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# Research on the Impact of Environmental Investment and Environmental Performance

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**Abstract:** In the context of the national "double carbon" goal, it is important to advocate enterprises to make environmental investment, increase environmental protection investment, improve the environmental performance of enterprises, and take the path of green and sustainable development. This paper selects data related to A-share listed companies in Shanghai and Shenzhen from 2019 to 2020, takes the environmental protection input of enterprises as the starting point, adds financial indicators and corporate governance indicators and other related variables, and elaborates the relationship between environmental protection input and other related variables and the environmental performance of enterprises through descriptive analysis, correlation analysis and regression analysis as well as robust type analysis. This paper concludes that corporate environmental investment is significantly and positively related to environmental performance. The environmental protection investment of enterprises is crucial to the improvement of the whole social environment, and government departments should formulate relevant policies to strengthen the guidance for enterprises to increase their environmental protection investment, require them to strictly comply with the social responsibility disclosure system, and promote the in-depth development of ESG concept in China.

**Keywords:** Environmental performance, ESG, Social responsibility.

## 1. Introduction

With the introduction of the "double carbon" target, the whole Chinese society has raised its concern and awareness of green, environmental protection and low-carbon lifestyle to a new level. From the macro level, the state has issued two top-level design documents to set the tone for China's industrial structure upgrade and energy structure transformation, and relevant supporting policies will be launched one after another to guide enterprises to practice the concept of green and sustainable development. At the micro level, the ESG investment concept is being promoted in China. E represents the environmental benefits that enterprises must pay attention to in the process of investment and production. Many companies are concerned about whether they can get a corresponding return on their economic investment to achieve environmental performance. This paper uses multiple regression analysis to investigate the relationship between corporate environmental performance and environmental investment.

## 2. Literature Review

In the 21st century, ESG concept has been deepened and ESG investment, which is the core of ESG concept, has been developed and plays an important role in improving corporate environmental performance.

There has been no uniform and standardized definition of the concept of corporate environmental performance. Hu Song (2006) [3]argues that corporate environmental performance should be interpreted from two perspectives. From a financial perspective, he analyzes the impact of corporate behavior in environmental protection and other aspects on financial performance, and from the aspect of environmental quality, he explores the improvement or damage of corporate environmental inputs on environmental conditions. Fang Xiaojuan (2013)[1], on the other hand, argues that environmental performance is the effect of corporate governance in terms of the environment and that environmental performance is independent of financial performance. As can be seen, there are various interpretations of environmental performance, and the different interpretations usually reflect the actual situation in a particular economic level and social context. Thus, corporate environmental performance is not a constant concept, but evolves with socioeconomic development and over time.

The inconsistent description of firms' environmental performance stems from the diversity of environmental performance indicators. For example, Lv, J. and Jiao, Shuyan (2011) [5] used environmental performance analysis of the environmental penalties imposed on the enterprises. Wang, Bo, and Zhao, Yongpeng (2012) [6] selected three indicators, whether the firm was certified by the environmental protection department, whether it received environmental penalties, and the expenditure that the firm invested in environmental management. Some other scholars represent environmental performance by constructing relevant indicators, such as Hu Quying (2012) [2] and Xu Qing (2014) [8] use the ratio of R&D expenses to operating costs as an environmental performance indicator, and Li Ping and Wang Yuqian (2015) [4] use the logarithm of the enterprise's emission costs to measure it. In conclusion, environmental performance can be measured in various ways and used flexibly according to research needs, which also leaves room for the development of further proposed more objective measurement methods.

From the research results at home and abroad, there are a lot of research results on the correlation between ESG investment and corporate financial performance, but less on the environmental performance. Therefore, this paper tries to conduct a theoretical analysis and an empirical study on the correlation between corporate ESG investment and its environmental performance.

# 3. Mechanism Study

## 3.1. Impact of environmental inputs on carbon intensity

Carbon intensity, as a visual representation of environmental performance, cuts down the impact of firm size and is a better measure of a firm's environmental performance. The impact of corporate environmental investment on carbon intensity is mainly reflected in the sustainability of environmental investment and feedback effects. The first is the sustainability of environmental investment. In the short term, in the environmental protection investment in environmental technology innovation and pollution control equipment to invest a large amount of money and short-term low returns resulting in high carbon intensity in contrast. In the long run, carbon intensity decreases with technological progress, and environmental investment enables technological progress and thus reduces carbon intensity. The second is the feedback effect of environmental investment, where companies spend a portion of their capital on environmental investment, which in turn acts on corporate value.

In summary, this paper proposes the hypothesis that

H1: There is a negative relationship between environmental investment and carbon intensity, and the higher the amount of environmental investment, the lower the carbon intensity.

## 3.2. Sample selection and data sources

In this paper, 319 samples were obtained from the data of companies listed in Shanghai and Shenzhen A-shares in China from 2019 to 2020 by manual collection. The data in the paper are obtained from WIND financial terminal database, CSMAR database, and annual reports of enterprises. In order to enhance the accuracy of the study and reduce the impact of abnormal data, this paper treats the sample as follows: (1) screen out the sample ST and ST* category companies to reduce the error caused by abnormal operation; (2) shrink the data of carbon intensity, environmental investment, cash structure and ROE by 1% of the upper and lower tail.

## 3.3. Variable Definition

(1) Explained variable: carbon intensity (CI)

In this paper, carbon intensity is defined as the ratio of a company's carbon emissions to its annual operating revenue. The larger the value of carbon intensity, the more CO2 produced per unit of output value of the enterprise, the worse the environmental performance of the enterprise, and conversely, the better the environmental performance of the enterprise. Carbon intensity is measured in tons of carbon dioxide equivalent per billion dollars.

(2) Explanatory variable: environmental protection input (EI)

As an important reflection of environmental performance in CSR reports of listed companies, environmental investment measures the funds directly invested by enterprises in environmental protection, which includes but is not limited to investment in reforming environmental protection technology, investment in purchasing emission reduction equipment and investment in various types of environmental consumables. Environmental protection investment is measured in tens of millions of RMB.

(3) Control variables

In order to reduce the interference of factors other than small independent variables, this paper selects financial indicators: ROE, corporate cash structure (CS); corporate governance indicators: equity concentration (TTS), and corporate size (lnSIZE) for a total of four control variables.

## 3.4. Model Setup

To test H1: There is a negative relationship between environmental investment and carbon intensity, the following model is constructed.

$$CI = \beta_0 + \beta_1 EI + \beta_2 CS + \beta_3 ROE + \beta_4 TTS + \beta_5 \ln SIZE + \varepsilon$$

# 4. Empirical Analysis

## 4.1. Descriptive statistics and correlation analysis

In order to better grasp the characteristics of each variable, descriptive statistics of 134 samples were conducted using Stata at first. The results are shown in Table 2.

**Table 2.** Descriptive statistics of each variable

| VARIABLES | N | mean | sd | min | max |
|---|---|---|---|---|---|
| CI | 134 | 1.323 | 3.132 | 3.28e-09 | 16.82 |
| EI | 134 | 22.14 | 88.95 | 0.00730 | 651.5 |
| ROE | 134 | 0.102 | 0.0752 | -0.171 | 0.351 |
| CS | 134 | 0.0760 | 0.0608 | -0.0361 | 0.266 |
| TTS | 134 | 71.39 | 18.35 | 12.02 | 98.41 |
| lnSIZE | 134 | 3.224 | 0.0820 | 3.080 | 3.438 |

The maximum value of the explained variable CI was 16.82 and the minimum value was 3.28e-09, indicating that there was a large gap between different enterprises in carbon intensity, and the overall level was near the average value of 1.323, which may be related to the nature of the industry and the size of the enterprise, and may also be directly related to the different investment in environmental protection of the enterprise. The maximum value of EI was 6.515 million, the minimum value was 0.0073 million, and the standard deviation was 88.95 million, indicating that the environmental protection investment of enterprises was also different due to different enterprise sizes and investment concepts.

By observing the correlation coefficient matrix, it can be concluded that the correlation coefficient between enterprise environmental protection input (EI) and enterprise carbon intensity (CI) is -0.061, and there is a negative correlation between the two. This correlation analysis did not pass the significance test and needs further analysis. The correlation coefficient between the control variables is small, so there is no multicollinearity problem in the preliminary judgment.

**Table 3.** Correlation analysis

| CI | EI | ROE | CS | TTS | lnSIZE | |
|---|---|---|---|---|---|---|
| CI | 1 | | | | | |
| EI | -0.0610 | 1 | | | | |
| ROE | 0.167* | 0.0100 | 1 | | | |
| CS | 0.288*** | -0.180** | 0.515*** | 1 | | |
| TTS | 0.0450 | 0.285*** | -0.125 | -0.211** | 1 | |
| lnSIZE | 0.0860 | 0.466*** | -0.0960 | -0.299*** | 0.406*** | 1 |

## 4.2. Regression analysis

The regression analysis results show that the regression coefficient between core explanatory variable EI and explained variable CI is -0.004, which is less than zero, indicating that the more enterprises invest in environmental protection, the more funds are available for purchasing energy-saving and emission reduction equipment, purchasing clean energy, and researching and developing technologies to improve energy efficiency, which is conducive to reducing the carbon emissions of enterprises and the lower the carbon intensity of enterprises. This regression coefficient is significant at the significance level of 1%.

According to the above analysis, there is a significant negative correlation between enterprise environmental protection input and enterprise carbon intensity. The research hypothesis H1 in this paper passes the test. Based on the above regression results, the linear regression equation of correlation between enterprise environmental protection input and enterprise carbon intensity is established as follows:

$$CI = -27.564 - 0.004EI + 1.094ROE + 17.063CS + 0.011TTS + 8.311\ln SIZE \quad (2)$$

n=134,$R^2 = .129$

## 4.3. Robustness analysis -- supplement of control variables

In addition to the above control variables, enterprise carbon intensity may also be affected by the degree of environmental information disclosure. Therefore, this paper tests the robustness of the model by increasing the number of control variables in the model.

The ESG investment concept requires enterprises to compile reports on the results of ESG management and disclose them to the public so as to reduce the information asymmetry between market investors and enterprise managers.

When an enterprise belongs to a heavy polluting industry, there are more quantitative indicators for measurement and disclosure of its environmental performance, so the degree of environmental disclosure is higher. When an enterprise belongs to a light polluting industry, its environmental performance may be difficult to be described by quantitative indicators, so the enterprise can only describe qualitatively or do not disclose, and the degree of environmental disclosure is low. The carbon intensity of heavy polluting enterprises is higher, and that of light polluting enterprises is lower. Based on the above analysis, the higher the degree of environmental information disclosure, the higher the carbon intensity. Therefore, EID, a dummy variable representing the degree of environmental information disclosure, is included in the empirical test in this paper, where 0 represents non-disclosure of environmental information by enterprises, 1 represents disclosure of qualitative environmental information by enterprises, and 2 represents disclosure of quantitative environmental information by enterprises.

The above new control variables are incorporated into the benchmark model, and the regression results are shown in the figure below. It can be seen that the regression coefficient value of core explanatory variable EI is close to the benchmark model, so the benchmark model is robust.

$$CI = -29.059 - 0.005EI + 0.602EID + 2.944ROE + 16.175CS + 0.013TTS + 8.437lnSIZE \quad (3)$$

n=134,$R^2 = .148$

# 5. Conclusions and Recommendations

## 5.1. Research Conclusions

This paper focuses on the core topic of the impact of ESG investment on corporate environmental performance, explores its related relationship, and tries to provide theoretical support for the development of ESG investment in China through the research results. Integrating the analysis results of the previous chapters, this paper obtains the following conclusions.

First, corporate investment in environmental protection can improve environmental performance.

Research shows that there is a significant negative correlation between the investment in environmental protection and the carbon intensity of enterprises practicing ESG concept. As companies become more aware of environmental protection and invest in related areas, environmental indicators improve and the overall emissions of pollutants and harmful substances to the outside world are significantly reduced, thus improving the environmental performance of companies.

Second, the correlation between the environmental performance of firms and the variables such as equity concentration and ROE of firms is not significant.

It is generally believed that large firms with high ROE have the ability and are more active in investing in environmental protection to enhance their corporate image to increase their corporate value. Companies with high equity concentration have large shareholders who, to some extent, influence corporate decisions on environmental investment. In contrast, the study shows that the effect of equity concentration and the level of ROE on environmental performance is not significant.

## 5.2. Related Suggestions

Based on the findings of this paper and the problems encountered in the research process, this paper proposes the following countermeasures and recommendations.

(1) Focus on improving corporate awareness of environmental protection and the enthusiasm of environmental protection practices. Strengthen the promotion

of ESG concept, promote ESG investment by enterprises, increase environmental protection investment, improve resource utilization efficiency, and promote high-quality development of enterprises in the direction of green and environmental protection.

(2) Strictly comply with the CSR disclosure system. before 2022, the number of enterprises publishing social responsibility reports in China is small, and voluntary disclosure is the main reason for the lack of substantial and important information. Due to information asymmetry, it is difficult for investors to make effective judgments on them. The SEC should establish a reasonable regulatory framework to promote enterprises to pay attention to their social responsibility responsibilities and improve their environmental performance.

(3) Promote the development of ESG responsible investment concept in China's in-depth practice. There have been many studies showing that good ESG performance can improve the financial performance of enterprises. Promoting the further development and practice of ESG responsible investment concept in China will not only enhance the value of enterprises, but also have a very important strategic significance for the transformation of China's high-quality economic development and the achievement of the goal of carbon neutral and carbon peak.

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