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Original Paper

The Impact of Corporate ESG Performance on Environmental Investment

Yuxi Qi[1], Ruimin Wang[1] & Ruiqi Wang[1]

[1] School of Management, Shandong University of Technology, Zibo, Shandong, China

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Abstract

As a standard for measuring corporate sustainability and long-term value growth investment, corporate ESG performance is of great significance for evaluating corporate sustainability, guiding investment decisions and promoting corporate improvement. Based on the sample of A-share listed companies in Shanghai and Shenzhen that have obtained SynTao Green Finance's ESG rating from 2011 to 2021, this paper empirically examines the role of corporate ESG performance on green investment based on the theory of "stakeholders" and the theory of "sustainable development". The results show that: (1) good ESG performance can significantly improve the level of environmental investment, and this conclusion is still valid under a series of robustness tests; (2) The mechanism test shows that good ESG performance can expand the scale of enterprises and indirectly promote corporate green investment; (3) The intermediary mechanism test shows that there is a partial mediating effect of managerial risk appetite (Mrip) on ESG performance in environmental investment. In the new stage of accelerating the green transformation of China's industry, Chinese enterprises urgently need to improve the green financial system, accelerate the process of green transformation, and help achieve the goals of "carbon peak" and "carbon neutrality".

Keywords

corporate ESG performance, environmental investments, stakeholder theory, mediator effect model

1. Introduction

In September 2020, China clearly stated its goals of "carbon peak" by 2030 and "carbon neutrality" by 2060. In October 2022, the 20th National Congress of the Communist Party of China proposed to "accelerate the green transformation of development mode, improve the fiscal, tax, financial, investment, price policies and standard systems that support green development, and develop green and low-carbon industries". At the 20th National Congress of the Communist Party of China (CPC) in 2022,

the Chinese government further emphasized the concept of "promoting green development and promoting the harmonious coexistence of man and nature". To effectively solve the dilemma of economic growth and environmental protection, the government and enterprises need to work together.

ESG is an acronym for Environment, Social, and Governance (Cao et al., 2019). The revised Code of Corporate Governance for Listed Companies, issued by the China Securities Regulatory Commission (CSRC) in 2018, explicitly requires listed companies to disclose information on environmental, social and corporate governance. In June 2022, the "General Principles for Corporate ESG Evaluation" and the "General Principles for Corporate ESG Information Disclosure" were officially implemented, providing high-standard services and a strong basis for the standardized development of enterprises and the harmonious development of society. At the same time, with the gradual improvement of the domestic ESG evaluation mechanism, more and more companies have begun to pay attention to their own ESG performance. According to previous research, corporate ESG performance can improve corporate performance and corporate innovation ability. Environmental investment can improve the economic and social benefits of enterprises, and then maximize the overall benefits and achieve sustainable development.

A large number of studies have been conducted on the economic consequences of corporate ESG performance, mainly from the impact of corporate ESG performance on corporate financing costs, governance systems, risk control capabilities, corporate performance, etc., and to explore the impact of corporate ESG performance on environmental investment. However, there are still problems such as imperfect evaluation system and insufficient relevant research. Therefore, this study combines empirical analysis and literature analysis, takes A-share listed companies in Shanghai and Shenzhen from 2011 to 2021 as the research object, analyzes the impact of ESG performance of different enterprises on environmental investment decision-making based on sustainable development theory and stakeholder theory, explores the path of corporate ESG performance on environmental investment, enriches the research perspective of corporate ESG performance and the research on environmental investment, promotes enterprises to further achieve high-quality development, and helps achieve the dual carbon goals.

After the introduction, the rest of the paper is organized as follows: the second part is a literature review, which reviews the research on corporate ESG performance, environmental investment, etc.; The third part elaborates the theoretical logic and research hypotheses of this paper. The fourth section describes the study design, including the selected econometric model, relevant variables, and data sources. The fifth part is an empirical test and a discussion of the results, and a series of robustness tests are conducted to verify the research hypothesis, the mechanism through which corporate ESG performance affects environmental investment, and further explore the heterogeneity effect. Finally, in section VI, we draw the main conclusions and make feasible policy recommendations.

2. Literature Review

2.1 Research on the Economic Consequences of Corporate ESG Performance

2.1.1 The Concept of Corporate ESG and the Establishment of an Evaluation System

In 2022, the latest definition of ESG proposed by domestic scholars: in order to maximize social welfare, enterprises take innovation, coordination, green, openness and sharing as the behavior and performance of the strategic guiding ideology in the context of the concept of sustainable development. That is, ESG has developed into a company evaluation standard, and through the analysis of the company's ESG performance, it can evaluate the company's environmental protection, social responsibility, governance ability, etc., and provide a basis for investors' investment activities

In terms of focusing on the three dimensions of corporate ESG, the environment (E) mainly focuses on the impact of corporate operations and investment activities on the environment, such as resource utilization and pollutant emissions; Society(s) is primarily concerned with coordination and balance between the business and its various stakeholders; Governance (G) focuses primarily on the governance structure and governance rules within the company (Yuan et al., 2022).

In recent years, China has paid more attention to the construction of ecological civilization and sustainable development, and more and more enterprises have begun to pay attention to their own ESG construction. On this basis, the content of corporate ESG performance in line with China's national conditions can be defined as the willingness and performance of enterprises to maximize value creation in environmental, social, and governance aspects under the guidance of the new development concept of innovation, coordination, green, openness, and sharing (Su et al., 2022).

2.1.2 A Study of the Economic Consequences of Corporate ESG Performance

At present, a large number of scholars have studied the economic consequences of corporate ESG performance, mainly focusing on corporate financing, corporate performance, and risk response.

In terms of the impact of corporate ESG performance on corporate financing, according to Gao et al. (2021), good ESG performance of enterprises can effectively reduce agency costs, alleviate financing constraints, and improve corporate investment efficiency. Companies' behavior of improving ESG performance indicates that their development plans are in line with the relevant national policies for green and low-carbon development, and they are more likely to receive care or subsidies from national policies, banks and investors are more optimistic about their future development capabilities, and financing constraints can be alleviated (Zhou et al., 2020). Good ESG performance strengthens stakeholder confidence, reduces risk asymmetry, and eases corporate financing constraints.

The good ESG performance of the enterprise sends a signal of good performance and responsibility to the society, which in turn reflects the performance of the enterprise from the side. Chen et al. (2023) concluded that the external ESG rating of enterprises has a positive impact on their internal R&D expenditure strategic decision-making, and has a positive effect on the improvement of corporate performance. At the same time, companies with strong ESG performance are generally able to use resources more efficiently, develop human capital, and motivate executives, among other things,

ultimately achieving higher profitability (Gregory, 2016). ESG performance can improve corporate performance, and good ESG performance can help improve corporate innovation capabilities, which in turn can improve corporate performance (Peng et al., 2023).

Good ESG performance can reduce corporate financial and operational risks, and studies have found that ESG performance is positively correlated with risk response ability. Broadstock (2020) conducted a study of the CSI 300 constituent stocks and concluded that during the pandemic, companies with higher ESG ratings had lower financial risks and outperformed companies with lower ESG ratings overall. Developing a corporate governance framework for ESG-related risks can help companies avoid risks and seize opportunities (Liu, 2023). Companies with good ESG performance usually have higher risk control capabilities, while improving the company's operating efficiency and reducing the company's operating risks.

2.2 Research on the Influencing Factors of Environmental Investment

2.2.1 Background on Environmental Investment

Environmental investment refers to the total expenditure incurred to maintain, restore, protect and develop the environment in order to prevent environmental pollution and prevent, mitigate or eliminate the decline of environmental quality. Since the 18th National Congress of the Communist Party of China, the CPC Central Committee with Comrade Xi Jinping at the core has taken the construction of ecological civilization as an important part of the overall layout of the "five-in-one" and the coordinated promotion of the "four comprehensives" strategic layout. China has accelerated the construction of a green, low-carbon and circular economic system, vigorously promoted green production methods, promoted the energy revolution and the intensive use of resources, systematically promoted cleaner production, coordinated the synergy of pollution reduction and carbon reduction, and achieved the coordination and unity of economic and social development and ecological and environmental protection. China's environmental protection investment policy has evolved from administrative regulation to market incentives, from single investment to diversified investment, and from quantity to quantity and quality (Cheng et al., 2021).

China is exploring the development of an enterprise-led EOD model, encouraging enterprises with strength and conditions to strive to innovate technologies and models, realize the return of operating income to ecological and environmental protection public welfare investment, and promote the internalization of the external economy of ecological environmental protection. A good ecological environment is an intrinsic requirement for the sustainable development of the Chinese nation and a priority area for improving people's livelihood and well-being. Comprehensively strengthening ecological environmental protection, enhancing ecological civilization, and building a beautiful China have been mentioned many times, and the importance of environmental investment is undoubted.

2.2.2 Research on the Influencing Factors of Corporate Environmental Investment

In recent years, environmental issues have received extensive attention from all walks of life, and mankind is a community with a shared future, and protecting the ecological environment is a common

challenge and responsibility faced by the world, and many scholars have conducted extensive research on the significance of environmental protection and government regulation (Zhang et al., 2022).

Environmental protection has economic and social significance. Sun et al. (2019) pointed out that under the guidance of the basic national policy of resource conservation and environmental protection, environmental protection investment, as an important component of basic environmental public services, provides support for effectively solving environmental pollution problems and promoting sustainable economic and social development. According to Qiao (2014) environmental protection investment, as an important component of basic environmental public services, can effectively solve the problem of environmental pollution and promote sustainable economic and social development. Studies have shown that with the increasing emphasis on environmental protection, the realization of corporate goals is not limited to economic interests, especially for heavily polluting enterprises, but should also pay more attention to environmental protection and long-term environmental performance.

According to existing research, the government still occupies a major position in China's environmental investment structure, accounting for a large share. In terms of environmental governance, some scholars have studied government decision-making on environmental investment, such as Azadegan (2018), which used the method of random allocation factorial survey (FSE) to analyze the environmental investment decisions of state managers. Under the dual role of government regulation, the impact of environmental regulation on corporate environmental investment has a "threshold effect". Environmental investment will become the top priority of China's investment and construction, and the existing research also analyzes how to realize the transformation of environmental investment from the state to the enterprise.

3. Current Situation Research and Theoretical Analysis

3.1 Analysis of the Current Situation

Referring to the existing literature at home and abroad, this paper analyzes the current situation of corporate ESG construction and development, predicts the future development of domestic corporate ESG by comparing relevant foreign research, reveals the research background and research significance of this study, and then clarifies the necessity of in-depth research on corporate ESG performance. The results and shortcomings of existing research are analyzed, and they are used for reference and improvement.

3.2 Theoretical Assumptions

This paper analyzes the relevant theoretical basis and puts forward research hypotheses, summarizes the theoretical basis of the impact of corporate ESG performance on environmental investment, and discusses the mediating role of corporate size and managers' risk preference in the relationship between corporate ESG performance and environmental investment. On the basis of theoretical support, the relationship between environmental investment, enterprise size, managers' risk appetite and corporate ESG performance is deduced, and the basic hypotheses are proposed.

3.2.1 Theoretical Basis

(1) Theory of sustainable development

Sustainable Development Theory refers to development that meets the needs of the present without jeopardizing the ability of future generations to meet their own needs. The concept of sustainable development was born in 1972 at a world summit held by the United Nations in Sweden, and the ecological environment has been deteriorating since the 20th century. Sustainable and green development has increasingly become a global issue of common concern to all mankind, and the coordination and unity of sustainable economic development and green ecological environment is the fundamental requirement for the harmonious and symbiotic development of economy, society and nature, and is also an important part of the transformation and development of modern enterprises.

In the context of carbon neutrality, higher requirements are put forward for the coordination of economic development and carbon emissions, and the sustainable development theory has extended and developed a more practical sustainable development framework with an inclusive relationship between “environmental-social-economic”. The theory of sustainable development has a profound impact on ESG, and most of the ESG reporting frameworks absorb the essence of sustainable development theory, which is to provide data for various stakeholders to judge the sustainable development ability of enterprises, and also reflects the core of the concept of sustainable development in the construction of the indicator system, especially in S (social responsibility) and E (environment).

(2) Stakeholder theory

Stakeholders include shareholders, creditors, employees, consumers, suppliers and other trading partners, as well as government departments, local residents, local communities, media, environmentalist pressure groups, and even objects that are directly or indirectly affected by the company’s business activities, such as the natural environment and human descendants. These stakeholders are closely related to the survival and development of the enterprise, some of them share the business risks of the enterprise, some pay the price for the business activities of the enterprise, and some supervise and restrict the enterprise, and the business decision-making of the enterprise must consider their interests or accept their constraints. In this sense, the enterprise is an institutional arrangement for investment in intellectual and managerial specialization, and the survival and development of the enterprise depends on the quality of the enterprise’s response to the demands of the interests of various stakeholders, not only on shareholders. This enterprise management idea theoretically expounds the center of enterprise performance evaluation and management, and lays the foundation for the subsequent performance evaluation theory.

Stakeholder theory advocates different governance concepts, which argues that traditional governance structures are prone to short-term behavior of managers and damage the long-term development of enterprises. Stakeholders have all contributed to the accumulation of corporate wealth to varying degrees, and therefore, the distribution rights of each stakeholder should be respected. In order for a business or company to achieve sustainable development, it must recognize what is the strategic

interest of the enterprise.

Only by unifying the realization of economic, environmental and social benefits will enterprises obtain the power for long-term development. At the same time, after ESG construction is required to be disclosed, companies will not only face stricter government supervision, but also face more attention from the market and investors. In the context of achieving the "dual carbon" goal and sustainable development, more and more corporate stakeholders have begun to pay attention to corporate ESG performance.

3.2.2 Research Hypothesis

According to the purpose and content of the study, the following three hypotheses are proposed, as shown in Figure 1.

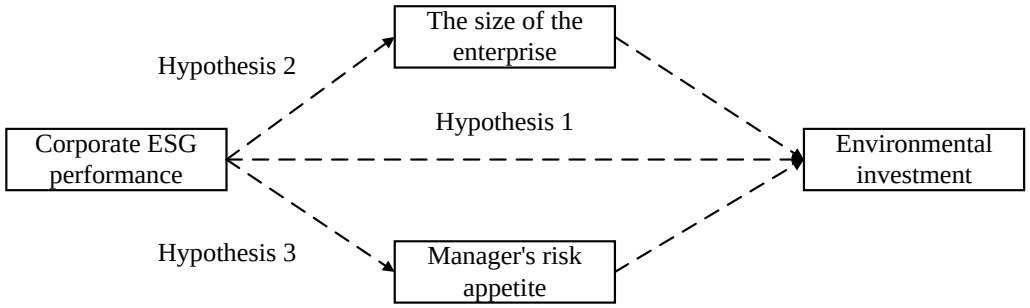

Figure 1. Research Hypothesis

(1) The impact of corporate ESG performance on environmental investment

Good ESG performance can not only reduce the financing constraints of enterprises, but also improve the trust of stakeholders in corporate managers, so that enterprises can improve their financing efficiency. One of the most important factors for companies to invest in the environment is capital, and the results of corporate ESG performance are the premise of environmental investment. Based on this, this study proposes:

Hypothesis 1: A company's good ESG performance has a positive effect on environmental investment

(2) The mediating effect of enterprise size

There is a significant correlation between the number of employees and CSR disclosure, and according to existing studies, environmental performance is positively correlated with corporate environmental disclosure. Larger companies face greater oversight pressure to disclose more information in order to gain legitimacy, and the current ESG rating system relies heavily on proactive information provided by companies. Based on this, this study proposes:

Hypothesis 2: Firm size plays a mediating role in the impact of corporate ESG performance on environmental investment.

(3) The mediating effect of managers' risk preference

As an objective factor, the personal characteristics of managers often act on the business

decision-making and resource allocation of enterprises from the implicit level. There is evidence that managers' risk appetite is an important determinant of corporate investment direction. Environmental investment requires continuous and stable capital investment, but it is difficult to win the favor of creditors due to its long cycle, high risk, and high degree of information asymmetry (Shen et al., 2014). The heterogeneity of risk appetite makes managers form differentiated perceptions of cash flow uncertainty, and risk-preference managers are more sensitive to negative information about the enterprise, and tend to fulfill social responsibilities in order to create a good corporate image. Based on this, this paper proposes:

Hypothesis 3: Managerial risk appetite plays a mediating role in the impact of corporate ESG performance on environmental investment.

4. Research Design

4.1 Sample Selection and Data Source

This study is based on the initial sample of A-share listed companies in Shanghai and Shenzhen that received ESG ratings from SynTao Green Finance from 2011 to 2021. The ESG rating data of SynTao Green Finance comes from the Wind data control variable database, and the financial data of other companies comes from the Guotaian database.

Referring to existing studies (Chen et al., 2023), this paper treats the sample data according to the following principles: excluding the data of ST, ST*, and PT companies; Exclude data for companies with a debt-to-asset ratio greater than 1; exclude data from companies in the financial sector; In order to reduce the influence of extreme values, 1% and 99% tailing treatments were applied to the main continuous variables. Missing data for primary variables is excluded.

4.1.1 Explanatory Variables

Based on the availability and authority of the data, this paper uses the ESG rating score of SynTao Green Finance to represent the explanatory variables and rate the ESG of enterprises. SynTao Green Finance's ESG rating is divided into 10 levels: "A+" to "D", with a score of 1-10 in turn.

4.1.2 Explanatory Variables

In this study, environmental investment was selected as the explanatory variable. Referring to existing research, this paper measures corporate environmental investment from two dimensions: absolute scale and relative proportion, in which the scale of corporate environmental protection investment is measured by the natural logarithm of the amount of investment in corporate environmental protection plus 1, and the proportion of corporate environmental investment is measured by multiplying the proportion of corporate environmental protection investment and the proportion of green R&D in total assets by 100 (Yu et al., 2023).

4.1.3 Mediator Variables

Enterprise Size (Size): Expressed as the natural logarithm of the total assets of the enterprise in the current year.

Managerial Risk Appetite (Mrip): Measured by dividing risky assets by total assets.

4.1.4 Control Variables

Referring to previous studies, this study selects senior executives' risk appetite, asset-liability ratio, book-to-market ratio, years of listing, management expense ratio, and number of employees as control variables, and the specific measurement formula is shown in Table 1.

Executive risk appetite (Risk): Measured by total assets divided by total liabilities.

Debt-to-asset ratio (Lev): Measured by dividing total liabilities by total assets.

Book-to-market ratio (BM): Measured by book value divided by total market capitalization.

Years on the market (Listage): The year of the current year minus the year of listing plus 1 is used to calculate the logarithm.

Management expense ratio (Mfee): Measured by dividing administrative expenses by operating income.

Number of employees (Employee): The number of employees in the enterprise is measured by the natural logarithm.

Table 1. Description of the Variable

Variable type	Variable Name	Variable Symbol	Variable measurement
Explained variable	Environmental investment	Inv	Environmental protection investment / total assets
Core explanatory variables	Corporate ESG performance	ESG	It is calculated based on the scores of SynTao Green Finance and Social Investment Alliance
Mechanism variables	The size of the enterprise	Size	The natural logarithm of total assets for the year
	Manager's risk appetite	Mrip	It is measured by dividing the risk assets by the total assets
	Executive risk appetite	Risk	Total assets /total liabilities
	Debt-to-asset ratio	Lev	Total liabilities / total assets*100%
Control variable	Book-to-market ratio	BM	Book value / total market capitalization
	Years on the market	Listage	ln(Year of the year - year of listing +1）
	Management expense	Mfee	Management

	rate		expenses/operating income
	Number of employees	Employee	The number of employees is taken as the natural logarithm

Considering the problem of data loss and availability, the data of ST, ST*, and PT companies are excluded in this paper. Exclude data for companies with a debt-to-asset ratio greater than 1; exclude data from companies in the financial sector; Finally, the panel data of A-share listed companies in Shanghai and Shenzhen that received ESG ratings from 2011 to 2021 were selected. The original data are all from the Wind Data Control Variable Database and Guotaian Database. In order to improve the accuracy and credibility of the estimation, and to avoid heteroskedasticity and multicollinearity, the relevant variables are logarithmic. The results of the descriptive statistics of the variables are shown in Table 2.

Table 2. Descriptive Statistics of the Main Variables

Variable name	Sample size	Mean	Standard deviation	25%	Median	75%
Inv	1637	16.22	2.43	14.60	16.38	17.91
ESG	2684	73.32	5.89	70.09	73.80	77.53
Mrip	2615	0.13	0.11	0.05	0.10	0.17
Size	2619	22.58	1.21	21.67	22.51	23.45
Risk	2615	-0.04	0.54	-0.36	-0.01	0.31
Lev	2619	0.47	0.20	0.32	0.48	0.62
BM	2642	0.68	0.25	0.49	0.69	0.87
Listage	2693	2.33	0.76	1.95	2.48	2.89
Mfee	2692	0.10	0.94	0.04	0.07	0.10
Employee	2693	7.99	1.16	7.20	7.98	8.75

The descriptive statistical analysis results in Table 1 show that the median natural logarithm (Inv) of environmental investment is 16.38, the mean is 16.22, and the standard deviation is 2.43. The median ESG performance of enterprises is 73.80, the standard deviation is 5.89, and the mean value is 73.32, which shows that the ESG performance of most A-share companies is poor, and there are very large differences among companies, which also proves that this study has a certain reference value for corporate strategic decision-making. The standard deviations of managers' risk appetite (Mrip), asset-liability ratio (Lev) and book-to-market value ratio (BM) were 0.11, 0.20 and 0.25, respectively, indicating that there were small differences in the proportion of risky assets, solvency and book value among enterprises.

4.2 Establishment of the Basic Model

In order to study the impact of corporate ESG performance and environmental investment, the following model is constructed:

$$Inv_{it} = \alpha_1 + \alpha_2 ESG_{it} + \alpha_3 X_{it} + \varepsilon_{it} \quad (1)$$

$$Size_{it} = \alpha_4 + \alpha_5 ESG_{it} + \alpha_6 X_{it} + \varepsilon_{it} \quad (2)$$

$$Inv_{it} = \alpha_7 + \alpha_8 ESG_{it} + \alpha_9 Size_{it} + \alpha_{10} X_{it} + \varepsilon_{it} \quad (3)$$

Among them, α_i is the intercept term, $Size$ is the scale of the enterprise, Inv is the environmental investment of the enterprise, X as the control variable, ε_{it} is the random error term. Referring to the sequential test method of Wen et al. (2022) to verify the research hypothesis: firstly, the impact of ESG on Inv is analyzed by model (1), and the impact of corporate ESG performance on environmental investment is judged by the significance of coefficient α_2. Secondly, model (2) is used to analyze the impact of corporate ESG on $Size$, and if the coefficient α_5 is significant, it indicates that there may be a mediating effect, and the next step is tested. Finally, model (3) is used to analyze the mediating effect of firm size, if α_8 is not significant and α_9 is significant, it means that firm size plays a complete mediating role, and if α_8 and α_9 are significant, it means that firm size plays a partial mediating role.

In the same way, the above testing process is used to test the mediating effect of managers' risk preference.

4.3 Correlation Analysis between Variables

In order to explore the relationship between corporate ESG performance and environmental investment, Pearson correlation analysis was conducted. The degree of correlation between the two variables is measured by calculating the Pearson correlation coefficient of and the two variables, Inv and ESG. The calculation formula is as follows:

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2} - \sqrt{n\sum y_i^2 - (\sum y_i)^2}}$$

where x and y represent Inv and ESG, r_{xy} are Pearson correlation coefficients, respectively.

Generally, the Pearson correlation coefficient above 0.7 indicates a very close relationship, the relationship between 0.4~0.7 is close, and 0.2~0.4 indicates a general relationship.

5. Empirical Test and Discussion of Results

5.1 Baseline Regression

The regression results show that in model (1), the correlation coefficient between corporate ESG performance and corporate environmental investment level is positive, and passes a significant test at the 1% level. It can be seen that the improvement of corporate ESG performance can significantly increase the level of environmental investment. Model (2) adds control variables on the basis of model

(1) to show the regression results of the impact of ESG and control variables on environmental investment, and the results show that the regression coefficient between ESG performance and the level of corporate environmental investment decreases, but is still significant at the level of 1%, indicating that the good ESG performance of enterprises significantly improves the level of environmental investment regardless of whether the control variables are added, which verifies Hypothesis 1.

Table 3. The Impact of Corporate ESG Performance on Environmental Investment

Variable	Inv	
	(1)	(2)
ESG	7333000.1***	5975115.0***
Risk		-191076453.1***
Lev		546313023.8***
BM		220032389.9***
Listage		47899813.6**
Mfee		243042633.3
Employee		-24089729
_cons	-431240431.3***	-680625288.9***
N	1625	1554

Note. * P < 0. 1， ** P < 0. 05， *** P < 0. 01;In parentheses is a robust standard error. The table below is the same.

5.2 Mechanism Test

Benchmark regression and a series of robustness tests have been used to verify that good ESG performance of enterprises has a promoting effect on environmental investment, so what are the key variables that affect the ESG performance of enterprises to promote environmental investment? This requires further dissection of its internal mechanism. Based on the above theoretical analysis and drawing on the causal step method of Baron et al., this paper comprehensively examines the specific mechanism of corporate ESG performance to promote environmental investment from the aspects of managers' risk appetite and firm size, based on the whole-process governance theory. The specific model is set as follows:

$$Inv_{it}=\beta_0+\beta_2 ESG_{it}+\alpha_s X_{it}+\mu_i+v_t+\varepsilon_{it} \quad (5)$$

$$M_{it}=\beta_0+\beta_3 ESG_{it}+\alpha_s X_{it}+\mu_i+v_t+\varepsilon_{it} \quad (6)$$

$$Inv_{it}=\beta_0+\beta_4 ESG_{it}+\beta_5 M_{it}+\alpha_s X_{it}+\mu_i+v_t+\varepsilon_{it} \quad (7)$$

Among them, equation (5) is consistent with the benchmark regression model in this paper, and the coefficient β_2 of ESG reflects the total effect of the ESG performance of A-share listed companies on the level of environmental investment. (6) The explanatory variables are M_{it}, and the mechanism

variables are managers' risk appetite and enterprise size. Equation (7) adds M_{it} to the basis of equation (5), where the ESG coefficient represents the direct effect of the ESG performance of A-share listed companies on the level of environmental investment, while the coefficient of M_{it} represents the impact of mechanism variables on the level of environmental investment after controlling ESG. The test results of the above mediation models are shown in Table 4 and Table 5

In Table 4, in column (1), the ESG coefficient is significantly positive at the 1% significance level, column (3) adds the size of the enterprise on the basis of column (1), the coefficient β_3 of ESG in column (2) and the coefficient β_5 of column (3) size are both significant at the level of 1%, and the coefficient β_4 of ESG in column (3) is not significant, indicating that there is a complete mediating effect of enterprise size (Size) on ESG performance in environmental investment, thus verifying hypothesis 2.

Table 4. Mechanism Testing 1

Variable	（1）	（2）	（3）
	Inv	Size	Inv
Size			1.379e+08***
			-1.76E+07
ESG	5.018e+06***	0.0226***	2.06E+06
	-1.93E+06	-0.00226	-1.93E+06
Risk	-2.383e+08***	-0.0288	-2.285e+08***
	-2.57E+07	-0.0275	-2.52E+07
Lev	6.027e+08***	0.966***	4.239e+08***
	-7.54E+07	-0.0843	-7.75E+07
BM	2.754e+08***	1.133***	1.303e+08**
	-5.19E+07	-0.0587	-5.42E+07
Listage	5.087e+07***	0.304***	1.02E+07
	-1.75E+07	-0.0191	-1.79E+07
Mfee	4.773e+08*	-1.730***	6.375e+08**
	-2.63E+08	-0.294	-2.59E+08
Employee	-3.652e+07***	0.543***	-1.121e+08***
	-1.17E+07	-0.0133	-1.50E+07
Constant	-5.949e+08***	14.76***	-2.625e+09***
	-1.65E+08	-0.191	-3.06E+08
Observations	1,554	2,558	1,554
R-squared	0.104	0.728	0.138

In Table 5, in columns (4) and (6), the coefficients of corporate ESG performance are significantly positive at the significance levels of 1% and 5%, respectively, and model (6) adds managerial risk appetite (Mrip) on the basis of model (4), and the regression results of ESG are significantly positive, and are weakened compared with the regression coefficient of ESG in model (4), so the effect of ESG performance on environmental investment decreases after controlling for managers' risk preference variables. The results show that there is a partial mediating effect of managerial risk appetite (Mrip) on ESG performance in environmental investment, which verifies Hypothesis 3. Therefore, in general, the impact of a company's ESG performance on the level of environmental investment can be achieved by expanding the scale of the company and enhancing the risk appetite of managers.

Table 5. Mechanism Testing 2

Variable	(4) Inv	(5) Mrip	(6) Inv
Mrip			1.00E+08
			-1.29E+08
ESG	5.018e+06***	0.000852***	4.882e+06**
	-1.93E+06	-0.000317	-1.94E+06
Risk	-2.383e+08***	0.116***	-2.499e+08***
	-2.57E+07	-0.00386	-2.98E+07
Lev	6.027e+08***	-0.105***	6.141e+08***
	-7.54E+07	-0.0118	-7.69E+07
BM	2.754e+08***	-0.0340***	2.794e+08***
	-5.19E+07	-0.00822	-5.22E+07
Listage	5.087e+07***	-0.0237***	5.310e+07***
	-1.75E+07	-0.00268	-1.77E+07
Mfee	4.773e+08*	-0.0658	4.858e+08*
	-2.63E+08	-0.0412	-2.63E+08
Employee	-3.652e+07***	-0.0128***	-3.496e+07***
	-1.17E+07	-0.00187	-1.19E+07
Constant	-5.949e+08***	0.303***	-6.245e+08***
	-1.65E+08	-0.0268	-1.70E+08
Observations	1,554	2,558	1,554
R-squared	0.104	0.306	0.104

6. Research Conclusions and Policy Recommendations

6.1 Conclusions of the Study

The dual carbon goal is not only a milestone in China's green development path, but also the general tone of the country's economic development in the coming decades. However, under the constraints of lack of capital, talent and resources, the contradiction between the economic profits of enterprises and the cost of green development is intensifying, and how to find a way to break the situation of green transformation in the context of "dual carbon" has become a practical problem that enterprises need to solve urgently (Liu et al., 2024). Based on the concept of ESG, this paper explores the impact of corporate ESG performance on environmental investment, selects the relevant data of A-share listed companies in Shanghai and Shenzhen from 2011 to 2021, and empirically examines the role of corporate ESG on environmental investment by using the difference-in-difference model based on the "interest correlation theory" and "sustainable development theory", and obtains the following main conclusions:

(1) There is a significant positive correlation between corporate ESG performance and the level of environmental investment; (2) Good ESG performance can have a positive effect on corporate environmental investment by expanding the scale of enterprises; (3) There is a partial mediating effect of managers' risk preference on ESG performance in environmental investment.

6.2 Policy Implications

Based on the above conclusions, the following enlightenment is summarized. (1) It is necessary to accelerate the establishment of a Chinese ESG evaluation system that is in line with international standards and national conditions. The evaluation should focus on two aspects: on the one hand, it is necessary to integrate some advanced foreign requirements and standards and refer to international practices; On the other hand, it must reflect Chinese characteristics, localize, adapt to China's national conditions, and adapt to the characteristics of each industry and enterprise (Du et al., 2023). (2) Help the development of small and medium-sized enterprises and gradually achieve the goal of green economy. The government should earnestly consider the practical problems of enterprises of different sizes in the green transformation, increase the assistance to small and medium-sized enterprises in terms of resources and technology, and promote them to complete the green transformation through green mergers and acquisitions (Wang et al., 2023). (3) Optimize the allocation of management, increase the proportion of risk-preference managers, and fully stimulate the decision-making guidance role of enterprise managers. From the empirical test results above, it can be seen that the degree of risk appetite of managers has a positive role in promoting the impact of corporate ESG performance on environmental investment. On the one hand, when selecting managers, enterprises should combine the explicit assessment criteria such as personal work ability and professional experience with the implicit assessment criteria such as value cognition and risk preference, and form an effective manager team that learns from each other's strengths and complements each other's weaknesses, so as to avoid decision-making errors caused by personal deviations and ensure the effectiveness of team

decision-making. On the other hand, when forming the management team, it is also necessary to comprehensively consider the characteristics of the industry and the development strategy needs of the enterprise, and appropriately increase the proportion of risk-oriented pioneering managers in the management, so as to fully stimulate the guiding role of the management in behavioral decision-making and provide assistance for the realization of the strategic goal of green development of the enterprise (Shi, 2023). (4) Enhance the enthusiasm of ESG responsibility fulfillment entities. The concept of sustainable development has not really gotten rid of the influence of anthropocentric thinking, nature has largely become a tool for development, in this environment, ESG rating may become a means of "greenwashing" for some enterprises, maintaining a false green corporate image, so the government should play an important guiding role, adopt policies based on encouragement and supplemented by punishment to enhance the enthusiasm of ESG responsibility fulfillment subjects, (Zhou et al., 2024). strengthen the supervision of ESG investment, and guide enterprises to correctly grasp the communication concept and culture.

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