

Original Research

The Impact of the Carbon Emissions Trading Policy on the Corporate ESG Performance – Evidence from China

Xinyu Yu¹, Liyun Chen^{1*}, Kun Ya²

¹School of Economics and Management, Tianjin Agricultural University, Tianjin, China

²School of Accounting, Shandong University of Finance and Economics, Jinan, China

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Abstract

Based on a sustainable development perspective, this study examines the impact of China's carbon emissions trading policy on corporate environmental, social, and corporate governance (ESG) performance. Data from 845 listed companies in China from 2011 to 2020 are used, and differences-in-differences (DID) and triple-difference models are adopted. The empirical results show that implementing carbon emissions trading policies significantly enhanced corporate ESG performance. According to the triple-difference model, as internal drivers, two different corporate sustainability indicators focus on different moderating roles in the relationship between carbon emissions trading policy and corporate ESG performance. The external driving factor (i.e., the regional digital economy's development level) positively moderates the relationship between carbon emissions trading policy and corporate ESG performance. Further analysis shows that larger companies and state-owned enterprises achieve more significant improvements in ESG performance under carbon emissions trading policy.

Keywords: carbon emissions trading policy, sustainable development, digital economy, ESG performance

Introduction

Integrating the relationship between economic growth and ecological protection has always been critical to the development of human society. The report of the 20th National Congress of the Communist Party of China emphasized that to promote green economic and social development, the green transformation of the development mode must be accelerated; further, green, circular, and low-carbon must be assumed as development goals,

and both carbon peak and carbon neutrality must be actively and steadily promoted. As China's dual-carbon plan continues to progress, the market's attention to the concept of green investment continues to increase. More and more companies are using environmental, social, and corporate governance (ESG) disclosure to demonstrate their sustainable development capabilities to the outside world. ESG was officially proposed by the United Nations Global Compact in 2004. For the first time, the three dimensions of the environment, society, and governance were integrated into one framework [1]. The core connotations of "green" and "sustainable development" advocated by the ESG concept are highly

*e-mail: chenliyun2011@126.com

compatible with China's new development concept and the strategic positioning of ecological civilization construction. Today, ESG is becoming a new mode of competition and cooperation among global enterprises. If Chinese enterprises cannot practice ESG concepts, thus lagging behind developed countries regarding the ESG green trend, the resulting formation of green trade barriers will severely limit the upgrading of China's industrial chain and the development of international trade. Accelerating ESG transformation is of great theoretical and practical significance for promoting China's dual-carbon goal, the green transformation of the economy and society, and overall high-quality development.

Listed companies form the backbone of economic development and are responsible for applying ESG. For sustainable development to take hold of the capital market, it must be linked to the guidance and constraints of relevant policies [2]. In recent years, China has advocated using market-based environmental regulatory tools to enhance its environmental performance, of which the carbon emissions trading policy, which came into effect in 2013, is regarded as a striking, innovative initiative directed by market incentives intended to control greenhouse gas emissions and an important policy tool for China to achieve the dual-carbon goal. Existing literature on the effects of carbon emissions trading has evolved from analyses of the macro level to those focusing on the micro level. Many studies have affirmed the environmental dividend created by carbon trading, arguing that carbon emissions trading is conducive to reducing carbon emissions [3–6]. A wealth of research on the economic and greening effects of carbon trading on enterprises has focused on the micro level [7–9]. Summarizing the existing literature, research on the impact of the carbon emissions trading policy on micro market players mainly concentrates on a single dimension. The ESG performance level of enterprises was rarely examined. In the context of the dual-carbon strategy, this paper explores the following two critical questions from the perspective of sustainable development: (1) Can the carbon emissions trading policy enhance corporate ESG performance? (2) What conditions make it easier for regions or enterprises to improve their ESG performance and realize ESG transformation?

While the ESG concept manifests enterprises' growth-seeking aspirations regarding economic benefits, it also considers the coordinated development of social and environmental benefits and provides the foundation of sustainable development. Under the dual pressures imposed by the carbon emissions trading market and governmental regulation to meet the requirements of regulators and cater to the government's policy direction of green and low-carbon development, enterprises' willingness to disclose ESG information may increase. In addition, as "rational economic beings," enterprises will improve their environmental protection efforts and establish a green and low-carbon image to gain a competitive advantage, thus also enhancing their enthusiasm for ESG disclosure. It has been shown that enterprises with better ESG performance tend also to have a positive social image

[10]. This image can help them to attract higher quality and sustainable investment, making it more likely to be recognized and favored by the capital market [11, 12]. Therefore, based on the dual-carbon goal and the new development concept, this paper uses China's carbon emissions trading policy as a quasi-natural experiment. Regional variability is also considered to test the dual effects of internal drivers and external incentives on corporate ESG performance.

The research contribution of this paper is mainly reflected in the following three aspects: Firstly, this paper examines the impact of the carbon emissions trading policy on the ESG performance of listed companies from the perspective of sustainable development at the micro level; moreover, research on the implementation effect of the carbon emissions trading policy is expanded, and empirical support is provided for the policy effect of market incentive-based environmental regulation tools. Secondly, this paper examines the impact of the carbon emissions trading policy on the ESG performance of enterprises from the perspective of sustainability focus of enterprises; further, a regional digital economy development perspective is applied to examine the impact of carbon emissions trading policy on corporate ESG performance. This approach further enriches research on the factors influencing corporate ESG performance and provides new ideas on how enterprises can realize sustainable development. Thirdly, this paper provides evidence for the heterogeneity of the carbon emissions trading policy on different corporate and regional levels. Policy insights for the government are offered further to promote the comprehensive construction of the carbon market and to provide targeted guidance for listed companies to carry out ESG work.

Literature Review and Research Hypothesis

Primary Impact Relationships

The concept of ESG embodies the development concept to unify economic and social benefits and forms an essential foundation for sustainable development. The literature has shown that ESG disclosure relies not only on macro factors such as policies and regulations, e.g., environmental regulation [13], but also on micro factors such as the nature of corporate ownership and differences in the cultural background [14, 15]. In the green transformation context, it has become a consensus that the difficulty associated with encouraging enterprises to practice sustainable green development lies in alleviating the negative externalities of environmental pollution brought about by economic growth. At the same time, based on Coase's theory, the carbon market is artificially established; it internalizes the ecological costs for enterprises through "quota trading and total amount control", thus aiming to intervene in the carbon emission behaviors of enterprises [16].

Under the carbon trading mechanism, enterprises can independently control their total carbon emissions through technological improvements and other means; alternatively,

they can purchase carbon allowances in the carbon trading market and fulfill their emission reduction obligations. [17, 18] found that the carbon emissions trading policy significantly enhanced pilot enterprises' green technology innovation level and their productivity. However, other scholars have found that the carbon trading policy inhibits corporate green innovation [19]. Under the carbon trading mechanism, as a "rational economic man", when choosing an appropriate response, an enterprise will consider several factors, such as its resource endowment, property rights attributes, scale size, cost-benefit factors, and other factors. By realizing high-quality and sustainable development, enterprises actively fulfill their social responsibility and conduct technological research and development to obtain core competitive advantages. Regarding the construction of China's ecological civilization, China's determination to achieve the "dual carbon" goal drives the growth of ESG. Introducing the carbon emissions trading policy is essential to attain low-carbon transformation and ESG emphasis by enterprises. It also considers the three central dimensions of the enterprise's energy-saving emission reduction efforts and other environmental dimensions, making it highly compatible.

Firstly, based on signaling theory, as a market incentive environmental regulation tool, the carbon trading policy presents the "signal" of government supervision as well as the green and low-carbon development orientation to the market; this policy also guides market participants to identify environmental risks, pay attention to environmental protection, and assume social responsibility. However, [20] concluded that the cost pressure induced by the carbon trading mechanism would inhibit enterprises from carrying out green innovation, which negatively impacts the value of enterprises. On the one hand, ESG disclosure can satisfy regulatory requirements. On the other hand, the capital market will provide positive feedback to enterprises with better ESG performance; this can alleviate the financing constraints of enterprises [21] and improve their operational efficiency [22]. ESG disclosure weakens the negative impacts of environmental regulation to a certain extent and ultimately enables enterprises to attain higher market value. At the same time, the ecological protection signals released by this policy also stimulate the market demand for green products and services. ESG disclosure can reduce information asymmetry between enterprises and stakeholders and improve stakeholder perception regarding the ESG behavior of enterprises [23]. Although enterprises need to invest considerable human, material, and other resources in the early stage of ESG management, in the long run, ESG disclosure can help them maintain a good reputation, increase their market share, and stimulate their future growth potential. Therefore, based on signaling theory, enterprises will strengthen ESG management and enhance ESG disclosure under the carbon trading mechanism after weighing the costs and benefits.

Secondly, under the carbon trading mechanism, the government allocates specific carbon emission quotas to enterprises free of charge, which can be freely circulated and transferred to the carbon market. Enterprises can sell

excess carbon quotas to gain direct benefits and regard them as assets with physical and option values that are part of the enterprise's proprietary resources. Based on a resource-based perspective, out of self-interest, enterprises have an incentive to convey the fulfillment of their corporate social responsibility (CSR) to the government through high-level ESG disclosure; consequently, the government can form a more accurate judgment of the policy implementation effect. This makes it easier for the enterprise to win the government's "preference" and obtain additional support for scarce resources, which ultimately helps the enterprise to establish and maintain sustainable competitive advantages. Therefore, enterprises' practice of ESG responsibility fits the current political orientation. Under the same market competition conditions, active ESG information disclosure may enable enterprises to obtain more carbon emission quotas in the carbon market, thus yielding tangible economic benefits.

In addition, as green and sustainable development becomes a consensus, based on the "signal-expectation" mechanism, participants in the carbon market will have rational expectations of the green signals released by the carbon trading mechanism. Faced with carbon quota compliance obligations, enterprises may complete required emission reduction tasks by reducing production in the short term. Still, to avoid being pushed out of the market in the long term, they will adjust their carbon asset management strategy accordingly. Specifically, they will turn passive into active, strengthen the management of their carbon assets, and enhance the content and quality of ESG disclosure to form a first-mover advantage in the capital market. At the same time, research has shown that external regulatory policies can strengthen the positive correlation between corporate governance and information disclosure [24]. A more transparent information disclosure reduces the information gap between management and stakeholders. Furthermore, it meets the demand of stakeholders for information on the environmental protection capability of the enterprise, its social responsibility, and governance; it also strengthens the supervision and appraisal of management and prompts the administration to incorporate ESG into the enterprise's strategic deployment level to achieve sustainable development. From this perspective, the corporate governance capacity will also be enhanced under the constraints of the carbon emissions trading policy.

Thirdly, against the comprehensive promotion of green and sustainable development and the continuous tightening of external regulation, listed companies—especially heavy polluters—face increasing legitimacy pressure. Emission-control enterprises will face stricter monitoring, reporting, and verification constraints under the carbon trading mechanism. ESG disclosure is essential for organizations to gain support from various entities and demonstrate their environmentally friendly "corporate citizenship" image to the outside world. Enterprises will more actively publicize their environmental activities and social responsibility fulfillment and take the initiative regarding ESG disclosure to maintain their legitimacy status and to differentiate

themselves from their competitors. An empirical study by [25] showed that corporate environmental information disclosure enhances corporate environmental performance while simultaneously bringing an excellent reputation to corporations. Therefore, to alleviate both the regulatory pressure and legitimacy pressure imposed by the carbon emissions trading policy, enterprises will take the initiative to improve their level of ESG information disclosure. Their underlying goal is to improve the enterprise's social acceptance and, ultimately, to achieve high-quality and sustainable development. Based on the above analysis, this paper proposes the following hypothesis:

H1: Implementing the carbon emissions trading policy can enhance the ESG performance of enterprises.

Moderating Roles of Corporate Sustainability Focus

The concept of organizational attention was first proposed by [26], who argued that corporate decisions and behaviors are closely related to allocating managerial attention. Since then, organizational attention has become a core resource for enterprises to create a competitive advantage. According to the fundamental interpretation of organizational attention, the embeddedness of the external environment will influence enterprise behavior and affect the results of subjective initiatives of top decision-makers. Combined with the above analysis, under the impact of the carbon emissions trading policy, different enterprises will react differently in light of their situation. At the same time, enterprises included in carbon emissions pilots face stricter monitoring, reporting, and verification constraints, and corporate attention will be dynamically adjusted in response to changes in both internal and external environments. This means there are differences in how different enterprises configure their attention and direction of focus, even under the same environmental regulation. Sustainability attention refers to enterprises' attention and resource allocation in the three dimensions of environmental protection, social responsibility, and corporate governance. It enables enterprises to effectively receive the green and low-carbon signals released by relevant policies, identify potential risks and opportunities for green development, and promptly adjust their corporate positioning and development strategies. Therefore, sustainability attention is an internal driver for enterprises to improve their ESG disclosure level. It exerts a moderating role with the carbon emissions trading policy, thus enabling enterprises to promptly perceive the intensity of environmental regulation and the direction of policy regulation, further enhancing their ESG performance. Based on this logic, this paper proposes the following hypothesis:

Hypothesis H2: Corporate sustainability attention positively moderates the relationship between the carbon emissions trading policy and corporate ESG performance.

Moderating Roles of Regional Digital Economy

The digital economy is not only an enabler that promotes the growth of the real economy but also an

enabler of the "double carbon" goal [27]. Firstly, the digital economy uses data and knowledge as core production factors and offers the natural advantage of low energy consumption. Traditional industries can reduce both their energy consumption and pollutant emissions while increasing their output by utilizing digital technology; consequently, both input and output streams can be greened, thus easing the pressure of resource constraints under environmental regulatory policies and promoting the green development of enterprises [28]. Secondly, the digital economy is based on fair sharing, and emission-control enterprises, i.e., key greenhouse gas emitters, can utilize digital technologies to carry out innovation cooperation, knowledge sharing, and resource mutual assistance in the carbon market [29]. Thus, these enterprises can better fulfill their social responsibility. Finally, the digital economy allows enterprises to innovate their governance mode. Enterprises can use technologies such as artificial intelligence or blockchain to collect, analyze, and store big data, establish a better corporate governance system, and rapidly implement adjustments in response to changes in the external environment. This enables these enterprises to meet stakeholder needs better. Overall, the digital economy creates more value for enterprises from the perspectives of environmental protection, social responsibility, and corporate governance and represents the potential for regional green and low-carbon transformation. Therefore, the level of regional digital economy development is regarded as an external incentive for enterprises to enhance their ESG disclosure. This disclosure strengthens the sustainable development signal sent by the region and provides an essential driver for enterprises to improve their ESG performance. Based on this, the following hypothesis is proposed:

Hypothesis H3: The development of the regional digital economy positively moderates the relationship between the carbon emissions trading policy and corporate ESG performance.

Materials and Methods

Model Setting

Because the carbon emissions trading market construction in seven pilot provinces and cities was concentrated in the second half of 2013 and the first half of 2014, 2014–2020 was defined as the experimental period of policy introduction. The following DID model is established to test the impact of the implementation of carbon emissions trading policies on the ESG performance of enterprises. In addition, to alleviate the omitted variable bias, the sample firms with year-fixed effects are further controlled in the model. The specific model is as follows:

$$ESG_{i,t} = \beta_0 + \beta_1 Treated_{i,t} \times Time_{i,t} + \beta_2 Controls_{i,t} + \sum Firm + \sum Year + \varepsilon_{i,t} \quad (1)$$

Where β_1 represents the net effect of the policy. According to Hypothesis H1, β_1 is expected to be positive, i.e., implementing a carbon emissions trading policy can enhance the ESG performance of enterprises.

In addition, to further examine the mechanism of the carbon emissions trading policy in enhancing the ESG performance of enterprises, the perspective of corporate sustainability focus and regional digital economy development level differentiation is assumed. A triple-difference model is constructed to test the moderating effect of internal drivers and external incentives on the ESG performance of enterprises; the specific model is as follows:

$$ESG_{i,t} = \beta_0 + \beta_1 Treated_{i,t} \times Time_{i,t} \times Focus_{SDG_{i,t}} + \beta_2 Controls_{i,t} + \sum Firm + \sum Year + \varepsilon \tag{2}$$

$$ESG_{i,t} = \beta_0 + \beta_1 Treated_{i,t} \times Time_{i,t} \times Dige_{eco_{i,t}} + \beta_2 Controls_{i,t} + \sum Firm + \sum Year + \varepsilon \tag{3}$$

Variables Description

Corporate ESG performance is the variable explained. This paper adopts the Bloomberg database's ESG composite score to measure corporate ESG performance. This score varies in the interval of [0,100], where the larger the value, the better the corporate ESG performance.

The Explanatory variable is the implementation of the carbon emissions trading policy. The year 2014 was assumed as the time point of the carbon emissions trading policy shock, and a value of 1 is considered for the time dummy variable *Time* if the year is 2014 and after that; otherwise, it takes the value of 0. If the enterprise is located in the above seven pilot provinces or cities, a value of 1 is assumed for the grouping dummy variable *Treated*. Otherwise, a value of 0 is assumed for this variable.

The sustainability focus of enterprises and regional digital economy development are moderating variables. Two variables were selected to measure the sustainability focus of enterprises. The first variable is whether enterprises disclose social responsibility reports concerning the global reporting initiative (GRI) standard. In sustainability reporting (i.e., ESG reporting), the GRI standard is the world's first standard for sustainability reporting and the most widely used framework by ESG reporting guidelines globally. The GRI standard provides detailed procedures and requirements for reporting disclosure items requiring high quantification. This can help enterprises and stakeholders comprehensively assess

the organization's development status and sustainable development capability. Therefore, an enterprise disclosing its social responsibility report regarding the GRI standard indicates that this enterprise has a high degree of focus on sustainable development. Another variable is the percentage of institutional investors' shareholding. ESG performance of enterprises is gradually incorporated into the investment assessment dimension of institutional investors who tend to favor companies with good ESG performance [30]. With an increasing shareholding ratio, institutional investors have a weightier say in the enterprise, and the formation of monitoring pressures can force enterprises to improve their non-financial performance and thus enhance enterprise value. Through their information advantage and financial support, institutional investors can also effectively identify and constrain self-interested behavior of enterprise management, motivate management to focus on ESG work development, and enhance enterprises' ESG performance. Therefore, if the shareholding ratio of institutional investors is greater than or equal to the annual industry median, the company has a high level of sustainability focus. Otherwise, the opposite can be assumed to be true.

Regional digital economy development level is measured via Internet development and digital financial inclusion. At the level of Internet development, drawing on the concepts presented by [31], the four indicators of Internet penetration rate, number of Internet-related employees, Internet-related output, and number of mobile Internet users were measured. The China Digital Financial Inclusion Index [32], jointly compiled by the Digital Finance Research Center of Peking University and the Ant Gold Service Group, was used to gauge digital financial inclusion. As the data of the above five indicators are dimensionless, principal component analysis was used to determine the weights of each indicator. Finally, the index of the level of digital economy development of the seven pilot provinces and cities from 2011 to 2020 was obtained.

Variables such as enterprise size, gearing ratio, net asset profit margin, operating income growth rate, equity concentration, nature of property rights, and whether the Big Four accounting firms have audited the enterprise were controlled.

Data Sources

This paper obtained ESG data from the Bloomberg database (BLOOMBERG), industry classification and company-level data from the Cathay Pacific database (CSMAR), and the regional digital economy development index was computed. The relevant data were obtained from the China Urban Statistical Yearbook. After excluding samples of companies with missing important variables, those receiving special treatment from the Stock Exchange, and those delisted after introducing the policy, 8365 sample observations from 845 companies were obtained. Among them, continuous variables were Winsorized at the upper and lower 1% quartiles to reduce the biased impact of extreme values on research conclusions.

Table 1. Descriptive statistics.

Variables	Mean	Min	Max	Mid	SD	Observations
ESG	21.42	9.091	45.61	20.66	7.044	8,365
E_Score	9.989	0.000	42.636	9.302	8.402	8,365
S_Score	23.825	0.000	56.140	22.807	10.408	8,365
G_Score	45.540	33.929	58.929	44.643	5.308	8,365
Time	0.700	0	1	1.00	0.458	8,365
Treated	0.427	0	1	0.00	0.495	8,365
Treated*Time	0.299	0	1	0.00	0.458	8,365
Focus_SDG1	0.173	0	1	0.00	0.378	8,357
Focus_SDG2	55.28	0.000	129.4	58.34	22.33	8,365
Dige_eco	1.688	-1.027	7.416	1.289	1.740	8365
Size	23.38	20.46	29.25	23.18	1.637	8,365
Lev	0.503	0.0686	0.938	0.51	0.212	8,365
Roa	0.0437	-0.166	0.224	0.04	0.0569	8,365
Ir	0.135	-0.521	1.835	0.09	0.326	8,365
Top1	37.37	8.210	78.02	35.88	16.33	8,365
Soe	0.588	0	1	1	0.492	8365
Big4	0.153	0	1	0	0.360	8365

Results and Discussion

Descriptive Statistics

The descriptive statistics of the main variables in this paper are provided in Table 1. From 2011–2020, the mean value of the ESG performance of listed companies is 21.42, the maximum value is 45.61, and the minimum value is 9.091. The standard deviation is 7.044, implying that corporate ESG disclosure quality is low and ESG performance differences exist among enterprises. The mean value of *Treated* is 0.427, which indicates that after the introduction of the policy, about 42.7% of all sample enterprises are included in the pilot region. The standard deviation of the regional digital economy development level is 1.749, indicating that the level of digital economy development among different areas needs to be balanced more.

Benchmark Regression Tests

Table 2 presents the empirical results. Among them, the results provided in Column (1) show that the estimated coefficient of *Treated*Time* is 1.179, which is significantly positive at the 1% level when firm-level characteristic variables are not included and only firm and year-fixed effects are controlled. Column (2) further controls for distinct firm-level variables such as equity concentration,

nature of ownership, fit size, and gearing based on Column (1). The estimated coefficient of *Treated*Time* is 0.994, which is significant at the 1% level. In Column (3), industry fixed effects are further controlled for, and the estimated coefficient of *Treated*Time* remains significantly positive at the 1% level. These results suggest that implementing the carbon emissions trading policy enhances firms' ESG performance. After its implementation, listed companies mandatorily included in the carbon trading pilots and facing the "ESG test" because of their carbon emission reduction performance can be fully integrated into assessing ESG environmental dimensions. These enterprises set up a green image to gain a competitive advantage and be first to strengthen industry-wide reduction of carbon emissions and actively improve ESG performance. The carbon emissions trading policy promotes enterprises to realize the green and low-carbon environment and enhance their ESG performance. Implementing this policy will encourage the realization of green, low-carbon, and sustainable development.

Moderating Effect Tests

Test of Moderating Effect of Corporate Sustainability Focus

The results of the moderated effects test for the dimension of firm disclosure of social responsibility

Table 2. Differences-in-differences (DID) test results.

Variables	ESG		
	(1)	(2)	(3)
Treated*Time	1.146*** (6.89)	0.998*** (5.98)	1.015*** (6.04)
Size	–	0.979*** (8.09)	1.063*** (8.65)
Lev	–	-1.196** (-2.39)	-1.297** (-2.56)
Roa	–	2.074* (1.90)	2.354** (2.15)
Ir	–	-0.132 (-0.99)	-0.120 (-0.89)
Top1	–	0.021*** (2.80)	0.023*** (3.10)
Soe	–	0.718** (2.07)	0.708** (1.99)
Big4	–	0.804** (2.32)	0.773** (2.24)
Constant	26.045*** (23.51)	-2.091 (-0.60)	-4.601 (-1.31)
Corporate-fixed	YES	YES	YES
Yearly-fixed	YES	YES	YES
Industry-fixed	NO	NO	YES
Observations	8,365	8,365	8,365
Adj R ²	0.756	0.759	0.763

Note: ***, **, * indicate significant at levels of 0.01, 0.05, and 0.1, respectively.

T-values in parentheses, the same as below.

reports about GRI standards are presented in the first two columns of Table 3. Specifically, the dummy variable of corporate sustainability focus (Focus_SDG1) is regressed on the Treated*Time constructed triple interaction term Focus_SDG1*Treated*Time. In Table 3, Panel A shows that the estimated coefficient of Focus_SDG1*Treated*Time is significantly negative at the 5% level compared to the very positive estimated coefficient of the double interaction term Treated*Time. This result indicates that the disclosure of social responsibility reports regarding the GRI standard negatively moderates the relationship between carbon emissions trading policies and corporate ESG performance. The reason may be that a particular unit needs to be chosen as the standard for ESG disclosure of Chinese listed companies. Listed companies can adopt more than 10 ESG disclosure standards [33].

In contrast, the GRI standard provides a framework for sustainability reporting with higher transparency and reliability and increasing disclosure difficulty. At this stage, enterprises that do not follow the GRI standard have more room for improvement in practicing ESG concepts. The carbon trading mechanism is more effective in guiding this enterprise to transition to a more sustainable development.

The results of the moderated effects test for the dimension of institutional investor shareholding are presented in the last two columns of Table 3. In Table 3, Panel B shows that the estimated coefficient of the tripartite interaction term Focus_SDG2*Treated*Time is significantly positive at the 10% level. This result indicates that institutional investors' shareholding ratio positively moderates

Table 3. Triple-difference test results.

Variables	ESG					
	Panel A refers to GRI or not		Panel B Ratio of institutional investors		Panel C Regional Digital Economy Development	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated*Time*Focus_SDG1	-0.977**	-0.884*	–	–	–	–
	(-2.15)	(-1.96)	–	–	–	–
Treated*Time*Focus_SDG2	0.867***	0.718***	0.541*	0.535*	–	–
	(4.86)	(3.99)	(1.91)	(1.90)	–	–
Treated*Time*Dige_eco	–	–	–	–	1.055***	1.002***
	–	–	–	–	(5.78)	(5.48)
Treated*Time	3.819***	3.720***	0.741***	0.615***	0.399*	0.296
	(11.40)	(11.21)	(3.51)	(2.92)	(1.90)	(1.41)
Time*Focus_SDG1	-0.977**	-0.884*	–	–	–	–
	(-2.15)	(-1.96)	–	–	–	–
Time*Focus_SDG2	–	–	1.052***	0.952***	–	–
	–	–	(6.32)	(5.70)	–	–
Time*Dige_eco	–	–	–	–	0.018	0.049
	–	–	–	–	(0.11)	(0.31)
Constant	24.589***	-0.897	26.489***	0.790	26.039***	-1.155
	(21.49)	(-0.24)	(31.02)	(0.21)	(29.61)	(-0.31)
Controls	NO	YES	NO	YES	NO	YES
Corporate-fixed	YES	YES	YES	YES	YES	YES
Yearly-fixed	YES	YES	YES	YES	YES	YES
Observations	8,365	8,365	8,365	8,365	8,365	8,365
Adj R ²	0.768	0.770	0.759	0.761	0.757	0.760

the relationship between the carbon emissions trading policy and corporate ESG performance: The higher the shareholding ratio of institutional investors, the more the short-sighted behavior of management can be circumvented. Consequently, enterprises can be guided to focus on their sustainable development, which helps them to improve their ESG performance. This result is consistent with Hypothesis H2.

In summary, the regression results differ when using two dimensions to measure corporate sustainability focus and constructing triple-difference terms. Under the constraints of the carbon trading mechanism, corporate sustainability is an internal driver of corporate environmental protection, social responsibility, and governance performance; different indicators exert different moderating roles in the relationship between the carbon emissions trading policy and corporate ESG performance. In enterprises that do not disclose their social responsibility reports according to the GRI standard

and have a high proportion of institutional investors' shareholding, the carbon emissions trading policy significantly affects ESG performance.

Test of Moderating Effect of Regional Digital Economy Development

To test Hypothesis H3, this paper constructs dummy variables to overcome the possible bias of measurement indicators. As shown in Table 3, the estimated coefficients of the tripartite interaction term $Dige_eco * Treated * Time$ are all significantly positive at the 1% level; these coefficients are also unaffected by firm-level characteristic variables. This suggests that the level of regional digital economy development positively moderates the relationship between carbon emissions trading policies and firms' ESG performance. This result is consistent with Hypothesis H3.

Table 4. Adjustment of time window.

Variables	ESG	
	(1)	(2)
Treated*Year2013	0.035 (0.15)	0.018 (0.08)
Constant	26.870*** (21.89)	-4.481 (-0.37)
Controls	NO	YES
Corporate-fixed	YES	YES
Yearly-fixed	YES	YES
Observations	2,508	2,501
Adj R ²	0.786	0.862

Robustness Analysis

Adjusting the Time Window

A counterfactual test for the placebo test is used to address the possibility that the results of this paper may be endogenous because of other events that happened before the introduction of the carbon emissions trading policy. Specifically, the policy implementation point is moved forward by one year, a new time dummy variable Year2013 is set, and data from 2011 to 2013 are used to test whether the main results that the carbon emissions trading policy can enhance the ESG performance of enterprises were already present in 2013. The results are shown in Table 4: the coefficient estimates of the core explanatory variable Treated* Year2013 are non-significant regardless of whether firm-level control variables are included. This result suggests the uniqueness of the impact of introducing the carbon trading policy on the ESG performance of enterprises; hence, the findings are robust.

PSM-DID Test

Because experimental and control groups are not randomized, this paper adopts propensity score matching (PSM) for robustness testing to address the estimation bias in sample selection. Specifically, the nearest-neighbor matching method (one-to-two) was adopted to match the samples of the new experimental and control groups. Firm size (Size), gearing ratio (Lev), net asset profitability (Roa), and whether these enterprises have been audited by the Big Four accounting firms (Big 4) were used as matching variables. Before regressing the samples, a PSM balance test was conducted to ensure the data were balanced after matching. Table 5 shows no significant difference between the matched experimental and control groups regarding the characteristic variables. The standardized errors are less than 10%, and the $P > \text{Chi}^2$ changes from 0.000 to 0.981,

indicating that the matching method and variable selection are reasonable and satisfy the balance test. The estimated coefficients on Treated*Time remain significantly positive at the 1% level for regressions applying the DID method after PSM, further demonstrating the robustness of the findings.

Heterogeneity Analysis

Fulfillment of ESG responsibilities by enterprises requires a large amount of financial support, and any financing constraints directly limit the ability of enterprises to obtain funds, thus hindering inputs and business activities. With the low degree of financing constraints enterprises face, they have more abundant funds and opportunities to support their continuous environmental protection behavior, innovation investment, and governance optimization. These more abundant funds will motivate these enterprises to practice ESG concepts consciously and take the initiative to improve their ESG performance. About the practice of [34], in this paper, the absolute value of the SA index is assumed to measure the degree of financing constraints, i.e., $SA = -0.737 \times \text{Size} + 0.043 \times \text{Size}^2 - 0.04 \times \text{Age}$. The greater the absolute value of the SA index, the higher the degree of financing constraints enterprises face. Table 6 presents the estimated results. After adding firm-level control variables, the estimated coefficient of Treated*Time is significantly positive in the group with a lower degree of financing constraints; however, for firms with a higher degree of financing constraints, the estimated coefficient of the cross-multiplier term Treated*Time is 0.371, but this result is not significant. This finding suggests that the carbon emissions trading policy substantially enhances the ESG performance of firms with lower financing constraints.

The heterogeneity of enterprise property rights will also affect the implementation effect of the carbon emissions trading policy. Sample firms are grouped and regressed according to the nature of their ownership, and the regression results are shown in Table 6. After adding firm-level control

Table 5. PSM-DID test results.

Variables	Brochure	Mean		Deviation		T-test	
		Test Group	Control Group	%bias	& reduct	t	P> t
Size	U	23.746	23.111	38.4	–	17.87	0.000
	M	23.684	23.674	0.6	98.4	0.23	0.817
Lev	U	0.52154	0.48867	15.5	–	7.02	0.000
	M	0.51811	0.51847	-0.2	98.9	-0.07	0.946
Roa	U	0.04356	0.04384	-0.5	–	-0.23	0.821
	M	0.04393	0.04415	-0.4	21.0	-0.17	0.868
Big4	U	0.24586	0.08497	44.3	–	20.68	0.000
	M	0.23695	0.23907	-0.6	98.7	-0.21	0.834
P>chi2	U	0.000					
	M	0.981					

Table 6. Heterogeneity analysis between financial constraints and different ownership.

Variables	ESG				ESG			
	Panel A Low level of financial constraints		Panel B High level of financial con- straints		Panel C State-owned		Panel D non-state-owned	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated*Time	1.597***	1.444***	0.617**	0.371	1.491***	1.259***	0.636**	0.378
	(5.44)	(4.91)	(2.57)	(1.54)	(6.01)	(5.04)	(2.23)	(1.34)
Constant	28.583***	-2.281	16.251***	-12.725***	34.55***	11.73**	26.43***	-17.36***
	(22.45)	(-0.34)	(22.97)	(-2.86)	(22.69)	(2.24)	(25.59)	(-3.09)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Corporate-fixed	YES	YES	YES	YES	YES	YES	YES	YES
Yearly-fixed	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,182	4,178	4,183	4,179	4,792	4,787	3,573	3,570
Adj R ²	0.782	0.784	0.715	0.723	0.756	0.758	0.740	0.747

variables, the estimated coefficient of Treated*Time is significantly positive in the SOE group. For non-SOEs, the estimated coefficient of the cross-multiplier term Treated*Time is 0.378, but this result is insignificant. This finding suggests that the enhancing effect of the carbon emissions trading policy on corporate ESG performance is more critical in SOEs.

Conclusions

Under the background of implementing the carbon emissions trading policy, this study uses the differences-in-differences model to test the impact of the carbon emissions

trading policy on corporate ESG performance. The results show that implementing a carbon emissions trading policy can significantly enhance the ESG performance of enterprises and prompt them to embark on the path of sustainable development. Additionally, the construction of a triple-difference model showed that, as an internal driver, two different indicators of corporate sustainability focus exert different moderating roles on the relationship between the carbon emissions trading policy and corporate ESG performance; as an external driver, the level of regional economic development exerts a positive moderating role on the relationship between the carbon emissions trading policy and corporate ESG performance. Heterogeneity analysis results indicate that the enhancing effect of the carbon trading mechanism on corporate ESG performance is more

evident in enterprises with lower financing constraints and in state-owned enterprises.

This research provides empirical evidence for the comprehensive promotion of the construction of the carbon trading market. Firstly, listed companies are an essential leading and promoting force in implementing national strategies. Facing stricter market regulation and capital concerns, more enterprises have incorporated green transformation and sustainable development into their development plans. Relevant departments should formulate a unified ESG disclosure standard and framework soon. Such a standard and framework are of great practical significance for prompting listed companies to deepen their ESG concepts, enhance the comparability of ESG information among enterprises, and improve confidence in investors and other information users. Secondly, in the process of the comprehensive promotion of market-based environmental regulatory tools, the government should focus on developing the regional digital economy and consider different green development requirements for enterprises with varying resource endowments and other property rights attributes.

Regarding the selection of indicators of corporate sustainability focus, there is currently no uniform standard for measuring the dimensions of corporate sustainability focus. Using different indicators to measure this variable may lead to inconsistent research conclusions. With increased attention to the ESG concept and corporate sustainability by various interest groups, future research on the construction of corporate sustainability focus indicator systems is enriched.

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Conflict of Interest

The authors declare no conflict of interest.

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