dominant suppliers, based on power, capture the value created by ESG efforts. Conversely, firms with low supplier concentration levels are better able to establish diverse, collaborative relationships through ESG activities (Li et al., 2025). Within the stakeholder management theory framework, a decentralized supply chain structure enables firms to leverage ESG as a tool for governing their suppliers, thereby enhancing resilience and encouraging supplier improvement through selective cooperation.

5.2.2 *Heavy-polluting vs. Non-heavy-polluting firms*

This research also investigates differences among firms based on their designation as major sources of pollution in an annual report. Data for classification came from the CSMAR database. As shown in Table 7,

Table 7
Heterogeneity Test

	Supplier Concentration		Heavy-Polluting Firms	
	(1)	(2)	(3)	(4)
	Low	High	No	Yes
ESG	0.004***	0.001	0.003***	-0.001
	(3.264)	(0.775)	(3.290)	(-0.965)
Control variables	Control	Control	Control	Control
Code	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	15335	15299	22277	8773
r2_a	0.563	0.552	0.549	0.596

t statistics in parentheses; ***p<0.01.

the results suggest that ESG performance ultimately has a positive impact on the resilience of firms classified as non-heavy polluters ($\beta = 0.003$, $p < 0.01$), while the impact is negative and not statistically significant for firms classified as heavy polluters ($\beta = -0.001$). In the context of stakeholder theory, heavy-polluting firms must manage greater complexity with multiple types of stakeholders from different groups. They must react simultaneously to the requests of coercive stakeholders (e.g., environmental regulators) and normative stakeholders (e.g., shareholders), who often have conflicting expectations. Consequently, while ESG investments in heavy-polluting firms may be made, they are typically for compliance purposes and therefore not likely to provide strategic value. In comparison, non-heavy-polluting firms have fewer competing stakeholder group interests and can generally align their ESG initiatives with market-oriented stakeholder expectations (e.g., the investment community and consumers). Consequently, they are more likely to convert ESG efforts into resilient outcomes. Moreover, heavy-polluting firms experience considerably greater institutional complexity when making ESG investment decisions. When environmental compliance requirements conflict with shareholder return objectives, the expenses related to ESG investments are often treated as compliance costs rather than strategic assets. This explains the insignificant coefficient of ESG for heavy-polluting firms in this study and is consistent Barnett and Salomon's (2012) "threshold effect" of CSR investment.

6 Discussion

Table 3 confirms Hypothesis 1, which states that ESG is positively related to organizational resilience. This finding is supported by previous research. For example, Lins et al. (2017) demonstrated that firms with robust ESG criteria received greater public support and funding during the Global Financial Crisis, resulting in improved market performance and trade recovery. Similarly, firms with high ESG metrics displayed greater resilience during the pandemic, as reflected by both lower stock price volatility and stable profits (Fink et al., 2020). Cheng et al. (2014) posited that well-developed CSR programs can mitigate the effects of external shocks on company operations. Broadstock et al. (2021) reported that, during the pandemic, Chinese firms engaged in more ESG activities experienced significantly lower stock price crash risk, demonstrating the mitigating impact that ESG has on risk in volatile conditions. Together, these studies suggest that ESG builds reputation capital and trust-based relationships between organizations and stakeholders, resulting in improved corporate adaptability, coordination efficiency, and overall resilience.

However, some studies have reported findings that diverge from ours. For example, Bax et al. (2023) found a relationship between ESG ratings and tail risk, whereby firms with high ESG scores may be able to receive tail risk payments, but also be more susceptible to systemic risks. Therefore, having high ESG ratings does not necessarily guarantee organizational resilience. Iannone et al. (2025) examined the resilience of ESG investments across Europe and found higher volatility and reduced resilience of ESG investments in Germany and Italy than in France. Thus, it is clear that ESG does not lead to resilience in all contexts. On the other hand, our analysis of listed companies in China suggests a positive correlation between ESG and organizational resilience, offering insight into the contextual limitations of the effectiveness of ESG.

Table 6 strongly supports Hypothesis 2, which states that firms with higher ESG performance are more likely to obtain trade credit from upstream suppliers (H2a), more inclined to extend credit to downstream customers (H2b), and better able to enhance resilience through the net balance of trade credit, i.e., trade credit financing (H2c). These findings are consistent with prior literature. For example, Yang et al. (2025) emphasized that strong ESG performance boosts a firm's reputation and risk control capacity, which reinforces its credit relationships with upstream and downstream partners. Wang and Yang (2024) also found that ESG governance mechanisms facilitate stable transactional relationships

under uncertainty by fostering trust and improving firms' short-term financing flexibility. Ferrando and Mulier (2015) further highlighted that trade credit serves not only as a critical interfirm financing tool but also as an essential liquidity buffer during crises. Its accessibility is closely tied to a firm's credit reputation in the supply chain. By introducing a three-dimensional trade credit mechanism as a mediator, this study enriches the explanatory pathway from ESG to organizational resilience and offers a more dynamic, microlevel perspective. This extends the existing literature beyond capital markets and macro-level governance to operational-level mechanisms. In this sense, ESG can be viewed as a relational governance mechanism that facilitates resource coordination among supply chain partners. This perspective highlights the importance of inter-firm financing relationships in shaping organizational resilience. The findings suggest that organizational resilience is not solely rooted in internal resources and capability accumulation but also in cooperative interactions and credit-based networks across the supply chain. Integrating the trade credit mechanism enhances the explanatory power of the theoretical model and provides a practical extension of stakeholder theory, further validating the mechanism by which resilience emerges through multilateral stakeholder relationships.

The heterogeneity analysis further uncovers the different mechanisms through which ESG influences CR. ESG has a significantly positive effect on resilience among non-heavy-polluting firms and those with low supplier concentration. However, this effect becomes statistically insignificant – or even negative – among heavy-polluting firms and firms with high supplier concentration. These findings align with previous literature. Garcia et al. (2017) noted that firms in highly polluting industries face greater external regulatory scrutiny and compliance costs, and even with ESG disclosures, the reputational returns from investors and the public remain limited. Lins et al. (2017) observed that the positive effect of ESG on post-crisis recovery is more evident in industries with lower environmental exposure. Zhu et al. (2021) argued that, when a firm's supply base is highly concentrated, its resilience depends heavily on a few dominant nodes in the supply chain, thereby weakening the effectiveness of social capital generated by CSR initiatives as a mechanism for risk dispersion. These findings suggest that ESG is not a universally effective resilience strategy, and that its effectiveness depends on industry characteristics and supply chain structures.

7 Conclusion

7.1 Key findings

This study examines how ESG performance influences a firm's ability to recover from operational disruptions. It does so by exploring the direct and indirect effects of ESG on CR. The empirical results confirm a significant and positive association between ESG and CR, showing that ESG enhances CR by reducing operational disruptions and bankruptcy risks. Further analysis shows that trade credit (including acquisition, provision, and net financing) significantly mediates the relationship between ESG and CR. Firms with strong ESG performance can enhance their ability to withstand risk and recover from shocks, while securing preferential trade credit terms in their supply chains. However, heterogeneity analysis shows that the positive effect of ESG on CR is less pronounced for heavy-polluting firms and those with higher supplier concentration. Therefore, the contribution of ESG to increasing organizational resilience depends on contextual factors, such as sectoral characteristics and supply chain composition.

7.2 Theoretical contributions

This research establishes a theoretical framework for the relationship between ESG and CR, expanding the boundaries of existing resilience research. In addition, by reconceptualizing organizational resilience as closely linked to sustainable development, the study enhances the analytical understanding of the organizational value of ESG. Furthermore, adding the three dimensions of the trade credit mechanism to represent the mediators in the ESG-trade credit-resilience transmission mechanism provides an explanatory micro-foundational view of the development of resilience. Finally, stakeholder theory forms the basis of this analysis. Our analysis shows that firms can build higher-quality partnerships with key stakeholders (suppliers and customers) by fulfilling environmental and social responsibilities, leading to better access to resources and trade credit support during external shocks. Thus, this research advances the empirical work on stakeholder theory as a foundation for resilience research.

7.3 Policy and managerial implications

This research provides practical guidance for firms seeking to improve their resilience. Strengthening

ESG governance and building strong relationships with stakeholders can enhance businesses' access to trade credit during disruptive events, thereby improving liquidity and recovery capabilities. The findings also provide several actionable implications for policymakers:

1. Policy Design: Policymakers should recognize the role of ESG in boosting organizational resilience and supply chain stability. When creating policies that encourage firms to disclose their ESG practices and implement responsible ones, they should consider contextual variables (e.g., industry type and supplier concentration). Policies that use incentives are likely more appropriate for non-heavy-polluting and dispersed supply firms, while additional assistance can be provided to high-risk firms to facilitate more efficient credit allocation through ESG.

2. Implementation Strategies: Differentiating ESG incentives and regulatory frameworks allows firms to capitalize on their ESG investments, improving their resilience and access to trade credit throughout the supply chain. Public officials can use empirical data to provide firms with information, resources, and technical assistance to help them connect their ESG efforts with trade credit management. This will allow firms to better position themselves to respond to shocks and recover more effectively while avoiding excessive compliance costs.

3. Stakeholder Engagement: Creditors and investors are encouraged to incorporate ESG performance into their risk assessments and investment decisions to identify firms with strong resilience capacities and promote the efficient allocation of capital to sustainable, adaptive firms.

7.4 Limitations and future recommendations

Despite its implications, this investigation has several limitations that warrant consideration in future studies.

1. Sample Scope: The study focuses on Chinese A-share firms, so generalizing beyond these firms is not possible. Future research should utilize cross-country or multi-regional datasets to improve external validity.

2. ESG Measurement: Wind ESG ratings may contain subjective elements. Integrating multiple ESG rating systems or constructing standardized composite indices could improve the robustness of the measurement.

3. Additional Mechanisms: Although trade credit was identified as the primary mediator in this study, other ways to include ESG factors merit examination, such as capitalizing on resilience through organizational learning, improving internal control quality, or promoting greener innovation.

4. Contextual Moderators: Future research can help determine whether institutional quality, regional governance, or marketization levels can serve as external moderators of the positive effect of ESG on the creation of resilient capital.

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SUPPLEMENTARY MATERIAL

Supplementary material accompanies this paper.
Supplementary Data 1 – Dataset
Supplementary Data 2 – Stata script

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The full data supporting the findings of this study has been made available at:
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