International Journal of
Financial Studies

MDPI

Article

Corporate Social Responsibility, Carbon Information Disclosure, and Enterprise Value: A Study of Listed Companies in China's Highly Polluting Industries

Feng Shi [1] and Yuan Wang [2,3,*]

[1] School of Economics and Management, Xi'an Kedagaoxin University, Xi'an 710109, China; kdgxshifeng@126.com
[2] School of Management, Xi'an Jiaotong University, Xi'an 710049, China
[3] School of Management, Xi'an University of Science & Technology, Xi'an 710054, China
* Correspondence: wangyuan19@stu.xjtu.edu.cn; Tel.: +86-133-6390-5799

Abstract: In 2022, China actively carried out economic transformation and sought high-quality development. To date, enhancing enterprise value is still one of the top priorities for enterprises. Enterprises should take various measures to continuously enhance their value in order to strive for their survival and development. The fulfillment of social responsibilities not only brings benefits to all stakeholders, but also establishes a good corporate image in front of the public and can increase enterprise value. At the same time, in the context of "carbon peaking and carbon neutrality", carbon information disclosure has an important impact on enterprises and their stakeholders. Taking the data of listed companies within China's Shanghai and Shenzhen A-share highly polluting industries from 2018 to 2022 as samples, this paper studies the relationship between the level of social responsibility fulfillment, carbon information disclosure, and enterprise value, and makes an empirical analysis. This research finds that social responsibility has a significant positive impact on enterprise value; carbon information disclosure has a significant positive impact on enterprise value; and carbon information disclosure plays a significant positive regulating role in the relationship between social responsibility and enterprise value. Finally, according to the research results, this paper puts forward relevant suggestions from two perspectives: enterprise and government.

Keywords: corporate social responsibility; carbon information disclosure; enterprise value

check for updates

Citation: Shi, Feng, and Yuan Wang. 2024. Corporate Social Responsibility, Carbon Information Disclosure, and Enterprise Value: A Study of Listed Companies in China's Highly Polluting Industries. *International Journal of Financial Studies* 12: 66. https://doi.org/10.3390/ijfs12030066

Academic Editor: Michael C. S. Wong

Received: 10 June 2024
Revised: 28 June 2024
Accepted: 1 July 2024
Published: 3 July 2024

Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Climate change has become a global environmental problem. In 1896, Sweden's scientist Arrhenius first put forward the idea of the famous "greenhouse effect", where carbon dioxide in the atmosphere causes warming of the Earth. Qalandar then pointed out that human activities lead to rising carbon dioxide emissions, which will have a serious impact on the future of the planet. Therefore, with economic development, the issue of climate change caused by carbon emissions has always been a focus of attention. In 2020, the Chinese government solemnly promised to the international community that they would ensure that "CO_2 emissions will peak by 2030 and strive for carbon neutrality by 2060". At the same time, President Xi Jinping also stressed that China should improve the mandatory disclosure system regarding enterprise information, actively participate in climate governance, and earnestly fulfill its emission reduction commitments (Xi 2017).

Enterprises are the main participants in economic activities and the main sources of energy consumption and carbon emissions. As microeconomic subjects participating in carbon emission reduction activities, they are also the main force in achieving China's dual carbon goals. Therefore, the awareness, actions, and effectiveness of reducing emissions for enterprises have become particularly important The Measures for the Administration of Legal Disclosure of Enterprise Environmental Information promulgated and implemented

by the Ministry of Ecology and Environment of the People's Republic of China in 2022 require qualified enterprises to disclose carbon emission information. This system clarifies that enterprises are the subject of responsibility for disclosing environmental information according to law, and also ensures mandatory and legal carbon information disclosure, giving the public more right to know. Therefore, carbon information disclosure has become a bridge for governments, enterprises, and the public to achieving a benign interaction in addressing climate change (Sun et al. 2019). On the one hand, carbon information disclosure is an important channel for regulators and the public to understand the current situation of enterprises' carbon emissions and supervise their low-carbon operations. On the other hand, it is also an important embodiment of enterprises' participation in environmental protection and the fulfillment of social responsibilities, making carbon information disclosure an inevitable trend to express enterprises' performance regarding environmental responsibilities (Shen 2022). Carbon information disclosure and social responsibility have become one of the focuses of theoretical and practical circles.

Against the backdrop of "carbon peaking and carbon neutrality" in China, two important aspects of fulfilling social responsibilities are carbon emission reduction and carbon information disclosure. As the main drivers of economic growth, enterprises in heavily polluting industries shoulder a huge responsibility for reducing emissions. Since an environmental information framework related to enterprises in heavily polluting industries has not been standardized (Harmes 2011) and the sources of information are very limited, sufficient carbon information disclosure becomes particularly important. On the one hand, maximizing enterprise value is the ultimate goal pursued by managers. The disclosure of carbon information by enterprises in heavily polluting industries can be regarded as an intertemporal investment behavior (Yang and Li 2017), which conveys a stronger sense of environmental protection and social responsibility to investors, attracting investors while significantly affecting enterprise value (Deegan and Rankin 1996). Moreover, carbon information disclosure is not only helpful for enterprises' regular calculations of income and costs in terms of carbon, but can also enable timely improvements of carbon management to avoid punishment, as well as reducing investor risks in order to better obtain investments and enhance enterprise value (Jiang et al. 2021; Yan and Chen 2017; Yang et al. 2018). However, enterprises usually need to invest more capital, technology, or equipment to carry out carbon governance when fulfilling this responsibility, which will inevitably increase the investment costs of these enterprises and thus reduce their value. Some scholars have shown that investors do not pay attention to corporate carbon emissions under non-mandatory circumstances (Wang and Niu 2013). There is a nonlinear U-shaped relationship between carbon information disclosure and enterprise value (Song et al. 2019). Therefore, the ultimate impact of carbon information disclosure on enterprise value is unclear. It is particularly urgent to verify the relationship between carbon information disclosure and enterprise value in heavily polluting industries. Based on this, this paper attempts to explore the impact of social responsibility and carbon information disclosure on enterprise value by taking data from the high-polluting industries of China A-share listed companies from 2018 to 2022 as a sample.

Research on social responsibility and corporate value has always been a hot topic in academia. In earlier years, scholars believed that fulfilling social responsibility would require more cost expenditures, leading to a decrease in corporate value (Aupperle et al. 1985; Crisóstomo et al. 2017; Louise et al. 2019). D'Amato and Falivena (2020) argued that corporate social responsibility is ineffective for small and young businesses. However, in recent years, strengthening social responsibility has become an important direction for corporate development. Scholars generally believe that fulfilling social responsibility can enhance corporate value and promote corporate development (Zhou et al. 2024; Tsang et al. 2024; Brick and Qiao 2024), and further verify corporations from the perspectives of property rights and cost (Wu and Liew 2023; Abdelqader et al. 2024). In the context of dual carbon goals, the existing social responsibility emphasizes environmental responsibility, and the disclosure of carbon information contained in environmental information is a manifestation

of corporate social responsibility. However, scholars have different views on how carbon information disclosure affects corporate value. The first viewpoint suggests that carbon information disclosure can promote the enhancement of corporate value (Hadiyansahand et al. 2021; Lee and Cho 2021; Zhu et al. 2024). The second viewpoint holds that carbon information disclosure by enterprises incurs certain disclosure costs and exposes environmental risks, thereby reducing the value of these enterprises (Ganda 2017; Lee et al. 2013). The third viewpoint suggests that carbon information disclosure will not affect corporate value (Kurnia et al. 2020; Downar et al. 2021). Some scholars have also shown that while the cost and risk of carbon information disclosure can have a negative impact on the short-term performance of enterprises, it is beneficial for their long-term development: that is, the two have a U-shaped relationship (Siddique et al. 2021; Wang et al. 2023; Lian et al. 2024; Gong et al. 2024).

The existing literature indicates that there is no consensus on the impact of social responsibility and carbon information disclosure on corporate value, and there are few studies that combine the two to explore their impact on corporate value; meanwhile, there is even less involvement in measuring indicators for carbon information disclosure. Therefore, there is still a lot of room for the research presented in this article. Compared with existing research, the main innovations and values of this paper are as follows: (1) Research contents: Different from existing studies, this paper measures carbon information and builds a quality evaluation system for corporate carbon information disclosure based on four dimensions: "carbon governance", "carbon business", "carbon accounting", and "carbon performance". Content analysis is used to measure the quality level of carbon information disclosure among the research objects. (2) Research significance: By exploring the impact mechanism of social responsibility and carbon information disclosure on enterprise value, this paper reveals the long-term positive impacts of carbon information disclosure and social responsibility performance on enterprise value, provides help for the government to guide them to carry out relevant publicity and policies, and promotes enterprises to actively fulfill their social responsibilities and disclose their carbon information.

2. Literature Review and Research Development

2.1. Social Responsibility and Enterprise Value

CSR is a form of corporate responsibility that concerns correcting the social inequality and environmental disruption that arises in the course of business operations—an accounting concept that enables companies to fulfill their environmental and social responsibilities (Iskandar and Fran 2016). In the context of achieving " emissions peakand carbon neutrality", it is a must for Chinese enterprises to actively disclose their carbon information in order to fulfill their social responsibilities. The stakeholder theory holds that the development of a company is not solely dependent on shareholders but also on stakeholders who have other relationships with the company, such as creditors, suppliers, customers, regulatory authorities, employees, etc. Enterprise development is not an island, but a complex of all stakeholders who interact and constrain each other, promoting enterprise development. Therefore, on the one hand, enterprises serve stakeholders, and on the other hand, they will inevitably be subject to the supervision and constraints of stakeholders. Stakeholder theory points out that actively undertaking social responsibilities helps to enhance the value of enterprises. The assumption of social responsibility by enterprises can send trustworthy signals to stakeholders, reduce transaction costs between enterprises and stakeholders, and improve the efficiency of stakeholders' participation in enterprise value creation (Freeman and Evan 1990). Theoretically speaking, the implementation of CSR is expected to have a positive impact on enterprise value (Iskandar and Fran 2016). On the one hand, CSR leads enterprises to earnestly fulfill their social responsibility and deepens their connection with stakeholders. This will encourage the stakeholders to play a supervisory role and give more feedback on problems existing in the enterprises' operations, thus helping each enterprise to improve their governance level and value (Wang et al. 2022). Social responsibility in relation to information disclosure serves both the needs of the public and shareholders

(Huang and Watson 2015). It prompts enterprises to pay more attention to the interests of the public and disclose relevant information. It is considered a responsible performance that will generate higher enterprise value (Gutsche et al. 2016). At the same time, transparent CSR activities help to coordinate the interests of shareholders and the public so that both can benefit from CSR activities (Wang and Li 2022). On the other hand, enterprises undertake social responsibilities to help them establish a good social image and accumulate moral values. Such moral values constitute moral capital and become relationship-based intangible assets (Godfrey 2005), which can help enterprises overcome difficulties when the external environment deteriorates (Lins et al. 2016), avoiding or reducing any loss of market value due to negative events (Peloza 2006).

The resource dependence theory holds that the most important thing for a company is survival. In order to survive, resources are needed, and the company itself cannot generate these resources. It must maintain survival by acquiring resources from the environment. Therefore, this theory emphasizes that the survival and development of enterprises need to draw various resources from the external environment (Pfeffer and Salancik 1978). Assuming social responsibility can help enterprises to obtain key strategic resources held by stakeholders in order to build their competitive advantages, which is conducive to maintaining stable and reliable cooperative relations with enterprises and domestic and foreign suppliers. Enhancing the market loyalty of partners will help enterprises obtain broader and more effective cooperation resources at home and abroad (Zhang 2023). Corporate fulfillment of social responsibility can attract investors' attention and obtain equity capital (Martin and Moser 2015) and more government-order resources (Flammer 2018). Therefore, the fulfillment of social responsibility can help enterprises obtain the resources required for their operation and development, thus improving their risk-taking level and promoting better innovation and development (Wang et al. 2019).

Based on the above analysis, this paper believes that undertaking social responsibilities can establish a good corporate image and take into account the interests of all parties, facilitating enterprises to obtain various resources from stakeholders, improve their competitiveness, and enhance their value. Therefore, Hypothesis 1 is proposed:

H1. *The active performance of social responsibilities by enterprises has a significant positive impact on enterprise value.*

2.2. Carbon Information Disclosure and Enterprise Value

The voluntary disclosure theory suggests that the market can spontaneously stimulate and punish companies, and these companies thus voluntarily disclose carbon information for their own interests in response to the demands of stakeholders and to maintain their social image. Therefore, under the theory of voluntary disclosure, enterprises' motivation for carbon information disclosure is mainly to release positive signals to the outside world. At this time, companies actively and voluntarily disclose relevant information. Companies often invest a lot in carbon management, hoping to highlight their "low-carbon" advantages through information disclosure and obtain certain returns (Du and Li 2019). Healy and Palepu (2001) found that enterprises send favorable signals to the outside world through voluntary information disclosure, attracting external investments and thus enhancing their value. Li et al. (2017) showed that Chinese enterprises' carbon information disclosure can enhance their value, and the higher their carbon emissions, the more obvious such enhancement will be. Active carbon information disclosure by an enterprise is conducive to sending good signals to investors, proving that the enterprise has great strength and can manage, govern, and disclose their carbon information to enhance the investment confidence of investors and creditors, thus reducing financing costs and increasing enterprise value. Relevant research shows that enterprises actively disclose carbon information, which reduces the information asymmetry between investors and enterprise management departments and the risk of investor decision-making, enabling them to obtain funds at lower capital costs. This reduction in capital costs increases the value of enterprises

(Liu and Liu 2019). Therefore, the quality of the carbon information disclosure undertaken by enterprises is negatively correlated with their capital costs (He et al. 2014). Improving the quality of carbon information disclosure can reduce equity financing costs (Li et al. 2019), as well as reducing high no-costs caused by negative impacts, lowering risks, and enhancing the sustainable development ability of enterprises (Wang et al. 2020). That is to say, under the same conditions of equal returns, enterprises' disclosure of carbon information will increase their value.

According to social and political theory, companies disclose information in order to cope with external social and political pressures and meet the pressure needs of stakeholders. Therefore, carbon information disclosure may give a good impression of an enterprise's carbon performance or improve its transparency in meeting external needs (Bai and Wang 2018). Enterprises are mainly motivated by meeting public expectations and complying with relevant policies. Consequently, companies are passive and have to disclose relevant information. Many such companies often do not perform very well in carbon governance. When their legal status is damaged by excessively high levels of carbon emissions, as external pressure forces them to disclose their carbon information in order to avoid damaging the company's image, many enterprises will cover up the actual situation through ambiguous carbon disclosure to protect their legal status (Hummel and Schlick 2016). To gain legal status, enterprises are motivated to disclose more carbon information and transmit more relevant information. After investors obtain more favorable information, they make investment judgments, which are ultimately reflected in the improvement of enterprise value (Li et al. 2016). In this process, the internal organizational results and culture of an enterprise are more reasonable, the loyalty and enthusiasm of its employees are stimulated, and its external recognition is higher, so that the value of the enterprise can be improved (Lin et al. 2023). Song Xiaohua et al. concluded that enterprises greatly affected by external pressure may demonstrate more obvious value effects due to the increase in information disclosure behavior (Song et al. 2019).

Based on this, this paper believes that the disclosure of carbon information can improve enterprise value by meeting the signal-acquisition needs of all parties, especially investors, and the requirements of government regulations and policies. Therefore, Hypothesis 2 is proposed:

H2. *Carbon information disclosure has a significant positive impact on enterprise value.*

2.3. Corporate Social Responsibility, Carbon Information Disclosure, and Enterprise Value

The theory of social responsibility holds that while enterprises enjoy social resources, power, and status in their production and operation processes, they should also bear corresponding social responsibilities and achieve development in social responsibility practice. Under the trend of global warming, society has put forward higher requirements for enterprises to assume environmental protection responsibilities, and the regular disclosure of environmental information has become a manifestation of corporate social responsibility. According to the theory of social responsibility, carbon information disclosure reflects and reflects CSR fulfillment (Du and Li 2019). Both positive and negative information reflect enterprises' active undertaking of social environmental responsibilities, helping them to establish a good corporate image, enhance market competitiveness, and establish their legal status (Tang et al. 2021). On the one hand, carbon information disclosure is the responsibility of enterprises to stakeholders (Iskandar and Fran 2016). If an enterprise is willing to disclose information, it means that it is willing to assume social responsibilities, which can not only improve that enterprise's reputation and image but also reduce the government's constraints on its actions (Clarkson et al. 2011). Lopin et al. (2012) pointed out that enterprises' efforts to reduce carbon emissions reflected in their disclosure of carbon emission information are a form of corporate social responsibility.

On the other hand, through carbon information disclosure, enterprises actively fulfill their social responsibilities and are more likely to gain trust and support from more

stakeholders (Cheng et al. 2014). In this case, carbon information disclosure as a way of enterprise information transmission can release positive signals to the outside world and alleviate doubts and concerns about whether enterprises will be punished for violating policies. When favorable carbon information disclosure demonstrates that the disclosure of carbon emission data has long-term and stable benefits, enterprises will consciously and spontaneously fulfill their social responsibilities and disclose their carbon data. At this time, enterprises that disclose unfavorable carbon data will naturally improve their production measures, research and develop science and technology, and replace their practices with clean-energy practices in order to reduce their carbon emissions. That is, when enterprises assume social responsibilities, their multi-faceted and concrete disclosure of carbon information can attract investments and promote an increase in enterprise value. Therefore, enterprises need to fulfill their environmental protection obligations and assume the corresponding social responsibilities. Specifically, in terms of carbon information, it is necessary to pragmatically reduce carbon emissions and disclose high-quality carbon information in order to reduce pollution costs and agency costs and gain sustainable advantages, thus enhancing enterprise value (Wang and Wei 2023).

Based on the above analysis, we believe that carbon information disclosure by enterprises is a way in which enterprises can fulfill their social responsibilities and promote the growth of enterprise value. Therefore, Hypothesis 3 is proposed:

H3. *Carbon information disclosure plays a positive role in regulating the relationship between social responsibility and enterprise value.*

3. Research Design

3.1. Sample Selection and Data Sources

This paper takes the industry classification of China Securities Regulatory Commission and listed companies within highly polluting industries in Shanghai and Shenzhen A-shares as research objects; we selected a total of 1092 companies in 16 highly polluting industries such as the coal, mining, textile, tanning, paper-making, petrochemical, pharmaceutical, chemical, metallurgical, and thermal power industries, specified in the Guidelines for Environmental Information Disclosure by Listed Companies issued by the Ministry of Environmental Protection of the People's Republic of China. Excluding incomplete data and ST (Special Treatment) and *ST companies, 967 sample companies were finally selected from the initial total. Meanwhile, in 2016 and 2017, seven ministries, including the People's Bank of China and the China Securities Regulatory Commission, successively issued relevant documents on the environmental information disclosure of listed companies, established and improved a mandatory environmental information disclosure system for listed companies, and urged listed companies to effectively fulfill their social responsibilities for environmental protection. Therefore, the selection of research samples in this article starts from 2018, and a total of 4520 observed values from 2018 to 2022 were counted. Among these, the enterprise value data came from the CSMAR (China Stock Market & Accounting Research Database) database; the carbon information disclosure data came from the CSMAR (China Stock Market & Accounting Research Database) database, annual reports of the listed companies, social responsibility reports of the listed companies, environmental, social, and governance reports of the listed companies, etc., which were manually sorted out; the social responsibility data come from third-party rating agencies and the social responsibility rating data of www.hexun.com; and other control variables come from the CSMAR database. Finally, all continuous variables were winsorized on the upper and lower 1% quantiles. SPSS25.0, Eviews12.0, Stata16.0, and Excel 2010 software were used in the statistical analysis.

3.2. Definition of Variables

3.2.1. Dependent Variable

The dependent variable in this paper is the enterprise value (CV). For the measurement of enterprise value, this paper uses the stock market value as a reflection of the enterprise value, and takes its natural logarithm. The stock market value represents the size of the enterprise value. There are two reasons for our choice to use the stock market value to measure enterprise value: (1) As the relevant information on enterprise operations will affect the number of investors, the investment amount, and stakeholders' decisions and be quickly reflected in the enterprise's stock market value, the more accurate stock market value will represent the performance of social responsibilities, and this value after carbon information disclosure will affect the public's investment intentions. (2) The stock market data are more accurate, and the reflection of enterprise information in the securities market is also relatively sensitive.

3.2.2. Independent Variable

The independent variable in this paper is corporate social responsibility (CSR). This paper uses the CSR scoring system of listed companies on Hexun to measure CSR indicators. Since the professional evaluation system for the social responsibility reports of listed companies on Hexun.com is based on investigating 5 aspects, namely shareholder responsibilities, employee responsibilities, environmental responsibilities, social responsibilities, and supplier–customer and consumer rights, interests, and responsibilities, 13 secondary indicators and 37 tertiary indicators were set up to comprehensively evaluate various aspects of social responsibility information. With its complete data and long duration, this evaluation system is currently one of the most commonly used databases for CSR research in China.

3.2.3. Moderating Variable

The moderating variable in this paper is carbon information disclosure (CID). At present, there is no consensus in the academic circle on the quantification of carbon information disclosure indicators. According to our sorting of the existing literature, there are three main methods for measuring existing carbon information disclosure indicators: ① Utilizing questionnaire survey data. This approach follows a standardized set of scoring methods by designing questionnaires, which gather various carbon-related information such as information on carbon governance, risk management, carbon accounting and verification, and emission reduction activities. The score is then obtained by analyzing the contents of the participating companies' responses to the survey questionnaires (Loe 2017; Perkins et al. 2022). ② Independently building a carbon information disclosure index system using the content analysis method. The aim of this method is mainly to independently build a carbon information disclosure index system from different aspects according to the relevant environmental information disclosure reports from enterprises, such as the annual reports of listed companies, social responsibility reports, and environmental information disclosure reports, and then quantifying its indexes by assigning values, calculating weights, and summing up according to the disclosed contents (Liu and Zhao 2023). ③ Using alternative variable substitution method. Since there is no unified requirement for carbon information disclosure in China at present, some scholars have selected the average social responsibility evaluation scores published by third-party institutions with high recognition (such as Runling Global and Hexun.com) to measure the levels of carbon information disclosure among listed companies (Zhao et al. 2019).

Based on the above three methods, the first method is rarely used because of limited research due to the insufficient data and sample sizes caused by the low participation of enterprises and the small number of questionnaires that can be collected. The third method, using social responsibility scores to replace carbon information disclosure indicators, cannot fully reflect the contents of carbon information disclosure, so it is not suitable. Therefore, this paper draws on the second method: we combined the research of Yang and Zhen (2017),

Li et al. (2018), and other scholars to manually calculate a hundred-mark value system for evaluating corporate carbon information disclosure using content analysis. We have thus compiled an evaluation index system for assessing the carbon information disclosure levels of listed companies, as shown in Table 1. Our index system consists of 4 primary indicators and 15 secondary indicators. We found relevant carbon information in the annual reports, CSR reports, and environmental reports of the sample listed companies through the text analysis method, assigned scores to each indicator, and calculated them. The specific assignment and calculation rules we used are as follows: First, the indicators include 2 points for quantitative information, 1 point for qualitative information, 0 points for undisclosed information, 2 points for the disclosure of a few secondary indicators (such as accounting methods), 1 point for calculation according to requirements, and 0 points otherwise. The full score of all items in the assessment is 30 points. Second, the preliminary scores of each sample company are divided by a full score of 30 and then multiplied by 100% to obtain the percentage of environmental information disclosure hundred-mark data, forming the carbon information disclosure data studied in this paper. The formula for this is shown in Equation (1):

$$CID = \frac{\sum CID_{i,t}}{30} * 100\% \quad (1)$$

where i represents the ith enterprise and t represents the disclosure year of the listed company.

Table 1. Scoring criteria for carbon information disclosure.

Level-I Indicator	Level-II Indicator	Assignment Criteria
A. Carbon Governance	A_1: Setting of functional organizations, posts, and personnel related to carbon emission reduction	2 points for the disclosure of specific matters that an institution or post is responsible for (for example, an Energy Conservation and Emission Reduction Committee has been established that is responsible for setting goals, assigning tasks, and assessing energy conservation and emission reduction work); 1 point for the establishment of an institution but failure to disclose specific matters it is responsible for; otherwise, 0 points
	A_2: Management system related to carbon emission reduction	2 points for quantitative description (for example, X energy-saving and emission reduction systems have been established); 1 point for qualitative description; 0 points otherwise
	A_3: Carbon emission reduction targets and plans	2 points for quantitative description (for example, we plan to reduce emissions by X tons of standard coal); 1 point for qualitative description; 0 points otherwise
	A_4: Low-carbon publicity, education, and training for employees	2 points for quantitative description (for example, we are conducting X low-carbon education sessions); 1 point for qualitative description; 0 points otherwise
	A_5: Emission treatment methods	2 points for quantitative description (for example, X method was adopted and X buildings were constructed, resulting in a total emission of X tons); 1 point for qualitative description; 0 points otherwise
	A_6: Presence of independent third-party authentication	2 points for having third-party independent authentication and disclosing the results (for example, X accounting firm was commissioned by X company to verify ESG reports, and, based on our work, we did not find any significant misstatements in ESG-related key performance indicators); 1 point for reporting no results while having third-party independent authentication; 0 points otherwise

Table 1. *Cont.*

Level-I Indicator	Level-II Indicator	Assignment Criteria
B. Carbon Business	B_1: Carbon risks and opportunities related to carbon emissions	2 points for quantitative description (for example, the implementation of lower-emission standards has increased environmental protection tax by XX million RMB); 1 point for qualitative description; 0 points otherwise
	B_2: Participation in carbon emission trading	2 points for quantitative description (for example, X subsidiaries completed carbon-trading pilot projects on schedule to fulfill their obligations); 1 point for qualitative description; 0 points otherwise
	B_3: Low-carbon project investments and technology R&D	2 points for quantitative description (for example, we are using low-carbon technology to renovate X equipment with an investment of X million RMB); 1 point for qualitative description; 0 points otherwise
C. Carbon Accounting	C_1: Carbon accounting methods	2 points for the disclosure of specific accounting methods or standards (for example, we are conducting carbon accounting according to X regulations or methods); 1 point for the description of accounting as required; 0 points otherwise
	C_2: Carbon energy savings	2 points for quantitative description (for example, our electricity consumption of X kilowatt hours decreased by X% year-on-year); 1 point for qualitative description; 0 points otherwise
	C_3: Carbon emission reduction indicators and completion	2 points for quantitative description (for example, our emission of pollutants is X% lower than the regulatory assessment indicators); 1 point for qualitative description; 0 points otherwise
	C_4: Pollutant discharge fees and treatment fees paid for carbon emission reduction	2 points for quantitative description (for example, our annual expenditure on environmental governance is X million RMB); 1 point for qualitative description; 0 points otherwise
D. Carbon Performance	D_1: Subsidies and incentives for carbon energy conservation and emission reduction	2 points for quantitative description (for example, we received a financial subsidy of X million RMB for energy-saving technology renovation); 1 point for qualitative description; 0 points otherwise
	D_2: Economic, environmental, and social benefits of carbon energy conservation and emission reduction	2 points for quantitative description (for example, energy conservation and emission reduction saved CNY X million in funds); 1 point for qualitative description; 0 points otherwise

3.2.4. Control Variables

For the control variables in this paper, combined with the existing research, we selected enterprise profitability (ROA), solvency (LEV), equity concentration (TOP10), and the age of enterprises (AGE). Profitability is the basis for the survival and development of an enterprise, reflecting its operating efficiency and financial management level. It can bring returns to shareholders and increase the value of an enterprise. In this paper, the return on assets is used to measure the profitability of an enterprise. Demonstrating a good debt-paying ability will improve the position of an enterprise in the supply chain, allow it to obtain better supply chain resources and support, and further promote the development of that enterprise. This paper chooses an asset–liability ratio to reflect the solvency of enterprises. Equity concentration will affect the decision-making speed and quality of enterprises. In this paper, the sum of the shareholding ratios of the top ten shareholders is used to measure the equity concentration. The age of enterprises will affect the overall

development and maturity of enterprises and their sensitivity to external pressure. In this paper, the age of enterprises is measured according to the number of years they have been public.

To sum up, the research variables and control variables selected in this paper are shown in Table 2.

Table 2. Definition of variables.

Variable Type	Variable Symbol	Definitions
DV	CV	LN (the stock market value is taken)
IV	CSR	Corporate social responsibility score from Hexun.com
MV	CID	Score of carbon information disclosure level
CV	ROA	Net profit/total assets at the end of the period
	LEV	(total liabilities/total assets) × 100%
	TOP10	The total shareholding proportion of the top ten shareholders
	AGE	The corporate reporting year-the first year of listing

3.3. Model Construction

To test Hypothesis 1, this paper establishes a regression model, named Model 2, that analyzes the relationship between the levels of social responsibility fulfillment exhibited by listed companies and their impact on enterprise value. For this we use the equation below, wherein CV is the dependent variable of corporate performance, CSR is the independent variable of corporate social responsibility, ε is an error term, γ_i is a year-fixed effect, and the rest are all control variables, including profitability, solvency, equity concentration, and enterprise age. In Model 2, α_1 is the element that we are focused on, and if α_1 is significantly positive, Hypothesis 1 holds.

$$CV = \alpha_0 + \alpha_1 CSR + \alpha_2 ROA + \alpha_3 LEV + \alpha_4 TOP10 + \alpha_5 AGE + \gamma_i + \varepsilon \quad (2)$$

To verify Hypothesis 2, this paper establishes another regression model, named Model 3, which analyzes the impact of the carbon information disclosure levels of listed companies on enterprise value. In the equation below, CV represents the performance of enterprises as the dependent variable, CID represents the carbon information disclosure as the independent variable, and all other variables have the same meanings as those described for Equation (2). The focus in this model is β_1, which must be significantly positive for Hypothesis 2 to hold.

$$CV = \beta_0 + \beta_1 CID + \beta_2 ROA + \beta_3 LEV + \beta_4 TOP10 + \beta_5 AGE + \gamma_i + \varepsilon \quad (3)$$

To test Hypothesis 3, this paper establishes a regression model called Model 4, which analyzes the relationship between the carbon information disclosure level of listed companies and the regulating effect of CSR and enterprise value. Among the variables in the equation below, CV represents corporate performance (dependent variable), CSR represents corporate social responsibility (independent variable), CID represents carbon information disclosure (regulatory variable), and CSR×CID represents the regulating effect. The remaining variables have the same meaning as those described for Model 2, and the focus in this model is μ_3, which is expected to be significantly positive when Hypothesis 3 is valid.

$$\begin{aligned} CV = {} & \mu_0 + \mu_1 CSR + \mu_2 CID + \mu_3 CSR * CID + \mu_4 ROA + \mu_5 LEV + \mu_6 TOP10 \\ & + \mu_8 AGE + \gamma_i + \varepsilon \end{aligned} \quad (4)$$

4. Empirical Results and Analysis

4.1. Descriptive Statistics

For this paper, a preliminary statistical analysis of all variables was carried out. The specific descriptive statistical results are shown in Table 3.

Table 3. Descriptive statistical analysis.

	N	MIN	MAX	Mean Value	Sd
CV	4520	20.49	28.50	23.10	1.22
CSR	4520	1.00	90.00	44.70	25.04
CID	4520	3.33	100.00	51.64	28.33
ROA	4520	−9.97	95.94	5.17	6.46
LEV	4520	10.00	99.95	41.31	20.27
TOP10	4520	12.29	99.99	58.78	15.99
AGE	4520	6.00	47.00	22.69	5.33

As shown in Table 3, the minimum value of enterprise value is 20.29, the maximum value is 28.50, and the standard deviation is 1.22. The difference between the minimum value, the maximum value, and the standard deviation is not large, because the enterprise value used is the value after taking the logarithm of the stock market value. The minimum social responsibility score is 1.00, the maximum is 90.00, and the standard deviation is 25.04. The difference and standard deviation between the minimum and maximum values are relatively large, indicating that there is a great difference in the level of CSR fulfillment, and some enterprises perform poorly. The minimum value of carbon information disclosure is 3.33, the maximum value is 100.00, and the standard deviation is 28.33. The difference between the minimum value, the maximum value, and the standard deviation is large, indicating that enterprises' carbon information disclosure levels are uneven. The minimum profitability is −9.97, the maximum is 95.94, and the standard deviation is 6.46, but the average value is only 5.17, indicating that there are extreme cases regarding the ability of the studied listed companies to obtain profits. The minimum solvency is 10.00, the maximum is 99.95, the average is 41.31, and the standard deviation is 20.27, indicating that a few companies have a very weak solvency. The minimum equity concentration is 12.29, the maximum is 99.99, the standard deviation is 15.99, and the average value is 58.78, indicating that most of the sample companies have a relatively concentrated equity. The minimum age of the enterprise is 6, the maximum is 47, and the standard deviation is 5.79, indicating that there is a large difference between the listing years of the sample companies.

4.2. Correlation Analysis

We conducted a Pearson correlation analysis on all variables to initially test the correlations between them. It can be seen from Table 4 that the correlation coefficients of CSR and CID to CV are 0.458 and 0.096, respectively, both of which have a positive impact on the explained variables at a significance level of 1%, indicating that the improvement of CSR and carbon information disclosure quality can significantly improve MV. It is thus preliminarily verified that Hypothesis 1 and Hypothesis 2 are valid. Among the control variables, profitability (ROA), the asset–liability ratio (LEV), and equity concentration (TOP10) are all significantly positively correlated with enterprise value (CV) at a level of 1%, indicating that the higher the profitability of an enterprise, the larger the asset–liability ratio, the more concentrated the equity is, and the higher the enterprise value. On the whole, among the control variables, except for the enterprise age variable, other variables are related to the explained variables, indicating that the selected control variables are reasonable. In addition, some independent variables also show significant correlations. The maximum correlation coefficient between the independent variables is 0.361. According to the judgment standard of multicollinearity, if the correlation coefficient is less than 0.7, it indicates that there is no serious problem of multicollinearity among variables. Further, we judged our data using the variance inflation factor (VIF). According to the SPSS24.0

calculation, the tolerances are greater than 0.1 and the VIF is less than 10, indicating that there is no serious multicollinearity problem between variables. Therefore, we deemed the selection of variables to be appropriate, and a multivariate regression analysis could be further carried out.

Table 4. Correlation analysis.

	CV	CSR	CID	ROE	LEV	TOP10	AGE
CV	1						
CSR	0.458 **	1					
CID	0.096 **	0.003	1				
ROA	0.049 **	0.021	−0.003	1			
LEV	0.068 **	0.055 **	−0.001	−0.491 **	1		
TOP10	0.241 **	0.116 **	0.361 **	−0.051 *	−0.061 *	1	
AGE	0.022	0.015	−0.042	0.024	0.031 *	−0.205 **	1

** indicates significance at the level of 0.01; * indicates significance at the level of 0.05.

4.3. Regression Analysis

Our analysis is shown in Table 5. First, from an overall perspective, the adj-R^2 values of the three models are 0.463, 0.544, and 0.701, respectively, and the F scores are 11.488, 15.910, and 22.828, respectively, all of which are significant, indicating that our model fits well and the model establishment is good. All models are valid.

Table 5. Multiple regression analysis.

	(1) Model 2 CV	(2) Model 3 CV	(3) Model 4 CV
CSR	0.044 **		0.142 ***
	(2.423)		(4.371)
CID		0.032 ***	0.098 ***
		(4.601)	(4.397)
CSR×CID			0.005 ***
			(5.933)
ROA	3.637 *	5.656 **	4.646 *
	(1.180)	(2.340)	(1.970)
STATE	−0.156	−0.017	−0.251
	(−0.536)	(−0.070)	(−1.142)
LEV	−0.226 *	−0.136 *	−0.199 **
	(−1.967)	(−1.308)	(−2.272)
TOP10	4.034 ***	3.245 ***	1.813 ***
	(5.758)	(4.814)	(3.017)
AGE	−0.016	−0.016	−0.003
	(−0.963)	(−1.085)	(−0.252)
Year	Controlled	Controlled	Controlled
Adj-R^2	0.463	0.544	0.701
F	11.488 ***	15.910 ***	22.828 ***
N	4520	4520	4520

The superscript asterisks ***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively.

Second, from the analysis of each model, in Model 2, the regression coefficient of social responsibility (CSR) is 0.044, which is positive and significant at the 5% level, indicating that it has a significant positive impact on corporate performance at the 5% level. By actively undertaking and fulfilling social responsibilities, enterprises can gain more trust and support from stakeholders and establish an efficient and harmonious interactive relationship with them. Such an efficient and harmonious interactive relationship can be regarded as a sustainable competitive advantage for enterprises and can promote better

benefits for enterprises; thus, the enterprise value is improved (Isabelle and Ferrel 2004), and H1 is assumed to be true.

In Model 3, the regression coefficient of carbon disclosure information (CID) is 0.032, which is positively significant at the 1% level, indicating that it has a positive impact on corporate performance at the 1% significance level. Through high-quality carbon information disclosure, enterprises have eliminated the hidden danger of information asymmetry on the one hand, alleviated the negative impact of carbon emissions on enterprises, broadened the channels for the outside world to understand enterprises, and thus enhanced investors' confidence in enterprises. On the other hand, the results show that enterprises have actively implemented low-carbon work, such as reducing their carbon emissions, reporting their low-carbon environmental protection concepts and environmental management results to the outside world, and accepting the supervision of the government and the public, in order to promote their better development. Therefore, Hypothesis 2 is established.

In Model 4, the regression coefficient of the interaction item between CSR and carbon information disclosure (CSR×CID) and enterprise value is 0.005, which is positively significant at the level of 1%, indicating that carbon information disclosure has a positive regulating effect on the impact of social responsibility on enterprise value at the significance level of 1%, with the regulating effect having a value of $0.701 - 0.463 = 0.238$. The regulating effect is very obvious. Carbon information disclosure can positively regulate the relationship between social responsibility and enterprise value. On the one hand, enterprises actively disclose their carbon information, which reflects their courage to fulfill social responsibilities, effectively reduces information asymmetry with stakeholders, and is conducive to reducing financing costs and increasing investments. On the other hand, carbon information disclosure conveys a positive corporate image to the public, establishes the concept of low-carbon operations, enhances the influence of enterprises, and leads to good social recognition. It is thus easier for enterprises to bear social responsibilities and improve their value. Therefore, Hypothesis 3 is established.

Finally, we analyzed the impact of the control variables in each model on enterprise performance. The table shows that the impact of profitability on enterprise value is positively and significantly correlated, which verifies that the shareholders' rights and the interests of enterprises with strong profitability are fully protected, thus increasing the enterprise value. At the same time, equity concentration also has a positive and significant impact on enterprise value, indicating that in the sample enterprises, equity is relatively stable, the possibility of being affected by equity dispersion is reduced, and the decision-making efficiency of companies is improved, thus improving enterprise value. There is a significant negative correlation between solvency and enterprise value, which indicates that under the condition of high debts, enterprises will have poor management, difficult capital operation, and other conditions, which lead to increased financing costs and financial risks, resulting in a decrease in enterprise value.

4.4. Robustness Tests

As the empirical results may have been affected by the measurement method used for the indicators and sample selection bias, a series of robustness tests was required. We adopted the following robustness test methods: ① Replacing the indicator measures. For this, the above regression analysis was carried out again by replacing the explained variable of enterprise value (CV) with Tobin's Q. ② Changing the measurement range of indicators. For the explanatory variable of social responsibility, we adopted Hexun's professional evaluation system for assessing listed companies' social responsibility reports in our previous analysis. This system includes five different aspects, of which environmental responsibility accounts for 20%. Since the focus of social responsibility in this paper is on environmental responsibility, and the evaluation of environmental responsibility in this assessment system includes environmental awareness, environmental management system certification, the amount of environmental protection investment, the number of pollutant discharge measures, and the number of energy-saving measures, which are more consistent with the

embodiment of social responsibility in this paper, we used the scoring of environmental responsibility for our robustness analysis. According to the method of Ye et al. (2015), disclosed carbon information can be divided into monetized and non-monetized carbon governance information. The latter mainly includes information on participation in carbon emission trading, low-carbon project investments, and technological developments in "carbon business"; carbon saving and energy consumption, carbon emission reduction indicators and completion, and pollutant discharge fees paid for carbon emission reduction, treatment costs, etc., in "carbon accounting"; and subsidies and incentives for carbon energy conservation and emission reduction, and the economic benefits, environmental benefits, and social benefits of carbon energy conservation and emission reduction, etc., in "carbon performance". Since the impact on corporate performance is mainly the effect of monetized information brought about by carbon disclosure, we used the disclosure of monetized carbon information for our robustness analysis. ③ Changing the time window of the samples. At the beginning of 2020, due to the rapid spread of COVID-19 around the world, delayed work resumption in various regions, and people's travel and logistics being controlled, the normal production and business activities of enterprises were greatly affected, thus affecting their value. So, we changed the research window to 2018–2019 for our robustness testing. The robustness of the data model was tested using the above three methods. The specific results are shown in Tables 6–8. It can be seen that the robustness test results for the three models are consistent with those mentioned above, which indicates that our data are robust and the above analysis conclusions are reliable.

Table 6. Robustness test 1.

	Model 2 CV	**Model 3 CV**	**Model 4 CV**
CSR	0.005 ***		0.380 ***
	(5.765)		(2.395)
CID		0.154 ***	0.323 ***
		(4.721)	(2.964)
CSR×CID			0.019 ***
			(4.383)
Control Variables	Yes	Yes	Yes
Year	Controlled	Controlled	Controlled
Adj-R^2	0.847	0.453	0.616
F	73.648 ***	11.037 ***	15.626 ***
N	4520	4520	4520

The superscript asterisks *** denote statistical significance at the 1% levels.

Table 7. Robustness test 2.

	Model 2 CV	**Model 3 CV**	**Model 4 CV**
CSR	0.006 ***		0.015 ***
	(31.070)		(11.717)
CID		0.105 ***	0.013 *
		(7.671)	(9.399)
CSR×CID			0.029 *
			(12.495)
Control Variables	Yes	Yes	Yes
Year	Controlled	Controlled	Controlled
Adj-R^2	0.304	0.165	0.314
F	394.627 ***	179.939 ***	295.755 ***
N	4520	4520	4520

The superscript asterisks ***, and * denote statistical significance at the 1, and 10% levels, respectively.

Table 8. Robustness test 3.

	Model 2 CV	Model 3 CV	Model 4 CV
CSR	0.010 *** (19.989)		0.023 *** (8.786)
CID		0.005 *** (3.272)	0.026 ** (6.730)
CSR×CID			0.005 ** (6.076)
Control Variables	Yes	Yes	Yes
Year	Controlled	Controlled	Controlled
Adj-R^2	0.351	0.203	0.345
F	184.387 ***	87.164 ***	123.363 ***
N	1699	1699	1699

The superscript asterisks ***, and ** denote statistical significance at the 1, and 5% levels, respectively.

4.5. Endogeneity Tests

There may be a reverse causal relationship between social responsibility and corporate value. On the one hand, fulfilling social responsibility can enhance corporate value, and on the other hand, the better the corporate value, the more it can promote companies to actively assume social responsibility. Similarly, there may be a reverse causal relationship between carbon information disclosure and corporate value. Carbon information disclosure will drive companies to increase their value, and companies with better profitability and development will be more actively motivated to engage in environmental governance and carbon information disclosure. Therefore, the previous research may have endogeneity issues.

For the endogeneity issue between social responsibility and corporate value, this article draws on the approach of Chen and Liu (2021) and tests CSR with a lag of one period, effectively alleviating the endogeneity problem. For the endogeneity issue between carbon information disclosure and corporate value, the instrumental variable method is adopted, drawing on the approach of Sun et al. (2023), and the proportion of the largest shareholder's shareholding is selected as the instrumental variable. The largest shareholder of a listed company has important decision-making and discourse power in corporate operations, especially in terms of environmental governance and carbon information disclosure. The higher the shareholding ratio of the largest shareholder, the stronger the supervision over the management of the enterprise. In this context, managers will disclose their carbon information and continuously improve the quality of this disclosure. Therefore, there is a close positive correlation between the shareholding ratio of the largest shareholder and carbon information disclosure, which meets the correlation requirements of the instrumental variables. At the same time, the decision-making power of listed companies also depends on the resolutions of all shareholders, as well as the possibility of making decisions according to existing agreed proportions. Furthermore, the shareholding ratio of the largest shareholder is not fixed, but is in a continuous process of changing and adjusting towards the optimal equity structure. The proportion of shares held by the largest shareholder reflects more on the interests and decision-making outcomes among shareholders, while the value of the enterprise is determined by various factors such as the company's operating conditions. Therefore, there is no direct connection between the shareholding ratio of the largest shareholder and the value of the enterprise, which satisfies the exogenous requirement of instrumental variables. Finally, after conducting over-identification and weak instrumental tests, it was found that the instrumental variables selected in this article are applicable.

The specific test results are shown in Table 9. The first column in the table shows the test of social responsibility lagged by one period, while the second and third columns show the two-stage test results of the instrumental variable method for carbon information

disclosure. It can be seen that the test results are still significant, indicating that the main-effect hypothesis of this article is still valid after considering endogeneity.

Table 9. Endogeneity test.

	(1) CV	(2) CID	(3) CV
CSR	0.040 ** (2.341)		
CID			0.128 ** (8.842)
IV		0.689 *** (63.834)	
Control Variables	Yes	Yes	Yes
Year	Controlled	Controlled	Controlled
Adj-R^2	0.005	0.474	0.115
F	4.464 ***	815.869 ***	118.608 ***
N	3553	4520	4520

The superscript asterisks ***, and ** denote statistical significance at the 1, and 5% levels, respectively.

4.6. Heterogeneity Analysis

According to the above analysis, we conclude that enterprises' fulfillment of social responsibility and active disclosure of carbon information can help improve their value. Therefore, by further combining China's market economy characteristics and enterprise characteristics, regional heterogeneity and property rights heterogeneity are introduced in order to deeply analyze whether there is a difference in the impact of social responsibility and carbon information disclosure on enterprise value again.

4.6.1. Regional Heterogeneity

Since China's reform and opening-up, the economy has developed rapidly. However, at the same time of rapid economic development, an imbalance in regional economic development has begun to appear gradually. The speed of economic development in the east is significantly higher than that in the central, western, and northeast regions. Therefore, we further considered the factors of regional economic development and distinguished between the eastern and western regions of China for analysis. China's east–west economic boundary is mainly based on the distribution of natural resources, the level of economic and social development, and other factors. It roughly divides China into two economic zones: the eastern and western regions. Specifically, the economic regions in eastern China include Liaoning, Hebei, Beijing, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi Zhuang Autonomous Region, Hainan Province, and other provincial administrative regions. The rest are in western China. The specific regression results are shown in Table 10. By comparing the eastern and western regions of China, we can conclude the following: (1) The results of Model 2 show that the influence coefficients of CSR on enterprise value in the eastern and western regions are 0.378 and 0.352, respectively, both of which are significant at the 1% level. This indicates that there is no regional difference between China and other countries in terms of the significant positive impact of enterprises' active fulfillment of social responsibility on enterprise value. The eastern and western regions both play a positive role in promoting development. (2) The results of Model 3 show that the influence coefficients of carbon information disclosure on enterprise value in eastern and western regions are 0.121 and 0.040, respectively, with significant impacts at the levels of 1% in the eastern region and 10% in the western region, indicating that carbon information disclosure for highly polluting enterprises in eastern and western China has a remarkable promoting effect on enterprise value. (3) The results of Model 4 show that the adjustment coefficient of carbon information disclosure between social responsibility and enterprise value in eastern China is 0.144 at a 10% level, while that in western China is not significant. This indicates that economic differences between East China and West

China cause differences in the regulating relationship between social responsibility and enterprise value.

Table 10. Analysis of regional heterogeneity.

	Model 2 CV		Model 3 CV		Model 4 CV	
	East	**West**	**East**	**West**	**East**	**West**
CSR	0.378 *** (24.723)	0.352 *** (16.784)			0.320 *** (8.916)	0.334 *** (6.224)
CID			0.121 *** (7.443)	0.040 * (1.814)	0.150 * (2.020)	0.003 (0.026)
CSR×CID					0.144 * (1.726)	0.048 (0.391)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Adj-R^2	0.386	0.287	0.267	0.170	0.399	0.288
F	295.482 ***	114.914 ***	171.363 ***	58.923 ***	234.385 ***	87.039 ***
N	2817	1703	2817	1703	2817	1703

The superscript asterisks ***, and * denote statistical significance at the 1, and 10% levels, respectively.

Based on the above discussion, we can analyze the reasons for these results as follows: In Model 4, the carbon information disclosure in eastern China has an adjustment effect between social responsibility and enterprise value, while that in western China does not exist. Therefore, this indicates that different market mechanisms, industrial structures, political factors, and natural conditions exist in eastern and western China due to different economic developments, resulting in different impact results. First, the eastern region has a more reasonable industrial structure, convenient transportation, certain advantages in its environmental and resource conditions, and greater national policy inclination. Therefore, enterprises can obtain sufficient funds and relatively preferential policy support during their operations. Second, the rapid economic development of eastern China allows more high-quality talents to gather there and has a siphon effect on them. Therefore, it can promote enterprises to continuously innovate their products, technologies, and management to meet market demands and enhance their competitive advantages. Third, due to the more sound system in the eastern region, stricter government environmental supervision, and more public social supervision, enterprises will be more proactive in complying with market systems, actively fulfilling their social responsibilities, and disclosing more carbon information. To summarize, in the context of it having a higher level of economic development than that of West China, the eastern region taking the initiative to assume social responsibilities and disclose carbon information will form a win-win effect that promotes other regions, thus effectively promoting enterprise value.

4.6.2. Property-Right Heterogeneity

With the acceleration of economic globalization and the increasingly perfect market economy system, China's state-owned enterprises and non-state-owned enterprises have become the two most important forms of enterprises in modern society. There are certain differences between the two in their nature, operations, and management; social responsibilities; environmental governance; and other aspects. Whether these have an impact on the value of the enterprises studied in this paper needs to be further analyzed. Therefore, we have distinguished the sample enterprises into state-owned enterprises and non-state-owned enterprises according to their different property rights. State-owned enterprises are economic organizations with the state or government as their main body, which implement production and business activities according to law. These are enterprises directly invested or controlled by the state, and their goal is to serve national economic development and social interests. Non-state-owned enterprises refer to enterprises invested

and established by private, collective, joint-stock, or other non-governmental organizations and individuals, aiming at making profits and maximizing economic benefits. The specific regression results are shown in Table 11. By comparing the SOEs with non-SOEs, we can conclude the following: (1) The results of Model 2 show that the coefficients of the influence of SOEs' and non-SOEs' social responsibilities on enterprise value are 0.346 and 0.366, respectively. State-owned enterprises are significantly affected at the level of 1%, while non-state-owned enterprises are significantly affected at the level of 10%, indicating a significant positive impact of CSR fulfillment on enterprise value. The slight differences in enterprise ownership have a promoting effect, but the degree of promotion is different. (2) The results of Model 3 show that the coefficients of the influence of carbon information disclosure by SOEs and non-SOEs on enterprise value are 0.065 and 0.090, respectively, with a significant impact at 10% for SOEs and 1% for non-SOEs. This indicates that the disclosure of carbon information by highly polluting enterprises with different ownership properties can promote their value. However, the performance of propulsion is slightly different. (3) The results of Model 4 show that the adjustment coefficient of carbon information disclosure between social responsibility and enterprise value for SOEs is 0.860 at a level of 1%, while that for non-SOEs is not significant. This indicates that different natures of corporate ownership lead to differences in the regulating relationship between social responsibility and enterprise value.

Table 11. Analysis of property-right heterogeneity.

	Model 2 CV		**Model 3 CV**		**Model 4 CV**	
	State-Owned Enterprises	**Non-State Enterprises**	**State-Owned Enterprises**	**Non-State Enterprises**	**State-Owned Enterprises**	**Non-State Enterprises**
CSR	0.346 ***	0.366 *			0.279 ***	0.355 ***
	(18.365)	(21.303)			(6.082)	(8.466)
CID			0.065 *	0.090 ***	0.860 *	0.063
			(3.361)	(4.855)	(8. 660)	(0.705)
CSR×CID					0.175 *	0.026
					(1.639)	(0.269)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Adj-R^2	0.442	0.210	0.340	0.187	0.448	0.217
F	281.285 ***	146.978 ***	183.490 ***	53.406 ***	206.295 ***	109.630
N	1776	2744	1776	2744	1776	2744

The superscript asterisks ***, and * denote statistical significance at the 1, and 10% levels, respectively.

Based on the above discussion, we can analyze the reasons for these results as follows: (1) In Model 2, since SOEs have natural political advantages, they mainly carry out social responsibility activities in the field of public interests, such as environmental protection, education, and poverty alleviation, while non-SOEs are mainly embodied in commercial fields, such as philanthropy, public welfare advertising, and employee benefits. Therefore, the social responsibilities undertaken by SOEs will bring greater public support and thus greatly improve enterprise value. (2) In Model 3, due to the unique identity of SOEs, it is easier to obtain government support in environmental governance. The cost of environmental governance for SOEs is lower than that for non-SOEs, and external stakeholders will have more trust in SOEs, so there is less demand for carbon information disclosure from SOEs. Non-state-owned enterprises do not have political asylum and face higher environmental governance risks. Stakeholders are more concerned about the carbon information disclosed by non-state-owned enterprises, which must be transmitted to obtain more external support. Therefore, carbon information disclosure among non-state-owned enterprises has a greater impact on enhancing enterprise value. (3) According to Model 4, with the help of the national background, SOEs will pay more attention to environmental governance, social responsibility, and sustainable development, and more funds will be used

for environmental governance. Based on public trust in the national background, carbon information disclosure will further enhance public recognition and support for enterprises. Non-state-owned enterprises do not have advantages in environmental governance, and are faced with greater pressure in relation to environmental protection. Enterprises pursue more short-term benefits during development. Therefore, carbon information disclosure among SOEs has a regulating effect between social responsibility and enterprise value, while that among non-SOEs does not.

5. Conclusions and Suggestions

5.1. Conclusions

This paper selects Shanghai and Shenzhen A-share listed companies in highly polluting industries from 2018 to 2022 as the research object, obtains social responsibility scores from Hexun for the sample companies, builds a carbon disclosure evaluation system to score the sample companies, calculates the carbon disclosure level score of each sample company, and obtains relevant data on enterprise value from the annual reports of the enterprises. The impact of measuring social responsibility and carbon information disclosure on enterprise value is discussed through descriptive statistics, correlation tests, a regression analysis, and robustness tests. The following conclusions are drawn from this study:

(1) Social responsibility is positively correlated with enterprise value. Since the national economic transformation, all sectors of society have put forward higher requirements for the performance of CSR. When enterprises actively fulfill their social responsibilities, they can establish a good social image, gain an extremely high reputation, and improve their value. At the same time, when fulfilling their social responsibilities, enterprises also take into account all stakeholders, which facilitates them to obtain feedback resources from these different subjects and thus enhances their enterprise value. Therefore, fulfilling social responsibilities can promote the improvement of enterprise value.

(2) Carbon information disclosure is positively correlated with enterprise value. In the stock investment market and securities trading market, investors and creditors mainly invest and purchase based on known information. In other words, information determines the number of investors, the investment amounts, and the liquidity of stocks and bonds. An enterprise's disclosure of carbon information can reduce the information risk for investors, lower the level of information asymmetry, and alleviate the doubts of investors and creditors who are worried that national carbon emission policies will hinder the development of that enterprise, which thereby reduces the cost of understanding, focuses their attention on the enterprise, and enables these stakeholders to better and reasonably evaluate the enterprise. This improves the reputation and brand value of the enterprise, and thus enhances its value. At the same time, enterprises' active disclosure of carbon information also reduces the risk of them being punished for violating carbon emission policies and promotes the enterprise value to increase. Therefore, carbon information disclosure can promote the value enhancement of enterprises.

(3) Carbon information disclosure plays a positive role in regulating the relationship between social responsibility and enterprise value. This is because since the national goal of achieving "emissions peak and carbon neutrality" was formulated, the public has been paying more attention to carbon information disclosure in relation to social responsibility disclosure. When enterprises disclose social responsibility information, their sufficient carbon information can better meet the public's information needs and promote enterprise value. Therefore, carbon information disclosure plays a positive role in regulating the relationship between social responsibility and enterprise value.

5.2. Suggestions

5.2.1. Government Perspective

At present, there are guiding documents for social responsibility disclosure in China, such as the Guidelines for Compiling Corporate Social Responsibility Report of the People's Republic of China, the Notice on Strengthening the Work of Listed Companies to Assume Social Responsibilities issued by the Shanghai Stock Exchange, etc. There are also guiding documents for environmental information disclosure, such as the Guidelines for Environmental Information Disclosure of Listed Companies issued by the Shanghai Stock Exchange, etc. However, in terms of carbon, the domestic guidance document on carbon information disclosure is still blank. Therefore, it is suggested that the relevant departments issue indexed and quantitative information disclosure guidelines regarding carbon emission reduction strategies, risks and opportunities, management, accounting, authentication, and performance.

5.2.2. Enterprise Perspective

China is on its way to economic transformation, and has put forward strategic goals of "carbon emissions peaking and carbon neutrality", which have put forward higher requirements for CSR fulfillment and carbon information disclosure. The public now pays more attention to enterprises' fulfillment of social responsibilities and their disclosure of carbon information. Therefore, enterprises should comply with the requirements of the times and set an example. On the premise of ensuring the sustainable development of companies, they should assume social responsibilities, carry out carbon management and carbon investment, and actively make their contributions to this national goal. At the same time, based on relevant management and investment, enterprises should formulate relevant information disclosure standards to show their own management and investment status in an all-round, indexed, and quantitative way, provide more sufficient information, attract more investments, and enhance their enterprise value.

5.3. Research Limitations and Prospects

Firstly, carbon information disclosure has been proposed in China for a relatively short time, and many companies produce carbon emissions but have not disclosed their carbon information. On the one hand, there is no unified disclosure standard for carbon information disclosure in China, and the forms of carbon information disclosure among listed companies are diverse and vary greatly. On the other hand, there is no unified evaluation index standard for the method of measuring carbon information disclosure, which leads to more measurement methods in existing research. Although we have comprehensively considered the advantages and disadvantages of various methods in our research, there is a certain subjectivity in the construction and measurement of carbon information disclosure indicators, and the measurement of each indicator does not consider the weighting, ignoring the weights of different information contents on the impact of different enterprises. Secondly, this article selected China's highly polluting industries as the research sample, but in actual production, some high-energy-consumption and high-carbon enterprises can also cause significant environmental pollution, and we have not yet considered this as part of our sample.

In future research, based on the policy documents related to carbon information disclosure issued by China after 2021, there will be more scientific and reasonable methods and norms for evaluating and measuring carbon information disclosure. At the same time, we will also attach importance to practical work; obtain more objective data through field research, questionnaire surveys, and other methods; and conduct a more comprehensive evaluation and measurement of carbon information disclosure. For the issue of sample selection, as energy conservation and emission reduction have become a global focus, any industry or enterprise must take low-carbon actions. Therefore, expanding the scope of sample selection and drawing more reasonable conclusions is the next requirement.

Author Contributions: Conceptualization, F.S. and Y.W.; methodology, F.S.; software, F.S.; validation, Y.W.; formal analysis, Y.W.; investigation, F.S.; data curation, Y.W.; writing—original draft preparation, F.S.; writing—review and editing, Y.W.; project administration, Y.W.; funding acquisition, Y.W. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Social Science Fund of China, grant number 19BJL043. The APC was funded by Y.W.

Informed Consent Statement: Not applicable.

Data Availability Statement: This study's data are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

References

Abdelqader, Muath, Ali Uyar, and Cemil Kuzey. 2024. CSR transparency and firm value: Is the connection differential for cost leaders and differentiators? *Journal of Cleaner Production* 443: 141102. [CrossRef]

Aupperle, Kenneth E., Archie B. Carroll, and John D. Hatfield. 1985. An Empirical Examination of the Relationship between Corporate Social Responsibility and Profitability. *Academy of Management Journal* 28: 446–63. [CrossRef]

Bai, Shixiu, and Yu Wang. 2018. A Review of Carbon Information Disclosure Research—Analysis based on domestic core journal literature. *Communication of Finance and Accounting* 28: 44–48.

Brick, Ivan E., and Yankuo Qiao. 2024. Attunement theory, CEO's cyclical influence on corporate social responsibility and firm value. *Managerial Finance* 50: 75–91. [CrossRef]

Chen, Xujiang, and Tingting Liu. 2021. Research on the Impact of Corporate Social Responsibility Management and Practice Capability on Corporate Performance. *Journal of Technology Economics* 40: 140–48.

Cheng, Beiting, Ioannis Ioannou, and George Serafeim. 2014. Corporate Social Responsibility and Access to finance. *Strategic Management Journal* 35: 1–23.

Clarkson, Peter M., Michael B. Overell, and Larelle Chapple. 2011. Environmental reporting and its relation to corporate environmental performance. *Abacus* 47: 27–60. [CrossRef]

Crisóstomo, Vicente Lima, Fatima de Souza Freire, and Felipe Cortes De Vasconcellos. 2017. Corporate social responsibility, firm value and financial performance in Brazil. *Social Science Electronic Publishing* 7: 295–309. [CrossRef]

D'Amato, Antonio, and Camilla Falivena. 2020. Corporate social responsibility and firm value: Do firm size and age matter? Empirical evidence from European listed companies. *Corporate Social Responsibility and Environmental Management* 27: 909–24. [CrossRef]

Deegan, Craig, and Michaela Rankin. 1996. Do Australian companies report environmental news objectively?: An analysis of environmental disclosures by firms prosecuted successfully by the environmental protection authority. *Accounting Auditing & Accountability Journal* 9: 50–67.

Downar, Benedikt, Jürgen Ernstberger, Stefan Reichelstein, Sebastin Schwenen, and Aleksandar Zaklan. 2021. The impact of carbon disclosure mandates on emissions and financial operating performance. *Review of Accounting Studies* 26: 1137–75. [CrossRef]

Du, Ziping, and Genzhu Li. 2019. Research on the Impact of Carbon Information Disclosure on Enterprise Value. *Friends of Accounting* 16: 66–70.

Flammer, Caroline. 2018. Competing for government procurement contracts: The role of corporate social responsibility. *Strategic Management Journal* 39: 1299–324. [CrossRef]

Freeman, R. Edward, and William M. Evan. 1990. Corporate governance: A stakeholder interpretation. *Journal of Behavioral Economics* 19: 337–59. [CrossRef]

Ganda, Fortune. 2017. The influence of carbon emissions disclosure on company financial value in an emerging economy. *Environment Development and Sustainability* 20: 1723–38. [CrossRef]

Godfrey, Paul C. 2005. The Relationship between Corporate Philanthropy and Shareholder Wealth. A Risk Management Perspective. *The Academy of Management Review* 30: 777–98. [CrossRef]

Gong, Ning, Jin Li, Congjia Luo, and Maosheng Duan. 2024. A Study on the Motivation and Economic Consequences of Carbon Information Disclosure by Enterprises in High Carbon Emission Industries: An Empirical Analysis Based on Listed Companies. *Securities Market Herald* 5: 14–24.

Gutsche, Robert, Jan-Frederic Schulz, and Michael Gratwohl. 2016. Firm-value effects of CSR disclosure and CSR performance. Paper presented at AAA—Annual Meeting 2016—Concurrent Session—Nonfinancial Disclosures and Firm Value, New York, NY, USA, August 8.

Hadiyansahand, Mohammad, Aisa Tri Agustini, and Indah Purnamawati. 2021. The Effect of Carbon Emission Disclosure on Firm Value: Environmental Performance and Industrial Type. *The Journal of Asian Finance, Economics and Business* 8: 123–33.

Harmes, Adam. 2011. The Limits of Carbon Disclosure: Theorizing the Business Case for Investor Environmentalism. *Global Environmental Politics* 11: 98–119. [CrossRef]

He, Yu, Qingliang Tang, and Kaitian Wang. 2014. Carbon Disclosure, Carbon Performance, and Cost of Capital. *Accounting Research* 1: 79–86+95. [CrossRef]

Healy, Paul M., and Krishna G. Palepu. 2001. Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics* 31: 405–40. [CrossRef]
Huang, Xiaobei, and Luke Watson. 2015. Corporate social responsibility research in accounting. *Journal of Accounting Literature* 34: 1–16. [CrossRef]
Hummel, Katrin, and Christian Schlick. 2016. The relationship between sustainability performance and sustainability disclosure-reconciling voluntary disclosure theory and legitimacy theory. *Journal of Accounting and Public Policy* 35: 455–76. [CrossRef]
Isabelle, Maignan, and O. C. Ferrel. 2004. Corporate social responsibility and marketing: An integrative framework. *Journal of the Academy of Marketing Science* 32: 3–19.
Iskandar, Diah, and Efita Fran. 2016. The Effect of Carbon Emissions Disclosure and Corporate Social Responsibility on the Firm Value with Environmental Performance as Variable Control. *Research Journal of Finance and Accounting* 7: 122–30.
Jiang, Yan, Le Luo, JianFeng Xu, and XiaoRui Shao. 2021. The value relevance of corporate voluntary carbon disclosure: Evidence from the united states and BRIC countries. *Journal of Contemporary Accounting & Economics* 17: 100279.
Kurnia, Pipin, Edfan Darlis, and Adhitya Agri Putra. 2020. Carbon EmissionDisclosure, Good Corporate Governance, Financial Performance, and FirmValue. *Journal of Asian Finance, Economics and Business* 7: 223–31. [CrossRef]
Lee, Jeong-Hwan, and Jin-Hyung Cho. 2021. Firm-Value Effects of Carbon Emissions and Carbon Disclosures—Evidence from Kore. *International Journal of Environmental Research and Public Health* 18: 12166. [CrossRef]
Lee, Su Yol, Yun-Seon Park, and Robert D. Klassen. 2013. Market responses to firms' voluntary climate change information disclosure and carbon communication. *Corporate Social Responsibility and Environmental Management* 22: 1–12. [CrossRef]
Li, Huiyun, Jing Shi, Hang Li, Shaoyan Fu, and Zheyuan Yang. 2018. Public Pressure, Equity Natuer and Carbon Information Disclosure. *Statistics & Information Foru* 33: 94–100.
Li, Huiyun, Shaoyan Fu, and Peng Gao. 2016. Media Attention, Carbon Disclosure and Corporate Value. *Statistical Research* 33: 64–69.
Li, Li, Quanqi Liu, and Dengli Tang. 2019. Carbon Performance, Carbon Information Disclosure Quality and Cost of Equity Financing. *Management Review* 31: 221–35.
Li, Xueting, Chang Song, and Xuemeng Guo. 2017. Enterprise-value Effect of Carbon Disclosure. *Management Review* 29: 175–84.
Lian, Hongda, Yuyou Zou, and Tianyi Ma. 2024. The Value Effect of Carbon Information Disclosure Quality in Enterprises under the "Dual Carbon" Goal: A Regulatory Effect Based on Institutional Isomorphic Pressure. *Academic Exchange* 3: 112–25.
Lin, Lin, Hongjuan Yang, and Bin Yang. 2023. Does ESG's Performance Enhance Corporate Value in the Context of Dual Carbon Targets: An Empirical Study Based on CSI 300 Index and CS 500 Stocks. *Scientific Decision Making* 6: 42–63.
Lins, Karl V., Henri Servaes, and Ane Tamayo. 2016. Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *Journal of Finance* 10: 1785–824.
Liu, Lina, and Yingxin Zhao. 2023. Quality of Carbon Information Disclosure, Carbon Emission Trading, and Green Innovation of Enterprises: Empirical Evidence from Listed Companies in China's High Carbon Industry. *Friends of Accounting* 17: 27–34.
Liu, Yufen, and Ying Liu. 2019. Carbon Information Disclosure, Investor Confidence, and Corporate Value. *Finance and Accounting Monthly* 18: 39–42.
Loe, Le. 2017. The influence of institutional contexts on the relationship between voluntary carbon disclosure and carbon emission performance. *Accounting and Finance* 59: 1235–64.
Lopin, Kuo, Chin-Chen Yeh, and Hu-Cheng Yu. 2012. Disclosure of corporate social responsibility and environmental management: Evidence from China. *Corporate Social Responsibility and Environmental Management* 19: 273–87.
Louise, Tourigny, Jian Han, Vishwanath V. Baba, and Polly Pan. 2019. Ethical Leadership and Corporate Social Responsibility in China: A Multilevel Study of Their Effects on Trust and Organizational Citizenship Behavior. *Journal of Business Ethics* 158: 427–440.
Martin, Patrick R., and Donald V. Moser. 2015. Managers' green investment disclosures and investors' reaction. *Journal of Accounting and Economics* 61: 239–54. [CrossRef]
Peloza, John. 2006. Using Corporate Social Responsibility as Insurance for Financial Performance. *California Management Review* 48: 52–72. [CrossRef]
Perkins, Jon, Cynthia Jeffrey, and Martin Freedman. 2022. Cultural influences on the quality of corporate social responsibility disclosures: An examination of carbon disclosure. *Sustainability Accounting, Management and Policy Journal* 13: 1169–200. [CrossRef]
Pfeffer, Jeffrey, and Gerald R. Salancik. 1978. *The External Control of Organizations: A Resource Dependence Perspective*. San Francisco: Stanford University Press.
Shen, Hongtao. 2022. Research on Carbon Information Disclosure in China under the "Dual Carbon" Goal. *Journal Friends of Accounting* 3: 1–9.
Siddique, Abubakar, Akhtaruzzaman, Afzalur Rashid, and Helmi Hammami. 2021. Carbon disclosure, carbon performance and financial performance: International evidence. *International Reviews of Financial Analysis* 75: 101734. [CrossRef]
Song, Xiaohua, Xiao Jiang, Jingjing Han, Caiping Zhao, Yiwei Guo, and Zhongfu Yu. 2019. Research on the Value Effect of Enterprise Carbon Information Disclosure—Based on the Adjustment of Public Pressure. *Accounting Research* 12: 78–84.
Sun, Xiaohua, Tianqi Che, and Xuejiao Ma. 2023. Catering Behavior of Firms'Carbon Information Disclosure: Identification, Premium Loss and Mechanisms. *China Industrial Economics* 1: 132–50.
Sun, Zhimei, Xuli Zhang, and Lihua Lu. 2019. Comparison of Carbon Information Disclosure among CDP Climate Change A-level Enterprises. *Friends of Accounting* 3: 112–16.

Tang, Yonhjun, Wenchao Ma, and Li Xia. 2021. Quality of Environmental Information Disclosure, Internal Control "Level"and Enterprise Value—Empirical Evidence from Listed Companies in Heavy Polluting Industries. *Accounting Research* 7: 69–84.
Tsang, Albert, Kun Tracy Wang, Yue Wu, and Jeff Lee. 2024. Nonfinancial Corporate Social Responsibility Reporting and Firm Value: International Evidence on the Role of Financial Ana-lysts. *European Accounting Review* 33: 399–434.
Wang, Deqing, Huang Yi, Mengxia Guo, Zhihao Lu, Shoucong Xue, and Yan Xu. 2023. Time dynamics in the effect of carbon information disclosure on corporate value. *Journal of Cleaner Production* 425: 138858. [CrossRef]
Wang, Jianling, Yueting Li, and Xuan Wu. 2019. Corporate Social Responsibility and Risk-taking Behavior: Based on Resource Dependence Theory. *Frontiers of Science and Technology of Engineering Management* 38: 45–51.
Wang, Juncai, and Xiaoye Niu. 2013. Empirical Research on the Factors and Market Reaction of Voluntary Responding to Carbon Disclosure Project Questionnaire—Based on CDP China Report from 2008 to 2011. *Journal of Central University of Finance & Economics* 1: 78–85.
Wang, Lin, and Yawei Li. 2022. Can strengthening social responsibility information disclosure enhance corporate value—An Empirical Study Based on Default Risk and Same Group Effect. *Review of Investment Studies* 41: 105–19.
Wang, Lin, Yonghui Lian, and Jie Dong. 2022. Research on the Impact Mechanism of ESG Performance on Enterprise Value. *Securities Market Herald* 5: 23–34.
Wang, Liping, Shuqin Li, and Chuang Li. 2020. Research on the Impact of Environmental Information Disclosure on Enterprise Value from the Perspective of Marketization. *Resources and Environment in the Yangtze Basin* 29: 1110–18.
Wang, Yuxin, and Yuanzhu Wei. 2023. The Impact of the Quality of Carbon Accounting Infoumation Disciosure of the Listed Forestry Companies on the Enterprises Value. *Issues of Forestry Economics* 43: 490–99.
Wu, Jing, and Chee Yoong Liew. 2023. Revisiting the nexus between corporate social responsibility and corporate value: Evidence from China. *Corporate Social Responsibility and Environmental Management* 31: 2066–85. [CrossRef]
Xi, Jinping. 2017. Decisive victory in building a moderately prosperous society in all respects, and the great victory of socialism with Chinese characteristics in the new era. Paper presented at Report at the 19th National Congress of the CPC, Beijing, China, October 18; Beijing: People's Publishing House, vol. 10.
Yan, Haizhou, and Baizhu Chen. 2017. Climate Change, Environment Regulation and the Firm Value of Carbon Emissions Disclosure. *Journal of Financial Research* 6: 142–58.
Yang, Huixian, and Zhaoxia Zhen. 2017. Research on the Influence of Regions on Enterprise Carbon Information Disclosure. *Journal of Xi'an Shiyou University (Social Science Edition)* 26: 23–29.
Yang, Yuanhua, and Li Li. 2017. Research on the Lag Effect of Carbon Information Disclosure on Enterprise Value Creation. *Soft Science* 31: 109–13.
Yang, Zixu, Juan Peng, and Qingliang Tang. 2018. Comparative Study of Compulsory and Voluntary Carbon Disclosure: Experience from China's Capital Market. *Journal of Systems & Management* 27: 452–61.
Ye, Chengang, Zi Wang, Jianfeng Wu, and Hui Li. 2015. External Governance, Environmental Information Disclosure and the Cost of Equity Financing. *Nankai Business Review* 18: 85–96.
Zhang, Xiaoxue. 2023. Study on the Relationship between Corporate Value, Corporate Social Responsibility, and Innovation. *Scientific Decision Making* 4: 92–102.
Zhao, Yuzhen, Yajie Qiao, and Junmei Zhao. 2019. Research on the Relationship among Heterogeneity of Institutional Investors, Carbon Information Disclosure and Firm Value. *Price: Theory & Practic* 10: 87–90.
Zhou, Zhiyong, Yanhong Wu, and Qinghua Xie. 2024. Social responsibility, information technology, and high-quality development of mining enterprise using structural equation modeling (SEM). *Resources Policy* 91: 104925. [CrossRef]
Zhu, Jing, Chen Zhang, Jingsong Zhao, Yuanpu Ji, and Wenjun Wang. 2024. The impact of declarative and interactive carbon disclosure on firm value: Complements or substitutes? *Environment, Development and Sustainability* 26: 13375–409. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.