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The Value of Sustainability: How Environmental, Social, and Governance Cost Investments Impact Corporate Financial Performance

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Abstract

This study aims to explore the impact of environmental, social, and governance (ESG) cost investment on corporate financial performance, using sustainable development theory, stakeholder theory, and agency theory as a comprehensive theoretical framework to clarify the definition and measurement standards of ESG cost investment (including environmental, social, and governance expenditures). The ESG cost investment data comes from the annual reports, sustainable development reports, or social responsibility reports released by listed companies, and return on assets and return on equity are selected as financial performance indicators for enterprises. The findings indicate that ESG cost investment, as well as environmental investment, social responsibility investment, and governance investment, have a positive impact on corporate financial performance. In addition, the study also considered corporate ownership structure and industry-specific factors to understand how ESG cost investment affect business performance in different contexts. By studying enterprise heterogeneity and industry-specific dynamics, this study aims to provide tailored management recommendations for enterprises in different ownership and industries. This study aims not only to contribute to academic discussions on corporate sustainability, but also to provide practical significance for businesses and investors by emphasizing the financial benefits of strategic ESG investments.

Keywords: investment; environment; governance; social; sustainability; corporate finance

1. Introduction

Investment decisions have increasingly prioritized ESG concerns in recent years. Investors are placing growing importance on corporate ESG performance as a means of evaluating the sustainability risks and opportunities connected with a company. Numerous studies have demonstrated the positive correlation between ESG performance and business financial performance. Nevertheless, prior research has not yet arrived at definitive findings about the influence of ESG performance on business financial performance. The majority of research has determined that there is a direct correlation between ESG performance and business financial performance (Alareeni, 2020; Friede et al., 2015; Lee et al., 2016; Velte, 2017; Huang, 2021; Busco, 2020). Nevertheless, other researches have also found evidence of a negative association (Qiu et al., 2016; Sassen, 2016; Duque-Grisales, 2021; Garcia et al., 2017). The majority of existing literature primarily examines the correlation between ESG performance and financial performance of companies. However, only a restricted number of studies have investigated the influence of corporate ESG investments on financial performance. Several research indicate a positive association between the two variables. Khan et al. (2016) discovered that ESG investments that align closely with a company's fundamental operations might produce additional profits for stockholders. Integrating ESG expenditures into a company's decisions on how to allocate capital can result in improved future performance. Bhaskaran et al. (2020) substantiated that organizations that allocate

resources towards ESG initiatives have a propensity to enhance their market worth. This conclusion was reached through an examination of 4,886 companies across both emerging and mature nations, employing a two-stage least squares model. Kotsantonis et al. (2016) found that companies that allocate substantial resources to address important ESG concerns have greater growth in profitability and achieve higher stock returns after accounting for risk, when compared to similar companies. In their study, Welch and Yoon (2023) discovered that skilled managers effectively distribute resources towards ESG initiatives. They do so by carefully choosing ESG programmes that align with the industry's needs and are in line with the board's strategic direction, ultimately benefiting shareholders. Koller et al. (2019) contend that a robust ESG proposition can enhance investment returns by directing money towards more favorable and sustainable opportunities, such as renewable energy and waste reduction. Furthermore, proficient integration of ESG practices can assist in managing the rising operational expenditures, such as escalating raw material expenses and the actual costs associated with water or carbon. Nevertheless, certain research indicates that including ESG factors into cost inputs has an adverse impact on the financial performance of enterprises. According to Di Giuli and Kostovetsky (2014), managers' varying political ideologies lead to divergent business expenditures on social responsibility. Companies with a democratic affiliation allocate an additional $20 million towards Corporate Social Responsibility (CSR) compared to companies with a Republican affiliation. Investments in CSR are linked to adverse future stock returns and reduced returns on company assets, indicating that any advantages for stakeholders resulting from social responsibility are obtained at the direct cost of corporate value. In their study, Izgarova, Rogova, and Bakhareva (2023) discovered that reports regarding Russian companies' investments in environmental initiatives and efforts to tackle social and corporate governance concerns did not result in a rise in the stock returns of these companies. Hence, Russian investors do not regard ESG programmes and practices as crucial factors that enhance the appeal of an investment in a company. The existing literature on quantifying companies' investment in ESG focuses on utilizing ESG scores or rankings, typically generated by professional ESG rating agencies. These agencies employ a combination of qualitative and quantitative data to assess companies, using a range of metrics and models to evaluate their ESG performance. Nevertheless, these ratings frequently fail to provide an honest representation of a company's genuine commitment and endeavors in ESG matters, since they prioritize surface-level achievements rather than the underlying investments and actions. Furthermore, variations in criteria and methodology employed by various rating organizations might result in disparities in ratings, hence causing divergent outcomes in publications that utilize diverse rating data. This paper's novelty is in its direct examination of the precise financial investments made by firms in ESG factors. This technique offers a more precise assessment of a company's genuine efforts and dedication to ESG factors as it emphasizes tangible financial contributions rather than merely depending on external ratings. By adopting this approach, we can effectively evaluate the correlation between a company's allocation of resources towards ESG factors and its financial outcomes.

The primary inquiry of this study revolves around the identification of techniques and standards for assessing ESG cost investment. The lack of study in this field may be attributed to various factors: first, the intricate and multifaceted nature of ESG poses a significant obstacle in terms of gathering and structuring data. The absence of universally standardized ESG cost investment results in a variety of data sources and inconsistent quality. The presence of many international frameworks (such as GRI, SASB, TCFD, etc.) might lead to confusion and lack of uniformity in reporting methodologies. Second, there exists variation in the degree of voluntary disclosure among agencies, with certain firms being more inclined to publish extensive ESG information while others disclose less. This discrepancy hampers the capacity to make meaningful comparisons between industries and firms. Firms frequently provide self-reported ESG data, which might vary in terms of the thoroughness and precision of the data collecting and reporting procedures (Kotsantois & Serafeim, 2019). Such behavior has the potential to erode the trustworthiness and consistency of ESG information, while also giving rise to apprehensions over "greenwashing" or deceptive assertions. Furthermore, the variability and uniformity of data may be influenced by disparate regulatory mandates for the disclosure of ESG information in various countries and regions.

In order to address this research challenge, this study will develop a theoretical framework to investigate the mechanism of the correlation between ESG cost investment and company financial performance. The research

framework incorporates sustainability, stakeholder, and principal-agent theories. The Brundtland Report, published in 1987, presented the concept of sustainable development, which entails satisfying the requirements of the current generation while safeguarding the capacity of future generations to fulfil their own needs. ESG categories sustainability into three components: environmental, social, and governance. This framework has emerged as the predominant benchmark for measuring sustainability and ensuring corporate accountability (Grenville, 2021). Companies should include sustainable development into their strategies and cultures in order to enhance their competitive edge while mitigating risks (Kurucz et al., 2009). Sustainability theory prioritizes the conscientious utilization of natural resources and the safeguarding of the environment. It promotes the reduction of harm to ecosystems and the preservation of biological diversity. Stakeholder theory was first proposed by R. Edward Freeman in 1984. Freeman argued that a company's growth and success depend on the involvement and contribution of different stakeholders. He emphasized that the enterprise should prioritize the collective interests of all stakeholders, rather than focusing solely on the interests of specific individuals or groups (Freeman, 1984). Implementing ESG practices can enhance shareholder value through reputation enhancement, consumer attraction, increased productivity of skilled personnel, and reduced regulatory expenses (Abdi et al., 2022). The principle-agent theory posits that an agency relationship occurs when a principal, bound by a contract, engages an agent to carry out designated activities on its behalf, which may include granting the agent decision-making authority in certain situations. Nevertheless, as a result of the disparity in information and conflicting interests, the agent may engage in acts that may not necessarily align with the principal's optimal outcome (Jensen & Meckling, 1976). Greater ESG disclosure leads to increased transparency. ESG practices contribute to the reduction of compliance costs, which in turn impact a firm's risk profile and valuation (Cormier et al., 2005). Simultaneously, in order to address principal-agent issues, shareholders must provide managers with an extra compensation for assuming risk, while also ensuring a balance between incentives and insurance. Well-designed compensation arrangements offer adequate protection to guarantee that managers exert the level of effort that shareholders anticipate (Gayle et al., 2018). Based on the above theoretical framework, this paper argues that ESG cost investment should include environmental investment (investment in environmental projects, waste management, environmental taxes, and fees, etc.), social responsibility investment (including charitable donations, employee welfare, employee training, community support, etc.), and governance investment (research and development (R&D) investment, management compensation, etc.).

Incorporating and enhancing ESG standards is a demanding undertaking that necessitates substantial financial and resource investments from firms. The expenses and allocation of resources can have a significant effect on the company's immediate profits and cash flow, potentially conflicting with other strategic goals. Therefore, the relationship between ESG cost investment and firms' financial success is complex and subject to disagreement. The main assertion of this study is that there is a clear and direct relationship between the expenses related to ESG aspects and the financial success of businesses. Moreover, the strength of this link may vary among firms with different characteristics. This study utilizes regression analysis with panel data. The dataset comprises data from publicly traded companies listed on the A-share markets in Shanghai and Shenzhen, covering the period from 2015 to 2021. The variables consist of the financial performance of the firm, the cost inputs related to ESG factors, and other control variables.

China is chosen for this paper for several reasons: first, China completed industrialization and urbanization in a relatively short period of time. Compared to the prolonged process in Western countries, China's rapid development since the reform and opening-up has led to significant economic achievements but also severe environmental problems. The energy-intensive and highly polluting traditional industrial structure, combined with intensive resource exploitation, has caused air pollution, water pollution, and ecological degradation. These issues pose serious threats to the environment and public health. In response to these challenges, China has set ambitious environmental targets, such as the two-carbon target and enacting a new environmental protection law, resulting in mandatory environmental performance requirements. This policy provides a unique context for the impact of ESG on firm performance (Li, 2023). Second, Chinese companies currently face stricter ESG goals and pressures compared to Western companies, reflected in several key areas: a. The Chinese government set the timeline for the "carbon peak" and "carbon neutrality" targets, which is more urgent than in many developed countries. This creates significant pressure on companies to reduce emissions,

especially in high-pollution, high-energy industries; b. Chinese companies face the challenge of rapid transition. While some Western countries have had a longer period to transition to a low-carbon economy, Chinese companies need to make the shift from a high-carbon model to a green economy in a much shorter time; c. As environmental policies tighten, the Chinese government holds companies increasingly accountable for their environmental responsibilities. The government not only introduced multiple environmental regulations but also increased penalties for environmental violations. Companies that fail to meet the standards face both legal and financial consequences. Third, China's corporate structure and market characteristics provide a unique ESG research perspective. China has a large number of state-owned enterprises (SOEs), which play a crucial role in China's economic and political landscape and whose operations are often intertwined with government policies and regulations (Zahid et al., 2023). Thus SOEs tend to be subject to more governmental expectations and pressures regarding fulfilling their social responsibilities and environmental protection. In addition, private companies and SMEs in China are also proliferating. However, SMEs need help complying with environmental regulations due to a lack of resources and expertise (Chen et al., 2022), and thus, they face different challenges and opportunities in ESG practices. Employing listed companies in China can provide this paper with rich firm heterogeneity to investigate the impact of ESG cost investment on firms' financial performance impacts. Analyzing listed companies in China can increase the depth and complexity of the study.

This work aims to introduce original contributions in the following areas: firstly, while past research has explored the correlation between ESG performance and corporate financial performance, few scholars have deeply investigated how ESG cost investment directly affects financial outcomes. By collecting detailed ESG investment data from multiple companies, this study reveals the actual expenditures these companies make in environmental protection, social responsibility, and corporate governance. This approach differs from traditional research that relies on external rating agencies, as external ratings often focus on superficial achievements and are not able to adequately reflect a company's genuine efforts and investments in ESG. Secondly, this paper constructs a comprehensive theoretical framework that combines sustainable development theory, stakeholder theory, and agency theory to deeply explain how ESG investment affects a company's financial performance by improving transparency and reducing compliance costs. The theory of sustainable development emphasizes the rational use of resources and the protection of the environment, while the stakeholder theory points out that the development of enterprises is closely related to the participation of their stakeholders. The integration of these theories not only provides a solid foundation for understanding the necessity of ESG investments, but also provides theoretical guidance for companies on how to implement these investments. Additionally, the study specifically considers factors such as ownership structure and industry characteristics that influence the relationship between ESG investment and financial performance. This analysis enhances the complexity of the research, allowing for more targeted management recommendations to help different types of companies make informed decisions when implementing ESG investments. By conducting an in-depth examination of corporate heterogeneity, this paper reveals the varying financial benefits of ESG investment across different market and industry environments, thereby promoting broader practical applications.

This paper is structured as follows: section I is the introduction, which describes the research background, research questions, research objectives, research methodology, research contributions, and the structure of the paper; section II is the literature review, which summarizes the relevant literature on the relationship between ESG cost investment and financial performance by analyzing the theoretical foundations, pointing out the shortcomings and gaps in the research, and proposing the research hypotheses; section III is the research design, which describes the variable definitions, the research's data sources, sample selection, and model setting; Section Ⅳ presents the empirical results, reporting the results of descriptive statistics, correlation analysis, regression analysis, and firm heterogeneity analysis, and conducting robustness tests; Section Ⅴ presents further tests, exploring the intrinsic mechanisms by which ESG cost investment affect firms' financial performance; and Section Ⅵ presents the conclusions and discussion, summarizing the main findings of the study.

2. Literature Review and Hypotheses Development

2.1. Cost Investment

Several papers offer empirical evidence that supports the notion of generating financial value through ESG investments (Khan & Yoon, 2016). Dimson, Karakasx, and Li (2015) demonstrate that enterprises' profitability will rise, stock prices will exhibit a positive response, and stock volatility will reduce after effective involvement in an ESG programme. However, reputational concerns and investor cooperation play a more substantial role in engaging with environmental and social issues. This is due to the fact that when management is hesitant to participate in ESG programmes, these programmes typically incur higher costs, present greater difficulties, and require a longer time frame to achieve their advantages. Eccles et al. (2014) demonstrate that companies who willingly implement sustainability practices achieve superior stock market and accounting performance compared to their counterparts. Borgers et al. (2013) discovered that companies with superior sustainable investment performance have greater future risk-adjusted returns. However, it should be noted that this finding has been contradicted in recent times. However, certain papers propose the contrary. Brown et al. (2006) contend that sustainability can incur agency costs, since managers obtain personal advantages from addressing environmental and social issues, which can result in adverse financial consequences for their organizations, such as an increased cost structure.

This study contends that the cost of ESG factors can be seen as a strategic investment with long-term implications, encompassing the wide-ranging advantages of environmental and social responsibility. By using ESG practices, firms can enhance the sustainability of their operations and successfully address environmental, social, and governance concerns and difficulties. This leads to a reduction in risks, improved financial performance, and increased returns for shareholders and investors. In addition, an increasing number of investors, particularly institutional investors, view ESG performance as a crucial determinant in their investment choices. Strong corporate performance in ESG factors can appeal to investors who prioritize sustainable investment and lead to a rise in their interest in the company's stock. Thus, this work puts forward the subsequent research hypotheses:

H1: ESG cost investment is positively related to corporate financial performance

2.2. Environment Investment

Lopez-Gamero et al. (2010) emphasized that when a company strategically invests in environmental preservation, it enhances its reputation as an environmentally responsible entity, hence enhancing its competitive advantage within the industry. Yadav, Han, and Rho (2016) discovered that a firm's long-term commitment to investing in environmental preservation leads to increased recognition of the firm's stock and helps to the overall enhancement of firm value and improvement of financial performance. Lai and Lu (2015) noted that when the government incentivizes businesses to invest in environmental protection, those businesses with good environmental performance can receive more advantageous loan interest rates and income tax rates. This ultimately enhances the financial performance of the businesses. Zhu, Zou, and Cui (2020) observed that when enterprises invest in environmental performance, it can have a substantial positive impact on their economic performance. Furthermore, they found that government actions that provide incentives can further enhance this effect. According to Keefe (2007), a potential method to ensure the long-term success of environmental investments is for investors who seek financial gains to integrate environmental and social considerations into their financial and decision-making procedures. However, certain studies have also determined that there is either no association or an inverse association between a company's environmental and financial performance. Lars and Henrik (2005) utilized a residual income valuation model to examine a group of publicly traded companies in Sweden. Their findings indicated a negative relationship between a company's investment in environmental performance and its earnings. Lioui (2012) has arrived at similar findings, contending that companies that take on environmental responsibility will increase their investments in research and development, leading to a decrease in their overall economic performance. Liu and Duan (2013) examine the relationship between environmental performance indicators and financial

performance in manufacturing enterprises. They find that there is a U-shaped relationship, meaning that as enterprises increase their environmental protection inputs, such as capital expenditure, it can lead to risks and a decrease in financial performance. However, they also find that when the environmental strategy is developed to a mature and adequate level, it can have a positive impact on the company's economic effects.

This paper contends that making investments in environmental sustainability, such as implementing cleaner energy sources or decreasing waste emissions, not only enables firms to evade the potential consequences of environmental regulations but also enhances resource efficiency and diminishes production costs, thereby enhancing firms' financial performance. Thus, this study presents the subsequent research hypothesis:

H2: Environmental investment is positively related to corporate financial performance.

2.3. Social Responsibility Investment

2.3.1. Charitable Donation

Charitable giving is a crucial means for businesses to achieve their social obligation, and the correlation between it and their financial performance is a well debated and contentious subject, with varying conclusions and perspectives among scholars. Several experts claim that there is a favorable correlation between philanthropic donations and business financial performance. Pan and Zhu (2021) discovered a favorable correlation between corporate financial performance and charitable donations by analyzing charitable donations data and financial data of listed businesses in China from 2008 to 2017 using dynamic panel data analysis. The association between charity donations and financial performance is influenced by the quality of the institutional environment. In other words, a higher quality institutional environment leads to a stronger beneficial impact of charitable donations on financial performance. In their study, Muller and Kräussl (2008) examine the influence of company statements on charitable donations on stock prices following Hurricane Katrina. They discover a significant positive correlation between donations made for post-disaster reconstruction and anomalous returns. On the other hand, there is a strong negative correlation between donations in kind and abnormal returns. According to Li and Liu (2010), the market responded favorably to corporate gifts during the Wenchuan earthquake. Zhang et al.(2016) used panel data regression to study the charitable giving and stock price data of Chinese listed companies from 2005 to 2013. Their research has revealed that philanthropic contributions have the potential to mitigate the likelihood of a significant decline in a company's stock value. The primary mechanism behind this effect is the signaling function of charitable donations. In other words, when firms make charitable gifts, they are able to communicate information to the market regarding their quality and transparency. This, in turn, enhances the market's confidence in the corporation and its evaluation of the corporation. Conversely, several experts argue that philanthropic contributions have an adverse impact on the financial performance of corporations. In a study conducted by Fang (2009), it was discovered that the response of investors in the market to the 5.12 Wenchuan earthquake was strongly and inversely correlated with the level of donations and the promptness of listed firms. Niu and Zhu (2012) utilized panel data regression analysis to examine the relationship between charitable donations and financial data of publicly traded companies in China from 2004 to 2009. The findings revealed a negative correlation between charitable donations and the financial success of these enterprises. The negative association will be modified by the societal norms and political dynamics. Greater societal expectations and stronger political relations result in a diminished adverse effect of charitable donations on financial success. There are also some views that suggest the relationship between philanthropic giving and business financial performance is ambiguous. According to Seifert et al. (2004), there is no significant impact of charity donation on shareholder return. The study conducted by Wang et al. (2008) clarified the non-linear correlation between charitable giving and company financial success. Specifically, it revealed that charitable giving had an inverted U-shaped association with corporate financial performance.

2.3.2. Employee Benefit

Various studies have pointed out that employee welfare plays a vital role in business management and employee satisfaction. According to Katou and Budhwar (2006), people's satisfaction with various types of benefits is crucial to them. Li Huai Kang (1990) argued that benefits play a more significant role in employee motivation than compensation. Faleye and Trahan (2011) showed that companies that offer higher employee benefits perform better in terms of long-term stock returns and firm performance, suggesting that caring for employees ultimately translates into higher productivity and profitability. Ghaly et al. (2015) study the economic consequences of employee benefits from a financial perspective and find that firms with better benefits tend to adopt more conservative financial strategies, such as holding more cash, to maintain high-quality employee benefits and honor commitments to current and potential employees. A study by Pan and Ming (2017) found that incorporating benefits management and innovative benefits into human resource management enhances employee motivation, which in turn fuels firm growth, while a study by Fauver et al. (2018) showed that firms with employee-friendly cultures which include high benefits as well as a focus on employee health and safety, among other things, have better firm value and performance. Ben-Nasr and Ghouma (2018) examined the impact of employee benefits in finance, particularly on the risk of share price collapse. They noted from the perspective of stakeholder theory that high-quality employee benefits can reduce the risk of share price collapse by generating a good reputation for the firm, ensuring sustained investor engagement, and reducing the likelihood of employee strikes.

2.3.3. Employee Training

The concept of human capital theory is rooted in neoclassical economics, which acknowledges that the abilities, skills, knowledge, and talents possessed by people are crucial for enterprises to gain a competitive edge. The concept was initially developed by Becker in his renowned publication Human Capital (1964). Human capital theory pertains to the allocation of resources, the cultivation of human resources, and the creation of compensation systems. According to the human capital theory, providing training to employees is a worthwhile investment that results in increased income for the employee and more advantages for society (Odhon'g & Omolo, 2015). The application of human capital theory can also aid in evaluating the influence of employees' input on the company and the value it brings to shareholders, as well as how value is generated from human resources, such as return on investment (Armstrong, 2012; Odhong & Were, 2013). Human capital theory posits that there is a positive correlation between education and earning capacity. In other words, the more educated an employee is, the greater their level of earnings and productivity (Dae-Bong, 2009). Employee training is a specific application of human capital theory that involves improving employees' knowledge, skills, and capacities through educational and training programs (Odhon'g & Omolo, 2015). The provision of employee training is essential for the development and functioning of an organization. Failure to address this issue will impede the organization's ability to adequately adapt to market fluctuations and overcome obstacles (Kurnia et al., 2019). Research has demonstrated that employee training is vital for attaining organizational expansion, and by means of employee training, corporate growth can be accomplished. Employee training necessitates a substantial allocation of financial resources and effort however it yields positive results.

This paper argues that the fulfillment of social responsibility, such as employee welfare, charitable donations, and community support, not only enhances corporate image, but also strengthens employees' sense of belonging and creativity, which ultimately has a positive impact on corporate financial performance. Therefore, this paper proposes the following research hypotheses:

H3: Social responsibility investment is positively related to corporate financial performance

2.4. Governance Investment

2.4.1. Research and Development Investment

Multiple studies have consistently demonstrated a substantial and favorable association between investment in research and development (R&D) and the performance of a company. The investment in research and development (R&D) plays a crucial and undeniable role in enhancing product technology and quality, as well as meeting consumer demand (Chen & Hu, 2020). Investing in internal research and development (R&D) can enhance a company's capacity to effectively leverage external technological knowledge and convert it into innovation. As a result, this can lead to improved innovation performance for firms following technological mergers and acquisitions (Song et al., 2005). Augmenting research and development (R&D) expenditure can enhance the performance of a company by facilitating the incorporation of state-of-the-art equipment, enhancing production capacity and management techniques, optimizing the allocation of resources, enabling the transfer of advanced production factors across various sectors, and elevating the overall productivity of the company (Ren et al., 2022). Artz's (2010) empirical study, which examined 272 enterprises across 35 industries, indicates that the ongoing implementation of novel goods can lead to sustained high performance for firms over time. Qiu and Wei (2016) discovered a strong positive correlation between high-intensity research and development (R&D) investment and the level of total factor productivity. They concluded that such investment unquestionably enhances business performance.

2.4.2. Management Compensation

The analysis of the correlation between executive remuneration and company performance is grounded in the principal-agent theory. The principal-agent theory states that there is a lack of equal information between the owner and an agent of a business, which can lead to the agents not acting in the best interest of the owner. As they possess direct control over the enterprise, they have the authority to make decisions regarding business management based on their own interests, potentially encroaching upon the interests of the enterprise owners. Enterprises must allocate resources towards corporate governance, establish an optimal governance mechanism, and strive to establish a just and effective incentive structure, as well as a system of checks and balances between owners and agents. This is necessary to mitigate the adverse impact and enhance the operational outcomes of the business. Several studies indicate a positive correlation between executive salary and firm performance, as evaluated by accounting-based and market-based metrics. For instance, Ozkan (2011), Farmer et al. (2013), and Swatdikun (2013a) have discovered that CEO compensation rises in correlation with market-based performance. Furthermore, Firth et al. (2006), Conyon and He (2011, 2012), Scholtz and Smit (2013), Conyon (2014), and Raithatha and Komera (2016) have found evidence supporting a favourable correlation between executive compensation and both accounting-based and market-based performance. Ntim et al. (2015) further validated that the total remuneration of executives, also known as executive compensation, is highly impacted by the success of the firm, namely the total shareholder return. Nevertheless, certain studies contradict this favorable correlation. Henderson & Fredrickson (2001), Sapp (2008), Luo and Jackson (2012), and Gigliotti (2013) have found no significant correlation between executive salary and firm success.

This paper suggests that investing in governance, namely by implementing a robust corporate governance framework and streamlining management compensation, enhances internal management efficiency and mitigates internal conflicts, thus diminishing company risks. The aggregation of these enduring assets fosters a propitious financial milieu for firms. Thus, this paper puts up the subsequent study hypotheses:

H4: Governance investment is positively related to corporate financial performance

3. Methodology

3.1. Research Design

Firm financial performance (ROA and ROE): The dependent variable is the financial performance of the firm through ROA and ROE, which are widely used in numerous empirical studies (Yu et al., 2018; Duque -Grisales and Aguilera-Caracuel, 2019; Bhaskaran et al., 2020). The two dependent variables help to analyze the impact of ESG project investments on firms' financial performance through accounting-based and market-based performance (Cherkasova & Nenuzhenko, 2022). ESG cost investment: In the study, the independent variable ESG cost encompasses the financial outlays and investments made by corporations in relation to environmental, social, and governance factors. This paper utilizes web crawler technology to extract data from the corporate sustainability report, social responsibility report, and annual report. Specifically, this paper focus on the fields and figures that include the ESG cost investment composition table. By aggregating this data, this paper calculates the total ESG cost investment for listed companies in a given year. To prevent individual data from skewing the results, all the data apply logarithmic treatment. Environmental investment (E cost), Social responsibility investment (S cost), Governance investment (G cost): To avoid individual data being too large, they are treated as logarithms. Control variables include capital expenditure intensity (Capex), calculated as the ratio of capital expenditure to total assets, reflecting investment capacity; firm age (logarithm of years listed), indicating market experience; total asset turnover (TAT), measuring operational efficiency; growth (operational income growth rate), capturing performance improvement potential; gearing ratio (LEV), representing financial leverage; and firm size (logarithm of revenue or market capitalization). In addition, the ESG rating itself may have a direct impact on a company's financial performance. Companies with higher ESG ratings may achieve better financial performance due to improved reputation, reduced operational risks, and greater attractiveness to investors. To ensure that the study accurately isolates the direct impact of ESG cost investments on financial performance and avoids omitting important variables, this paper includes the ESG rating score as a control variable. The ESG rating scores used in this study are sourced from Huazheng ESG rating system, which has been widely adopted in China. And this paper also simultaneously controls for year, industry, and province effects. Specific variable definitions are shown in Table 1.

Table 1. Definition of variables.

Variable	Variable name	Variable Symbol	Variable Description
Dependent variable	Return On Assets	ROA	The ratio of Net profit to average total assets
	Rate of Return on Common Stockholders' Equity	ROE	The ratio of Net profit to average net assets
Independent variable	ESG cost investment	Logesgcost	The logarithm of total ESG cost investment
	Environment cost	Logecost	The logarithm of environment investment
	Social responsibility cost	Logscost	The logarithm of social responsibility investment
	Governance cost	Loggcost	The logarithm of governance investment
Control variables	Capital Expenditure Intensity	Capex	The ratio of capital expenditure to total assets
	Listing Age	Age	The logarithm of the years of listing up to the current period
	Total Asset turnover	TAT	Sales revenue/total assets
	Growth ability	Growth	Revenue growth rate
	Asset liability ratio	LEV	Total liabilities/total assets
	Firm Size	Size	The logarithm of total revenue and market capitalization
	ESG Performance	ESGscore	Huazheng ESG Rating Score

3.2. Data Source and Processing

This paper analyzes the ESG cost input data of A-share listed businesses in Shanghai and Shenzhen from 2015 to 2023. The financial performance indicators of listed firms and other variables are sourced from the CSMAR database and WIND database. The ESG rating score comes from the Huazheng ESG Rating, where the nine rating levels (C, CC, CCC, B, BB, BBB, A, AA, AAA) are assigned values from 1 to 9, respectively. The data on ESG cost investment are obtained from the annual reports, sustainability reports, or social responsibility reports published by listed corporations. In order to make the sample data more representative, this paper excludes financial sector entities like banks, securities, and insurance companies, which have distinct capital

structures. Companies bearing the ST and ST* designations, indicating financial distress, are also omitted. Entries lacking comprehensive data for the essential variables were removed from consideration. Additionally, to address the potential distortion by outliers, a Winsorization technique was applied to continuous variables at both ends of the distribution spectrum. Following the screening process, a grand total of 2997 sample companies were ultimately acquired, resulting in a cumulative count of 20979 valid data points.

3.3. Model

In order to study the impact of ESG cost investment on financial performance of sample listed companies, this paper constructs the following econometric model based on the refining and summarizing of previous literature. The dependent variables ROA is return on assets, ROE is return on equity, and the independent variables ESGcost is the ESG cost investment of listed companies. E cost is the environmental investment, S cost is the social responsibility investment, and G is the governance investment, and the other control variables include the Capital expenditure intensity(Capex), the turnover rate of total assets (TAT), the growth rate of operating income (Growth), the number of years since the listing of the company (Age), the assets and liabilities ratio (LEV), the size of the company(Size) and ESG rating performance(ESGscore); δi denotes the industry fixed effect, θt denotes the year fixed effects, μp denotes the province fixed effects and εi,t denotes the random error term.

$$ROA = a0 + \beta 1 ESGcost/\text{E cost/S cost/G cost} + \beta 2 Capex + \beta 3 Age + \beta 4 TAT + \beta 5 Growth + \beta 6 Size + \beta 7 ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

$$ROE = a0 + \beta 1' ESGcost/\text{E cost/S cost/G cost} + \beta 2' Capex + \beta 3' Age + \beta 4' TAT + \beta 5' Growth + \beta 6' Size + \beta 7 ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

4. Results

4.1. Descriptive Analysis

Table 2 reports the basic statistical characteristics of the main variables. The minimum value of the explanatory variable ROA is -0.265, the maximum value is 0.229, and the standard deviation is 0.0707. The minimum value of ROE is -0.752, the maximum value is 0.374, and the standard deviation is 0.146, which shows a large difference between the financial performances of the sample listed companies. The average value of the key explanatory variable ESGcost is 210.09 million yuan, which indicates that the overall view of the listed companies on the degree of attention to ESG needs to be improved, the performance of ESG cost investment has a greater room for improvement, ESG cost investment the minimum value and the maximum value of the difference is large, indicating that there is a large gap between different listed companies in the investment of ESG costs. Regarding environmental investment, the minimum value is 0, and the maximum value is 309.11 million yuan; some listed companies did not invest in the environment that year and the average value is only 9.123 million yuan, which is a lower level. In terms of social responsibility investment and governance investment, there is a large gap between the minimum value and the maximum value. However, the in-sample anomaly value is optimized after logarithmic treatment for all independent variables.

4.2. Correlation and Multicollinearity Analysis

Before conducting regression analysis, in order to initially study the correlation between ESG cost investment and corporate financial performance and verify the scientificity of variable selection, this paper first tests the correlation between the explanatory variables, key explanatory variables and other control variables, and the results are as follows. From the results shown in the table 3, the key explanatory variable ESG cost investment is positively correlated with the explanatory variables and is significant at the 1% significance level for ROA and at the 1% significance level for ROE, which is consistent with the expected direction, and initially verifies the hypothesis of this paper. Environmental investment is negatively correlated with ROA. The results will differ after applying the fixed effect model in the basic regression model. Environmental, social responsibility, and governance investments are positively related to ROE and are significant at the 1% significance level. As for other control variables, Growth and Total Asset Turnover (TAT) are significantly positively related to the

explanatory variables, which aligns with the findings in the past literature and the theoretical analysis in this paper. Listing years (lnage) and gearing ratio (LEV) are significantly negatively related to ROA and ROE.

Table 2. Descriptive statistics.

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
ROA	26,973	0.0419	0.0707	-0.265	0.229
ROE	26,973	0.0611	0.146	-0.752	0.374
ESGcost	26,973	21,009	50,486	177.1	373,394
Ecost	26,973	912.3	3,916	0	30,911
Scost	26,973	332.5	1,116	0	8,230
Gcost	26,973	18,429	44,513	142.4	332,542
Logesgcost	26,973	8.756	1.529	5.177	12.83
Logecost	26,973	5.836	3.052	-12.72	10.34
Logscost	26,973	1.676	4.287	-4.605	9.016
Loggcost	26,973	8.587	1.566	4.958	12.71
Capex	26,973	0.0464	0.0423	0.000839	0.207
Age	26,973	9.307	8.009	1	33
Growth	26,973	0.253	0.585	-0.652	3.520
TAT	26,973	0.624	0.378	0.0986	2.359
LEV	26,973	0.409	0.190	0.0649	0.885
Size	26,973	22.28	1.285	16.41	26.24
ESGscore	26,973	3.789	1.496	0	7.750

Table 3. Correlation analysis.

ROA	ROA	ROE	Logesg~t	Logecost	Logscost	Loggcost	Capex	logage	TAT	Growth	LEV	Size	ESGscore
ROA	1												
ROE	0.901***	1											
Logesgcost	0.077***	0.108***	1										
Logecost	-0.002	0.022***	0.295***	1									
Logscost	0.021***	0.028***	0.246***	0.113***	1								
Loggcost	0.024***	0.068***	0.627***	0.145***	0.156***	1							
Capex	0.147***	0.129***	0.069***	0.077***	0.006	0.026***	1						
logage	-0.168***	-0.110***	0.120***	0.120***	0.099***	0.158***	-0.238***	1					
TAT	0.196***	0.200***	0.126***	0.039***	0.040***	0.108***	-0.005	0.084***	1				
Growth	-0.045***	-0.016***	-0.006	-0.030***	-0.055***	-0.017***	-0.102***	-0.039***	-0.159***	1			
LEV	-0.350***	-0.223***	0.205***	0.130***	0.072***	0.204***	-0.018***	0.284***	0.164***	0.012**	1		
Size	-0.025***	0.038***	0.385***	0.253***	0.237***	0.598***	0.008	0.208***	0.01	-0.027***	0.303***	1	
ESGscore	-0.116***	-0.091***	0.214***	0.078***	0.070***	0.175***	0.081***	-0.080***	-0.123***	0.086***	-0.045***	0.212***	1

Note: * denotes P<0.1; ** denotes P<0.05; *** denotes P<0.01

In order to avoid serious correlation between the selected variables, this paper applies the method of variance inflation factor analysis to carry out the multicollinearity test, and the results are shown in the Table 4. According to the diagnostic criteria of multicollinearity, when the variance inflation factor (VIF) of the independent variables is less than 10, that is, the tolerance (1/VIF) is more than 0.1, it can be considered that there is no covariance problem between the independent variables. According to the results of the above table, the independent variables selected in this paper satisfy the above conditions. Therefore, it can be considered that there is no multicollinearity problem among the explanatory variables selected when constructing the research model in this paper, and the next step of regression analysis can be carried out.

4.3. Regression Analysis

The Hausman test was first conducted to clarify whether the model should use fixed effects or random effects. After the test, the p-value was 0.000, and the original hypothesis should be rejected. Therefore, based on the results of the Hausman test, the fixed effect model should be used in this model for analysis. According to the variable settings, the screened sample data are regressed using the fixed effect model, and time, industry, and province are controlled and the results from the regression are shown in the Table 5.

Table 4. Multicollinearity analysis.

Variable	VIF	1/VIF
Logesgcost	1.91	0.523663
Ecost	1.16	0.861051
Scost	1.11	0.903582
Gcost	2.29	0.437131
Capex	1.11	0.897743
Logage	1.21	0.82696
TAT	1.13	0.883907
Growth	1.05	0.953222
LEV	1.36	0.732679
Size	1.87	0.534048
ESGscore	1.14	0.879448
Mean VIF	1.38	

Table 5. Fixed effect model.

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROE	(6) ROE	(7) ROE	(8) ROE
Logesgcost	0.009***				0.017***			
	(0.001)				(0.002)			
Logecost		0.002***				0.003***		
		(0.000)				(0.001)		
Logscost			0.002***				0.003***	
			(0.000)				(0.000)	
Loggcost				0.009***				0.017***
				(0.001)				(0.002)
Capex	0.153***	0.157***	0.172***	0.157***	0.316***	0.328***	0.347***	0.324***
	(0.019)	(0.029)	(0.017)	(0.019)	(0.033)	(0.062)	(0.032)	(0.034)
Logage	-0.007***	-0.002	-0.005***	-0.007***	-0.009***	0.001	-0.006***	-0.009***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.002)	(0.002)
TAT	0.038***	0.040***	0.041***	0.038***	0.078***	0.082***	0.081***	0.078***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.011)	(0.006)	(0.005)
LEV	-0.149***	-0.149***	-0.141***	-0.149***	-0.248***	-0.243***	-0.214***	-0.248***
	(0.005)	(0.007)	(0.005)	(0.005)	(0.014)	(0.019)	(0.012)	(0.014)
Growth	0.006***	0.006***	0.006***	0.006***	0.019***	0.016***	0.018***	0.018***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.004)	(0.003)	(0.003)
Size	0.000**	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ESGscore	0.008***	0.007***	0.008***	0.008***	0.016***	0.014***	0.017***	0.016***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)	(0.002)	(0.001)
_cons	-0.032***	0.032***	0.029***	-0.036***	-0.114***	0.004	-0.000	-0.120***
	(0.006)	(0.009)	(0.004)	(0.007)	(0.011)	(0.018)	(0.010)	(0.013)
N	26973	26973	26973	26973	26973	26973	26973	26973
r2	0.269	0.265	0.249	0.270	0.197	0.184	0.170	0.197
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard error in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

The empirical results demonstrate a significant positive correlation between the ESG cost investment of listed companies and their ROA, with a correlation coefficient of 0.009 at a significant level of 1%. Additionally, there is a significant positive correlation between the ESG cost investment and ROE, with a correlation coefficient of 0.017 at a significant level of 1%. These results provide evidence supporting the hypothesis H1 proposed in this paper. The relationship between environmental investment and return on assets (ROA) is positively correlated at a 1% level of significance, with a correlation coefficient of 0.002. Similarly, the relationship between environmental investment and return on equity (ROE) is also strongly correlated at a 1% level of significance, with a correlation coefficient of 0.003. The validity of Hypothesis H2, as suggested in this study, has been demonstrated. The relationship between social responsibility investment and return on assets (ROA) is strongly linked at a significant level of 1%, with a correlation coefficient of 0.002. Similarly, social

responsibility investment is positively correlated with return on equity (ROE) at a significant level of 1%, with a correlation coefficient of 0.003. The hypothesis H3 proposed in this study has been substantiated. The relationship between governance investment and return on assets (ROA) is positively connected, with a correlation value of 0.09, and this correlation is statistically significant at the 1% level. Similarly, the relationship between governance investment and return on equity (ROE) is also positively correlated, with a correlation coefficient of 0.017, and this correlation is statistically significant at the 1% level. The paper successfully validates Hypothesis H4 as proposed. By examining the disparity in the regression coefficients, it reveals that governance investment have a more pronounced impact on enhancing the company's financial success.

As for the control variables, capital expenditure intensity (Capex), growth capacity (Growth), and total asset turnover (TAT) are all significantly positively correlated with the explanatory variables, suggesting that the higher the capital expenditure, the higher the growth capacity, and the higher the operational capacity of listed companies are the better their financial performance. Years of listing (Age) is significantly negatively correlated with the explanatory variables, possibly because firms that have been listed for a more extended period may be constrained by the traditional business model and have difficulty adapting to the fast-changing market environment. With the emerging trend of ESG inputs positively affecting firms' financial performance, long-standing firms may be less able to flexibly adjust their strategies to accommodate these changes, which affects the depth and breadth of their ESG practices and, consequently, their financial performance. The gearing ratio (LEV) is negatively correlated with the explanatory variables at the 1% significance level; the possible reason is that higher gearing ratios may imply that firms are overly reliant on debt financing, leading to elevated financial risk. This may be manifested in the form of a high-interest rate burden, which increases the financial cost of the firm, thus affecting net profit and overall financial performance. In addition, a high gearing ratio may raise market concerns about a firm's financial stability, affecting investor confidence and thus leading to a decline in the firm's share price. The decline in share price may lead to a loss of shareholder value and adversely affect the firm's financial performance. Meanwhile, ESG performance is significantly positively correlated with ROA and ROE, which is consistent with most literature.

4.4. Robustness Test

While the aforementioned empirical findings confirm the beneficial influence of ESG cost expenditure on the financial performance of publicly traded companies, it is important to acknowledge the potential issue of reverse causality in this model. Companies are more likely to engage in socially responsible and environmentally conscious investments when they are financially successful, as they have greater financial resources available to them. Consequently, the financial performance of companies may lead to increased investments in ESG costs. Furthermore, the model may have neglected certain factors or encountered statistical mistakes in the ESG cost investment, which could introduce bias into the conclusions and lead to endogeneity issues. This research will employ an instrumental variables methodology to mitigate the issue of endogeneity. This research will employ the environmental regulation intensity of local government as an instrumental variable to tackle the issue of endogeneity.

Environmental regulation intensity pertains to the level of strictness in the rules, regulations, and policies that are enforced in a specific region or country to govern the actions of corporations and individuals in relation to the environment. This includes the oversight of emissions, waste management, utilization of natural resources, and other endeavors that may have influence on the environment. The stringency of environmental regulation may differ across regions and countries, contingent upon the local legal and regulatory structure, the government's environmental policies, and the degree of societal apprehension regarding environmental matters. Typically, stricter environmental regulations impose greater limitations and regulations on firms and individuals, so constraining their environmental conduct to a greater extent. Environmental rules encompass various restrictions on emission standards, waste disposal protocols, land use planning, and wildlife conservation measures, among others. The purpose of these regulations is to ensure that both businesses and individuals engage in activities that have minimal detrimental effects on the environment and encourage sustainable and eco-friendly economic growth.

The instrumental variables must meet two essential criteria: (1) they must exhibit correlation with the explanatory variables in the model, and (2) they must demonstrate no correlation with the random error of the model. The level of local government environmental regulation is directly related to the cost inputs of firms' ESG practices. This means that as the intensity of local government environmental regulation increases, firms may have to allocate more resources to meet the legal and regulatory requirements set by the local government. There is no correlation between environmental regulatory intensity and the random error term. This could be due to the fact that environmental regulatory intensity is typically established and implemented by governmental bodies or regulatory agencies, and these policies are generally unrelated to the performance of enterprises. Hence, the development and alterations in the strength of environmental regulations may not be directly influenced by the ESG behavior of enterprises. In addition, the primary objective of the government in creating environmental rules is to safeguard the environment and societal concerns, rather than directly impacting the performance of businesses. Thus, the implementation of environmental legislation may not be influenced by the random elements affecting corporate performance. Liu Rongzeng et al. (2021) propose a formula to quantify the magnitude of environmental control implemented by municipal governments.

Environmental regulation intensity = completed investment in industrial pollution control (million yuan) / value added of secondary industry (billion yuan) / 10000. After calculating the environmental regulation intensity at the municipal level, the instrumental variable for environmental regulation intensity is obtained by matching it with the municipality where each listed company is located. The following Table 6 shows the regression results after introducing the instrumental variable.

Table 6. Instrument variable.

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROE	(6) ROE	(7) ROE	(8) ROE
Logesgcost	0.003***				0.006***			
	(0.000)				(0.001)			
Logecost		0.000**				0.002**		
		(0.000)				(0.001)		
Logscost			0.000***				0.001***	
			(0.000)				(0.000)	
Loggcost				0.003***				0.006***
				(0.000)				(0.001)
Capex	0.118***	0.117***	0.121***	0.118***	0.257***	0.241***	0.260***	0.257***
	(0.012)	(0.023)	(0.014)	(0.012)	(0.029)	(0.056)	(0.032)	(0.029)
Logage	-0.012***	-0.006*	-0.011***	-0.011***	-0.018***	-0.011**	-0.018***	-0.017***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.005)	(0.002)	(0.002)
TAT	0.065***	0.076***	0.062***	0.064***	0.123***	0.150***	0.115***	0.122***
	(0.002)	(0.004)	(0.002)	(0.002)	(0.005)	(0.010)	(0.006)	(0.005)
Growth	0.011***	0.010***	0.011***	0.011***	0.028***	0.026***	0.027***	0.027***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.002)	(0.002)
LEV	-0.189***	-0.205***	-0.196***	-0.190***	-0.402***	-0.412***	-0.394***	-0.403***
	(0.004)	(0.008)	(0.005)	(0.004)	(0.010)	(0.020)	(0.011)	(0.010)
Size	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ESGscore	-0.001*	-0.002*	-0.001	-0.001*	-0.003**	-0.006**	-0.002*	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
_cons	0.062***	0.076***	0.089***	0.061***	0.102***	0.151***	0.154***	0.097***
	(0.005)	(0.009)	(0.004)	(0.004)	(0.011)	(0.019)	(0.009)	(0.011)
N	26973	26973	26973	26973	26973	26973	26973	26973
r2	0.178	0.225	0.161	0.179	0.138	0.147	0.120	0.139
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard error in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

After considering the possible endogeneity problem between ESG cost investment and the explanatory variables, the coefficient of ESG cost investment and their respective investments are still positive and significant after adding the instrumental variable environmental regulation intensity, indicating that ESG cost investment and their respective investments are positively associated with firms' financial performance, which is in complete agreement with the previous results.

Tobin's Q and ROIC (Return on Invested Capital) are selected as proxy variables for corporate financial performance to perform the same regression as previously conducted. Tobin's Q is commonly used to measure corporate financial performance, while ROIC evaluates the efficiency of a company's capital investment, reflecting a company's ability to use capital to generate profits. The findings are displayed in the subsequent Table 7. From the regression results, after replacing the dependent variables, ESG cost investment and their respective investments still have a positive impact on financial performance at the 1% significance level and 5% significance level. Therefore, based on the above regression results, the results of the previous empirical analysis can be considered reliable. The impact of ESG cost investment on corporate financial performance may exhibit a time lag effect. For instance, implementing environmental technologies or improving supply chain management may require significant initial investment, and the benefits in the current period may not be reflected in the financial statements. However, in the long run, these measures can reduce operating costs and enhance efficiency, thereby improving financial performance. This paper conducts regressions with ESG cost investment lagged by one period and two periods, and the results still show a significant positive impact on corporate financial performance.

Table 7. Robustness test.

	(1) Tobin'Q	(2) Tobin'Q	(3) Tobin'Q	(4) Tobin'Q	(5) ROIC	(6) ROIC	(7) ROIC	(8) ROIC
Logesgcost	0.179***				0.011***			
	(0.036)				(0.001)			
Logecost		0.040***				0.002***		
		(0.009)				(0.000)		
Logscost			0.023**				0.002***	
			(0.011)				(0.000)	
Loggcost				0.194***				0.011***
				(0.031)				(0.001)
Capex	2.306***	2.181***	2.146***	2.395***	0.174***	0.171***	0.198***	0.180***
	(0.410)	(0.574)	(0.530)	(0.420)	(0.024)	(0.036)	(0.023)	(0.024)
Logage	0.267***	0.382***	0.661***	0.269***	-0.008***	-0.002	-0.006***	-0.008***
	(0.063)	(0.049)	(0.091)	(0.064)	(0.001)	(0.002)	(0.001)	(0.001)
TAT	0.080	-0.047	0.426	0.078	0.051***	0.051***	0.055***	0.051***
	(0.166)	(0.092)	(0.284)	(0.163)	(0.003)	(0.006)	(0.004)	(0.003)
LEV	-0.469	0.871***	0.379	-0.466	-0.136***	-0.132***	-0.124***	-0.136***
	(0.301)	(0.191)	(0.351)	(0.301)	(0.007)	(0.008)	(0.006)	(0.007)
Growth	-0.050*	-0.115***	-0.117**	-0.053**	0.009***	0.008***	0.009***	0.008***
	(0.025)	(0.040)	(0.048)	(0.025)	(0.002)	(0.003)	(0.002)	(0.002)
Size	-0.643***	-0.831***	-0.984***	-0.645***	0.000**	0.000***	0.000***	0.000***
	(0.092)	(0.039)	(0.251)	(0.087)	(0.000)	(0.000)	(0.000)	(0.000)
ESGscore	0.009	-0.017	0.027	0.009	0.009***	0.008***	0.010***	0.009***
	(0.020)	(0.026)	(0.018)	(0.019)	(0.001)	(0.002)	(0.001)	(0.001)
_cons	14.390***	19.332***	22.742***	14.335***	-0.054***	0.024**	0.020***	-0.058***
	(1.627)	(0.804)	(5.424)	(1.563)	(0.008)	(0.011)	(0.006)	(0.008)
N	26973	26973	26973	26973	26973	26973	26973	26973
r2	0.148	0.075	0.162	0.149	0.205	0.193	0.183	0.205
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard error in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

The impact of ESG cost investment on corporate financial performance may exhibit a time lag effect. For instance, implementing environmental technologies or improving supply chain management may require significant initial investment, and the benefits in the current period may not be reflected in the financial statements. However, in the long run, these measures can reduce operating costs and enhance efficiency, thereby improving financial performance. This paper conducts regressions with ESG cost investment lagged by one period and two periods, and the results still show a significant positive impact on corporate financial performance (Table 8).

Performing a heterogeneity analysis of firms is crucial for exploring the correlation between ESG cost investment and firms' financial performance. This is because the variations among firms, as well as the disparities in their operational environments, industry traits, and governance frameworks, can have a

substantial impact on the efficacy of ESG practices. Firstly, various categories of companies may be susceptible to distinct external influences and stakeholder anticipations. State-owned businesses (SOEs) can be significantly influenced by government policies and public obligations, whereas private firms tend to prioritize market competition and shareholder value. By examining these disparities, it becomes feasible to gain a deeper comprehension of how ESG cost investment affect the financial performance of companies within various governance frameworks. Secondly, corporations operating in various sectors encounter distinct ESG difficulties and prospects. Industries that produce a significant amount of pollution are likely to be more vulnerable to the influence of environmental restrictions and social concerns. ESG practices can potentially strengthen the brand image of technology or renewable energy industries. By examining the diversity across industries, it becomes feasible to comprehend the varying effects of ESG cost investments on enterprises within their particular sectors.

Table 8. Long-term impact.

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROE	(6) ROE	(7) ROE	(8) ROE
$Logesgcost_{t-1}$	0.007***				0.013***			
	(0.001)				(0.002)			
$Logecost_{t-1}$		0.001***				0.003**		
		(0.000)				(0.001)		
$Logscost_{t-1}$			0.001***				0.002***	
			(0.000)				(0.000)	
$Loggcost_{t-1}$				0.007***				0.012***
				(0.001)				(0.002)
$Logesgcost_{t-2}$	0.005***				0.010***			
	(0.001)				(0.002)			
$Logecost_{t-2}$		0.002**				0.003*		
		(0.001)				(0.002)		
$Logscost_{t-2}$			0.001***				0.001***	
			(0.000)				(0.000)	
$Loggcost_{t-2}$				0.005***				0.009***
				(0.001)				(0.002)
N	26973	26973	26973	26973	26973	26973	26973	26973
r2	0.315	0.322	0.302	0.315	0.214	0.213	0.202	0.214
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4.5. Sub-sample Study based on Enterprise Ownership

The national economy of China is predominantly controlled by state-owned enterprises (SOEs). State-owned enterprises (SOEs) are primarily owned by the government or government-controlled entities, and the government exerts a more direct influence in the decision-making process at the corporate level. Conversely, the governing framework of non-state-owned enterprises (non-SOEs) tends to be more market-driven and subject to the influence of private shareholders and market procedures. When it comes to ESG cost investment, state-owned enterprises (SOEs) prioritize social responsibility and public interest, which might have a greater impact on these cost inputs. The ESG practices of non-state-owned enterprises (non-SOEs) may prioritize meeting market needs and achieving shareholder returns.

Models 1 and 3 represent state-owned enterprises, and models 2 and 4 represent non-state-owned enterprises. ESG cost investment and financial performance of state-owned and non-state-owned enterprises are positively correlated at the 1% significance level. To compare whether there is a significant difference between the two sets of coefficients, this paper uses the Chow Test statistic to conduct the test. The result is not significant enough to reject the original hypothesis, indicating that the difference between these two coefficients is insignificant. This result may be due to the fact that ESG standards and practices are gradually becoming a global business standard, which is not only valued by the market and shareholders but also regulated by international institutions and regulators. Therefore, SOEs and non-SOEs may be subject to similar international pressures and standards on ESG practices. In addition, as society's focus on sustainability and social responsibility continues to grow, companies generally recognize the importance of emphasizing ESG

practices to maintain public image, attract investors, and meet consumer expectations. Non-state corporations are also willing to do more to invest in ESG costs. This shared sense of social responsibility may lead to a convergence between SOEs and non-SOEs on ESG cost investment.

4.6. Sub-sample Study based on Pollution Level

The production activities of highly polluting companies often result in various pollutants, such as air and water pollution. These sectors can exert significant strain on the local environment, leading to issues of air and water pollution. Due to the energy-intensive nature of the production process, high-pollution businesses typically exhibit a relatively high level of energy consumption, mostly relying on conventional energy sources. Furthermore, industries that produce a significant amount of pollution may encounter more rigorous enforcement of environmental protection laws and regulations, necessitating adherence to more stringent emission standards and environmental protection mandates. Regarding industries that do not cause large levels of pollution, their production processes typically prioritize environmental friendliness and employ cleaner technology. These technologies have a comparatively lower environmental impact and align more closely with the principles of sustainable development. Industries that do not produce a significant amount of pollution may be more likely to adopt cleaner energy sources and decrease their reliance on conventional energy sources in order to mitigate carbon emissions and reduce energy usage. Furthermore, industries that do not emit substantial levels of pollution may be subjected to less strict environmental rules.

Models 5 and 7 represent highly polluting industries. Models 6 and 8 represent the non-high pollution industries. ESG cost investment and financial performance are positively correlated at a 1% significance level for both high-polluting and non-high-polluting industries. A Chow Test was conducted, and the original hypothesis was found to be rejected at the 1% significance level, indicating that the difference between these two coefficients is significant (Table 9). The coefficient of ESG cost investment in high-polluting industries is much larger than that of non-high-polluting industries, indicating that for high-polluting industries, ESG cost investment has a more significant positive impact on corporate finance and that for high-polluting industries, ESG practices are not only an environmental and social responsibility in these industries but also a strategic investment. By investing more in ESG costs, companies in high-pollution industries are expected to improve productivity, reduce environmental risks, and achieve more sustainable financial returns in the long run. Increasing ESG costs in highly polluting industries is imperative.

Table 9. Heterogeneity analysis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROA	ROA	ROE	ROE	ROA	ROA	ROE	ROE
Logesgcost	0.003***	0.003***	0.005***	0.006***	0.005***	0.002***	0.011***	0.004***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
N	6822	16478	6822	16478	6822	16478	6822	16478
r2	0.212	0.174	0.138	0.141	0.218	0.165	0.160	0.131
year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chow test	0.066		0.569		0.000		0.000	

Standard error in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

4.7. Impacts of China's Dual-Carbon Policy

China's dual-carbon policy has caused Chinese firms to face tougher ESG targets and pressures than Western firms, especially in high-pollution and high-energy-consumption industries. In order to compare the differences in the impact of dual-carbon policy on the financial performance of Chinese firms, as well as to illustrate the reasonableness of the research sample selected in this paper, this paper will test whether the ESG cost investment of high-polluting firms under the dual-carbon policy is able to affect their corporate financial performance and construct a DID model. Before using the difference in difference method, it is necessary to determine the experimental group and control group. In this paper, high-pollution enterprises are selected as the experimental group and non-high-pollution enterprises as the control group. China's dual-carbon policy

was proposed by President Xi Jinping on September 22, 2020 at the general debate of the 75th United Nations General Assembly. Therefore, the policy start year is set to 2020. The DID model is set as follows:

$$ROA = \theta 0 + \theta 1 time \times treat + \theta 2 Capex + \theta 3 Age + \theta 4 TAT + \theta 5 Growth + \theta 6 Size + \theta 7 ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

$$ROE = \lambda 0 + \lambda 1 time \times treat + \lambda 2 Capex + \lambda 3 Age + \lambda 4 TAT + \lambda 5 Growth + \lambda 6 Size + \lambda 7 ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

The dummy variable treat indicates whether the firm belongs to the experimental group or not, taking 1 if the firm is a high polluter and 0 otherwise. the dummy variable time is equal to 1 in 2020 and beyond and 0 otherwise.

Table 10 reports the regression results, and the coefficients of the dual carbon policy are all positive at the 1% significance level, indicating a significant positive impact on corporate financial performance under the dual carbon policy. In addition, with the addition of ESG cost investment and the interaction term between ESG cost investment and the dual carbon policy, the coefficient of the interaction term is significantly positive, indicating that ESG cost investment of enterprises under the dual carbon policy can have a positive impact on financial performance.

Table 10. DID model.

	(1)	(2)	(3)	(4)
	ROA	ROE	ROA	ROE
Time×Treat	0.007***	0.015***		
	(0.003)	(0.005)		
Time×Treat×Logesgcost			0.001**	0.001**
			(0.000)	(0.001)
Logesgcost	0.009***	0.016***	0.009***	0.016***
	(0.001)	(0.002)	(0.001)	(0.002)
Capex	0.155***	0.320***	0.154***	0.320***
	(0.018)	(0.033)	(0.018)	(0.033)
Logage	-0.008***	-0.011***	-0.008***	-0.010***
	(0.001)	(0.002)	(0.001)	(0.002)
TAT	0.038***	0.078***	0.038***	0.078***
	(0.003)	(0.005)	(0.003)	(0.005)
LEV	-0.149***	-0.249***	-0.149***	-0.248***
	(0.005)	(0.014)	(0.005)	(0.014)
Growth	0.006***	0.018***	0.006***	0.018***
	(0.001)	(0.003)	(0.001)	(0.003)
Size	0.000**	0.000***	0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
ESGscore	0.008***	0.016***	0.008***	0.016***
	(0.001)	(0.001)	(0.001)	(0.001)
_cons	-0.031***	-0.112***	-0.031***	-0.111***
	(0.006)	(0.012)	(0.006)	(0.012)
N	26973	26973	26973	26973
r2	0.270	0.198	0.270	0.197
year	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes

Figure 1 and Figure 2 shows the estimation results of θ and λ at a 99% confidence interval and the two results are basically consistent. This paper found that θ and λ were not significant from 2016 to 2020, indicating that there was no significant difference between the experimental group and the control group before the implementation of the dual carbon policy. After the implementation of the dual carbon policy, the estimated coefficients θ and λ began to be significant. Therefore, the DID model used in this paper conforms to the prerequisite of the parallel trend hypothesis.

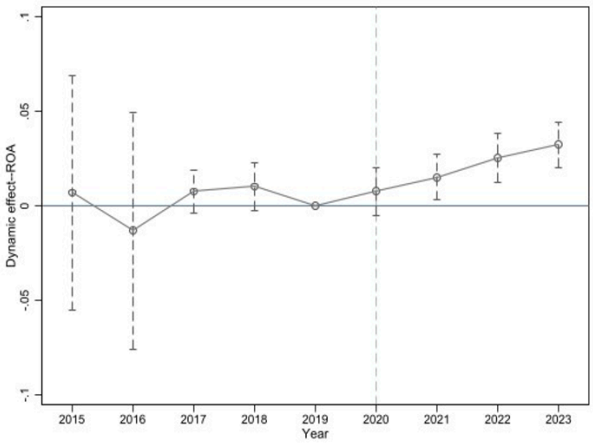

Figure 1. DID model of ROA

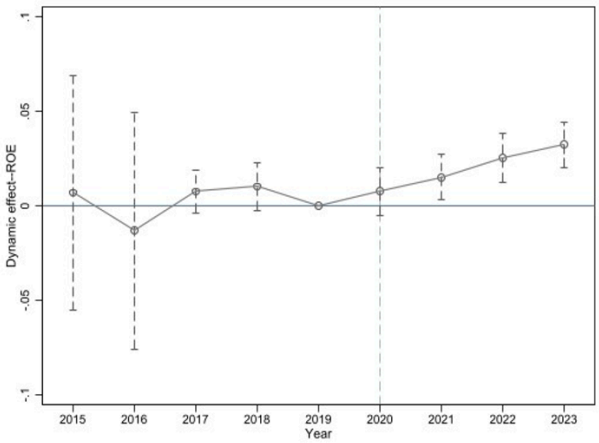

Figure 2. DID model of ROE

4.8. Channel Tests

Previous studies have shown that ESG cost investment positively impact corporate financial performance, and this section examines the intrinsic mechanism of ESG cost investment for corporate financial performance improvement based on international ESG practices.

Many studies support that ESG has a positive impact on the green innovation capability of enterprises. Long et al. (2023) examined the impact of national environmental, social, and governance (ESG) performance on green innovation using panel data from 37 countries between 1990 and 2019. Their research suggests that improvements in national ESG performance significantly promote green innovation. Specifically, enhancements in environmental and governance performance significantly foster green innovation. However, in countries with weaker green innovation capacity, improvements in social performance reduced green innovation output. Wang et al. (2023) found that green innovation output from companies covered by ESG rating agencies increased by 3.9%, mainly driven by an increase in green invention patents. The positive impact of ESG ratings on green innovation was more pronounced for companies with less investor short-termism, non-state-owned enterprises, and firms facing higher financial constraints. Tan & Zhu (2022) found that ESG ratings significantly boosted both the quantity and quality of corporate green innovation by alleviating financial constraints and raising managers' environmental awareness. Wang & Chu (2024), using data from Chinese A-share listed companies between 2011 and 2020, employed multiple models, such as multi-period difference-in-differences (DID), event studies, staggered DID, and synthetic DID (SDID). Their analysis revealed that ESG ratings had a significant impact on corporate green innovation, promoting a shift from end-of-pipe treatment to source governance in green innovation activities. This transition was facilitated by reducing managerial short-termism, increasing the proportion of R&D personnel, and alleviating financial constraints. Li et al. (2023) found that a company's ESG has a significant green innovation spillover effect on its industry, manifested in easing financing constraints and raising environmental awareness among executives of peer firms.

Industrial companies, due to their inherent characteristics, do not show this effect as clearly, while the ESG performance of non-industrial firms can guide peer firms to adopt green innovation practices, thus enhancing sustainable development performance. Zhang (2022), using a quasi-natural experiment based on the enactment of regulations in China that mandate certain companies to disclose their corporate social responsibility (CSR) activities, found that mandatory CSR disclosure encourages corporate innovation. This positive correlation was more pronounced for companies with lower pre-disclosure transparency. Chen et al. (2023) found a significant relationship between ESG disclosure and corporate innovation indicators (OTI, STI, NSTI), and that ESG disclosure played a prominent role in promoting TIC across different levels of corporate innovation. Additionally, ESG disclosure in non-green (high-tech) industries was more effective in promoting TIC than in green (non-high-tech) industries. Broadstock et al. (2020), using a sample of 320 Japanese firms between 2008 and 2016, applied a non-parametric frontier analysis framework and provided evidence of a non-linear relationship between ESG policy adoption and corporate innovation capabilities. Initially, the

adoption of CSR/ESG policies enhanced firms' capacity to engage in innovation activities, which eventually had a positive impact on their value creation and financial/operational performance.

Green invention patent is one of the achievements of enterprises in environmental protection technology research and development and innovation, and the number of its independent applications can objectively reflect the innovation ability and innovation level of enterprises in the field of green transformation. This paper adopts the number of independent applications for green patents as a proxy variable for the green innovation capability of enterprises, and the data come from the State Intellectual Property Office of China and the WIPO Green Patent List, and takes the natural logarithm of the number of independent applications for green invention patents of an enterprise in a year to measure the green innovation capability. Based on the above research, this paper constructs the model of innovation capability as a channel for ESG cost investment to affect corporate financial performance.

$$ROA/ROE = a0 + a1ESGcost + a2Capex + a3Age + a4TAT + a5Growth + a6LEV + a7Size + a8ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

$$Innovation = b0 + b1ESGcost + b2Capex + b3Age + b4TAT + b5Grwoth + b6LEV + b7Size + b8ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

$$ROA/ROE = c0 + c1ESGcost + c2Innovation + c3Capex + c4AGE + c5TAT + c6Growth + c7LEV + c8Size + c9ESGscore + \delta i + \theta t + \mu p + \varepsilon i$$

Based on the above research, this paper constructs the model of innovation capability as a channel for ESG cost investment to affect corporate financial performance (Figure 3).

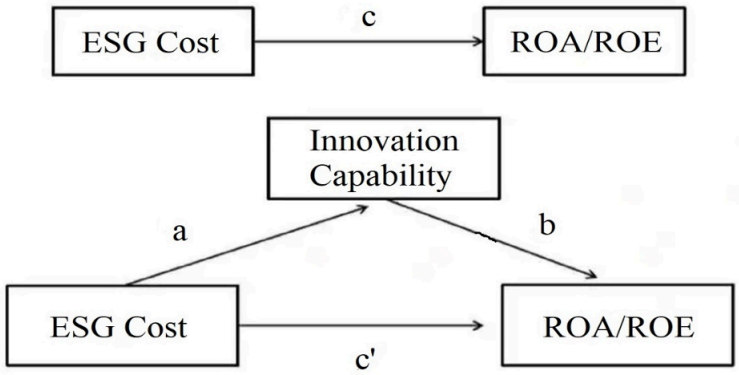

Figure 3. Model of innovation capability.

Table 11 reports the results of the above model. Similar to the previous section, ESG cost investment all significantly positively impact financial performance. The results in columns (2) and (5) show that ESG cost investment have a significant positive effect on green innovation capability. Columns (3) and (6) shows that the effect of green innovation capability on financial performance is also significantly positive, and after controlling for green innovation capability the coefficients of ESG cost are slightly lower comparing with columns (1) and (4), which suggests that green innovation capability is a channel for ESG cost investment to promote firms' financial performance. This result implies that the improvement of ESG cost investment can promote the improvement of corporate green innovation capability, which in turn promotes the improvement of firms' financial performance.

Table 11. Mediating effect.

	(1) ROA	(2) Innovation	(3) ROA	(4) ROE	(5) Innovation	(6) ROE
Logesgcost	0.004***	0.180	0.003***	0.017***	0.180	0.016***
	(0.001)	(0.109)	(0.000)	(0.002)	(0.109)	(0.002)
Innovation			0.000***			0.000***
			(0.000)			(0.000)
Capex	0.119***	-4.157	0.119***	0.316***	-4.157	0.317***
	(0.013)	(2.784)	(0.013)	(0.033)	(2.784)	(0.034)
Logage	-0.009***	-0.345***	-0.012***	-0.009***	-0.345***	-0.009***
	(0.001)	(0.118)	(0.001)	(0.002)	(0.118)	(0.002)
TAT	0.066***	0.011	0.065***	0.078***	0.011	0.078***
	(0.005)	(0.165)	(0.005)	(0.005)	(0.165)	(0.005)
LEV	-0.187***	0.757**	-0.188***	-0.248***	0.757**	-0.248***
	(0.007)	(0.337)	(0.007)	(0.014)	(0.337)	(0.014)
Growth	0.010***	0.029	0.011***	0.019***	0.029	0.019***
	(0.001)	(0.112)	(0.001)	(0.003)	(0.112)	(0.003)
Size	0.000***	0.000**	0.000***	0.000***	0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ESGscore	-0.001	0.067	-0.001	0.016***	0.067	0.016***
	(0.001)	(0.085)	(0.001)	(0.001)	(0.085)	(0.001)
_cons	0.047***	-1.085	0.061***	-0.114***	-1.085	-0.114***
	(0.008)	(1.186)	(0.006)	(0.011)	(1.186)	(0.012)
N	26973	26973	26973	26973	26973	26973
r2	0.185	0.099	0.180	0.197	0.099	0.197
year	Yes	Yes	Yes	Yes	Yes	Yes
industry	Yes	Yes	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes	Yes	Yes

Standard error in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

5. Conclusion

China has had significant advancements in the realm of ESG in recent years, demonstrating a favorable trajectory towards sustainable growth. The 19th Congress of the Communist Party of China (CPC) explicitly advocated for the swift advancement of ecological civilization reform and the establishment of a picturesque China. The significance of ecological civilization has grown significantly, as evidenced by its inclusion of "carbon neutrality" and "peak carbon" targets in the 14th Five-Year Plan and the 2035 goals for the first time. There is a growing societal focus on the ESG performance of companies. In light of this context, it is highly important to examine the influence of ESG cost investment on the financial performance of corporations. This paper utilizes the data of A-share listed companies in China's Shanghai and Shenzhen stock markets from 2015-2021 to measure the level of corporate ESG cost investment by identifying the summed data of ESG cost components in corporate sustainability or social responsibility reports and annual reports and to study the impact of ESG cost investment on corporate financial performance. The results find that ESG cost investment, environmental investment, social responsibility investment, and governance investment all significantly contribute to the growth of corporate financial performance. This finding still holds after considering a series of robustness tests, such as endogeneity issues and substitution of dependent variables. In the analysis of firm heterogeneity, the impact of ESG cost investment on promoting corporate financial performance is not significantly different between state-owned and non-state-owned firms; for high-pollution industries, ESG cost investment promote corporate finance more than non-high-pollution industries. Meanwhile, this paper uses the difference in differences (DID) method to examine the exogenous impact of the implementation of China's dual carbon policy on corporate financial performance. The results show that the implementation of the dual carbon policy enables companies to make ESG investments, which can significantly positively affect corporate financial performance. At the same time, it also demonstrates the rationality and feasibility of studying Chinese companies in this paper. Further, testing the intrinsic mechanism of ESG cost investment to promote corporate financial performance finds that improving corporate green innovation capability explains the promotion effect of ESG cost investment on corporate financial performance.

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