

Article

Environmental, Social, and Governance (ESG) Performance and Firm Value: Evidence from Chinese Manufacturing Firms

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Abstract: In an era of great skepticism and distrust, companies' ESG performances are under ever-increasing scrutiny. Stakeholders are urging companies to integrate ESG goals into their business strategic plans, practices, and value chains. Drawing upon a sample of publicly listed manufacturing companies in China from 2009 to 2021, this study aims to investigate the relationships between ESG performance and corporate values, especially the mediating role of financing constraints and the moderating effect of R&D investment intensity. Findings show that the ESG performance of manufacturing companies has a significant positive effect on corporate value. Financing constraints play a partial intermediary role between ESG performance and enterprise values. R&D investment intensity negatively moderates the relationship between ESG performance and manufacturing companies' enterprise values. The heterogeneity study indicates that the beneficial impact of ESG performance on company value is particularly pronounced in the eastern region of China, non-state-owned companies, and heavily polluting industrial enterprises. Our findings provide important practical implications for a range of stakeholders, such as enterprises and investors, and enrich our current understanding of ESG research.

Keywords: ESG performance; corporate value; financing constraints; mediating effect; R&D investment intensity; moderating effect



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1. Introduction

The onset of the COVID-19 pandemic has had a severe impact on the global economy and caused negative repercussions for countries around the globe. In response to the COVID-19 pandemic, support for “green economic recovery” has become the international communities' consensus [1]. Most countries adopt a low-carbon economic transformation as a policy-oriented economic recovery and development, with an emphasis on green and sustainable practices. Under the green, low-carbon, and sustainable development contexts, the concept of environmental, social responsibility, and governance (ESG) that centers around sustainable development has garnered significant attention from various domains [2]. As an emerging approach to business evaluation, ESG factors have been increasingly incorporated into the research and investment decision-making system. Many national stock exchanges and regulators have also formulated policies and regulations that require listed companies to voluntarily disclose ESG-related information or make it mandatory. It is evident that ESG is crucial for the future success of businesses in the globalized world, and the implementation of a robust ESG system will drive long-term sustainability and new avenues of growth for companies [3,4].

Although research on the relationship between ESG performance and firm value is not new, inconsistent findings were reported. The mainstream view supports a positive relationship between ESG performance and corporate value [5–7]. Companies with better ESG performance have more substantial competitiveness and are more likely to be selected

by investors. Furthermore, firms that excel in ESG performance often exhibit robust profitability and risk management capabilities, leading to higher valuation levels. However, based on neoclassical theory, some scholars hold that corporate ESG performance does not have a favorable enough impact to compensate for or outweigh the increasing cost of ESG investment [8,9], as corporate managers often exploit ESG for their own advantage [10]. In contrast, Behl et al. [11] argue that corporate social responsibility does not affect a company's short-term financial performance due to a time lag.

Some academics concentrate on how specific ESG factors might affect the value of a company. For instance, Mardini [12] found that social factors have a significantly negative impact on corporate performance, while environmental and governance factors have a substantial positive effect. There is a perspective among scholars that emphasizes the need to develop and prioritize all aspects of ESG within a company to leverage the synergistic benefits on stock value. For instance, Pornanong and Boonlert [13] argue that businesses concentrating on just one ESG factor undervalue the importance of corporate sustainability. Some academics have included mediating variables further to explore the impact of ESG performance on business value. For instance, Wang et al. [14] examined the mediation effect of auditing quality, while Cahan et al. [15] investigated media attention's mediating effect between ESG and corporate performance. In the research on the impact of ESG performance on business value, some academics have also included moderating variables. For instance, Wu et al. [16] investigated the moderating influence of executive and institutional ownership. Falah and Mita [17] tested the moderating role of CEO narcissism in the relationship between ESG performance and firm value. However, there appears to be little, if no, research on the moderating impact of R&D investment intensity, with only one piece of literature available treating R&D as a mediator [18].

Our review of the pertinent literature above thus suggests that the impact of ESG performance on the value of manufacturing enterprises, as well as the mechanisms through which this impact occurs, still remains unknown. For this reason, drawing upon a sample of publicly listed manufacturing companies in China from 2009 to 2021, this study aims to explore the mechanisms underlying the relationships between ESG performance and corporate values through the mediating role of financing constraints and the moderating effect of R&D investment intensity.

This paper makes substantial contributions to ESG research and practices in three ways. First, it conducts an empirical analysis by selecting the data of ESG information disclosure of A-share listed companies in China's manufacturing industry to offer reference suggestions for the entities. The ESG research in China is relatively new. However, during the past two years, with the introduction of sustainable investment and green finance concepts, the Chinese government and regulators have implemented a series of policies to support ESG investment that have actively promoted the transition of enterprises towards eco-friendly practices and the development of sustainable industries [19]. ESG aligns with the green development concept and high-quality development directives [20,21], making it crucial in achieving the country's aspiration to become a true "manufacturing powerhouse" [22]. Second, this study introduces financing constraint as a mediating variable and R&D investment intensity as a moderating variable. By conducting a mechanism of action analysis, the paper aims to elucidate the underlying mechanisms of the role played by financing constraint and R&D investment intensity in the relationship between ESG performance and enterprise value, an area that has been largely ignored by ESG research. Last, this article undertakes a heterogeneity analysis to enhance the understanding of ESG investment in manufacturing firms of various types. This analysis takes into account the diverse firm characteristics and contexts, providing insights into how ESG performance can be strengthened across different settings.

2. Literature Review and Hypotheses Development

To better understand the mechanisms underlying ESG performance on enterprise value, the following sections provide an in-depth review of literature on the relationships

between (1) ESG performance and corporate value; (2) ESG performance and financing constraints; (3) ESG performance and R&D investment intensity.

2.1. ESG Performance and Corporate Value

According to the stakeholder hypothesis, a company's contribution to its stakeholders leads to its committed investment in the company [23]. Simply put, a company can only realize its value if it meets the demands of its stakeholders. The concept of ESG provides a comprehensive framework for companies to accomplish this mission and goal. Proactive ESG management by businesses has several advantages, such as coordinating relationships with stakeholders, including employees, clients, and the general public. It also helps optimize internal operations and direction and creates a favorable external corporate image [24]. This, in turn, makes it easier to attract investors and promotes business efficiency and expansion.

The concept of green development was first introduced at the 20th National Congress of the Communist Party of China to promote green development and harmonious coexistence between human beings and nature. The concept of green development contains two aspects: decoupling economic growth and resource and environmental loads. Economic activities should follow the laws of nature and enhance the sustainability of resources and the environment. The second aspect involves transforming resources and the environment into productive assets and promoting economic growth. By actively practicing ESG, companies can show their good image of caring for the environment, promote sustainable development of society and gain stable income [25]. For example, embracing corporate ESG responsibilities fulfills social obligations towards the government [26,27]. By fostering strong partnerships with the government, companies can receive appropriate policy support and promote their business value.

Signaling theory suggests companies should have good signals as a transmission vehicle [28]. Good ESG performance of a company can convey positive information to the market, thus gaining the trust and recognition of stakeholders and establishing a good cooperative relationship. Additionally, to avoid the issue of information asymmetry, companies with better ESG performance would utilize ESG investments as a way to signal good business operations and distinguish themselves from companies with poorer performance [29]. This, in turn, helps attract higher-quality customers and reduce contract costs.

To summarize, a company that actively practices ESG is embracing the concept of green development, which leads to improved ESG performance. Simultaneously, an enterprise's excellent ESG performance can send a good signal to the market, attract more stakeholders' attention and investment through a perfect corporate image, and ultimately enhance corporate value. Therefore, Hypothesis 1 is suggested in this paper.

Hypothesis 1 (H1). *ESG performance of manufacturing companies has a significant positive effect on enterprise value.*

What are the channels of action for ESG performance improvement? In order to answer the above questions, this paper examines financing constraints and corporate R&D investment, respectively. On the one hand, according to the information asymmetry theory, reputation theory, and relevant research literature, the article explores the mechanism through which financing constraints influence the relationship between ESG performance and the value of manufacturing firms. On the other hand, leveraging resource allocation theory and relevant literature, the article investigates whether there is a mutual crowding-out effect between R&D investment and ESG performance in the context of manufacturing firms.

2.2. Mediation Effects of Financing Constraints

The term "financing constraint" was first used by Fazzari and Athey [30], who claimed that it is caused by the difference between a firm's internal and external financing costs.

It is worth mentioning that information asymmetry plays a crucial role in causing this disparity. The theory of information asymmetry, initially proposed by Baron [31], highlights the differentiation in access to relevant information among various market participants. Individuals with better information tend to have an advantage, while those with limited access to information face disadvantages. Drawing from the information asymmetry theory, internal business managers tend to have more accurate and detailed information about the firm than external investors. This leads to higher external financing costs than internal financing costs for the firm, thereby imposing restrictions on the firm's investments and creating a financing constraint problem [32,33]. Notably, the manufacturing industry, characterized by its capital-intensive nature and reliance on traditional growth models, is particularly prone to financing constraints. According to Sahar et al. [34], factors such as information asymmetry might cause a firm to incur disproportionate internal and external financing expenses, further exacerbating financial restrictions. However, if enterprises can improve ESG disclosure, it will reduce the time cost of searching for information and reduce the information asymmetry of enterprises. Additionally, enhanced transparency of market information empowers investors to make more informed decisions, ultimately reducing financing constraints for enterprises.

On the other hand, Fombrun and Rindova thought that corporate reputation could serve as a measure of an organization's standing in its relationships with internal employees, external stakeholders, and within competitive and institutional environments [35]. Based on reputation theory, when a company invests in ESG initiatives and achieves excellent ESG performance, it enhances its reputation, thereby increasing public trust and attracting more investors to support the company. Consequently, the company can mobilize more social resources and secure additional financing, ultimately reducing the cost of capital [36,37].

Some scholars have found that ESG performance can significantly alleviate firms' financing constraints. ESG performance may alleviate firms' financing constraints from both cost and efficiency aspects. On the one hand, by giving the public more non-financial information, companies that perform well in ESG narrow the information gap between creditors and corporations. This, in turn, decreases the transaction costs for investors and alleviates financing constraints. Cheng et al. [38] have shown that increased ESG transparency can help reduce information asymmetry and alleviate corporate financing constraints. On the other hand, active improvement in ESG performance can help improve corporate investment efficiency, improving corporate liquidity and easing financing constraints. Maaloul et al. [39] confirm this view.

To summarize, disclosing a firm's commendable ESG performance can reduce the degree of information asymmetry and enhance its reputation. Consequently, more investors will invest their funds in a firm with a better reputation, thereby alleviating its financing constraints. Based on the above analysis, this paper proposes a hypothesis.

Hypothesis 2 (H2). *The ESG performance of manufacturing companies can alleviate financing constraints, thereby enhancing firm value. In this case, financing constraints serve as a mediating factor.*

2.3. Moderating Effect of R&D Investment Intensity

As society progresses, companies need to strike a balance between their corporate responsibility performance and their investments in R&D and innovation, aiming to enhance their visibility and competitiveness. The process of corporate ESG investment is accompanied by technological innovation [40], and corporate technological innovation can also serve corporate ESG investment [41,42]. Therefore, it is rather one-sided to study the impact of ESG performance and R&D investment on enterprise value separately; instead, the synergistic effects on firm value should be taken into account.

Based on resource allocation theory, an enterprise should allocate its limited economic resources proportionately to maximize profitability, taking into consideration various product development and technological conditions [43]. However, if investors perceive that

a company is spending a lot of money on ESG performance or product upgrades and R&D to the detriment of others, the company's ESG performance or R&D investment may have a negative impact [44]. In other words, there exists a zero-sum game between a company's investment in these two aspects when a certain amount of capital is available. Excessive investment may lead to a decline in short-term profitability, which is not conducive to enhancing corporate value. Furthermore, a significant amount of capital support is required for an enterprise's R&D activities. However, investing this capital in R&D activities with inconsistent results can lead to uncertain consequences for the enterprise. If the results are not satisfactory, a large amount of sunk costs will be incurred, which will not only directly affect the enterprise's R&D activities but even affect the normal production and operation activities due to the shortage of funds. Zhao et al. [45] used data from Chinese listed companies between 2010 and 2020 to explore the limited role of ESG in corporate performance during the study period, while corporate innovation played a negative role. Belderbos et al. [46] find that new R&D investments in weak IPR countries negatively affect a firm's market value. Based on the above analysis, this paper proposes the third research hypothesis.

Hypothesis 3 (H3). *The intensity of corporate R&D investment negatively moderates the impact of ESG performance on firm value in manufacturing firms.*

It is worth mentioning that this paper further divides the research sample into three aspects: eastern, central, and western enterprises; state-owned and non-state-owned enterprises; and heavily polluting and non-heavily polluting enterprises. The purpose is to study the differences in the impact of ESG performance on enterprise value among manufacturing enterprises with different characteristics. By drawing on previous research, the appropriate research hypotheses are formulated.

2.4. Differential Analysis of Impact under Heterogeneity

2.4.1. Analysis of the Impact of Regional Heterogeneity

China's economic development is characterized by regional inequalities. For one thing, the eastern region boasts a well-developed economy and a conducive market climate, making it easier for businesses to access capital and resources for corporate ESG investments [47]. For another thing, the institutional environment in the eastern region is favorable, and the government will provide more policy support to motivate enterprises to improve ESG performance actively [48]. On the contrary, the central and western areas need better physical investment opportunities, and businesses prioritize economic efficiency above social responsibility, which results in generally lower ESG levels [49]. In conclusion, Hypothesis 4 is suggested.

Hypothesis 4 (H4). *Manufacturing companies in the eastern area, as opposed to those in the central and western regions, are more significantly impacted by ESG performance on enterprise value.*

2.4.2. Analysis of the Impact of Property Rights Heterogeneity

China's institutional framework gives rise to evident differences between state-owned and non-state-owned enterprises in terms of social responsibility, organization, and management. State-owned enterprises, whose controlling shareholder is the state, have a policy-oriented approach to fulfilling their ESG responsibilities due to their dual identity as agents of state intervention and market participants [50]. However, non-state firms, as more pure market participants, actively raise their ESG performance to chase more significant financial gains and meet stakeholder expectations that contribute to increased financial benefits [51]. Additionally, non-state firms must improve their ESG performance to win the support of the government, banks, and investors because they lack direct ties to the government [52]. Therefore, Hypothesis 5 is suggested.

Hypothesis 5 (H5). *The impact of ESG performance on enterprise value is more significant for non-state manufacturing companies when compared to state-owned manufacturing firms.*

2.4.3. Analysis of the Effect of Contamination Heterogeneity

Under the concept of green development, heavily polluting enterprises will undoubtedly face more environmental regulations. Due to the regulatory pressure from the government and media, heavily polluting enterprises will be more proactive in strengthening technological innovation to improve environmental management [53]. Additionally, manufacturing polluters are highly sensitive to environmental concerns, so it is simple to elicit a strong response from the market once they communicate green development to the market [54]. Moreover, Investors usually pay more attention to the efforts made by heavy polluters to improve the environment and save energy. The ESG performance of such companies plays a significant role in influencing investors' investment decisions [55]. Therefore, this paper proposes Hypothesis 6.

Hypothesis 6 (H6). *The impact of ESG performance on firm value is more significant for Heavily polluting manufacturing firms than non-heavily polluting manufacturing firms.*

To gain a better understanding of this section, Figure 1 illustrates the logic and content of the research hypotheses in this paper. Hypothesis 1 examines whether the ESG performance of manufacturing firms promotes firm value. Hypothesis 2 explores the role of financing constraints in the relationship between ESG performance and manufacturing firms' substantial value. Hypothesis 3 investigates whether there is a crowding-out effect between ESG performance and R&D investment in manufacturing firms, ultimately influencing enterprise value. Hypotheses 4, 5, and 6 further investigate the differences in the impact of ESG performance on enterprise value of manufacturing enterprises in terms of regional differences, nature of property rights, and pollution levels, respectively.

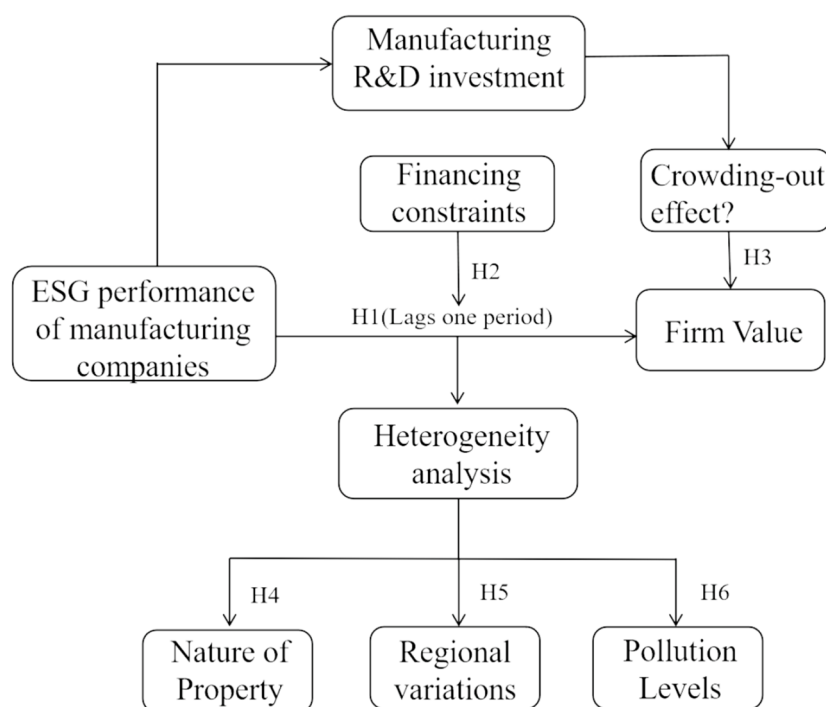


Figure 1. Theoretical framework.

3. Methodology

3.1. Sample Selection and Data Sources

Based on the 2012 edition of the industry classification of the Securities and Futures Commission (SFC) and considering that the ESG rating of Huazheng started in 2009, this paper finally selects the unbalanced panel data of listed manufacturing enterprises in Shanghai and Shenzhen A-shares from 2009 to 2021, with a total of 16,185 observations as the research sample. It empirically analyzes the process by which ESG performance affects the enterprise value of manufacturing businesses using STATA16.0 software. The ESG data from the Wind database are based on SNSI ESG Rating [56,57]. Huazheng ESG Rating Index is a method for assessing companies' environmental, social, and governance performance. It includes three first-tier pillars, 16 second-tier themes, 44 third-tier key issues, 80 fourth-tier indicators, and 300+ underlying data points. In addition, Huazheng ESG Rating has the most comprehensive coverage and the most frequent updates in the domestic rating system. Furthermore, Huazheng ESG Rating has added more indicators that are close to China's development stage, such as the quality of information disclosure, SEC penalties, rural revitalization, etc., which is close to the Chinese market. Please refer to Appendix A for the specific SNSI ESG rating process. Other data from China Stock Market and Accounting Research Database (CSMAR). The data collation process is as follows. (1) Excluding companies with abnormal financial conditions (ST and ST*) and excluding companies with significant missing research variables. (2) 1% and 99% tailing of all continuous variables to avoid the effect of extreme values. (3) Logarithmic treatment of some variables.

3.2. Empirical Model and Variable Definitions

The model for Hypothesis 1 is constructed in accordance with the theoretical approach in this study.

$$TQ_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t-1} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 Age_{i,t} + \alpha_5 CF_{i,t} + \alpha_6 Rec_{i,t} + \alpha_7 Growth_{i,t} + \alpha_8 Era_{i,t} + \alpha_9 Top_{i,t} + \alpha_{10} Indep_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t} \quad (1)$$

where i denotes individual and t represents time. Considering that the ESG evaluation system has a certain lag, the explanatory variables are treated with a one-period lag to reduce the endogeneity issue caused by reverse causality. $Size_{i,t}$, $Lev_{i,t}$, $Age_{i,t}$, $CF_{i,t}$, $Rec_{i,t}$, $Growth_{i,t}$, $Era_{i,t}$, $Top_{i,t}$, and $Indep_{i,t}$ are all control variables. $\sum Year$ indicates control for time effect, and $\sum Id$ indicates the power for individual impact. This paper focuses on the regression coefficient, and if α_1 is positive and significant, then Hypothesis 1 is valid.

In this paper, we applied Wen et al. [58] and used a three-step approach to test for mediating effects. The mediating effect transmission mechanism means that the explanatory variables have some influence on the explained variables through the mediating variables. The following mediating effect model is developed in this research based on the abovementioned analysis. Hypothesis 2 is modeled as follows.

$$Fc_{i,t} = \beta_0 + \beta_1 ESG_{i,t-1} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \beta_4 Age_{i,t} + \beta_5 CF_{i,t} + \beta_6 Rec_{i,t} + \beta_7 Growth_{i,t} + \beta_8 Era_{i,t} + \beta_9 Top_{i,t} + \beta_{10} Indep_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t} \quad (2)$$

$$TQ_{i,t} = \gamma_0 + \gamma_1 ESG_{i,t-1} + \gamma_2 Fc_{i,t} + \gamma_3 Size_{i,t} + \gamma_4 Lev_{i,t} + \gamma_5 Age_{i,t} + \gamma_6 CF_{i,t} + \gamma_7 Rec_{i,t} + \gamma_8 Growth_{i,t} + \gamma_9 Era_{i,t} + \gamma_{10} Top_{i,t} + \gamma_{11} Indep_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t} \quad (3)$$

This paper focuses on the regression coefficients of equation α_1 , β_1 , γ_1 and γ_2 . As shown in Figure 2, the mediating effect mechanism test diagram. If α_1 is insignificant, the mediating effect is invalid, and the test is discontinued. If α_1 is insignificant, Then the model continues to test the coefficients β_1 and γ_2 in turn. If both results are significant, then the mediation effect holds. Further test γ_1 , if γ_1 is significant, then the effect is partial mediation; if γ_1 is not significant, then the product is complete mediation. If at least

one of the coefficients β_1 and γ_2 is not significant, further Sobel test is performed; if it is significant, the mediating effect is valid. Otherwise, the mediating effect is invalid, and the test is stopped.

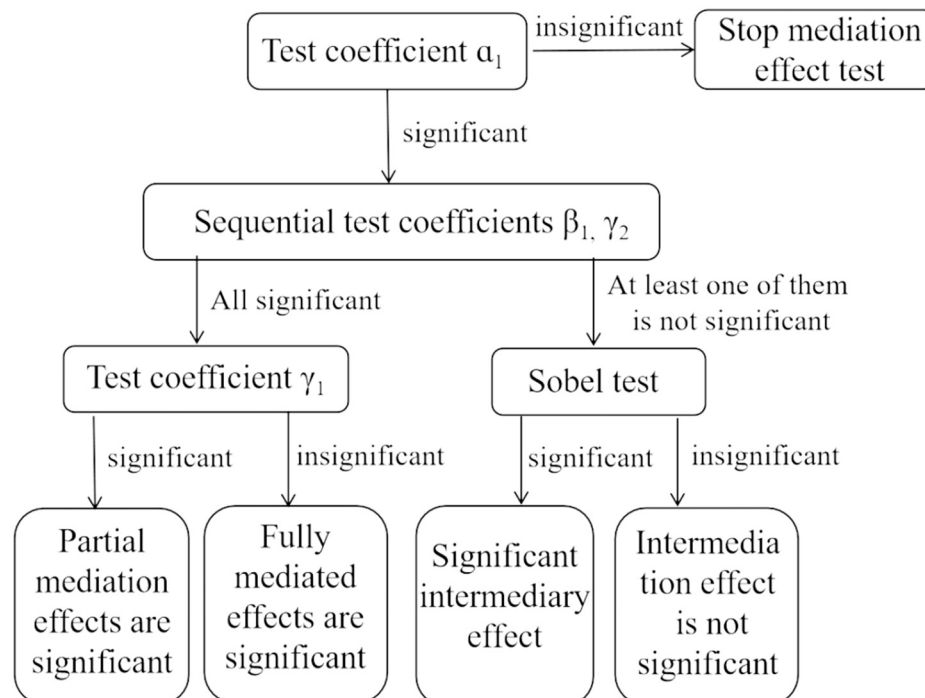


Figure 2. Test chart of mediating effect mechanism.

In this paper, we consult Dong et al. [59]. The moderating effect influence mechanism means that the moderating variables influence the relationship between the explanatory variables on the explained variables. In order to verify the moderating effect of corporate R&D investment in the relationship between corporate ESG performance and corporate value, the following model is constructed to test its moderating influence, and the Hypothesis 3 model is expressed as.

$$\begin{aligned}
 TQ_{i,t} = & \omega_0 + \omega_1 ESG_{i,t-1} + \omega_2 RD_{i,t} + \omega_3 ESG_{i,t-1} \times RD_{i,t} + \omega_4 Size_{i,t} + \omega_5 Lev_{i,t} + \omega_6 Age_{i,t} \\
 & + \omega_7 CF_{i,t} + \omega_7 CF_{i,t} + \omega_8 Rec_{i,t} + \omega_9 Growth_{i,t} + \omega_{10} Era_{i,t} + \omega_{11} Top_{i,t} \\
 & + \omega_{12} Indep_{i,t} + \Sigma Year + \Sigma Id + \varepsilon_{i,t}
 \end{aligned} \quad (4)$$

According to Hypothesis 3, the moderating effect of corporate R&D investment on firm value holds if the coefficient of the interaction term between corporate ESG performance and R&D investment intensity in Model (4) is significant.

We employed Tobin's Q as a dependent variable. Based on the studies of Bhandari and Javakhadze [60] and Abdi et al. [61], Tobin's Q is used to measure the firm's value. Moreover, the independent variable is the ESG performance of enterprises (ESG). The Huazheng ESG Rating system is divided into nine levels. Hence, this paper employed a nine-point scale, with nine being the best and one being the worst, to rank the ESG performance of firms. Meanwhile, to improve the data's dependability, the average score of each quarterly score is used to calculate the annual ESG performance. In addition, the intermediate variable is the financing constraint. In this paper, the financing constraint is measured using the Fc index, which was developed by Edward et al. [62] and ranges between 0 and 1. The larger the Fc index is, the larger the financing constraint is. Furthermore, the moderating variable in this paper is the intensity of enterprise R&D investment. We refer to most of the studies [63,64] and take the ratio of corporate R&D expenditure to corporate gross operating income as the intensity of corporate R&D investment. Referring to the existing

literature [65,66], we employed financial and corporate governance levels indicators such as Enterprise size (*Size*), Gearing ratio (*Lev*), Business Age (*Age*), Total cash assets ratio (*CF*), Business Growth (*Growth*), Credit Status (*Rec*), Shareholder equity ratio (*Era*), Shareholding ratio of the first largest shareholder (*Top*), Board Independence (*Indep*) as control variables in this paper. We also control year and individual effects by including year (*Year*) and industry (*Ind*). Moreover, we selected three dummy variables for heterogeneity analysis, which were Regional Nature (*Area*), Nature of ownership (*SOE*), and Nature of pollution (*Pollut*). The specific names and definitions are shown in Table 1.

Table 1. Variable names and definitions.

Variable	Symbol	Variable Definition
Enterprise Value	TQ	(Market value of shares outstanding at year-end + Market value of non-marketable shares at year-end + Market value of net debt at year-end)/Total assets at year-end Where Market value of non-marketable equity is calculated by replacing net assets
ESG Performance	ESG	According to the ESG evaluation system of China Securities, the score of “9~1” is assigned in descending order, and the average value of each quarterly score is selected as the annual ESG index
ESG performance lags one period	ESG_lag	To avoid endogeneity problems, the indicator lagged one period after ESG assignment is used as the explanatory variable
Financing constraints	Fc	$P(\text{QUFC} = 1 \text{ or } 0 Z_{i,t}) = \frac{e^{Z_{i,t}}}{1 + e^{Z_{i,t}}}$, P takes a value between 0 and 1
R&D investment intensity	R&D	Corporate R&D expenditure/total operating
Enterprise size	Size	Total assets at the end of the period are taken as a logarithm
Gearing ratio	Lev	Total liabilities at the end of the year/Total assets at the end of the year
Business Age	Age	Logarithm of the number of years since the establishment of the enterprise
Total cash assets ratio	CF	Net cash flow for the period/Total assets at the end of the year
Business Growth	Growth	Total market value of the enterprise/Total assets at the end of the year
Credit Status	Rec	Accounts receivable/Operating revenue
Shareholder equity ratio	Era	Shareholders’ equity ÷ Total assets at the end of the year
Shareholding ratio of the first largest shareholder	Top	Number of shares held by the first largest shareholder/Total number of shares × 100
Board Independence	Indep	Number of independent directors/numbers of board of directors × 100
Year	Year	controlling for time effects
Individuals	Id	controlling for individual effects
Regional Nature	Area	If the company is registered in the eastern region = 1, in the central and western region = 0
Nature of ownership	SOE	State-owned enterprises = 1, non-state-owned enterprises = 0
Nature of pollution	Pollut	Heavily Polluting enterprises = 1, Non-heavily polluting enterprises = 0

Notes: Referring to the study by Liu and Liu [67], enterprises in a total of 14 industries, B07, B08, B09, C17, C19, C22, C25, C26, C28, C29, C30, C31, C32 and D44, were treated as Heavily polluting enterprises, and enterprises in the remaining industries were non-heavily polluting enterprises.

4. Empirical Analysis

4.1. Descriptive Statistics

As shown in Table 2, the mean value of Tobin’s Q is 2.278, more significant than the median, which is significantly higher than the median, indicating that the value of listed manufacturing enterprises in China is generally higher. However, the standard

deviation is as high as 1.421, showing the significant variation in market values among different businesses. The ESG performance of China's listed manufacturing industry has a broad range, with a maximum weight of 8 and a minimum value of 1.250, demonstrating significant variation. The mean value of 5.202, which is the same as the median, implies that the overall ESG performance of the sample is at a medium level. The mean value of financing constraint F_c is 0.495, revealing that Chinese manufacturing enterprises generally face financing constraints. The mean value of enterprise R&D investment intensity R&D is 4.127, reflecting that the R&D investment of manufacturing enterprises in China is relatively low. The extreme difference of 19.19 indicates that different industrial companies have varying R&D spending budgets. In addition, there are significant differences in control indicators, such as enterprise size. These financial indicators and company management characteristics can affect the value of enterprises, indicating that the sample data in this paper have certain reliability.

Table 2. Descriptive statistics.

Variables	Number	Average	Median	Standard Deviation	Minimum	Maximum	Range
TQ	16,185	2.278	1.783	1.421	0.895	8.110	7.215
ESG	16,185	5.202	5.250	1.534	1.250	8	6.750
F_c	16,185	0.495	0.520	0.272	0.008	0.938	0.930
R&D	16,185	4.127	3.520	3.298	0.050	19.240	19.19
Size	16,185	22.07	21.96	1.280	19.23	25.67	6.446
Lev	16,185	0.427	0.422	0.204	0.0510	0.956	0.904
Age	16,185	2.743	2.833	0.437	1.099	3.466	2.367
CF	16,185	0.0500	0.0460	0.0710	−0.150	0.266	0.416
Growth	16,185	2.303	1.590	2.341	0.205	15.09	14.89
Rec	16,185	0.240	0.188	0.215	0.001	1.077	1.076
Era	16,185	0.594	0.560	0.353	0.0250	2.719	2.694
Top	16,185	33.50	31.31	14.22	8.740	72.96	64.22
Indep	16,185	37.30	33.33	5.328	33.33	57.14	23.81

Notes: TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; F_c : Financing constraints; R&D: Research and Development investment intensity; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

4.2. Results of the Main Regression Analysis

The Hausman test determined the fixed-effects model was superior to the random-effects model. Therefore, this paper estimates the model using a two-way fixed-effects model with robust standard errors. As shown in Table 3, from columns (3) and (4), both ESG and ESG_{t-1} are significantly positively correlated with TQ, indicating a significant positive regression relationship between TQ and ESG. Thus, Hypothesis 1 is verified.

Regarding controlled variables, enterprise age, total cash assets ratio, and growth are significantly positively correlated with enterprise value. On the one hand, the longer an enterprise exists, the more advantages it has in terms of capital, technology, talent, and other aspects of resource accumulation, which are conducive to improving enterprise value [68]. On the other hand, the better the solvency of the enterprise, the higher the Growth, leading to better development of the enterprise and an increased enterprise value. This conclusion is consistent with the research by Chouaibi et al. [69]. The asset-liability ratio, shareholders' equity ratio, and the shareholding ratio of the largest shareholder are significantly negatively correlated with corporate value, indicating that a higher asset-liability ratio results in worse solvency and corporate value [70]. A high percentage of shareholders' equity means that the enterprise does not actively use financial leverage to expand the scale of operations, which may lead to a decrease in enterprise value to a certain extent. Additionally, the shareholding ratio of the largest shareholder is negatively correlated with the enterprise value because when the largest shareholder's shareholding ratio reaches the company's actual control, they may use the enterprise's resources for their

own welfare. Their purpose is not to increase the value of the enterprise but to divert the economic benefits of the enterprise into their own pockets through various means, which inevitably affects the value of the enterprise.

Table 3. Basic regression results.

	(1)	(2)
	TQ	TQ
ESG	0.034 *** (2.836)	
ESG _{t-1}		0.037 *** (3.406)
Size	−0.222 *** (−5.572)	−0.089 ** (−2.429)
Lev	−1.090 *** (−9.815)	−0.905 *** (−6.891)
Age	0.681 *** (7.566)	0.560 *** (6.844)
CF	0.760 *** (4.208)	0.731 *** (4.202)
Growth	0.291 *** (19.931)	0.469 *** (20.603)
Rec	0.132 (1.220)	0.119 (1.206)
Era	−1.596 *** (−21.943)	−1.758 *** (−17.645)
Top	−0.009 *** (−4.450)	−0.007 *** (−4.000)
Indep	0.003 (1.010)	0.004 * (1.779)
Year	Yes	Yes
Id	Yes	Yes
Constant	5.557 *** (6.335)	2.776 *** (3.486)
R-squared	0.446	0.542
Observations	16,185	14,940

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

4.3. Robustness Tests

This paper draws on previous literature to ensure the robustness and reliability of the research results. It applies the variable substitution method, replacing the calculation method of Tobin's Q value of firm value. Here, the market value of outstanding shares is used to replace the market value of non-marketable stock rights to obtain TQ2. Table 4 shows the robustness test results after adjusting the indicators for assessing the explanatory variables. As shown in Table 4, ESG_{t-1} is still significantly and positively correlated with TQ after replacing the dependent variable. Therefore, the conclusions of this paper are robust.

Table 4. Robustness test results.

	(1)	(2)	(3)	(4)
	TQ2	TQ2	TQ	TQ
ESG	0.036 *** (2.478)		0.020 * (1.764)	
ESG _{t-1}		0.040 *** (2.960)		0.033 *** (3.309)

Table 4. Cont.

	(1)	(2)	(3)	(4)
	TQ2	TQ2	TQ	TQ
Size	−0.464 *** (−10.519)	−0.387 *** (−9.060)	−0.192 *** (−10.321)	−0.136 *** (−8.361)
Lev	−0.887 *** (−7.790)	−0.656 *** (−5.255)	−1.769 *** (−17.255)	−1.386 *** (−11.115)
Age	0.273 *** (3.261)	0.097 (1.173)	0.260 *** (7.074)	0.186 *** (5.854)
CF	0.900 *** (4.590)	0.987 *** (4.839)	1.237 *** (5.680)	0.906 *** (4.655)
Growth	0.167 *** (11.795)	0.258 *** (12.143)	0.405 *** (25.157)	0.587 *** (26.522)
Rec	0.002 (0.020)	−0.014 (−0.134)	0.087 (1.329)	0.057 (1.004)
Era	−1.304 *** (−19.800)	−1.315 *** (−16.710)	−1.928 *** (−26.154)	−1.937 *** (−18.385)
Top	−0.008 *** (−3.671)	−0.006 *** (−2.679)	−0.002 ** (−2.215)	−0.002 *** (−2.943)
Indep	0.005 * (1.654)	0.006 ** (2.308)	0.006 *** (2.800)	0.004 ** (2.292)
Year	Yes	Yes	Yes	Yes
Id	Yes	Yes	Yes	Yes
Constant	12.000 *** (12.514)	10.217 *** (10.803)	5.547 *** (13.777)	4.477 *** (11.687)
R-squared	0.241	0.263	0.541	0.651
Observations	16,185	14,940	16,185	14,940

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

In addition, this paper draws on most of the literature to further verify the robustness by replacing the econometric model [71]. As shown in Table 4, the OLS model is reapplied to regress the sample data. ESG is significantly positively correlated with TQ at the 10% level, and ESG_{t-1} is significantly positively correlated with TQ at the 1% level, further indicating that the findings of this paper are robust.

4.4. Mediating Effect Test

Table 5 describes the mediating effect test for financing restrictions. As shown in column (4), ESG_{t-1} is significantly positively correlated with TQ. ESG_{t-1} is significantly negatively correlated with Fc in column (5), and column (6) shows that ESG_{t-1} is still significantly positively correlated with TQ after adding Fc, while Fc is significantly negatively correlated with both ESG_{t-1} and TQ. This reflects that the mediation effect of financing constraint holds. Industrial companies with more robust ESG performance will have fewer financing restrictions, leading to an increase in their value. Hypothesis 2 is verified. On the other hand, compared with the coefficient in column (4), the coefficient of ESG_{t-1} in column (6) decreases by 0.003, which also fully suggests that financial restrictions mediate the relationship between ESG performance and firm value. Furthermore, this paper performs a Sobel check on the mediating effects to ensure the stability of the test results. The Z-statistic of the Sobel test passes the significance test at the 1% level, which means the above conclusion is robust.

Table 5. Intermediation effect test: based on financing constraints.

	(1)	(2)	(3)	(4)	(5)	(6)
	TQ	Fc	TQ	TQ	Fc	TQ
ESG	0.034 *** (2.836)	−0.006 *** (−3.393)	0.032 *** (2.614)			
ESG _{t−1}				0.037 *** (3.406)	−0.011 *** (−5.479)	0.034 *** (3.128)
Fc			−0.482 *** (−4.498)			−0.296 *** (−2.871)
Size	−0.222 *** (−5.572)	−0.149 *** (−26.448)	−0.294 *** (−6.622)	−0.089 ** (−2.429)	−0.151 *** (−25.450)	−0.133 *** (−3.160)
Lev	−1.090 *** (−9.815)	−0.397 *** (−23.171)	−1.281 *** (−10.853)	−0.905 *** (−6.891)	−0.430 *** (−22.979)	−1.032 *** (−7.520)
Age	0.681 *** (7.566)	−0.046 *** (−4.303)	0.658 *** (7.378)	0.560 *** (6.844)	−0.055 *** (−5.029)	0.544 *** (6.701)
CF	0.760 *** (4.208)	−0.005 (−0.232)	0.757 *** (4.194)	0.731 *** (4.202)	0.006 (0.264)	0.733 *** (4.211)
Growth	0.291 *** (19.931)	−0.011 *** (−10.541)	0.286 *** (19.647)	0.469 *** (20.603)	−0.013 *** (−9.538)	0.466 *** (20.392)
Rec	0.132 (1.220)	0.030 (1.631)	0.147 (1.363)	0.119 (1.206)	0.039 ** (2.035)	0.130 (1.325)
Era	−1.596 *** (−21.943)	0.019 *** (2.942)	−1.587 *** (−21.964)	−1.758 *** (−17.645)	0.006 (0.799)	−1.756 *** (−17.640)
Top	−0.009 *** (−4.450)	0.001 *** (3.472)	−0.009 *** (−4.267)	−0.007 *** (−4.000)	0.001 *** (3.308)	−0.007 *** (−3.865)
Indep	0.003 (1.010)	0.000 (1.058)	0.003 (1.078)	0.004 * (1.779)	0.000 (0.668)	0.004 * (1.810)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Id	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.557 *** (6.335)	4.051 *** (33.498)	7.510 *** (7.432)	2.776 *** (3.486)	4.191 *** (32.080)	4.015 *** (4.178)
R-squared	0.446	0.473	0.448	0.542	0.456	0.543
Observations	16,185	16,185	16,185	14,940	14,940	14,940

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

4.5. Moderating Effect Test

Table 6 examines the moderating role of corporate R&D investment intensity. As shown in column (2), both ESG_{t−1} and corporate R&D investment intensity are significantly positively related to firm value, but the interaction term of both is significantly negatively related to firm value. The results indicate that the intensity of corporate R&D investment negatively moderates the relationship between corporate ESG performance and firm value, which is consistent with Hypothesis 3.

Table 6. Moderating effect test: based on R&D input intensity.

	(1)	(2)
	TQ	TQ
ESG	0.035 *** (3.451)	
ESG _{t−1}		0.066 *** (4.961)
R&D	0.023 ** (2.082)	0.039 *** (3.238)

Table 6. Cont.

	(1)	(2)
	TQ	TQ
interact	−0.004 ** (−2.095)	−0.007 *** (−3.493)
Size	−0.089 ** (−2.443)	−0.092 ** (−2.532)
Lev	−0.898 *** (−6.731)	−0.938 *** (−7.048)
Age	0.565 *** (6.940)	0.549 *** (6.805)
CF	0.750 *** (4.359)	0.745 *** (4.319)
Growth	0.469 *** (20.554)	0.470 *** (20.633)
Rec	0.110 (1.099)	0.105 (1.062)
Era	−1.756 *** (−17.702)	−1.752 *** (−17.763)
Top	−0.007 *** (−3.983)	−0.007 *** (−3.903)
Indep	0.004 * (1.702)	0.004 * (1.735)
Year	Yes	Yes
Id	Yes	Yes
Constant	2.778 *** (3.490)	2.734 *** (3.443)
R-squared	0.542	0.543
Observations	14,940	14,940

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; R&D: Research and Development investment intensity; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

5. Heterogeneity Analysis

5.1. Regional Heterogeneity Analysis

Table 7 shows the results of the test for heterogeneity of firms' property rights. By comparing columns (1) and (3), it can be found that ESG_{t-1} is not significantly relevant to TQ for the sample group in the Midwest. In contrast, the sample group in the East shows a significant and positive correlation between ESG_{t-1} and TQ. This suggests that manufacturing companies in the Eastern region are more significantly impacted by ESG performance in terms of enterprise value. This finding is consistent with Hypothesis 4. The empirical evidence shows that the ESG performance of eastern manufacturing companies can better alleviate financing constraints and contribute more to enterprise value than manufacturing firms in the Central and Western regions.

Table 7. Results of regional heterogeneity test.

	(1)	(2)	(3)	(4)
	Eastern Region		Midwest Region	
	TQ	TQ	TQ	TQ
ESG_{t-1}	0.041 *** (3.324)	0.037 *** (3.013)	0.026 (1.150)	0.026 (1.123)
Fc		−0.342 *** (−2.880)		−0.190 (−1.041)

Table 7. Cont.

	(1)	(2)	(3)	(4)
	Eastern Region		Midwest Region	
	TQ	TQ	TQ	TQ
Size	−0.039 (−0.945)	−0.093 * (−1.909)	−0.247 *** (−3.338)	−0.272 *** (−3.377)
Lev	−0.796 *** (−5.328)	−0.938 *** (−6.085)	−1.137 *** (−4.287)	−1.221 *** (−4.467)
Age	0.515 *** (6.098)	0.498 *** (5.974)	0.685 *** (2.716)	0.674 *** (2.667)
CF	0.697 *** (3.784)	0.696 *** (3.776)	0.970 ** (2.390)	0.975 ** (2.397)
Growth	0.479 *** (18.459)	0.474 *** (18.329)	0.433 *** (9.402)	0.431 *** (9.291)
Rec	0.119 (0.984)	0.135 (1.111)	0.123 (0.761)	0.125 (0.782)
Era	−1.747 *** (−15.702)	−1.749 *** (−15.733)	−1.748 *** (−8.089)	−1.740 *** (−8.016)
Top	−0.008 *** (−3.729)	−0.008 *** (−3.579)	−0.004 (−1.135)	−0.004 (−1.113)
Indep	0.005 * (1.870)	0.005 * (1.899)	0.003 (0.670)	0.003 (0.680)
Year	Yes	Yes	Yes	Yes
Id	Yes	Yes	Yes	Yes
Constant	1.666 * (1.874)	3.165 *** (2.845)	6.173 *** (3.825)	6.885 *** (3.785)
R-squared	0.562	0.563	0.493	0.494
Observations	11,235	11,235	3705	3705

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

5.2. Analysis of Property Rights Heterogeneity

Table 8 shows the results of the test for heterogeneity of enterprise ownership. By comparing columns (1) and (3), it is evident that there is no significant relationship between ESG_{t-1} and TQ for state-owned manufacturing firms. However, ESG_{t-1} is significantly and positively related to TQ for non-state-owned firms. These results indicate that the ESG performance of non-state manufacturing firms has a more significant effect on enterprise value, which is consistent with Hypothesis 5. According to the findings, non-state manufacturing firms are more significantly affected by the impact of ESG performance on financing limitations compared to state-owned manufacturing companies. Furthermore, this effect has a more significant positive impact on firm value.

Table 8. Results of the test for heterogeneity of property rights.

	(1)	(2)	(3)	(4)
	State-Owned Enterprises		Non-State Owned Enterprises	
	TQ	TQ	TQ	TQ
ESG_{t-1}	0.022 (1.632)	0.021 (1.553)	0.050 *** (3.313)	0.045 *** (2.983)
Fc		−0.160 (−1.340)		−0.417 *** (−2.950)
Size	−0.054 (−1.363)	−0.078 (−1.611)	−0.092 * (−1.724)	−0.157 ** (−2.569)

Table 8. Cont.

	(1)	(2)	(3)	(4)
	State-Owned Enterprises		Non-State Owned Enterprises	
	TQ	TQ	TQ	TQ
Lev	−0.636 ** (−2.212)	−0.701 ** (−2.419)	−0.641 *** (−4.170)	−0.815 *** (−4.921)
Age	0.158 (1.474)	0.148 (1.389)	0.402 *** (4.082)	0.389 *** (3.983)
CF	0.530 ** (2.508)	0.530 ** (2.520)	0.760 *** (3.273)	0.763 *** (3.285)
Growth	0.706 *** (22.960)	0.704 *** (22.764)	0.395 *** (16.378)	0.389 *** (16.121)
Rec	0.165 (1.191)	0.172 (1.228)	0.078 (0.611)	0.099 (0.764)
Era	−1.298 *** (−4.610)	−1.299 *** (−4.629)	−1.472 *** (−14.207)	−1.472 *** (−14.235)
Top	−0.001 (−0.302)	−0.001 (−0.290)	−0.007 *** (−2.820)	−0.007 *** (−2.664)
Indep	0.002 (0.600)	0.002 (0.610)	0.006 * (1.852)	0.006 * (1.867)
Year	Yes	Yes	Yes	Yes
Id	Yes	Yes	Yes	Yes
Constant	2.342 ** (2.361)	2.995 ** (2.470)	2.839 ** (2.498)	4.608 *** (3.364)
R-squared	0.670	0.670	0.547	0.549
Observations	5659	5659	9281	9281

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

5.3. Contamination Heterogeneity Analysis

Table 9 shows the test results of pollution heterogeneity among manufacturing firms. Columns (1) and (3) reveal that the ESG_{t-1} is significantly and positively related to TQ for both heavily polluting and non-heavily polluting manufacturing firms. Moreover, when comparing the magnitude of the ESG_{t-1} coefficient, it is observed that the coefficient in column (1) is more significant than that in column (3). The empirical evidence demonstrates that each unit increase in ESG performance adds more value to heavily polluting manufacturing firms than non-heavily polluting manufacturing firms, which is consistent with Hypothesis 6. These findings imply that ESG performance has a considerable mitigating impact on financing limitations for both heavily polluting and non-heavily polluting manufacturing enterprises, ultimately leading to an increase in firm value.

Table 9. Pollution heterogeneity test results.

	(1)	(2)	(3)	(4)
	Heavily Polluting Enterprises		Non-Heavily Polluting Enterprises	
	TQ	TQ	TQ	TQ
ESG_{t-1}	0.051 *** (3.125)	0.050 *** (3.127)	0.037 *** (2.741)	0.032 ** (2.428)
Fc		−0.066 (−0.457)		−0.393 *** (−3.183)
Size	−0.111 (−1.522)	−0.121 (−1.543)	−0.111 *** (−2.605)	−0.172 *** (−3.481)

Table 9. Cont.

	(1)	(2)	(3)	(4)
	Heavily Polluting Enterprises	Non-Heavily Polluting Enterprises		
	TQ	TQ	TQ	TQ
Lev	−0.902 *** (−3.903)	−0.930 *** (−3.825)	−0.890 *** (−5.434)	−1.062 *** (−6.093)
Age	0.552 *** (3.371)	0.550 *** (3.379)	0.588 *** (6.190)	0.565 *** (5.981)
CF	0.974 *** (3.391)	0.969 *** (3.387)	0.578 *** (2.803)	0.588 *** (2.853)
Growth	0.453 *** (8.158)	0.453 *** (8.086)	0.480 *** (19.494)	0.475 *** (19.210)
Rec	0.490 * (1.851)	0.491 * (1.854)	0.026 (0.242)	0.043 (0.397)
Era	−1.609 *** (−9.387)	−1.608 *** (−9.376)	−1.803 *** (−15.538)	−1.803 *** (−15.558)
Top	−0.007 ** (−2.060)	−0.007 ** (−2.058)	−0.008 *** (−3.627)	−0.008 *** (−3.457)
Indep	−0.001 (−0.296)	−0.001 (−0.277)	0.006 ** (2.167)	0.006 ** (2.139)
Year	Yes	Yes	Yes	Yes
Id	Yes	Yes	Yes	Yes
Constant	3.229 * (1.911)	3.501 * (1.898)	3.171 *** (3.452)	4.856 *** (4.320)
R-squared	0.522	0.522	0.557	0.558
Observations	3947	3947	10,993	10,993

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. TQ: Enterprise Value; ESG: Environmental, social, and governance Performance; Fc: Financing constraints; Size: Enterprise size; Lev: Gearing ratio; Age: Business Age; CF: Total cash assets ratio; Growth: Business Growth; Rec: Credit Status; Era: Shareholder equity ratio; Top: Shareholding ratio of the first largest shareholder; Indep: Board Independence.

6. Discussion and Conclusions

6.1. Discussion

Four important findings were emerged from the current study. First, good ESG performance can significantly increase the value of manufacturing enterprises, which is consistent with the mainstream research findings [72,73]. One possible explanation might be that by actively practicing ESG, enterprises are able to comply with green development. As a result, stakeholders have a high degree of recognition for the enterprise, which helps establish a positive image in the minds of investors, improve the enterprise's reputation, and yield higher economic and social benefits [19]. Additionally, good ESG performance can send positive signals to consumers, particularly in the post-pandemic era when consumers place a greater emphasis on a company's ability to sustain itself [74].

Second, in line with the existing literature [75,76], our study found that financing constraints play a mediating role in the impact of ESG performance on manufacturing firm value. Enterprises with better ESG performance can establish a positive image in the public eye, leading to an improved reputation. As a result, they can attract more investors to provide sufficient funds for the development of the enterprise. This, in turn, expands the channels for enterprise financing and reduces the cost of financing, thereby alleviating the financing constraints faced by the enterprise [77]. This finding enriches our understanding of the mechanism by which ESG performance enhances the value of manufacturing firms.

Third, different from previous studies [41,78], we found that R&D investment negatively moderates the effect of ESG performance on manufacturing firm value. One possible reason is that it is challenging for firms to optimize the allocation of valuable resources. When firms have a certain amount of available capital, there may be a mutual crowding-out effect between their investments in ESG and R&D [79]. If investors believe that firms spend a large amount of money on improving ESG performance rather than R&D, it might result

in a negative impact on either ESG performance or R&D investment. Moreover, excessive investment that leads to a decline in short-term profitability may not be conducive to attracting investment from institutional investors [80]. Future research might benefit from this finding and take further investigations on the impact of corporate ESG investment and R&D investment on firm value.

Last but not least, through the heterogeneity analysis, it is found that the ESG performance of eastern China and non-state-owned firms contribute more significantly to firm value, which is consistent with many previous studies [52,81]. It is noteworthy that, in contrast to non-heavily polluting manufacturing firms, the ESG performance of heavily polluting manufacturing firms has a more significant positive effect on firm value [82]. Heavily polluting enterprises' production and operational activities have higher negative externalities, leading to a more substantial adverse impact on the environment and public safety and health [83]. Consequently, the public will pay more attention to enterprises in the pollution industry, imposing greater pressure on heavily polluting enterprises to reduce emissions, conserve energy, and protect the environment. The heightened social attention allows enterprises to send signals to the market about their broader development prospects, ultimately enhancing their enterprise value [84].

Although this study made substantial contributions to our theoretical and practical understanding of ESG performance, it has inherent limitations. Firstly, this paper only selects data from A-share non-financial listed manufacturing companies from 2009 to 2021, and the selected sample may not fully represent all Chinese manufacturing enterprises and companies in other countries. Future studies would benefit from diversifying the sample and time range to enhance the representativeness of the sample. Secondly, due to the difference in the time range of different ESG rating agencies, this paper only selects the Huazheng ESG Rating Index. Future research can also consider MSCI, SynTao Green Finance, and other indicators. This study has identified a phenomenon of crowding between ESG performance and R&D input in manufacturing enterprises, which might be an interesting research topic for future studies.

6.2. Conclusions

Based on financial data from 2009 to 2021, this study assessed the environmental, social, and governance (ESG) performance and firm value of manufacturing companies listed in the Shanghai and Shenzhen A-share markets in China. Findings suggest that improving ESG performance can significantly increase a company's enterprise value and support sustainable development. Financing constraints partially mediate the impact of ESG performance on firm value in manufacturing firms. Strong ESG performance in manufacturing companies can help alleviate financial limitations, thereby increasing the firm's value. Additionally, the study found that the intensity of R&D investment negatively moderates the impact of ESG performance on firm value in manufacturing companies. Moreover, the positive impact of ESG performance on firm value is more pronounced for eastern manufacturing firms, non-state manufacturing firms, and heavily polluting manufacturing firms. Targeting the impact of ESG performance on firm value and its heterogeneous characteristics, these findings add much-needed nuance and detail to the ESG research in the manufacturing sector.

As the globalization of ESG continues to expand, stakeholders worldwide are faced with both opportunities and challenges. It is crucial to address the question of how to foster the growth of ESG in the post-pandemic period, particularly in light of the significant impact the pandemic has had on economies worldwide. This paper proposes the following policy recommendations.

First, manufacturing companies should be proactive in fulfilling their ESG disclosure responsibilities and focus on building an ESG internal control governance system so as to strengthen their capacity to mitigate risks and safeguard their long-term sustainability. Companies that actively uphold their ESG disclosure responsibilities tend to have better strength to cope with long-term risks and turbulence. Such stability will be valued higher

by investors when the epidemic's expected impact on the economy is not clear. In addition, manufacturing companies must optimize resource allocation and adequately address the problem of mutual resource crowding between ESG investment and R&D investment intensity.

Second, investors should integrate corporate ESG performance into their investment strategies, which helps investors achieve stable and sustainable investment returns. Corporate ethics, environment, and other non-financial risks have become essential risks that cannot be ignored in investment. Investors can avoid unnecessary controversy by adopting effective ESG investments. Moreover, we should give full play to the leading role of institutional investors. During the post-epidemic era, the capital market is changing rapidly. By establishing an ESG investment strategy system, institutional investors can better identify and mitigate high-risk or "black swan" events.

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Appendix A

This section details the entire process of SNSI ESG rating for readers' reference.

Appendix A.1. ESG Ratings System

SNSI ESG rating system fully draws on the core of international ESG experience and combines China's characteristics to build ESG rating system, including 3 first-tier pillars, 16 second-tier themes, 44 third-tier key issues, 80 fourth tier indicators, and 300+ underlying data points. It integrates AI, such as semantic analysis and NLP, to build an ESG big data platform, covering all A-share listed companies and investable Hong Kong-listed companies with cumulative market value coverage at 95%.

Table A1. SNSI ESG rating indicators.

3 Pillars	16 Themes	40+ Key Issues
Environment (E)	Climate Change	Greenhouse gas emissions, GHG emissions reduction roadmap, response to climate change
	Resource Utilization	Water consumption, land use and biodiversity. Material consumption
	Environmental Pollution	Industrial emissions, electronic waste, Hazardous waste
	Environmentally Friendly	Renewable energy, green buildings, Green factories

Table A1. Cont.

3 Pillars	16 Themes	40+ Key Issues
Environment (E)	Environmental Management	Sustainable certification, environment penalty, Supply chain management-E
Social (s)	Human Capital	Employee health and safety, employee inspiration and development. Employee relations
	Product Liability	Quality certification, Recall and complaints
	Supply Chain	Supplier risk and management, supply chain relationship
	Community investment	Inclusion, community investment, Employment, technology innovation
	Data Security and Privacy	Data Security and Privacy
Governance (G)	Shareholders' interest	Protection of shareholder's interests
	Governance Structure	EsG governance, risk control, Board structure, executive turnover
	Information Disclosure Quality	EsG external assurance, Credibility of information disclosure
	Governance Risk	Major shareholder behavior, Solvency, Litigation, Tax transparency
	External Punishment	Various external punishments
	Business Ethics	Business ethics, anti-corruption

Appendix A.2. Value Assignment

To ensure the objectivity and comparability of SNSI ESG ratings, we assign values to each indicator according to the quantitative and objective principles.

First, we set the theoretical benchmark of each indicator according to literature research, practical experience, and national standards, and then standardize the values.

Secondly, we divide the underlying data into structured data and unstructured data. For unstructured data, SNSI uses algorithms based on NLP technology, semantic analysis, and other technologies.

Finally, as ESG information disclosure of listed companies has not yet been established in China, statistical methods are used to fill in the missing values in the data during the evaluation process.

Appendix A.3. Weight Setting

After a key issue has been selected for a industry, the weighting is set based on its impact on the industry and expected timeline for the risk/opportunity to materialize. The principle of value assignment is that the weight of the higher degree of influence is higher, and the weight of the shorter influence time is higher. For indicators that are not relevant issues to the industry, the weight is directly set to 0. Each company receives a final ESG score based on the weighted average score of three pillars.

Table A2. SNSI ESG Rating Industry Weight Setting.

		Impact Time		
		Short Term	Medium Term	Long Term
Influence level	high	highest weight	→	decrease
	higher			
	middle		weight is 0	minimum weight
	lower			
	low	decrease		
none				

Appendix A.4. Description of Ratings Results

SNSI ESG ratings give a nine-grade rating of “AAA-C”. The total score of ESG, first-level indicators, second-level indicators, and third-level indicators are all standard scores ranging from 0 to 100. The higher the score, the better the performance of the indicator.

Table A3. Correspondence between ESG rating and ESG score.

ESG Rating	ESG Score
AAA	score $\geq$ 95
AA	$90 \leq \text{score} < 95$
A	$85 \leq \text{score} < 90$
BBB	$80 \leq \text{score} < 85$
BB	$75 \leq \text{score} < 80$
B	$70 \leq \text{score} < 75$
CCC	$65 \leq \text{score} < 70$
CC	$60 \leq \text{score} < 65$
C	score < 60

Appendix A.5. Regular Review by ESG Committee

To strengthen the standardized management of SNSI ESG rating business, improve the scientific nature, authority and consistency of SNSI ESG rating data, and improve the independence and impartiality of SNSI ESG rating work, SNSI has established an ESG expert committee to regularly provide advice on the ESG rating including methodology and data.

Appendix A.6

ESG Rating search site: chindices.com

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