# The value of sustainability: How ESG cost investment impact corporate financial performance

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Abstract

This study aims to explore the impact of 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 ROA and ROE 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: ESG cost investment; environment investment; social responsibility investment; governance investment; corporate financial performance; sustainability

# I. 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; Lucia et al., 2020). Nevertheless, other research 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 indicate 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 company Social Responsibility (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 (Faccia et al., 2021). 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. Greenwashing is the act of overstating or distorting a company's environmental or social qualifications in order to create the false impression that it is more sustainable than it truly is (Jonsdottir et al., 2022). 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). Stakeholders incentivize corporations to participate in ESG activities (Diez-Cañamero et al., 2020). 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). Agents may prioritize their own interests over the interests of the principal, resulting in agency costs and disputes (Pulino et al., 2022). ESG practices are thought to decrease agency costs by addressing information asymmetry (Chong & Loh, 2023). 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, regarding the policy and regulatory environment, 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). With the introduction of the national sustainable development strategy, Chinese regulators have increasingly emphasized ESG evaluation of listed companies (Feng et al., 2022). Second, 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. In addition, China's rapid economic development and increasing integration into the global market have brought about environmental and social issues, such as pollution, over-consumption of resources, and labor issues, which are the focus of ESG concerns, making it important to understand the relationship between ESG and financial performance in the Chinese context (Zhao et al., 2018).

This work aims to introduce original contributions in the following areas: firstly, This paper collects data on the specific financial inputs of a range of companies in ESG-related areas, including, but not limited to, expenditures on environmental protection measures, social responsibility activities, and governance structure improvements. These data are derived from corporate annual reports, sustainability reports, and other public financial statements. Second, this research examines other factors influencing the correlation between ESG cost investment and business financial performance, including corporate ownership, industry characteristics and more. The analysis involves examining corporate heterogeneity, allowing for a better understanding of the influence of ESG

cost investment in various situations. This approach enhances the complexity and depth of the study, enabling the provision of more precise management recommendations tailored to enterprises with diverse ownership and industries. Thirdly, this work introduces the instrumental variable of environmental regulatory intensity, which effectively addresses the issue of endogeneity in the model and enhances the sensitivity and accuracy of the analysis. Finally, this paper uses ESG rating scores as a mediator variable to provide a channel for the promotion of ESG cost investment on corporate financial performance.

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.

## II. Literature Review and Research Hypotheses

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

**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

**Social Responsibility Investment—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 analysing 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.

**Social Responsibility Investment — Employee Benefits**

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.

**Social Responsibility Investment—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

**Governance Investment—R&D 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.

**Governance Investment—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 validate 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

## III. Research Design

**Key variable measures**

**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 ESGcost 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.

**Other control variables**

**Capital Expenditure Intensity (Capex):** Capex intensity is estimated by the ratio of capital expenditure to total assets, and firms with high capex are likely to allow more investment in stakeholder welfare and business expansion (Bhaskaran et al., 2020).

**Length of listing (Age):** Over an extended duration of operation, organizations that have been listed for a longer period have developed a reliable business model and a strong corporate basis, which allows them to

function more effectively in the market. The accumulation of experience results in enhanced financial stability and fosters investor confidence in the organization. Nevertheless, companies with a longer listing history may possess a well-established business model and may require additional incentives to allocate resources towards ESG expenses, which can have a negative impact on their financial performance. The number of years of listing is treated logarithmically.

**Total Asset Turnover (TAT):** Total Asset Turnover (TAT) quantifies a company's ability to efficiently utilize its assets in its operations. A high Turnaround Time (TAT) is widely seen as a favorable sign of a company's financial performance. A high turnover ratio indicates that a corporation can efficiently transform its assets into sales revenue within a short timeframe, demonstrating its effectiveness in allocating resources and managing operations. It demonstrates a company's capacity to optimize the utilization of existing resources and attain greater levels of profitability. A low total asset turnover ratio indicates that the organization may be facing challenges in effectively utilizing its assets, maybe caused by issues such as excessive inventory, delays in production, or improper allocation of resources. This could potentially hinder the company's financial success by not fully optimizing the utilization of capital.

**Growth:** The company's growth capability directly correlates with the speed of relative performance improvement. Furthermore, considering the company's current stage of development, its limited growth potential may be attributed to either a decline in the enterprise life cycle or a downturn in the industry. Besides, from the perspective of the capital market, a higher growth rate of the firm leads to a larger potential for an increase in the stock price. This, in turn, allows the company to attract more financial resources, ultimately enhancing profitability. This paper employs the operational income growth rate as a metric to assess the growth of corporations.

**Gearing ratio(LEV):** The gearing ratio is a significant metric that assesses a company's financial framework by examining the correlation between its assets and liabilities. Alterations in the gearing ratio can have an influence on the company's financial performance. A high gearing ratio can result in increased financial leverage, which in turn raises financial risk but may also offer greater capital for ESG cost investment, hence impacting the extent and scope of ESG activities. This paper employs the year-end liabilities to year-end total assets ratio as a metric for assessing the gearing ratio.

**Firm size(Size):** estimated by the logarithm of total revenue and market capitalization, larger firms typically have more resources to invest in ESG-

related activities. This may include higher capital investment, better environmental management systems, stronger social responsibility programs, etc.

**Industry dummy variable (δi):** There are large differences in business models and production operations across industries, and it is difficult to cross industry barriers even with good ESG performance. Therefore, this paper argues that the financial performance of listed companies may be significantly affected by industry fixed effects, so industry dummy variables are constructed to eliminate this effect.

**Year dummy variables (θt)**: Different macro policies and market environments exist in different years, and this paper argues that the empirical study may be affected by time-fixed effects, so time dummy variables are constructed to eliminate such effects.

**Province dummy variable ($\mu_p$):** Different provinces have different economic fundamentals and firms face different policy environments and other resources; this paper argues that the empirical study may be affected by province fixed effects, and therefore constructs province dummy variables to eliminate such effects.

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 |

**Data source and data processing**

This paper analyzes the ESG cost input data of A-share listed businesses in

Shanghai and Shenzhen from 2015 to 2021. The financial performance indicators of listed firms and other variables are sourced from the CSMAR database and WIND database. 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.

**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:

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

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

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) and the size of the company; δi denotes the industry fixed effect, θt denotes the year fixed effects, $\mu_p$ denotes the province fixed effects and εi,t denotes the random error term.

# Ⅳ. Empirical results

**Descriptive analysis**

Table 4.1 reports the basic statistical characteristics of the main variables. The minimum value of the explanatory variable ROA is -0.278, the maximum value is 0.234, and the standard deviation is 0.0702. The

minimum value of ROE is -0.687, the maximum value is 0.404, and the standard deviation is 0.138, which shows a large difference between the financial performances of the sample listed companies. The average value of the key explanatory variable ESGcost is 204.66 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 218 million yuan; some listed companies did not invest in the environment that year and the average value is only 6.897 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.

For the controlling variables, the average Capex intensity is 0.0415, indicating a relatively low overall level; The minimum value of growth ability is 0.935, the maximum value is 139.2, and the standard deviation is 20.76, indicating that different companies may exhibit different levels of

growth ability due to their different industries, development stages, and operational capabilities; The maximum value of Total Asset Turnover (TAT) is 2.62, while the minimum value is 0.106, with a significant difference between the maximum and minimum values; In terms of listing age, the maximum value is 31 and the minimum value is only 1. Combined with a standard deviation of 6.841, it can be seen that there is a significant difference in the listing time of listed companies in the sample; In terms of asset liability ratio (LEV), the maximum value is 0.882 and the minimum value is 0.063. There is a significant difference between the maximum and minimum values, but the standard deviation is only 0.19, indicating that the overall distribution of this variable may be relatively concentrated. In terms of company size, after taking the logarithm, the maximum value is 26.06, the minimum value is 16.412, and the standard deviation is 7.113, indicating a significant difference in the size of listed companies in the sample.

Table4.1:Decriptive statistics

| VARIABLES | (1)<br>N | (2)<br>mean | (3)<br>sd | (4)<br>min | (5)<br>max |
|---|---|---|---|---|---|
| ROA | 20,979 | 0.0465 | 0.0702 | -0.278 | 0.234 |
| ROE | 20,979 | 0.0741 | 0.138 | -0.687 | 0.404 |
| ESGcost | 20,979 | 20,466 | 46,556 | 243.9 | 346,884 |
| Ecost | 20,979 | 689.7 | 2,784 | 0 | 21,800 |
| Scost | 20,979 | 228.3 | 657.9 | 0.01 | 3,337 |
| Gcost | 20,979 | 18,933 | 43,694 | 180.2 | 326,767 |
| Logesgcost | 20,979 | 8.750 | 1.417 | 4.904 | 12.71 |
| Logecost | 20,979 | 6.594 | 2.066 | -4.605 | 9.990 |

| | | | | | |
|---|---|---|---|---|---|
| Logscost | 20,979 | 1.228 | 4.283 | -4.605 | 8.113 |
| Loggcost | 20,979 | 8.810 | 1.361 | 5.194 | 12.70 |
| Capex | 20,979 | 0.0415 | 0.0428 | 0 | 0.204 |
| Age | 20,979 | 9.335 | 6.841 | 1 | 31 |
| Growth | 20,979 | 45.45 | 20.76 | 0.935 | 139.2 |
| TAT | 20,979 | 0.686 | 0.424 | 0.106 | 2.620 |
| LEV | 20,979 | 0.403 | 0.190 | 0.0630 | 0.882 |
| Size | 20,979 | 19.71 | 7.113 | 16.412 | 26.06 |

## Correlation analysis and multicollinearity analysis

### Correlation 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:

Table4.2: Correlation analysis

| ROA | ROA | ROE | Logesg~t | Logecost | Logscost | Loggcost | Capex | logage | TAT | Growth | LEV | Size |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROA | 1 | | | | | | | | | | | |
| ROE | 0.888*** | 1 | | | | | | | | | | |
| Logesgcost | 0.017** | 0.037*** | 1 | | | | | | | | | |
| Logecost | -0.031*** | 0.019*** | 0.094*** | 1 | | | | | | | | |
| Logscost | 0.016** | 0.141*** | 0.067*** | 0.159*** | 1 | | | | | | | |
| Loggcost | 0.004 | 0.045*** | 0.661*** | 0.117*** | 0.172*** | 1 | | | | | | |
| Capex | 0.038*** | 0.008 | 0.112*** | 0.067*** | -0.086*** | 0.054*** | 1 | | | | | |
| logage | -0.265*** | -0.251*** | 0.306*** | 0.077*** | -0.148*** | 0.224*** | 0.056*** | 1 | | | | |
| TAT | 0.239*** | 0.276*** | 0.092*** | 0.031*** | 0.123*** | 0.092*** | -0.056*** | -0.107*** | 1 | | | |
| Growth | 0.028*** | 0.049*** | -0.009 | -0.028*** | -0.013* | -0.022*** | -0.091*** | -0.089*** | -0.119*** | 1 | | |
| LEV | -0.346*** | -0.169*** | 0.232*** | 0.140*** | 0.089*** | 0.226*** | -0.027*** | 0.235*** | 0.146*** | -0.002 | 1 | |
| Size | -0.260*** | -0.289*** | 0.322*** | 0.027*** | -0.251*** | 0.202*** | 0.339*** | 0.619*** | -0.223*** | -0.073*** | 0.073*** | 1 |

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

From the results shown in the table above, the key explanatory variable ESG cost investment is positively correlated with the explanatory variables and is significant at the 5% 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, and governance investment is positively correlated with ROA, though not significant. 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), gearing ratio (LEV), and firm size are significantly negatively related to ROE.

**Multicollinearity analysis**

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 below:

Table4.3: Multicollinearity analysis

| Variable | VIF | 1/VIF |
|---|---|---|
| Logesgcost | 1.96 | 0.511481 |
| Logecost | 1.06 | 0.944352 |
| Logscost | 1.16 | 0.860565 |
| Loggcost | 1.85 | 0.540256 |
| Capex | 1.2 | 0.833765 |
| Logage | 1.83 | 0.545555 |
| TAT | 1.13 | 0.882808 |
| Growth | 1.04 | 0.96151 |
| LEV | 1.16 | 0.865349 |
| Size | 2.15 | 0.464866 |
| | | |
| Mean VIF | 1.45 | |

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.

## Regression analysis

### Basic regression results

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 below:

Table4.4: Fixed effect model

| | (1) ROA | (2) ROA | (3) ROA | (4) ROA | (5) ROE | (6) ROE | (7) ROE | (8) ROE |
|---|---|---|---|---|---|---|---|---|
| Logesgcost | 0.011*** | | | | 0.020*** | | | |
| | (0.001) | | | | (0.002) | | | |
| Logecost | | 0.003*** | | | | 0.006*** | | |
| | | (0.000) | | | | (0.001) | | |
| Logscost | | | 0.002*** | | | | 0.004*** | |
| | | | (0.000) | | | | (0.000) | |
| Loggcost | | | | 0.010*** | | | | 0.019*** |
| | | | | (0.001) | | | | (0.002) |
| Capex | 0.160*** | 0.141*** | 0.165*** | 0.167*** | 0.294*** | 0.253*** | 0.303*** | 0.306*** |
| | (0.015) | (0.026) | (0.015) | (0.015) | (0.024) | (0.054) | (0.024) | (0.024) |
| Logage | -0.008*** | -0.007** | -0.005*** | -0.008*** | -0.013*** | -0.010* | -0.007** | -0.012*** |
| | (0.001) | (0.003) | (0.001) | (0.001) | (0.002) | (0.005) | (0.002) | (0.002) |
| TAT | 0.043*** | 0.038*** | 0.046*** | 0.043*** | 0.083*** | 0.083*** | 0.091*** | 0.084*** |
| | (0.003) | (0.008) | (0.003) | (0.003) | (0.005) | (0.012) | (0.005) | (0.005) |
| LEV | -0.152*** | -0.122*** | -0.136*** | -0.151*** | -0.178*** | -0.130*** | -0.147*** | -0.175*** |
| | (0.008) | (0.018) | (0.007) | (0.008) | (0.014) | (0.040) | (0.012) | (0.014) |
| Growth | 0.002*** | 0.0001** | 0.0002*** | 0.0002*** | 0.001*** | 0.0003* | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Size | -0.003*** | -0.002*** | -0.003*** | -0.003*** | -0.005*** | -0.003*** | -0.005*** | -0.005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| _cons | 0.040*** | 0.079*** | 0.117*** | 0.044*** | 0.001 | 0.093*** | 0.144*** | 0.009 |
| | (0.006) | (0.007) | (0.003) | (0.006) | (0.014) | (0.015) | (0.007) | (0.014) |
| N | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 |
| r2 | 0.340 | 0.303 | 0.321 | 0.338 | 0.232 | 0.187 | 0.215 | 0.230 |
| 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 errors 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 0.011 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 0.02 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 0.003. 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 0.006. 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 0.004. 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 0.01, 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 0.019, 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. Firm size (Size) is negatively correlated with the explanatory variables at the 1% level of significance, which may be due to the fact that large firms may not be as flexible as small and medium-sized firms in terms of operational efficiency often due to the many layers of management, long decision-making process, and high cost of internal coordination. Moreover, as the company's size increases, the marginal return from each input unit (including capital, labor, etc.) may gradually decrease. In this case, large firms may not be able to utilize their assets as well as small firms in generating returns, leading to lower financial performance.

**Robustness Test**

**Endogeneity problem**

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 include 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 shows the regression results after introducing the instrumental variable:

Table4.5: Instrument variable

| | (1) ROA | (2) ROA | (3) ROA | (4) ROA | (5) ROE | (6) ROE | (7) ROE | (8) ROE |
|---|---|---|---|---|---|---|---|---|
| Logesgcost | 0.006*** | | | | 0.012*** | | | |
| | (0.001) | | | | (0.002) | | | |
| Logecost | | 0.000*** | | | | 0.000*** | | |
| | | (0.001) | | | | (0.002) | | |
| Logscost | | | 0.001*** | | | | 0.001*** | |
| | | | (0.000) | | | | (0.000) | |
| Loggcost | | | | 0.006*** | | | | 0.010*** |
| | | | | (0.001) | | | | (0.002) |
| Capex | 0.098*** | 0.116*** | 0.102*** | 0.098*** | 0.191*** | 0.232*** | 0.199*** | 0.193*** |
| | (0.012) | (0.028) | (0.012) | (0.012) | (0.027) | (0.067) | (0.027) | (0.027) |
| Logage | -0.012*** | -0.003 | -0.008*** | -0.012*** | -0.021*** | 0.002 | -0.014*** | -0.020*** |
| | (0.001) | (0.003) | (0.001) | (0.001) | (0.003) | (0.007) | (0.002) | (0.003) |
| TAT | 0.092*** | 0.106*** | 0.094*** | 0.092*** | 0.176*** | 0.213*** | 0.180*** | 0.177*** |
| | (0.002) | (0.005) | (0.002) | (0.002) | (0.004) | (0.011) | (0.004) | (0.004) |
| Growth | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| LEV | -0.176*** | -0.188*** | -0.174*** | -0.176*** | -0.266*** | -0.330*** | -0.261*** | -0.265*** |
| | (0.004) | (0.010) | (0.004) | (0.004) | (0.009) | (0.025) | (0.009) | (0.009) |
| Size | -0.002*** | -0.001** | -0.002*** | -0.002*** | -0.003*** | -0.002** | -0.003*** | -0.003*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) |
| _cons | 0.033*** | 0.057*** | 0.081*** | 0.036*** | 0.004 | 0.062** | 0.096*** | 0.017 |
| | (0.006) | (0.012) | (0.003) | (0.006) | (0.013) | (0.028) | (0.007) | (0.013) |
| N | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 |
| r2 | 0.277 | 0.229 | 0.266 | 0.276 | 0.182 | 0.131 | 0.172 | 0.180 |
| 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 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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 at the 1% level of significance 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.

**Replace dependent variables:** 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:

Table4.6: Robustness test

| | (1) Tobin'Q | (2) Tobin'Q | (3) Tobin'Q | (4) Tobin'Q | (5) ROIC | (6) ROIC | (7) ROIC | (8) ROIC |
|---|---|---|---|---|---|---|---|---|
| Logesgcost | 0.156*** | | | | 0.012*** | | | |
| | (0.027) | | | | (0.001) | | | |
| Logecost | | 0.010*** | | | | 0.004*** | | |
| | | (0.014) | | | | (0.001) | | |
| Logscost | | | 0.007*** | | | | 0.003*** | |
| | | | (0.002) | | | | (0.000) | |
| Loggcost | | | | 0.170*** | | | | 0.012*** |
| | | | | (0.026) | | | | (0.001) |
| Capex | 1.750*** | 1.007*** | 1.115*** | 1.740*** | 0.189*** | 0.146*** | 0.186*** | 0.189*** |
| | (0.338) | (0.300) | (0.234) | (0.336) | (0.019) | (0.032) | (0.019) | (0.019) |
| Logage | 0.313*** | 0.240* | 0.908*** | 0.314*** | -0.009*** | -0.006* | -0.005*** | -0.009*** |
| | (0.042) | (0.117) | (0.134) | (0.042) | (0.002) | (0.003) | (0.002) | (0.002) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TAT | -0.005 | 0.286*** | 0.348*** | -0.012 | 0.061*** | 0.060*** | 0.066*** | 0.061*** |
| | (0.039) | (0.055) | (0.073) | (0.039) | (0.003) | (0.008) | (0.003) | (0.003) |
| LEV | -0.908*** | -0.454 | -0.345** | -0.901*** | -0.133*** | -0.120*** | -0.114*** | -0.133*** |
| | (0.155) | (0.308) | (0.142) | (0.154) | (0.007) | (0.012) | (0.006) | (0.007) |
| Growth | 0.000 | -0.002 | -0.003*** | 0.000 | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Size | -0.495*** | -0.367*** | -0.567*** | -0.505*** | -0.004*** | -0.002*** | -0.004*** | -0.004*** |
| | (0.030) | (0.035) | (0.035) | (0.029) | (0.000) | (0.000) | (0.000) | (0.000) |
| _cons | 11.420*** | 9.550*** | 12.843*** | 11.499*** | 0.048*** | 0.092*** | 0.132*** | 0.043*** |
| | (0.561) | (0.883) | (0.713) | (0.561) | (0.008) | (0.011) | (0.004) | (0.008) |
| N | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 |
| r2 | 0.271 | 0.267 | 0.261 | 0.272 | 0.282 | 0.234 | 0.268 | 0.283 |
| 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 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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. Therefore, based on the above regression results, the results of the previous empirical analysis can be considered reliable.

**Heterogeneity analysis**

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.

**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.

**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. 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.

Table4.7: Heterogeneity analysis

| | (1) ROA | (2) ROA | (3) ROE | (4) ROE | (5) ROA | (6) ROA | (7) ROE | (8) ROE |
|---|---|---|---|---|---|---|---|---|
| Logesgcost | 0.007*** | 0.007*** | 0.013*** | 0.012*** | 0.010*** | 0.005*** | 0.020*** | 0.008*** |
| | (0.001) | (0.001) | (0.003) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) |
| N | 5565 | 15414 | 5565 | 15414 | 6644 | 14335 | 6644 | 14335 |
| r2 | 0.210 | 0.203 | 0.135 | 0.174 | 0.242 | 0.192 | 0.194 | 0.155 |
| 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 | | 0.004 | |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

## Further tests

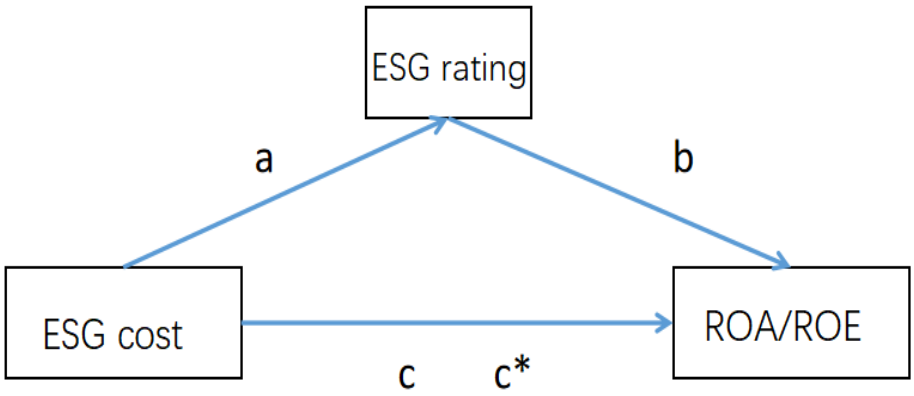
Previous studies have shown that ESG cost investment positively impact corporate financial performance, and this section examines the intrinsic mechanism of ESG cost investment for corporate financial performance improvement based on international ESG practices.

The ESG cost investment data for this paper is sourced from the disclosure of publicly traded corporations. ESG disclosure requirements for listed corporations vary across countries. ESG disclosure is currently mandated for listed corporations in the U.S., while the EU has implemented semi-mandatory disclosure of environmental information. In Hong Kong, companies are required to provide an explanation if they choose not to

disclose. China is currently in the phase of promoting voluntary publication of social responsibility reports by companies, with forced disclosure only applicable to certain select enterprises. The ESG cost input data pertains to the quantitative data included in companies' ESG disclosure. Academics hold varying perspectives on the impact of ESG disclosure on ESG ratings. According to conventional wisdom, more levels of disclosure are linked to decreased rating divergence. This has been supported by various studies such as Lang and Lundholm (1996), Morgan (2002), and Hope (2003), since they argue that greater disclosure helps to lessen information asymmetry (Christensen et al., 2022). Quantitative ESG disclosure helps reduce rating disagreement by improving the clarity and comparability of information. This is achieved by compressing and simplifying data, which facilitates decision-making (Espeland & Stevens, 1998). Nevertheless, a growing number of experts have contended, based on actual research, that the provision of quantitative ESG disclosure results in increased difference in ratings. Christensen et al. (2022) examine the relationship between the level of company ESG disclosure and the agreement or divergence in ESG ratings. They discover that increased transparency results in a higher degree of rating divergence. The individual measurement indicators used to build ratings are classified into inputs and outcomes. Inputs refer to the actions taken by organizations to attain specific goals, such as implementing a diversity policy. Outcomes, on the other hand, are the

actual results achieved, such as the proportion of women in the workforce. ESG assessors exhibit greater consensus regarding ESG inputs, but diverging opinions are more prevalent when evaluating ESG results. This paper suggests that the indicators in the input may include the company's investment in ESG. The annual survey conducted by Berg et al. (2022) identified measurement inconsistencies as the main factor influencing variations in ESG ratings. The disparities in ESG ratings stem from divergent definitions and significant disputes on the foundational facts. A direct relationship exists between the level of quantitative ESG disclosure and the variations in ESG ratings.

Based on the above research, this paper constructs the model of ESG rating performance as a channel for ESG cost investment to affect corporate financial performance as follows:




$$ROA/ROE = \mathrm{a0} + \mathrm{a1ESGcost} + \mathrm{a2Capex} + \mathrm{a3Age} + \mathrm{a4TAT} +$$

$a5Growth + a6LEV + a7Size + \delta i + \theta t + \mu p + \varepsilon i$

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

$$ROA/ROE = c0 + c1ESGcost + c2Esgrating + c3Capex + c4AGE + c5TAT + c6Growth + c7LEV + c8Size + \delta i + \theta t + \mu p + \varepsilon i$$

Table4.8: Mediating effect

| | (1) ROA | (2) ESGrating | (3) ROA | (4) ROE | (5) ESGrating | (6) ROE |
|---|---|---|---|---|---|---|
| Logesgcost | 0.011*** | 0.125*** | 0.010*** | 0.020*** | 0.125*** | 0.019*** |
| | (0.001) | (0.015) | (0.001) | (0.002) | (0.015) | (0.002) |
| ESGrating | | | 0.004*** | | | 0.008*** |
| | | | (0.000) | | | (0.001) |
| N | 20979 | 20979 | 20979 | 20979 | 20979 | 20979 |
| r2 | 0.340 | 0.614 | 0.343 | 0.232 | 0.614 | 0.236 |
| year | Yes | Yes | Yes | Yes | Yes | Yes |
| industry | Yes | Yes | Yes | Yes | Yes | Yes |
| province | Yes | Yes | Yes | Yes | Yes | Yes |

| | | |
|---|---|---|
| sobel | 0.000(z=9.356) | 0.000(z=9.476) |
| Goodman1 | 0.000(z=9.346) | 0.000(z=9.467) |
| Goodman2 | 0.000(z=9.365) | 0.000(z=9.486) |
| Indirect effect | 0.001 | 0.001 |
| Direct effect | 0.007 | 0.015 |
| Total effect | 0.008 | 0.016 |
| Mediate Proportion | 0.066 | 0.062 |

Table 4.8 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 (3), as well as columns (5) and (6), show that ESG cost investment have a significant positive effect on ESG rating performance. The effect of ESG rating performance on

financial performance is also significantly positive when comparing with Esgcost regression coefficients in columns (1) and (4), which are slightly lower after controlling for ESG rating performance and also passed the Sobel test, Goodman1's results rejected the original hypothesis, which suggests that ESG rating performance is a channel for ESG cost investment to promote firms' financial performance, which implies that the improvement of ESG cost investment can promote the improvement of ESG rating performance, which in turn promotes the improvement of firms' financial performance.

## Ⅴ. Research Conclusions

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. Further, testing the intrinsic mechanism of ESG cost investment to promote corporate financial performance finds that improving ESG rating performance explains the promotion effect of ESG cost investment on corporate financial performance.

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