

# Research on the Impact of Corporate Social Responsibility and Performance under the Background of Carbon Neutralization

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## Abstract

Under the background of global carbon neutrality, all sectors of society pay more attention to corporate social responsibility and sustainable development. The scores of environmental protection, social responsibility and corporate governance of enterprises (ESG) have been regarded by most countries in the world, as the micro-level reflection of the concept of sustainable development, which is closely related to corporate performance and high-quality development. Many scholars have failed to reach a consistent conclusion on the research on the influence of ESG on enterprise performance. This paper uses the data of Chinese A-share listed companies from 2015 to 2021 to explore the influence of ESG quality on enterprise performance and its mechanism. The results show that the quality of ESG can promote the performance of enterprises, and innovation investment can inhibit the positive effects of ESG. Further research shows that ESG scores do not show heterogeneity in heavily polluted and non-heavily polluted industries, but ESG scores have a significantly positive influence on the performance of non-state-owned enterprises. This study enriches the previous literature, and the research results are conducive to promoting enterprises to improve the quality of ESG information disclosure, and provide useful reference for departments to design policies about high-quality development.

## Keywords

ESG Score, Enterprise Innovation, Financial Performance, Market Performance, China, Listed Companies

## 1. Introduction

In recent years, the increase in greenhouse gas emissions, global warming and

other environmental issues have attracted the attention of all countries in the world, and sustainable development has become a global issue. As an important practitioner of global green investment, China's "Twelfth Five-Year Plan" and "the 18th National Congress of the Communist Party of China (CPC)" also clearly stated that China would actively promote the development of low-carbon economy and green finance. In January 2022, in the video conference of the World Economic Forum General Secretary Xi Jinping emphasized that achieving carbon neutrality in peak carbon dioxide emissions is an inherent requirement for implementing the new development concept, constructing a new development pattern, and promoting high-quality development. Furthermore, it is a major strategic decision made by the CPC Central Committee to coordinate the two overall domestic and international situations.

ESG refers to the combination of environment, society, and Governance, and it is an important concept put forward by the United Nations Environment Programme in 2004. Because ESG score can comprehensively measure the sustainable development ability from the influence of enterprise environment, society and corporate governance. The China Securities Regulatory Commission (CSRC) and the Exchange have issued a number of rules and guidelines to standardize and improve the information disclosure of listed companies' ESG responsibility performance. For instance, No. 2 Guidelines on Contents and Formats of Information Disclosure of Companies Offering Securities to the Public-Contents and Formats of Annual Reports (revised in 2021) (CSRC Announcement No. 15 (2021)) and Guidelines on Investor Relations Management of Listed Companies (CSRC Announcement No. 29 (2022)). In this context, enterprise ESG scoring is not only an important part of evaluating the sustainability of enterprise operation and its impact on social values, but also crucial for China to achieve the "double-carbon goal" of peak carbon dioxide emissions and carbon neutrality, and gradually becomes an effective way to supervise and promote the low-carbon transformation and sustainable development of enterprises.

At present, because the development of ESG in China is in its infancy, compared with foreign rating systems, the domestic evaluation system of ESG information disclosure quality is not perfect, and the willingness of enterprises to disclose voluntarily is generally not strong, the existing research on the influence of ESG on the financial performance of enterprises in China started late, mainly focusing on the impact of corporate social responsibility information disclosure and environmental information disclosure on financial performance. At the same time, the existing research results and conclusions at home and abroad are also different in the study of the correlation between them.

Most scholars have conducted empirical research on enterprises in heavily polluting industries and found that there is a positive correlation between the level of environmental information disclosure and the financial performance of enterprises (Xie et al., 2022). Based on the research of 238 listed companies in the heavily polluted A-share industry on the main board of the Shanghai Stock

Exchange from 2014 to 2016, [Dai and Shi \(2019\)](#) found that there is a positive correlation between them, and the level of environmental information disclosure showed a lagging impact on financial performance. Focusing on the listed companies under the State-owned Assets Supervision and Administration Commission (SASAC) during 2011-2015, [Dong and Liu \(2018\)](#) found that there was a positive correlation between corporate social responsibility information disclosure and corporate performance. Considering the external market performance of enterprises, [Searcy and Elkhawas \(2016\)](#) investigated companies that use the Dow Jones Sustainability Index and found that companies with good ESG performance usually have better financial performance and market performance. [Chatterji and Levine \(2006\)](#) indicated that the empirical research on ESG data and financial data of German companies also reached the same conclusion. At the same time, different scholars have different perspectives on the mechanism of ESG performance and financial performance. For instance, from the media perspective, [Tao and Jin \(2013\)](#) and [Li \(2015\)](#) showed that under the influence of media attention as an intermediary variable, social responsibility information disclosure has a significant positive effect on corporate financial performance. Through the investigation of American enterprises, [Flammer & Luo \(2017\)](#) found that the influence of corporate social responsibility (CSR) on enterprise performance was mainly achieved by improving employee satisfaction, and the higher employee satisfaction, the better enterprise performance. Through the analysis of stock performance and market value growth in different countries, [Eccles and Serafeim \(2013\)](#), [Flammer \(2015\)](#), and [Lee et al. \(2020\)](#) showed that companies with high ESG scores perform better in financial performance, that is, companies have lower equity costs in the stock market ([Cai et al., 2019](#)).

However, the relationship between ESG score and enterprise performance is not static, and there may be a negative relationship between them, for example, [Hawn et al. \(2015\)](#) showed that enterprises blindly pursued high social responsibility performance and invested too much resources and time, which led to worse financial performance. In addition, [Flammer and Luo \(2017\)](#) found that the better the performance of a company in social responsibility, the more willing its employees are to participate in corporate governance and put forward more objections and objections to the company's business decisions, thus influencing the performance of the company. Similarly, in the analysis of moral investment funds in Sweden and the Netherlands, [Bauer et al. \(2005\)](#) found that companies with good ESG performance had relatively poor stock performance in the long term.

Other studies have found that there is no obvious relationship between them, [Zhang and Wang \(2015\)](#) focused on the voluntary environmental disclosure information of 100 listed companies in heavily polluting industries from 2009 to 2011, and it was found that there was no significant correlation between environmental information disclosure and corporate financial performance. [Renneboog et al. \(2008\)](#) showed that the performance of socially responsible invest-

ment is not worse than that of traditional investment, but its performance is not better than that of a traditional investment. In addition, Wang and Choi (2010) found that institutional investors' shareholding had no obvious influence on the financial performance and market value of enterprises. Using the social responsibility reports of listed companies in China from 2014 to 2018, Wei et al. (2020) found a nonlinear relationship between them and financial performance. Wang and Choi (2010) believed that the reason for this difference may lie in different research methods and different samples.

Regarding ESG, innovation, and financial performance, previous studies that analyzed the integration of the three had their own focus, and the relationship among them may be quite different in different types of enterprises. Most studies believe that innovation plays an intermediary role between ESG score and financial performance and has a positive impact. Focusing on listed companies in China from 2014 to 2018, Zhang et al. (2020) showed that ESG performance and innovation investment had a significant positive impact on the financial performance of enterprises, and innovation investment can strengthen the positive relationship between ESG performance and financial performance. Qi, Sun, and Quan (2021) focused on enterprises with internationalization backgrounds and found that R&D investment plays a certain role in ESG's path to promote enterprises' return on total assets. Yunus et al. (2020) showed that ESG performance and innovation had a significant positive impact on the financial performance of enterprises. In addition, innovation plays an intermediary role between ESG performance and financial performance (Xu, Yang, & He, 2021). Further research shows that innovation has a more significant impact on ESG performance. The research on manufacturing enterprises in China shows that CSR has a positive impact on enterprise performance, but this relationship is more significant in enterprises with low investment in innovation. Similarly, Almahmeed et al. (2018) found that environmental, social and governance (ESG) practices had a significant positive impact on innovation, while innovation had a positive impact on corporate financial performance, and innovation played an intermediary role between ESG practices and corporate financial performance.

Huang and He (2017) found that technological innovation played a regulatory role in a state-owned enterprise, but played an intermediary role in non-state-owned enterprises. By introducing internal control, Zhang and Li (2021) found that internal control regulates the relationship between ESG and financial performance, while technological innovation plays a regulatory role between internal control and financial performance. Li, Li and Zhang (2019b) analyzed the data of the top 500 A-share listed companies with the most brand value in China, and showed that corporate social responsibility had a negative impact on brand value, while high-tech innovation level could weaken the negative effect of corporate social responsibility on brand value. Meanwhile, if the company's innovation investment is not appropriate, it will offset the positive impact of ESG behavior (Kacperczyk & Hong, 2018), which has a negative impact on financial

performance (Serafeim, 2018; Oikonomou et al., 2012). Liao et al. (2021) found that the positive impact of CSR on corporate performance in China was different in enterprises with different financial constraints, while innovation investment had a negative impact on the relationship between CSR and performance. From the perspective of government supervision, Tong et al. (2021) found that CSR and innovation had positive effects on corporate performance, but the government could adjust the negative impact of excessive investment in innovation on corporate performance through a high supervision buffer. Through the analysis of listed companies in Taiwan Province, Chiu et al. (2014) indicated that enterprises can improve their reputation and credibility by fulfilling their social responsibilities, thus stimulating employees' innovative behavior, and then improving their innovative investment and financial performance. Although the current research has basically proved that there is a certain correlation between ESG performance and enterprise performance, the influence path and mechanism between ESG, innovation, and financial performance have not yet reached a consistent conclusion. In addition, the time span and industry scope of the existing research sample are narrow, mostly concentrating on the year before 2020, which may not be applicable to all enterprises.

In this paper, all A-share listed companies are selected as research samples, and the return on net assets and TobinQ are selected as the measurement indicators of enterprise performance, which spans from 2015 to 2021, making the research conclusions more universal and accurate. The present study explores the influence effect and mechanism between ESG score, innovation investment, and enterprise performance, it is found that: 1) when R&D investment increases, the focus of enterprise resources shifts to innovation field, and the promotion effect of ESG performance on enterprise performance will be weakened; 2) When R&D investment decreases, enterprises will invest limited resources in financial performance management, and the positive effect of ESG performance on performance is more obvious.

Specifically, the research contribution of this paper is reflected in the following three aspects. First, it enriches the domestic and foreign literature on the influence of ESG on enterprise performance. Although the current academic research has proved the positive or negative relationship between ESG performance and enterprise performance, the mechanism of ESG, innovation and financial performance has not yet reached a consistent conclusion. Based on the data of all A-share listed companies in China from 2015 to 2021, this study introduces innovation investment as an intermediary variable, which enriches the relevant literature.

Secondly, through the investment in enterprise innovation, this paper provides new micro-evidence for the influence of ESG score on enterprise performance. At the same time, it further deepens the understanding of the internal mechanism affecting the relationship between enterprise performance and ESG scoring, which is of guiding significance for enterprises to improve their per-

formance.

Thirdly, in the China's A-share market, it is of practical significance to investigate the mechanism of ESG scoring on enterprise performance. With the increasing attention of domestic and foreign investors to ESG, more companies are beginning to realize the importance of ESG. This study aims to explore the relationship between corporate social responsibility and performance, provide a reference for enterprises to achieve sustainable development and investors' investment, and provide decision-making basis for the government to formulate more scientific and reasonable policies.

## 2. Theoretical Analysis and Hypothesis

### 2.1. ESG Score and Corporate Performance

With the goal of "peak carbon dioxide emissions" and "carbon neutrality" put forward, investors pay more and more attention to the performance of corporate social responsibility. A high-quality ESG score generally means that enterprises adopt a long-term sustainable development strategy to obtain sustainable profits. At the same time, based on the stakeholder interest theory (Garcia et al., 2017), the company should make decision-making activities in line with the interests of groups or individuals (that is, stakeholders). Therefore, the enterprise ESG score can affect investors' decision-making, reduce information asymmetry with stakeholders, and gain more recognition from investors, thus improving enterprise performance (Velte, 2017). The positive impact of ESG score on enterprise performance mainly focuses on the following aspects: 1) Improving enterprise reputation and brand value: ESG score has a positive impact on enterprise reputation and brand value. Some studies show that enterprises with good ESG performance are more popular among consumers and investors, which enables enterprises to better promote products and services and increase sales and market share (Mansouri et al., 2020; Khan et al., 2020). In addition, ESG scoring will also affect the position and value of enterprises in the supply chain. A study shows that most enterprises in the supply chain regard ESG score as one of the criteria for evaluating their suppliers, so enterprises with high ESG scores are more likely to get contracts and get better prices (Eccles et al., 2019). ESG score has a positive impact on corporate performance, mainly in the following aspects: 2) Improving shareholder value: ESG score has a positive impact on corporate shareholder value. Enterprises with good ESG performance tend to have higher stock returns and more stable stock prices in the long run (Eccles et al., 2019; Friede et al., 2015). Khan et al. (2020) showed that the return on the stock of enterprises with high ESG scores is 2.6% higher than that of the Standard & Poor's 500 Index on average during the whole period from 2006 to 2017. 3) Reducing the risks and costs of enterprises: ESG scoring has a positive impact on the risks and costs of enterprises. Some studies show that enterprises with good ESG performance are more stable in the face of environmental and social risks, and can avoid unnecessary legal proceedings and financial risks, which helps to reduce the costs

and risks of enterprises (Mansouri et al., 2020; Khan et al., 2020). In addition, enterprises with good ESG performance also have advantages in financing, because banks and investors tend to provide financing and more favorable financing conditions for these enterprises (Eccles et al., 2019).

However, some studies show that ESG scoring may have a negative impact on the performance of enterprises. For example, some studies show that there may be a negative correlation between ESG scores and financial performance in some industries (Gao et al., 2020; Flammer, 2015). This negative association may be because in some cases, in order to improve the ESG score, enterprises may take some measures that have a negative impact on their financial performance, such as reducing environmental and social risks, but this may increase the cost of enterprises. Although there are some negative effects, on the whole, the influence of ESG scores on enterprise performance is positive. Good ESG performance can improve the reputation and brand value of enterprises, increase sales and market share, improve shareholder value and reduce enterprise risks and costs.

Therefore, this paper puts forward the following hypotheses:

Hypothesis 1: There is a correlation between ESG score and enterprise performance.

Hypothesis 1a: ESG score has a positive impact on corporate financial performance.

Hypothesis 1b: ESG score has a positive impact on enterprise market performance.

## **2.2. ESG Score, Innovation Investment, and Enterprise Performance**

In the research on the relationship between ESG score and enterprise performance, innovation investment is often considered as a positive factor to enterprise performance. However, some studies have also found that innovation investment may have a negative impact on ESG scores and corporate performance (e.g. Jiao et al., 2020; Chen et al., 2021; Pindado et al., 2018). This paper will summarize the relevant literature and discuss the negative impact of innovation investment on ESG score and enterprise performance, mainly in three aspects: environmental pollution, corporate governance problems and economic uncertainty.

First of all, innovation investment may lead to environmental pollution, thus influencing ESG score and enterprise performance. Jiao et al. (2020) showed that too much investment in innovation may lead to negligence of environmental responsibility of enterprises, because enterprises invest more energy and resources in the development and promotion of new products, thus ignoring social responsibilities such as environmental protection. Chen et al. (2021) found that innovation investment has little influence on ESG score in areas with stricter environmental protection standards. This shows that excessive innovation investment may have a negative impact on ESG scoring, because environmental issues

occupy an important position in ESG scoring. Secondly, innovation investment may have a negative impact on corporate governance issues, thus influencing ESG scores and corporate performance. Li and Liu (2020) showed that excessive investment in innovation may lead to the aggravation of corporate governance problems, thus affecting corporate performance. Because excessive investment in innovation may lead to problems such as improper management, decision-making mistakes and increased credit risk, which will have a negative impact on enterprise performance. In addition, Pindado et al. (2018) found that excessive investment in innovation may lead to imperfect corporate governance structure, which will have a negative impact on corporate performance. Finally, innovation investment may lead to economic uncertainty, which will influence ESG score and enterprise performance. Li et al. (2019a) showed that excessive investment in innovation would increase the risk and uncertainty of enterprise operation, which would have a negative impact on enterprise performance. Pang and Yuan (2019) studied the impact of corporate social responsibility reputation on financial performance based on listed company data. At the same time, innovation investment may also lead to the instability of the company's profitability, which will affect the ESG score. Accordingly, this paper puts forward the following hypothesis:

Hypothesis 2: Innovation investment has a negative impact on ESG score and enterprise performance.

### 3. Empirical Design

#### 3.1. Samples and Data Sources

In this paper, all A-share listed companies were selected as research samples, and the time span is from 2015 to 2021. At the same time, ST companies and companies with missing financial data were excluded, and finally, the annual observation values of 21,620 companies in 4541 companies were obtained. Among them, the ESG scores of listed companies are obtained from Global ESG Rating Research Database, and other data are all from China Stock Market Accounting Research (CSMAR).

#### 3.2. Main Variables

##### 3.2.1. Explained Variables

Enterprise performance, enterprise performance measurement indicators include market performance and financial performance indicators. The commonly used indicators to measure the market performance of enterprises include the P/E ratio, TobinQ value and P/B ratio, etc. This paper chooses TobinQ as the indicator to measure the market performance of enterprises. Common accounting indicators to measure the financial performance of enterprises include return on equity (Roe), return on total assets (Roa) and earnings per share (EPS), etc. By referring to relevant literature, we know that the return on equity is comprehensive and can completely measure the profitability, operating ability and solvency



of enterprises. Therefore, this paper chooses Roe as the evaluation index of enterprise financial performance.

### 3.2.2. Explanatory Variables

Regarding the enterprise ESG rating, the present study selects the basic information, ESG rating statistics, E (environment), S (society), G (governance), industry rating statistics, stock and financial data of CSI 800 constituent companies included in CSMAR Global ESG Rating Research Database, and builds an ESG rating based on international standards and the information disclosure characteristics of listed companies in China. Finally, we assign the rating results from high to low. That is, the highest AAA score is 10 and the lowest CCC score is 0, which indicates that significant ESG negative events occurred during the rating period.

### 3.2.3. Mediator Variable

Investment in innovation (Inv) refers to the ratio of R&D investment in products or technologies to operating income in the current year as an indicator to measure the expenditure on innovation activities.

### 3.2.4. Control Variables

By referring to the relevant literature, this paper chooses listing year, total market value, company size, financial risk, number of board meetings, regional economy, operating income growth rate, equity concentration, total asset turnover rate and equity nature as control variables. In addition, this paper sets up industry dummy variable (ind) to control the influence of industry, and Year dummy variable (Year) to control the influence of year. The specific variable design is shown in **Table 1** below.

## 3.3. Model Setting

According to the above research hypotheses and variable setting, taking enterprise performance as the dependent variable, this paper establishes the following multiple linear regression model to test the influence of ESG score of listed companies on enterprise performance:

$$Y_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_k X_{it} + Time + Industry + \varepsilon \quad (1)$$

$$Y_{it} = \beta_0 + \beta_1 ESG_{it} \times Inv_{it} + \beta_k X_{it} + Time + Industry + \varepsilon \quad (2)$$

Model (1) examines the influence of ESG scores of listed companies on enterprise performance, including enterprise financial performance ( $Roe_{it}$ ) and market performance ( $Tobinq_{it}$ ), and enterprise ESG scores. Model (2) is mainly used to investigate the intermediary role of innovation investment in the process of ESG influencing enterprise performance,  $Inv_{it}$  indicating the natural logarithm of enterprise R&D investment in this period, and the interactive  $ESG_{it} \times Inv_{it}$  measures the intermediary role of enterprise R&D investment on enterprise ESG scores on financial performance.  $X_{it}$  is a set of control variables, including listing year, total market value, company size, financial risk, number of board

**Table 1.** Main variables and definitions.

Variable property	Variable meaning	Variable symbol	Variable definition
Explained variable	Enterprise financial performance	Roe	Return on net assets = net profit/net assets
	Enterprise market performance	TobinQ	TobinQ = market price of the business (share price)/ replacement cost of the business
	Company performance	EPS	Earnings per share
Explanatory variable	ESG score	ESG	Using the grading method commonly used in international credit rating, the ESG rating results are divided into 7 grades, with scores ranging from 0 to 10.
Mediator variable	Innovation investment	Inv	Ratio of R&D investment to operating income (%)
Control variable	Year of listing	IPO	Year of listing of enterprises
	Company size	Size	Natural logarithm of total assets at the end of the year.
	Financial risk	Lev	Total liabilities at the end of period/total assets at the end of period * 100%.
	Number of board meetings	BM	Number of board meetings held by the company within one year.
	Regional economy	GDP	Natural logarithm of GDP in the current year where the enterprise is located.
	Operating income growth rate	Growth	Increase in operating income in the current period/operating income in the previous period * 100%.
	Ownership concentration	Share	Number of shares held by the largest shareholder/ total shares of the company.
	Turnover of total assets	Asset_turnover	Average balance of main business income/total assets.
	Year	Year	Year (dummy variable).
	Heavy pollution industry	Polluted_ind	Virtual variable, heavily polluted industry = 1, otherwise = 0.
Nature of equity	SOE	Virtual variable, state-owned enterprise = 1, otherwise = 0.	
Industry code	ind	Industry dummy variable, industry code of the enterprise.	

meetings, regional economy, growth rate of operating income, concentration of equity, total assets turnover rate, etc. See **Table 1** for detailed variable measurement standards. Time is an annual fixed effect, and Industry is an industry fixed effect, indicating a random error term.

## 4. Empirical Results

### 4.1. Descriptive Statistics

As indicated in **Table 2**, the 25% upper percentile of the total return on assets is

0.283, the 75% upper percentile is 0.1149, and the average value is 0.0205, suggesting that there is a big gap in the profitability among sample companies, and different types of enterprises have both surpluses and losses. The 25% upper score of TobinQ is 1.3309, the 75% upper score is 3.2677, the average is 2.886, and the standard deviation is 7.074, which shows that the external performance of different enterprises is quite different. By observing the innovation investment of enterprises, we can know that the upper score of R&D investment accounts for 2.22%, the upper score of 75% is 6.05, the variance is 281.2, and the average value is 9.016, which shows that there is a big gap in R&D expenditure among enterprises in China, and there is a lack of innovation consciousness as a whole.

The maximum value of enterprise ESG score is 8, the minimum value is 0, and the average value is 4.055, which shows that the ESG score of the selected samples is generally evenly distributed, but the ESG level of the industry is still in the middle and lower level, and the overall level is not high. As can be seen from **Table 3**, with the increase of year, the sample number of ESG level of enterprises has gradually increased, indicating that China's ESG information disclosure quality evaluation system has gradually improved, and the average ESG level has

**Table 2.** Descriptive statistical results of main variables.

Variable	Sample number	Average value	Standard deviation	min	p25	p50	p75	max
code	30,075	334,341	268,843	1	2600	300,699	600,941	874,000
Year	30,075	2018	1.964	2009	2017	2018	2020	2021
TobinQ	25,617	2.886	7.074	0.062	1.3309	2.0107	3.2677	983.500
Roe	25,617	0.0205	2.701	-176.400	0.283	0.704	0.1149	282.000
EPS	25,617	0.426	1.14	-16.460	0.842	0.292	0.6562	41.760
ESG	24,884	4.055	1.221	1	3	4	five	8
IPO	25,617	2008	8.326	1990	2000	2010	2015	2021
ind	25,617	5.056	3.649	1	3	3	6	19
Polluted_ind	25,617	0.455	0.498	0	0	0	1	1
SOE	25,617	0.327	0.469	0	0	0	1	1
Size	25,617	22.32	1.512	15.980	21.3027	22.0746	23.0404	31.190
Lev	25,617	0.445	1.167	0.008	0.2568	0.4136	0.5812	178.300
Growth	25,617	0.286	6.96	-3.728	-0.0292	0.1039	0.2674	944.100
Share	25,617	0.593	0.159	0.000	0.4807	0.6016	0.7102	1.012
Asset_turnover	25,617	0.625	0.537	-0.062	0.334	0.5259	0.7704	12.370
GDP	25,584	7.808	3.307	0	7.7626	8.9531	9.8282	38,700
BM	25,644	9.955	4.248	0.000	7	9	12	58.000
Inv	26,273	9.016	281.2	-15.110	2.22	3.87	6.05	133.600

**Table 3.** Descriptive statistical results of ESG level.

Year	Sample number	Average value	Standard deviation	min	P25	P50	P75	max
2015	2765	3.966004	1.038479	0	3	4	5	8
2016	2942	3.917063	1.124329	0	3	4	5	8
2017	3397	4.053871	1.140994	0	3	4	5	8
2018	3549	4.142012	1.184552	0	3	4	5	8
2019	3695	4.044655	1.351335	0	3	4	5	8
2020	4058	4.082307	1.338874	0	3	4	5	8
2021	4478	4.1159	1.239371	0	3	4	5	8
Total	24,884	4.054935	1.221351	0	3	4	5	8

increased rapidly from 2016 to 2018, and then increased to 4.1159 after 2018, indicating that the awareness of ESG information disclosure of Chinese enterprises has gradually improved.

## 4.2. Principal Regression Model

Firstly, this paper studies the influence of ESG score on enterprise performance, and the main regression results are shown in **Table 4**. Column (1 - 2) shows the influence of ESG score (ESG) on enterprise financial performance (Roe), column (3 - 4) shows the influences of ESG score on enterprise financial performance (TobinQ). Specifically, the column (2) and column (4) further control the time fixed effect and industry fixed effect on the basis of column (1) and column (3). The results of **Table 4** column (1 - 2) show that whether the time and industry effects are controlled or not, the ESG score of enterprises is significantly positively correlated with financial performance, and it has passed the significance test of 5% level ( $t = 2.4885$  and  $t = 2.3199$ ), which verifies hypothesis 1a. The **Table 4** column (4) results show that enterprise ESG performance has a positive effect on market performance at least at a 10% significance level ( $t = 1.9100$ ), and hypothesis 1b is verified.

## 5. Further Analysis

### 5.1. Mechanism Inspection

Finally, it is tested whether innovation investment plays an intermediary role in the promotion of ESG performance to enterprise performance. From the column (1) and (2) in **Table 5**, it can be seen that the regression coefficient of innovation input to enterprise performance is  $-0.0032$  when both innovation input and ESG score are included in the model, and it is significant at 5% level ( $t = -2.0534$ ). After controlling the year and industry effects, the regression coefficient of innovation input to enterprise performance is  $-0.0029$ , and it is significant at 10%

level ( $t = -1.8540$ ). According to the test method of mediation effect, innovation investment plays a partial mediating role in the relationship between ESG performance and enterprise performance, that is, innovation investment has a significant negative regulatory effect.

**Table 4.** The influence of ESG score on enterprise performance.

	(1)	(2)	(3)	(4)
	Roe	Roe	TobinQ	TobinQ
ESG	0.0378** (2.4885)	0.0360** (2.3199)	0.0589 (1.5513)	0.0736* (1.9100)
IPO	0.0035 (1.3321)	0.0042 (1.4956)	-0.0315*** (-4.8465)	-0.0312*** (-4.4685)
SOE	0.0889** (2.1137)	0.0982** (2.2788)	-0.3318*** (-3.1502)	-0.4061*** (-3.8010)
Size	0.0109 (0.7940)	0.0172 (1.1111)	-1.1170*** (-32.4453)	-1.1820*** (-30.8036)
Lev	-0.0054 (-0.3642)	-0.0044 (-0.2981)	1.2506*** (33.9012)	1.2576*** (34.3860)
Growth	0.0028 (1.1321)	0.0027 (1.1011)	0.0093 (1.5085)	0.0088 (1.4427)
Share	0.1309 (1.0493)	0.1155 (0.9020)	2.2705*** (7.2695)	2.3809*** (7.5022)
Asset_turnover	0.0404 (1.2430)	0.0444 (1.2580)	0.3351*** (4.1154)	0.6233*** (7.1321)
GDP	0.0042 (0.7901)	0.0050 (0.8550)	0.0290** (2.2008)	0.0354** (2.4386)
BM	-0.0121*** (-2.8504)	-0.0118*** (-2.7020)	0.0404*** (3.7827)	0.0366*** (3.3814)
Constant	-7.3693 (-1.3959)	-9.1080 (-1.5486)	88.2726*** (6.6784)	89.4589*** (6.1368)
Year fixed effect	N	Y	N	Y
Industry fixed effect	N	Y	N	Y
Sample size	24,821	24,821	24,821	24,821
Adjusted R <sup>2</sup>	0.0010	0.0010	0.0880	0.1062

Note: \*, \*\*, and \*\*\* indicate significance at the level of 10%, 5% and 1%, respectively. The numbers in brackets are the t statistics of the parameters. The following tables are the same.

**Table 5.** Mechanism test of enterprise performance.

	(1)	(2)
	Roe	Roe
ESG*Inv	-0.0032** (-2.0534)	-0.0029* (-1.8540)
ESG	0.0394** (2.0657)	0.0368* (1.9007)
Spend	0.0093* (1.7726)	0.0086 (1.6276)
IPO	0.0037 (1.1516)	0.0046 (1.3415)
SOE	0.0895* (1.8268)	0.1056** (2.1131)
Size	0.0258 (1.4026)	0.0305 (1.5708)
Lev	-0.1366** (-2.1800)	-0.1233* (-1.9491)
Growth	0.0030 (1.1483)	0.0029 (1.1137)
Share	0.0723 (0.5027)	0.0624 (0.4236)
Asset_turnover	0.0313 (0.7752)	0.0460 (1.0719)
GDP	0.0058 (0.9830)	0.0073 (1.1208)
BM	-0.0134*** (-2.6455)	-0.0124** (-2.3931)
Constant	-8.1446 (-1.2277)	-10.0479 (-1.4364)
Year fixed effect	N	Y
Industry fixed effect	N	Y
Sample size	21,367	21,367
Adjusted R <sup>2</sup>	0.0010	0.0012

## 5.2. Heterogeneity Analysis

### 5.2.1. Grouped Regression According to Industry

Existing research shows that the level of environmental information disclosure has significant industry differences (Wang, 2008). In order to further test whether the enterprise performance will be affected by the nature of the industry, this paper uses the dummy variable *Polluted\_ind* to indicate whether the enterprise is a heavily polluted industry as a classification index, and makes a group regression on the samples to test whether the nature of the heavily polluted industry will affect the positive effect of the quality of environmental information disclosure on the enterprise performance. The results show that the influence of ESG scores of heavily polluted industry groups (columns 1 and 3) on TobinQ is significantly positive at the level of 1% ( $t = 4.9276$ ), but the influence on return on net assets is not significant. For enterprises in non-heavy pollution industries (columns 2 and 4), the influence of ESG score is just the opposite, and its influence on return on equity (Roe) is significantly positive at the level of 5% ( $t = 2.1187$ ), but its influence on TobinQ (TobinQ) in column (2) is not significant ( $t = 0.4330$ ) (Table 6).

### 5.2.2. Grouped Regression According to Property Rights Attributes

In order to verify that ESG performance has a more significant effect on the performance improvement of non-state-owned enterprises (Li, Yang et al., 2021). In this paper, the heterogeneity of the above results is tested according to the property rights of enterprises. Supposing that the company is a state-owned enterprise with a value of 1, and a non-state-owned enterprise with a value of 0. The column (1) and column (3) are results for non-state-owned enterprises, and column (2) and column (4) are results for state-owned enterprises. The results show that the financial performance (Roe) and market performance (TobinQ) of non-state-owned enterprises are significantly positive at the level of 5%, but ESG score is not significant in improving the performance of state-owned enterprises, which indicates that the positive effect of ESG score on enterprise performance is more significant in non-state-owned enterprises. This is consistent with the existing research conclusions (Table 7).

## 6. Robustness Test

In order to avoid the subjective choice of the explained variables, this paper makes a robustness test by changing the proxy variables of enterprise performance. Table 8 shows the regression results. Column (1) shows the influence of ESG score on EPS, column (2) shows the regression results after adding control variables and controlling time effect, and column (3) shows the results after column (2) controls industry effect. The results show that the coefficient of core explanatory variables is positively significant at the level of 1%, indicating that a good ESG score of listed companies can improve enterprise performance, which is consistent with the previous conclusions.

**Table 6.** The heterogeneity test for heavy pollution industries.

	(1)	(2)	(3)	(4)
	TobinQ	TobinQ	Roe	Roe
ESG	0.1102*** (4.9276)	0.0294 (0.4330)	0.0347 (1.3476)	0.0407** (2.1187)
IPO	-0.0179*** (-4.3859)	-0.0353*** (-2.8945)	0.0014 (0.3021)	0.0073** (2.1218)
SOE	-0.3468*** (-5.6259)	-0.4893*** (-2.6038)	0.0970 (1.3685)	0.0946* (1.7801)
Size	-0.9708*** (-41.1016)	-1.3280*** (-20.3673)	0.0244 (0.8980)	0.0108 (0.5843)
Lev	1.2924*** (16.4148)	1.2559*** (25.8405)	0.0471 (0.5198)	-0.0056 (-0.4101)
Growth	0.0077*** (3.2510)	0.0122 (0.2749)	0.0014 (0.5280)	0.0401*** (3.1987)
Share	2.9988*** (16.5173)	1.6742*** (2.9714)	-0.0186 (-0.0890)	0.2515 (1.5788)
Asset_turnover	0.4494*** (7.8568)	0.6875*** (4.8227)	-0.0305 (-0.4643)	0.0638 (1.5840)
GDP	0.0316*** (3.9803)	0.0431 (1.6088)	0.0061 (0.6692)	0.0051 (0.6772)
BM	0.0320*** (4.9853)	0.0379** (2.0268)	-0.0139* (-1.8882)	-0.0115** (-2.1747)
Constant	58.1099*** (6.9582)	100.0511*** (3.9895)	-3.5276 (-0.3672)	-15.3025** (-2.1585)
Year fixed effect	Y	Y	Y	Y
Industry fixed effect	Y	Y	Y	Y
Sample size	11,282	13,539	11,282	13,539
Adjusted R <sup>2</sup>	0.2282	0.0981	-0.0001	0.0024

**Table 7.** Heterogeneity test between state-owned enterprises and non-state-owned enterprises.

	(1)	(2)	(3)	(4)
	TobinQ	TobinQ	Roe	Roe
ESG	0.0085 (0.3830)	0.1283** (2.2690)	0.0389 (1.1104)	0.0357** (2.1597)



## Continued

IPO	-0.0030 (-0.8481)	-0.0581*** (-5.2639)	-0.0019 (-0.3401)	0.0081** (2.5082)
Size	-0.6453*** (-30.1240)	-1.5446*** (-25.1165)	-0.0307 (-0.9124)	0.0489*** (2.7179)
Lev	-0.2189 (-1.6370)	1.2549*** (28.5606)	0.4318** (2.0591)	-0.0056 (-0.4356)
Growth	0.0842*** (3.7536)	0.0087 (1.1860)	-0.0022 (-0.0625)	0.0027 (1.2673)
Share	1.5684*** (8.6713)	2.2830*** (4.8796)	-0.1973 (-0.6957)	0.3281** (2.3952)
Asset_turnover	-0.0641 (-1.3061)	1.0135*** (7.9097)	-0.0446 (-0.5787)	0.0677* (1.8044)
GDP	0.0065 (0.7268)	0.0488** (2.3960)	0.0084 (0.5977)	0.0049 (0.8273)
BM	0.0087 (1.5665)	0.0600*** (3.5925)	-0.0116 (-1.3282)	-0.0138*** (-2.8159)
Constant	22.5845*** (3.1558)	148.9067*** (6.5188)	4.1864 (0.3730)	-17.6721*** (-2.6425)
Year fixed effect	Y	Y	Y	Y
Industry fixed effect	Y	Y	Y	Y
Sample size	8250	16,571	8250	16,571
Adjusted R <sup>2</sup>	0.2385	0.1079	-0.0022	0.0035

Table 8. Robustness test on the influence of ESG score on enterprise performance.

	(1)	(2)	(3)
	EPS	EPS	EPS
ESG	0.2070*** (36.4677)	0.1415*** (24.0553)	0.1378*** (22.9538)
IPO		0.0140*** (13.4634)	0.0126*** (11.5886)
SOE		-0.1120*** (-6.8751)	-0.0876*** (-5.2642)
Size		0.1144*** (21.2292)	0.1215*** (20.3189)

**Continued**

Lev		-0.0381***	-0.0372***
		(-6.6741)	(-6.5227)
Growth		0.0015	0.0015
		(1.6050)	(1.5944)
Share		0.7193***	0.7637***
		(14.7787)	(15.4434)
Asset_turnover		0.2156***	0.2296***
		(17.0993)	(16.8612)
GDP		0.0003	0.0015
		(0.1206)	(0.6444)
BM		-0.0114***	-0.0106***
		(-6.8732)	(-6.2770)
Constant	-0.4348***	-31.1499***	-29.2410***
	(-18.0859)	(-14.8047)	(-12.8724)
Year fixed effect	N	Y	Y
Industry fixed effect	N	N	Y
Sample size	24,884	24,821	24,821
Adjusted R <sup>2</sup>	0.0507	0.1105	0.1155

**7. Research Conclusions and Suggestions**

Taking all A-share listed companies from 2015 to 2021 as research samples, this paper analyzes the influence of ESG score on enterprise performance, and further discusses the relationship among them. Through research, it is found that ESG score has a significant impact on enterprise performance, which is consistent with the research results of Lee et al. (2017), which means that the higher ESG score, the better enterprise performance. And ESG score can influence enterprise performance through innovation investment. Further analysis of the relationship among the three shows that innovation investment plays a partial intermediary role between environmental information disclosure and enterprise performance. The main variables of the model are transformed and tested for robustness, and the conclusions are consistent with the main regression. This study is of great practical significance to deeply explore the promotion path of enterprise ESG performance to enterprise performance.

According to the above research conclusions, this paper puts forward the following suggestions for enterprises and governments to promote the implementation of high-quality sustainable development and the realization of peak carbon dioxide emissions' carbon neutrality goal:

From the perspective of enterprises, first, the enterprise should optimize the allocation of enterprise resources. Enterprise funds and resources are limited. In order to play the role of ESG performance and innovative technology investment, enterprises should strengthen the management of ESG performance and R&D investment, coordinate the relationship between them, enhance the ability of innovation and sustainable development, and steadily improve enterprise performance from a long-term perspective. Second, the enterprise should actively respond to relevant government policies, improve ESG performance from three aspects of environment, society and governance, actively undertake corporate social responsibility, provide more comprehensive information for stakeholders, reduce information asymmetry, and achieve long-term high-quality and sustainable development goals of enterprises.

For the government, relevant departments should formulate and improve ESG policies, enhance the awareness of ESG participation in practical activities firstly, and mobilize the enthusiasm of enterprises for green technology innovation. Second, while paying attention to the ESG performance of enterprises, the government should also pay attention to the innovation activities of enterprises, increase the encouragement measures and policies for innovative enterprises, and avoid some enterprises with low innovation consciousness from simply pursuing high performance and adopting false ESG performance. At the same time, the government should pay attention to the long-term effect of innovation investment, and in the initial stage by subsidizing R&D for enterprises with high innovation investment to create a good innovation environment. Third, the government should accelerate the construction and improvement of ESG scoring quality evaluation system, and encourage investors and other stakeholders to pay attention to and make full use of relevant information disclosure.

### Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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