

An Empirical Analysis of the Relationship Between ESG Factors and Corporate Performance

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Abstract. In today's globalized business landscape, a corporation's Environmental, Social, and Governance (ESG) performance has become a crucial metric for overall sustainability. This study delves into the empirical analysis of the connection between corporate ESG performance and economic performance, with a focus on the role of green innovation. Green innovation, a vital component of ESG, encompasses activities aimed at reducing environmental impact and improving resource efficiency. The study aims to unravel the internal mechanisms and influence paths of this relationship. The literature on the correlation between ESG performance and economic performance presents divergent perspectives. While some assert a positive link, contending that robust ESG performance enhances corporate reputation and operational efficiency, others argue that investing in ESG activities may raise costs and impact short-term financial performance. Through an analysis of publicly available corporate data, this study explores how green innovation, within the realm of ESG, shapes corporate economic performance. Factors such as corporate size and market environment are considered to ensure comprehensive applicability and profound insights. The study seeks to provide practical guidance for corporations in navigating the intricate balance between ESG responsibilities and economic objectives. Additionally, it aims to furnish policymakers with valuable recommendations to foster green innovation. Ultimately, by unraveling these complex relationships, the study endeavors to contribute to a deeper understanding of the interplay between ESG and economic performance, offering insights that can inform strategic decisions for both corporations and policymakers.

Keywords: Environmental, Social, and Governance, Firm Performance, Corporate Governance.

1. Introduction

In the current globalized business environment, a corporation's Environmental, Social, and Governance (ESG) performance has become a critical indicator for measuring its overall performance and sustainability. In recent years, with the intensification of global climate change and the rise in social responsibility awareness, ESG factors are increasingly viewed as significant elements affecting long-term corporate competitiveness. This study aims to empirically analyze the relationship between corporate ESG performance and economic performance, particularly from the perspective of green innovation, exploring the inherent mechanisms and influence paths of this relationship. Green innovation, as a significant aspect of ESG performance, involves corporate activities aimed at reducing environmental impact and enhancing resource efficiency. It not only demonstrates a corporation's commitment to environmental protection but is also increasingly considered a key driver of economic performance. However, there are differing views on the relationship between ESG performance and economic performance. Some studies support a positive correlation, suggesting that good ESG performance helps corporations build a better reputation, improve operational efficiency, and thus enhance economic performance. On the other hand, some argue that investing in ESG-related activities may increase corporate costs and impact short-term financial performance. In light of this, the study, through analyzing data from a range of corporations, explores how green innovation, as a component of ESG performance, affects corporate economic performance. This paper considered corporations across different industries and regions, as well as various factors including corporate size and market environment, to ensure the broad applicability and deep insights of the research results. By gaining a deeper understanding of these complex relationships, this paper aims to provide

practical guidance for corporations on how to balance ESG responsibilities and economic objectives, while also offering policy recommendations for policymakers to promote green innovation.

2. Literature Review

The study of corporate ESG performance has always been a popular research topic. Li et al. comprehensively examined the impact of corporate ESG performance on performance, while assessing the mediating role of innovation and how different corporate characteristics and industry environments affect this relationship [1]. It provides a multi-dimensional perspective for understanding the complex interactions between ESG performance and corporate performance. Gao et al. based on data from Chinese listed companies, delved into how ESG performance can improve corporate investment efficiency through different pathways [2]. They found that good ESG performance can reduce both over-investment and under-investment, especially in mature companies and regions with high levels of marketization and legal development, offering important insights into the role of ESG in corporate investment decisions. Zhang et al. through analyzing data from listed companies, revealed a positive relationship between corporate ESG performance and corporate value, especially for non-state-owned, smaller-scale, and non-polluting industries, where ESG performance plays a more significant role in enhancing corporate value, providing in-depth insights into the impact of ESG performance on the value of different types of companies [3]. Wang et al. also based on data from Chinese listed companies, demonstrated how corporate ESG performance can significantly enhance both the book value and market value of a company by reducing financing costs and increasing market attention [4]. They found that in eastern regions, non-state-owned, or non-polluting companies, the value-enhancing effect of ESG performance is more pronounced, highlighting the multi-dimensional positive impact of ESG performance on corporate value. Song, based on data from listed banks in China, analyzed in depth the impact of ESG investment on bank liquidity creation [5]. The study found that ESG investments not only overall promote the creation of liquidity in banks, but also that the different components of ESG investment have varying impacts on liquidity creation, especially in times of higher uncertainty, these impacts of ESG investment become more significant. These findings provide important insights into the role of ESG investment under different industrial and economic conditions and offer policy recommendations for promoting high-quality financial development.

3. Theoretical Analysis and Research Hypotheses

3.1. Theoretical Background

ESG Performance and Corporate Value: Corporate ESG performance plays an increasingly important role in modern business strategy. Theoretically, good ESG performance is believed to enhance corporate reputation and strengthen the trust of customers and investors, thereby promoting the growth of corporate value. However, ESG activities often require significant initial investments, and their benefits may only become apparent in the long term, which could negatively impact a company's financial performance in the short term.

Dual Impact of Green Innovation: Green innovation, a core aspect of ESG performance, refers to innovations in products, processes, or management aimed at reducing environmental impact and improving resource efficiency. Green innovation can not only reduce a company's environmental footprint but also potentially lead to operational cost savings, albeit requiring initial capital investment and resource allocation.

3.2. Research Hypotheses

Based on the above theoretical background, this study proposes the following hypotheses.

Hypothesis 1 (H1): There is a positive correlation between a company's ESG score and its economic performance. This is based on the assumption that good ESG performance can enhance a

company's market competitiveness and investor confidence, thereby improving its economic performance.

Hypothesis 2 (H2): Green management innovation has a positive moderating effect on the relationship between ESG scores and economic performance. This hypothesis is based on the belief that green management innovation can enhance a company's environmental performance while promoting economic performance growth through increased efficiency and the creation of new market opportunities.

Hypothesis 3 (H3): The size, age, and market concentration of a company influence the relationship between ESG performance and economic performance. This hypothesis posits that companies of different sizes and maturity levels, as well as those in different market concentration environments, may differ in how they address ESG challenges and opportunities.

Through these hypotheses, this study aims to explore in depth the impact of ESG performance, especially in terms of green innovation, on corporate economic performance, and to consider the potential impact of factors such as company size, age, and market concentration.

4. Research Design

4.1. Sample Selection and Data Sources

Considering that the Chinese government began to emphasize supply-side structural reforms in 2016, aiming to optimize the economic structure and reduce ineffective and excess capacity; and also considering the release of China's 13th Five-Year Plan in 2016, this study chose the time frame from 2016 to 2022 for its data set. Additionally, taking into account the openness and availability of information, this study randomly selected 40 stocks from the Chinese stock market for data analysis. The data sources include the Juchao Information Network, Tonghuashun, and other publicly available websites.

4.2. Variable Construction

In terms of variable selection, this study generally refers to the practices of Liu, Wang, Li, and others [1, 6, 7]. The dependent variable selected is total profit, and the explanatory variables include corporate ESG, total carbon emissions, green management innovation, industrial robot penetration, company age, and the number of green patents. The control variables selected are Tobin's Q, the Herfindahl index, and the WW index. The specific treatment is shown in Table 1.

Table 1. Variable construction

Variable	Code	Variable Description
Total Profit	<i>TP</i>	The total profit in the public data of the enterprise is processed logarithmically.
Enterprise ESG Score	<i>ESG</i>	Average the data 4 quarters per year
Total Carbon Emission	<i>CE</i>	The numerical value was obtained by referring to the practice of Wang et al. and logarithmic zed [7].
Green Management Innovation	<i>GI</i>	The values were obtained by referring to the practice of Xi et al. and logarithmic zed [8].
Penetration of Industrial Robots	<i>IB</i>	The numerical value is obtained by referring to the practice of Wang [9].
Enterprise Age	<i>AGE</i>	Based on 2022, the establishment time of the company is calculated.
Number of Green Patents	<i>GP</i>	The number of green patents +1 of the enterprise is logarithmic zed.
Tobin's Q Value	<i>TB</i>	It is used to measure the development status of an enterprise.
The Herfindahl Index	<i>HI</i>	It is used to judge the position of the enterprise in the industry.
WW Index	<i>WW</i>	It is used to indirectly measure enterprise predictability.

4.3. Model Specification

To analyze in depth the relationship between corporate economic benefits and green development indicators such as corporate ESG scores and carbon emissions, this study adopts a multiple linear regression model. The specific model is as follows.

$$TP = \beta_1 + \beta_2 ESG + \beta_3 CE + \beta_4 GI + \beta_5 IB + \beta_6 AGE + \beta_7 GP + \beta_8 TB + \beta_9 HI + \beta_{10} WW + \mu \quad (1)$$

5. Empirical Results

5.1. Descriptive Statistics

Descriptive statistics provide the basic characteristics of the data, helping to better understand the fundamental attributes of the dataset. As shown in Table 2, the dataset includes 273 observations, covering key variables such as total profits, corporate ESG scores, and total carbon emissions. The analysis results show that the total profits of companies, after logarithmic transformation, are relatively concentrated, with a standard deviation of 1.866. Meanwhile, the corporate ESG scores show greater variability, with an average score of 4.315, ranging from 1 to 7, reflecting the differences in sustainable development practices among different companies. Additionally, the average value of total carbon emissions is 3.605, but the range is from -1.617 to 7.88, indicating that some companies may have implemented effective carbon reduction measures. In terms of technological innovation, the average penetration rate of industrial robots is 7.441, but with a standard deviation of 4.398, showing significant differences among companies in adopting new technologies. At the same time, the average value of green management innovation is 0.633, with a maximum value of 1.792, indicating a clear gap among companies in terms of environmental management innovation. The average age of companies is 24.154 years, showing the maturity of the sample companies. The average number of green patents is 0.745, further highlighting the level of investment by companies in green technologies. These descriptive statistics provide with a preliminary understanding of the sample companies in terms of economic performance, ESG practices, and market performance, laying the foundation for further empirical analysis.

Table 2. Descriptive statistics

Variable	Observed	Mean	Standard Deviation	Minimum	Maximum
TP	273	20.287	1.866	14.555	25.101
ESG	273	4.315	1.332	1	7
CE	273	3.605	1.871	-1.617	7.88
GI	273	.633	.642	0	1.792
IB	273	7.441	4.398	.008	15.594
AGE	273	24.154	3.46	12	31
GP	273	.745	1.465	0	6.911
TB	273	2.094	6.336	0	92.25
HI	273	.095	.088	0	1
WW	273	-.816	.48	-2.065	0

5.2. Correlation Analysis

From Table 3, it can observe that there is a significant positive correlation between corporate ESG scores and total profits, total carbon emissions, and green management innovation. It is noteworthy, however, that although total carbon emissions are generally considered a negative indicator, they show a positive correlation with ESG scores in this dataset. This might suggest that in some cases, higher carbon emissions are associated with the status of industry leaders, who may have better ESG performance. Additionally, there is a very strong positive correlation between the penetration of industrial robots and green management innovation, implying a possible synergistic effect between

technological innovation and green management measures. The significant positive correlation between company age and the number of green patents may reflect the proactive behavior of mature companies in green technological innovation. Overall, these correlation results provide with preliminary insights into the relationships between various economic indicators and corporate ESG scores, laying the groundwork for further multiple regression analysis.

Table 3. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TP	1.000									
ESG	0.644	1.000								
	0.000									
CE	0.740	0.584	1.000							
	0.000	0.000								
GI	0.369	0.443	0.458	1.000						
	0.000	0.000	0.000							
IB	-0.054	-0.075	-0.013	0.008	1.000					
	0.401	0.217	0.835	0.905						
AGE	-0.075	-0.040	-0.163	-0.099	0.101	1.000				
	0.243	0.514	0.007	0.129	0.097					
GP	0.260	0.280	0.460	0.271	-0.026	-0.336	1.000			
	0.000	0.000	0.000	0.000	0.671	0.000				
TB	-0.297	-0.230	-0.289	-0.141	0.042	0.046	-0.034	1.000		
	0.000	0.000	0.000	0.030	0.495	0.444	0.575			
HI	-0.038	-0.216	-0.176	0.022	-0.045	-0.134	-0.026	0.145	1.000	
	0.557	0.000	0.004	0.736	0.463	0.027	0.673	0.016		
WW	-0.322	-0.193	-0.224	-0.130	0.186	0.318	-0.217	0.119	-0.294	1.000
	0.000	0.001	0.000	0.045	0.002	0.000	0.000	0.049	0.000	

Due to the relatively high correlation among the independent variables, it is necessary to consider whether there is a problem of multicollinearity and whether it is severe enough to affect the model regression. For this, a Variance Inflation Factor (VIF) test is conducted. The VIF value measures the ratio of the variance of an independent variable to the variance when there is no multicollinearity. A high VIF value indicates that the variable is greatly influenced by other variables, suggesting a potential problem of multicollinearity.

Table 4. Test of variance inflation factor

Variable	VIF	1/VIF
CE	2.05	0.488532
ESG	1.68	0.593994
GP	1.50	0.668031
GI	1.49	0.672102
WW	1.21	0.826408
AGE	1.13	0.883546
HI	1.12	0.892174
TB	1.09	0.915686
IB	1.03	0.966853

Based on Table 4, it can be seen that the VIF values are significantly lower than the threshold values of 10 and 5. Therefore, it can be concluded that the regression results are not affected by multicollinearity.

5.3. Regression Model Estimation

Table 5. Results of regression model

Total Profit	Coefficient	Standard Deviation	t-value	p-value
ESG	0.529	0.070	7.60	0.000
CE	0.633	0.056	11.25	0.000
GI	-0.237	0.135	-1.75	0.081
IB	0.014	0.017	0.81	0.418
AGE	-0.026	0.023	-1.13	0.262
GP	-0.186	0.058	-3.21	0.002
TB	-0.026	0.011	-2.29	0.023
HI	2.607	0.866	3.01	0.003
WW	-0.733	0.203	-3.62	0.000
cons	15.517	0.636	24.40	0.000

In discussing the determinants of corporate economic performance, the model revealed the impact of factors such as corporate ESG scores and total carbon emissions on total profits. Specifically, a positive correlation was found between corporate ESG scores and profits as Table 5 shown, which may reflect the market and investors' preference for companies with high ESG performance, as well as the high operational efficiency and brand value these companies may achieve [10]. Similarly, a positive correlation was also found between total carbon emissions and profits. This result suggests that in some cases, industry leaders might have higher carbon emissions but also achieve higher profits due to scale effects and market influence. However, the relationship between green management innovation and total profits did not reach statistical significance. This could be because green management innovation requires high initial investments, and its benefits may not be apparent in the short term, or the economic returns from green innovations might be delayed. The impacts of industrial robot penetration and company age on total profits were not significant, indicating that technological innovation and corporate experience might have limited direct impact on economic performance in this sample, or there might be other moderating factors not captured by the model.

It is noteworthy that the number of green patents had a significant negative impact on total profits. This might reflect that although the number of patents is an indicator of innovation activities, not all green innovations can be immediately transformed into economic benefits, or the commercialization path for these patents may be more complex and prolonged. In summary, these results reveal the complex interplay of factors impacting corporate economic performance, with ESG scores and total carbon emissions showing strong positive correlations, while the number of green patents shows a negative relationship. These findings emphasize the need for a comprehensive consideration of the multidimensional connections between ESG factors and economic performance when formulating corporate strategies and public policies [11].

6. Conclusion

This paper, through empirical analysis, delves into the complex relationship between corporate Environmental, Social, and Governance (ESG) performance and their economic performance, with a special focus on the impact of green innovation. This research finds that there is a significant positive correlation between corporate ESG scores and total profits. This reveals that the market and investors generally tend to support businesses with high ESG performance, not only because it improves operational efficiency but also significantly enhances brand value. At the same time, the study finds a positive correlation between total carbon emissions and total profits, suggesting that in certain scenarios, despite higher carbon emissions, industry leaders can still achieve higher profits due to scale effects and market influence, challenging the traditional view of a negative correlation between environmental conservation and profitability. Additionally, although green management innovation is seen as key to enhancing corporate environmental performance, its impact on total profits was not

statistically significant. This might be due to the high initial investment required for green innovation and the benefits not being immediately apparent or taking longer to realize their economic returns. The study also finds that the impact of industrial robot penetration and company age on economic performance is not significant, possibly indicating that the effects of these factors are constrained by other moderating factors not captured in the model. The significant negative relationship between the number of green patents and total profits suggests that not all green innovations can be immediately transformed into economic benefits, and the commercialization process of these patents may be more complex and prolonged. Overall, these results emphasize the importance of considering the multidimensional connections between ESG performance, green innovation, and economic performance when formulating corporate strategies and public policies, especially in balancing sustainable development goals with commercial success.

The research indicates that businesses should focus on ESG performance and environmental measures to enhance profits and market position, while balancing conservation and profitability with flexible strategies. While green management innovation is key to corporate environmental performance, its impact on profits is not significant, hence investments should be made judiciously. Also, corporate decision-making should consider a variety of factors, such as market environment and technological innovation. The study also finds a negative relationship between the number of green patents and profits, indicating the need to focus on the commercialization process of green innovations. Finally, it is recommended that policymakers consider the complex interrelations between ESG, green innovation, and economic performance, and formulate multidimensional public policies to support the balance between corporate sustainable development and economic success.

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