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The Impact of Corporate ESG Performance on Firm Value: The Mediating Effect of R&D Investment

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Abstract. Against the backdrop of the maturation of sustainable development concepts and ESG metrics, research on their impact on firm value has become increasingly significant. This not only helps enterprises enhance their value while balancing sustainable development but also amplifies their environmental externalities. This study employs a sample of A-share listed companies in China from 2017 to 2023, grounded in stakeholder theory, sustainable development theory, and resource management theory, to construct a time-fixed effects regression model. The aim is to explore the impact of ESG performance on firm value. The findings reveal a positive correlation between ESG performance and firm value. Further analysis indicates that R&D investment serves as a mediating factor in this relationship. Heterogeneity analysis demonstrates that the positive effect of ESG performance on firm value is more pronounced in enterprises located in western China. This research provides theoretical insights into corporate sustainable development and offers empirical guidance for enhancing firm value within a sustainable framework.

Keywords: ESG performance, firm value, R&D investment, mediating effect

1. Introduction

In the context of the global prevalence of sustainable development concepts, corporations face multifaceted challenges and opportunities in economic, environmental, and social dimensions. The market is increasingly focusing on sustainable development and ESG investing. The ESG framework, encompassing environmental (E), social (S), and governance (G) dimensions, has become a critical guideline for corporate development, profoundly influencing long-term growth and value creation. More enterprises are integrating ESG principles into their strategic planning and daily operations.

However, corporations still encounter numerous challenges when addressing ESG-related issues. Many lack a clear understanding of how ESG performance affects their value and whether R&D investment can translate into tangible comprehensive benefits and competitive advantages. Although existing studies have explored the relationships among ESG performance, corporate R&D investment, and firm value, the underlying mechanisms and conditions require further analysis. Such research holds significant practical implications for formulating scientific development strategies and enhancing sustainable development capabilities. Particularly in China, where the promotion and practice of ESG concepts are still in their infancy, whether enterprises should strengthen ESG performance to improve firm value has become a focal point of current research.

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This study selects A-share listed companies in China from 2017 to 2023 as the sample. Based on stakeholder theory, sustainable development theory, and resource management theory, a time-fixed effects regression model is constructed to investigate the relationships among ESG performance, R&D investment, and firm value. Specifically, the study first analyzes the direct impact of ESG performance on firm value and then examines the mediating role of R&D investment in this relationship. Additionally, heterogeneity analysis is conducted to explore regional differences in the impact of ESG performance on firm value, providing targeted policy recommendations for enterprises in different regions.

The contributions of this study are as follows: First, it not only examines the direct impact of ESG performance on firm value but also delves into the mediating role of R&D investment, revealing the intrinsic mechanism through which ESG performance indirectly enhances firm value. This addresses gaps in prior research. Second, through heterogeneity analysis, the study highlights regional variations in the impact of ESG performance on firm value, compensating for the lack of geographical diversity in existing studies. By aligning with China's unique economic and social context, it offers valuable insights for the sustainable development of Chinese enterprises.

2. Literature review and theoretical analysis

2.1. The impact of ESG ratings on firm value

Under the ESG policy framework, an increasing number of enterprises are prioritizing environmental protection and strengthening corporate social responsibility. As ESG concepts gain traction, rating agencies have introduced indices to measure corporate ESG performance, making ESG metrics a crucial criterion for investors evaluating corporate performance [1]. Empirical studies suggest that firm value reflects the rational allocation of resources, guiding investors in assessing development potential and investment value.

Some studies indicate that ESG ratings positively influence firm value. Generally, strong ESG performance helps reduce operational risks, thereby enhancing firm value [2]. According to stakeholder theory, corporate survival and development depend on the input and participation of various stakeholders, including social, environmental, and economic dimensions [3]. Enterprises must pursue the collective interests of all stakeholders rather than focusing solely on specific groups [4].Environmentally, proactive climate action and emission reductions ensure regulatory compliance, minimizing penalties, litigation, and operational disruptions. Socially, robust employee welfare and product safety measures enhance satisfaction and community support, which reduces risks like strikes or recalls. For governance, transparent decision-making and oversight mechanisms bolster investor confidence while curbing mismanagement and corruption, thereby lowering agency costs.

From a sustainable development perspective, robust ESG performance fosters comprehensive benefits, laying the groundwork for future growth and value enhancement. Sustainable development theory emphasizes the coordinated development of economic, social, and environmental dimensions, balancing contemporary and future human needs with environmental preservation [5].As key actors in modern economic activities, corporations align their ESG performance with sustainable development principles. Effective ESG governance facilitates strategic planning that harmonizes economic, social, and environmental benefits, thereby elevating firm value [6].

An analysis of firms across diverse industries reveals that enterprises demonstrating robust social responsibility practices and exemplary environmental management tend to attain higher ESG ratings. Concurrently, such firms garner greater recognition from capital markets, as evidenced by enhanced corporate valuation and superior stock price performance[7].

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Nevertheless, extant research in this domain remains insufficient in elucidating the precise mechanisms through which ESG performance influences corporate value. The majority of studies confine their focus to aggregate correlation analyses, failing to undertake a granular examination of the underlying pathways. This paucity of mechanistic exploration represents a critical lacuna in the current literature.

2.2. The impact of corporate R&D investment on firm value

According to resource management theory, enterprises must acquire external resources to sustain their development, and the rational allocation and utilization of limited resources can help them gain competitive advantages [8]. From the perspective of green innovation, increasing the proportion of resources allocated to R&D investment can not only improve work processes and enhance resource utilization at the technological level, but also drive innovation in management models and business models, thereby identifying sustainable development pathways suited to the enterprise [9]. Consequently, many firms choose to increase R&D investment and focus on green development to maintain competitive advantages and enhance corporate value.

R&D investment is crucial for sustaining competitive advantages. Appropriate levels of R&D expenditure can promote technological innovation, improve product quality and production efficiency, thereby strengthening market competitiveness and increasing firm value. He employed panel data regression analysis to demonstrate a significant positive correlation between R&D investment and corporate value [10].However, excessive R&D investment may lead to resource misallocation and financial strain, particularly when R&D projects fail or market responses are unfavorable, potentially imposing substantial financial pressure on firms and even disrupting normal operations [11].Moreover, the extended payback period of R&D investments means that short-term economic benefits may not be immediately apparent, placing higher demands on corporate financial management and strategic planning [12].

2.3. Literature critique

Current research on the relationship between corporate R&D investment, ESG performance and market value remains insufficient. In terms of research content, existing studies primarily focus on corporate financial performance or innovation capability, while paying relatively less attention to factors such as social responsibility. These studies fail to comprehensively examine the integrated role of ESG in corporate value creation, nor do they adequately explore the potential synergistic effects between R&D investment and ESG performance on firm value. Methodologically, the current literature predominantly employs quantitative approaches, lacking qualitative analyses and in-depth interpretation of the causal mechanisms underlying economic phenomena. Consequently, future research should expand its scope, diversify methodological approaches, and conduct more thorough investigations into the mechanisms and conditions through which corporate R&D investment and ESG performance influence firm value, thereby providing more targeted theoretical support and practical recommendations for corporate sustainable development.

2.4. Research hypotheses

Drawing upon stakeholder theory and sustainable development theory, superior ESG performance can mitigate corporate operational risks while strengthening investor and consumer confidence, thereby enhancing market valuation. Specifically, exemplary performance in environmental stewardship, social responsibility, and corporate governance effectively reduces economic losses stemming from

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adverse events such as environmental incidents, labor strikes, and product recalls. Concurrently, it attracts long-term investors and consumers, ultimately driving value creation. This leads to our first hypothesis:

H1: ESG performance exhibits a positive correlation with corporate value.

Building upon resource management theory and green innovation theory, ESG performance fosters corporate value appreciation by stimulating R&D investment, which subsequently enhances green innovation capabilities and sustainable development competencies. Specifically, firms demonstrating stronger environmental and social responsibility performance exhibit greater propensity to increase R&D expenditures, developing more environmentally friendly and efficient production technologies and products. This simultaneously improves operational efficiency across business models and management systems, thereby strengthening market competitiveness and long-term value[13]. Consequently, we propose our second hypothesis:

H2: R&D investment partially mediates the relationship between ESG performance and corporate value.

3. Empirical research design

3.1. Model specification

To test H1, the following time-fixed effects regression model (1) is established:

$$TobinQ = \alpha_0 + \alpha_1 ESG + \alpha_2 Size + \alpha_3 DebtRaio + \alpha_4 Cashflow + \sum Year + \varepsilon \quad (1)$$

The coefficient α_1 of the core explanatory variable ESG is the primary predictor, $Size$ $DebtRaio$ $Cashflow$ are control variables, $Year$ represents annual dummy variables, and ε represents the error term.

To test H2 and examine the mediating effect of R&D investment, models (2) and (3) are proposed:

$$RDCostRaio = \alpha_0 + \alpha_1 ESG + \alpha_2 Size + \alpha_3 DebtRaio + \alpha_4 Cashflow + \sum Year + \varepsilon \quad (2)$$

$$TobinQ = \alpha_0 + \alpha_1 ESG + \alpha_2 Size + \alpha_3 DebtRaio + \alpha_4 Cashflow + \alpha_5 RDCostRatio + \sum Year + \varepsilon \quad (3)$$

If the coefficients α_1 in models (2) and (3) are significant, R&D investment plays a mediating role in the relationship between ESG performance and firm value.

3.2. Sample selection and data sources

Due to severe data deficiencies in 2024, this study selects annual data from A-share listed companies in China from 2017 to 2023 as the initial sample. Continuous variables are winsorized at the 1% level, and ST, *ST, and financial sector samples are excluded, resulting in 4,383 valid observations. Industry classification follows the China Securities Regulatory Commission's 2012 standards.

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3.3. Variable definitions

Table 1: Variable Definitions

Variable Type	Variable Name	Variable Symbol	Variable Definition
Dependent Variable	Tobin's Q	TbQ	Market value of the firm
Independent Variable	ESG Performance	ESG	Huazheng ESG rating ESG performance
Mediating Variable	R&D Investment Ratio	RD	Ratio of R&D investment to operating revenue
Control Variables	Firm Size	Size	Natural logarithm of total assets at the end of the period
	Debt-to-Asset Ratio	DR	Ratio of total liabilities to total assets
	Cashflow Ratio	CF	Ratio of net cash flow from operating activities to total assets
	Year Dummy Variable	Year	Year dummy variable

Table 1 presents the types, names, symbols, and detailed definitions of the selected indicator variables.

3.3.1. Dependent variable

Tobin's Q (TbQ)： This study employs Tobin's Q ratio to measure market value. Tobin's Q is defined as the ratio of a firm's market capitalization to the replacement cost of its assets, reflecting market participants' perceptions and expectations regarding the firm's future development. Following the methodological approaches of Li [14] and Xu et al. [15], we select Tobin's Q as the dependent variable to represent corporate value.

Compared to conventional financial metrics, Tobin's Q provides a more comprehensive assessment by incorporating both current operational performance and future growth potential. This multidimensional characteristic enables a more holistic evaluation of a firm's market value. When examining the impact of ESG performance on corporate value, Tobin's Q serves as a more precise indicator for capturing overall value fluctuations.

3.3.2. Core explanatory variable

ESG Performance (ESG): Following the methodology of Wang et al., this study utilizes the comprehensive ESG scores from the SinoSec ESG ratings in the WIND database as the core explanatory variable [16].

The SinoSec ESG rating system is particularly suitable for China's capital market research due to its comprehensive data coverage, robust sample size, and strong alignment with domestic policy priorities (e.g., the "dual-carbon" targets and high-quality development strategy). The use of continuous composite scores, as opposed to the nine-tier classification, enables more precise quantitative measurement and facilitates regression analysis.

3.3.3. Mediating variable

R&D Intensity (RD): This study employs the ratio of R&D expenditure to operating revenue as the mediating variable to measure corporate R&D investment intensity. Amid intensifying market

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competition, an increasing number of enterprises are augmenting R&D investments to enhance comprehensive competitiveness. Furthermore, elevated R&D expenditures can improve a firm's innovation-oriented image, attracting potential consumers and investors while gaining greater market recognition. Through initiatives such as energy efficiency improvements and optimized resource utilization, enterprises can effectively enhance their green innovation capabilities, thereby achieving superior ESG performance.

3.3.4. Control variables

To ensure the accuracy and reliability of research findings, this study incorporates three potential determinants of corporate value as control variables: firm size (Size), debt-to-asset ratio (DR), and cashflow ratio (CF). Additionally, year dummy variables (Year) are included to account for temporal effects in the model.

3.4. Descriptive statistics

Table 2: Descriptive Statistics of Main Variables

Variable	Sample Size	Mean	Standard Deviation	Minimum	Maximum
TbQ	4383	2.1083	1.4088	0.7888	9.8173
ESG	4383	73.1591	4.9407	51.02	87.71
RD	4383	5.3732	5.3010	0.02	123.02
Size	4383	22.3208	1.2345	19.7968	26.4403
DR	4383	0.3942	0.1939	0.0489	0.9244
CF	4383	0.0596	0.0659	0.1720	0.2656

Table 2 presents the descriptive statistical results of each variable.

For the dependent variable, corporate value (Tobin's Q), the mean value is 2.1083 with a range from 0.7888 to 9.8173 and a standard deviation of 1.4088, indicating substantial variation in market valuations across the sample firms.

The explanatory variable, ESG performance, shows a mean score of 73.1591 (range: 51.02-87.71), suggesting relatively high overall ESG levels among the sampled companies. The standard deviation of 4.9407 reflects significant inter-firm differences in ESG engagement.

Regarding the mediating variable, R&D intensity (measured as R&D expenditure to revenue ratio), the average is 5.3732% with extreme values ranging from 0.02% to 123.02%. This distribution reveals generally modest R&D investment levels among most firms, though with notable outliers in certain firm-years.

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3.5. Variable definitions

Table 3: Correlation Coefficients of Main Variables

Variable	GVIF	Df	GVIF^(1/(2*Df))
ESG	1.1771	1	1.0849
Size	1.5146	1	1.2307
DR	1.5003	1	1.2249
CF	1.1581	1	1.0761
Factor(Year)	1.0513	6	1.0042

To avoid the issue of multicollinearity among the regression variables, this study calculated the Variance Inflation Factor values for the main variables. As shown in Table 3, the VIF values for all main variables are less than 5, indicating that multicollinearity is not a concern in the baseline regression.

Table 4: Correlation Coefficients of Main Variables

	TbQ	ESG	Size	DR	CF	RD
TbQ	1					
ESG	0.0501	1				
Size	-0.1918	0.2836	1			
DR	-0.3055	-0.0814	0.4599	1		
CF	0.2907	0.1733	0.0460	-0.2752	1	
RD	0.1806	0.0097	-0.1171	-0.1439	-0.0679	1

To prevent spurious regression results, this study conducted correlation analysis among key variables, with the correlation coefficients presented in Table 4.

The correlation test results in Table 3 demonstrate a significant positive relationship between ESG performance and corporate value (TbQ). All control variables show meaningful correlations with corporate value, confirming their appropriateness as controls. Furthermore, all inter-variable correlation coefficients remain below 0.8, indicating no multicollinearity concerns among the explanatory variables.

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4. Empirical results and analysis

4.1. Baseline regression results

Table 5: Benchmark Regression Results

Variable	(1) TbQ	(2) TbQ
ESG	0.0165***	0.0116**
	(0.0042)	(0.0042)
Size		-0.1653***
		(0.0191)
DR		-1.2892***
		(0.1212)
CF		5.0144***
		(0.3135)
Year Fixed Effects	YES	YES
_cons	0.9015***	5.1566***
	(0.3110)	(0.4165)
N	4383	4383
R^2	0.0019	0.1870
F	15.12	34.02

Standard errors in parentheses. *p < 0.05，**p < 0.01，***p < 0.001.

The regression results in Table 5 demonstrate a statistically significant positive correlation between ESG performance and corporate value (TbQ) in the baseline model without control variables. After incorporating control variables, the coefficient for ESG performance remains significantly positive at the 5% level (β=0.0116), indicating that a one-point increase in the composite ESG score corresponds to a 0.0116 unit increase in corporate value. This finding confirms that superior ESG performance among A-share listed companies significantly enhances firm value, thereby validating H1.

Notably, all control variables exhibit statistically significant relationships with corporate value, confirming their appropriateness as control variables in the empirical model.

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4.2. Mediating effect analysis

Table 6: Mediating Model Results

Variable	(1)	(2)
ESG	0.0290*	0.0104*
	(0.0171)	(0.0042)
Size	-0.2974***	-0.1529***
	(0.0777)	(0.0189)
DR	-4.2500***	-1.1119***
	(0.4924)	(0.1205)
CF	-9.3537***	5.4046***
	(1.2734)	(0.3109)
RD		0.0417***
		(0.0037)
_cons	12.1225***	4.6509***
	(1.6918)	(0.4130)
N	4383	4383
R^2	0.0527	0.2102
F	15.05	194.69

Standard errors in parentheses. *p < 0.05，**p < 0.01，***p < 0.001.

As shown in Table 6, Model (2) examines R&D intensity (RD) as the dependent variable instead of corporate value (TbQ). The results reveal a statistically significant positive coefficient for ESG performance (β=0.0290, p<0.10), indicating that firms with stronger ESG performance tend to invest more heavily in R&D. This relationship stems from both external pressures (e.g., environmental regulations and consumer preferences) and internal motivations (e.g., management's commitment to sustainable development).

In Model (3), which reintroduces corporate value (TbQ) as the dependent variable while incorporating R&D intensity (RD) as an additional explanatory variable, the ESG coefficient remains significant but decreases to 0.0104 (p<0.10). This reduction confirms the partial mediating role of R&D investment, thereby supporting Hypothesis 2. The findings suggest that superior ESG performance enhances corporate value through increased R&D expenditures, which subsequently improve green innovation capabilities, sustainable development potential, market competitiveness, and long-term profitability. This mediating pathway substantiates R&D investment's bridging function between ESG performance and firm value.

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5. Heterogeneity analysis

Table 7: Heterogeneity Test by Region

Variable	Eastern Group TbQ	Central Group TbQ	Western Group TbQ
ESG	0.0087*	-0.0012	0.0376*
	(0.0050)	(0.0095)	(0.0167)
Size	-0.2122***	-0.2050***	0.1046
	(0.0215)	(0.0489)	(0.0817)
DR	-1.0897***	-1.1625***	-2.3465***
	(0.1389)	(0.2808)	(0.5203)
CF	4.4283***	4.8587***	9.1229***
	(0.3701)	(0.6788)	(1.3360)
Year Fixed Effects	YES	YES	YES
_cons	6.3338***	6.9141***	-2.1852
	(0.4696)	(1.0639)	(1.7042)
N	3052	784	385
R^2	0.1873	0.1908	0.2859
F	142.64	42.24	31.55

Standard errors in parentheses. *p < 0.05，**p < 0.01，***p < 0.001.

Regional heterogeneity should be considered when examining the impact of ESG performance on corporate value. Aligning with Shen et al.'s methodology, we divided the sample into eastern, central, and western regional subgroups for separate regression analyses [17].The results are presented in Table 7.

The regression outcomes reveal that ESG performance exerts a more pronounced positive effect on corporate value among western region firms compared to their eastern and central counterparts. This regional disparity may stem from the industrial composition of western firms, which are predominantly concentrated in pharmaceuticals and biotechnology - sectors particularly reliant on technological innovation and human capital development. Consequently, these firms demonstrate greater sensitivity to social and environmental considerations. Furthermore, the substantial waste generation and resource consumption characteristic of these industries subject them to stricter regulatory oversight. Strong ESG performance signals lower environmental risks and heightened social responsibility, thereby attracting greater attention from investors and consumers.

In contrast, the more diversified industrial landscape of eastern and central regions yields weaker ESG-value correlations, suggesting that, with the exception of environmentally sensitive industries,

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firms in these regions generally prioritize operational performance and revenue generation over ESG considerations.

6. Conclusions and policy recommendations

6.1. Conclusions

This study empirically examines the relationship between ESG performance, R&D investment, and corporate value, yielding the following key findings:

First, ESG performance demonstrates a significant positive impact on corporate value. Grounded in stakeholder theory and sustainable development theory, proactive fulfillment of environmental responsibilities, social commitments, and governance obligations enables firms to mitigate operational risks while strengthening investor and consumer confidence, thereby enhancing long-term corporate value.

Second, R&D investment serves as a partial mediator in the ESG-corporate value relationship. From a resource management theory perspective, increased R&D expenditures facilitate optimal resource allocation and technological innovation capabilities, consequently improving market competitiveness.

Third, regional heterogeneity analysis reveals a more pronounced value-enhancing effect of ESG performance among western region firms. This likely stems from the greater relative importance of environmental and social performance for industries predominant in western China.

6.2. Policy recommendations

6.2.1. Corporate level

Enterprises should comprehensively integrate ESG principles into strategic planning and daily operations. Environmentally, they should increase R&D investment in environmental protection technologies, establish clear improvement targets, and explore green development models. Socially, companies need to improve employee welfare systems, ensure product quality and safety, actively participate in public welfare activities to enhance corporate reputation. For governance, optimizing corporate governance structures, strengthening internal supervision, improving transparency and quality of information disclosure, and refining business models will boost investor confidence. Regarding R&D strategies, firms should determine appropriate investment scales and directions based on development strategies and market demands, focusing on both green innovation (including environmental technologies, sustainable products and resource recycling) and technological advancements with operational model reforms to enhance production efficiency and commercialization rates.

6.2.2. Government level

Authorities should promote regional coordinated development by formulating differentiated policies according to regional disparities in ESG performance and development needs. For western region enterprises, particularly in pharmaceuticals and biotechnology, the government should increase support and guide the coordinated development of technological innovation and ESG practices. Eastern and central region enterprises should be encouraged to leverage their advantages and enhance cooperation with western counterparts through technology transfer and industrial relocation to improve ESG performance and corporate value.

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The government is supposed to implement differentiated policies tailored to regional disparities in ESG performance and development needs.

6.2.3. Social level

It is crucial to enhance ESG awareness among investors and consumers by improving their understanding of ESG concepts and focusing on corporate ESG performance. Investors should be guided to pay attention to long-term sustainable development capabilities rather than short-term financial performance. Public education on environmental protection and social responsibility should be strengthened to raise awareness and expectations regarding corporate ESG performance, thereby motivating companies to actively fulfill their ESG responsibilities.

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