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How Does Corporate Social Responsibility Affect Corporate Productivity? The Role of Environmental Regulation

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Abstract: Corporate social responsibility (CSR) plays a vital role in facilitating sustainable long-term development. Despite its importance, the specific mechanisms through which CSR interacts with business productivity have not been extensively explored. This paper selects 4167 Chinese enterprises from 2011 to 2021 for study to elucidate this mechanism. The results of the study show that (i) CSR has a significant positive effect on enterprise productivity. (ii) Environmental regulation has a negative and significant moderating effect on the effect of CSR. After endogeneity and robustness tests, the findings of (i) and (ii) remain valid. (iii) There is heterogeneity in (i)–(ii) concerning corporate social responsibility, corporate shareholding structure, region, and degree of marketization. Based on these findings, sound recommendations are proposed for enterprise managers and governments.

Keywords: corporate social responsibility; corporate productivity; environmental regulation; moderating effects

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1. Introduction

As a core component of corporate objectives, corporate social responsibility (CSR) is crucial to studying enterprise-idiosyncratic risks and the dissection of stakeholder governance mechanisms. It has become a critical issue that modern enterprises must face to sustain their operations [1]. According to stakeholder theory and legitimacy theory, CSR is an enterprise's legal or ethical responsibility to its stakeholders, such as shareholders, employees, suppliers, and consumers. By fulfilling corporate social responsibility, an enterprise not only shapes its reputation but also influences stakeholders' perceptions of the enterprise. This will have an impact on the enterprise's production [2], which is significant in enhancing the corporate total factor productivity. Corporate social responsibility is also a signal. By disclosing corporate social responsibility information, an enterprise can satisfy its stakeholders about its operations, leading to more investment and support [3]. Transparent and positive CSR performance can convey the long-term value of an enterprise to the market and positively affect the long-term TFP.

In their pursuit to maximize economic benefits, enterprises may encounter issues such as environmental pollution, deteriorating labor conditions, unpaid wages, defaulted payments, malicious debt evasion, poor product and service quality, and tax evasion [4]. Ignoring corporate social responsibility may lead to short-term profits but falls short of achieving long-term development. Therefore, enterprises should pay attention to corporate social responsibility to promote enterprises to achieve sustainable development.

Corporate total factor productivity (TFP) plays a vital role in enterprise development, especially at a time when China's economy is undergoing an essential transition from factor-driven to innovation-driven. TFP not only reflects the core competitiveness of an enterprise, but also attracts extensive attention from market participants and stakeholders [5]. As a reliable indicator of an enterprise's innovation capability, TFP also has a significant impact on market value [6].

In China, there is a widespread view that increasing enterprise TFP often requires sacrificing corporate social responsibility. Many enterprises may choose to ignore their

corporate social responsibility in order to maximize profits. However, Xia and Xu (2020) pointed out that by optimizing energy and industrial structure, enterprises can also increase productivity without sacrificing the environment [7]. Therefore, this paper examines the corporate total factor productivity of Chinese enterprises, intending to promote the rational allocation and reallocation of productive resources [8], and offers insights for sustainable corporate growth.

In addition, environmental regulation (ER) plays an essential role in the relationship between CSR and TFP. In recent years, global warming and environmental degradation have received widespread attention. In this context, China has proposed a new development concept that advocates sustainable development and encourages enterprises to transform to green and low-carbon development while safeguarding economic efficiency. On 1 January 2018, China implemented the Environmental Protection Tax Law and began to formally levy an environmental tax on enterprises that discharge taxable pollutants. Moreover, China is also improving its environmental subsidy mechanism to encourage enterprises to adopt environmentally friendly technologies and processes to reduce pollution emissions and enhance environmental protection.

Currently, increasingly stringent environmental regulations may impose additional constraints on corporate decision-making processes [9], increasing the operating costs and financial burdens on enterprises. Under such pressure, some enterprises may avoid corporate social responsibility, resulting in "greenwash" behavior, negatively affecting corporate productivity. However, the Porter Hypothesis suggests that environmental regulation may also stimulate innovative activities by enterprises, prompting them to adopt more efficient production methods and develop new environmentally friendly technologies, thereby increasing their productivity [10]. Many scholars have studied how corporate productivity is affected by various factors. However, the impact of corporate social responsibility on enterprise productivity has yet to be sufficiently studied.

Despite valuable insights from previous literature, two research gaps remain. Firstly, since Oliver Sheldon (1924) first introduced the concept of CSR, a substantial amount of research has explored the positive impacts of CSR on corporate reputation, company value, profitability, and investment efficiency [11–14]. However, the specific mechanisms through which CSR affects TFP remain unclear, especially regarding its applicability and heterogeneity. Moreover, the different effects of heterogeneous corporate social responsibility on productivity have not been adequately studied. Secondly, while previous studies have examined the U-shaped relationship between environmental regulation and green technological innovation [15], there has been no in-depth research into whether environmental regulation might have a synergistic effect with CSR, or if they have contrary impacts on each other. The contributions of this paper are as follows. Firstly, from a research perspective, this paper considers the impact of corporate social responsibility on stakeholders, and therefore on enterprise productivity, which completes the research in this area. The empirical results show that CSR has a positive and significant effect on TFP. This paper also investigates how environmental tax and subsidiaries can negatively and significantly moderate the relationship between CSR and corporate productivity. Examining the heterogeneity of CSR indicators, I found that the responsibilities towards shareholders and employees have a significant positive impact on productivity. Regarding enterprise heterogeneity, CSR has a more significant positive impact on TFP in non-state-owned enterprises than in state-owned enterprises. Regional heterogeneity analysis indicates that while CSR has a more significant positive impact on TFP in the eastern regions, the difference is not statistically significant. In central and western regions, environmental taxes have a more notable dampening effect on the positive outcomes of CSR. In contrast, in the eastern regions, environmental subsidies are more effective in promoting CSR effects. Considering the heterogeneity of marketization levels, CSR has a more evident productivity improvement effect in areas with lower marketization, and the negative regulatory effect of environmental taxes on productivity is more evident in these regions. From the perspective of CSR disclosure, there is a significant positive correlation between mandatory CSR disclosure and

TFP. Secondly, from the research design, this paper considers the heterogeneity of corporate social responsibility and the heterogeneity of enterprise type, region, and marketization. This paper first incorporates corporate social responsibility, total factor productivity, and environmental regulation into one research framework. The paper utilizes panel data from 4167 enterprises from 2011 to 2021 and examines the moderating effects of corporate social responsibility and heterogeneous environmental regulations on total factor productivity.

The rest of the paper is organized as follows. Section 2 is the literature review, Section 3 is the mechanism analysis, and Section 4 is the principal research methodology, including the model setup, the definition of relevant variables, sample selection, and data sources. Section 5 is the analysis of empirical results, including the endogeneity test and robustness test. Section 6 analyzes the impact of heterogeneous corporate social responsibility and the moderating effect of heterogeneous environmental regulation. Section 7 is the conclusion and provides relevant recommendations for enterprise managers and policymakers.

2. Literature Review

2.1. Studies on Corporate Social Responsibility

Corporate social responsibility (CSR) refers to "actions and strategies of companies that consider stakeholder expectations and the triple bottom line of economic, social and environmental benefits" [16].

The importance of CSR to business has been rising. In the late 1970s, less than 50 percent of Fortune 500 companies mentioned social responsibility in their annual reports. In comparison, by the end of the 1990s, about 90 percent of companies had made it a core component of their corporate goals [17].

The impact of CSR on enterprise development is reflected in both internal and external perspectives. From the perspective of internal enterprise development, CSR may first impact financial performance. The fulfillment of CSR is an externalization of corporate ethics and values, and responsible management is conducive to gaining market trust and sustainably obtaining various types of capital inputs from stakeholders, thus contributing to corporate financial performance [18]. However, CSR has different impacts on long- and short-term financial performance. While active CSR may not significantly impact short-term financial performance, it can directly contribute to the long-term financial performance of enterprises [19]. At the same time, the increase in corporate financial performance will also have a positive impact on the enterprise's fulfillment of social responsibility. Therefore, there is a mutually reinforcing and promoting relationship between CSR and corporate financial performance [18]. Moreover, the impact of CSR on financial performance is particularly significant in larger enterprises [20]. Additionally, CSR can promote the realization of value creation. In the long run, according to the critical stakeholder theory and social capital theory, there is a positive correlation between taking social responsibility and corporate value [21]. Thirdly, CSR has an impact on consumer willingness and behavior. Whether in terms of treating employees well, environmental protection, or charitable donations, CSR behaviors significantly impact consumer purchase intention. By fulfilling CSR, it enhances corporate reputation and customer satisfaction, thus affecting customer loyalty. Finally, the complex relationship between CSR behaviors and consumer responses is influenced by consumer characteristics and product features [22,23]. Therefore, by improving the quality of their products, enterprises are tantamount to fulfilling their corporate social responsibility to consumers.

From an external perspective, CSR may influence outsiders' perceptions of the company, thus promoting the development of the company. The formulation and implementation of social responsibility strategy, the fulfillment of social responsibility, and the disclosure of social responsibility information may affect investors' judgment on the operating conditions and profit sustainability of the enterprise [24]. Higher CSR fulfillment leads to better corporate performance and increases the information content of enterprise surplus. It elevates the market's evaluation of the company and its reputation, which may attract more investment and enhance the productivity of the company.

Finally, different scholars have studied the measurement of CSR from different aspects. Carroll (1979) believed that CSR includes economic, legal, ethical, and voluntary (philanthropic) responsibility [25]. Chen and Han (2005) classified CSR into three levels according to the closeness of the relationship between social responsibility and enterprise [26]. The first is basic CSR, including responsibility to shareholders and treating employees well; the second is intermediate CSR, including responsibility to consumers, obeying government leadership, improving relations with the community, and protecting the environment; and the third is advanced CSR, including active charitable donations and enthusiasm for public welfare [27]. classified the measurement of CSR into five dimensions: giving back to society, sponsoring social welfare such as education and culture, protecting consumers' rights and interests, protecting the natural environment, and assuming responsibility for economic aspects. Inoue and Lee (2011) classified it into five dimensions: employee relations, product quality, community relations, environmental issues, and diversity issues [28].

2.2. Studies on Total Factors Productivity

Total factor productivity (TFP) is often interpreted as the "surplus" in total output that cannot be accounted for by factor inputs and reflects the average level of output per unit of the various input factors in the production process, i.e., the overall efficiency with which inputs are transformed into final output [29].

The enterprises' internal control and the external environment can affect total factor productivity. From the viewpoint of firms' internal control, firstly, technology development and transformation inputs have a significant positive correlation with corporate total factor productivity [30]. The increase in inputs may enhance technological efficiency and frontier technological advancement, which are the main structural factors for the growth of TFP [31]. Secondly, enterprise reforms can facilitate the entry of other capital into Chinese SOEs, which can revitalize corporate dynamism and increase TFP. Among these reforms, complete privatization of SOEs and state-controlled mixed-ownership reforms have been found to enhance TFP. Of these, mixed-ownership reforms stand out, especially in competitive industries, where they significantly affect enterprise efficiency [32]. Thirdly, digital factors of production have become an emerging strategic option for firms. Digital transformation of enterprises may contribute to TFP by improving innovation capability, optimizing human capital structure, reducing costs, and promoting the integration of advanced manufacturing and modern service industries [33].

External factors, including both formal and informal regulations, also significantly impact TFP. On the one hand, government regulation plays a vital role in the formal environment and has an impact on TFP in both the short and long term. In the short run, industrial policy can have an impact on total factor productivity, which varies according to the characteristics of firms. In the long run, the government can create an excellent institutional environment to increase TFP through financial marketization, mixed ownership reform, and other initiatives [34]. Moreover, increased government protection of intellectual property rights (IPR) strengthens the impact on firm productivity [35]. An increase in the level of IPR protection may provide incentives for the commercialization of patents, increase the innovation efficiency of firms, and contribute to the productivity of firms [36]. A high level of IPR protection also amplifies the benefits of firms' innovation investment and promotes more innovation investment, which can increase TFP [32].

On the other hand, the informal environment, shaped by public attention, media attention, and stakeholders, also affects TFP. Voluntary regulation impacts TFP mainly by inhibiting the efficiency of technological innovation and balanced regional development while promoting scale efficiency [37]. Media monitoring has a positive moderating effect on the relationship between corporate total factor productivity [38], which mainly works on productivity through four channels: information transparency, financing constraints, internal control, and enterprise innovation [39]. Stakeholders mainly include controlling shareholders, employees, and consumers. Among them, the controlling shareholders of an enterprise may, through their role in corporate governance, influence how the firm

converts inputs into outputs, which, in turn, affects the firm's overall performance [40]. Therefore, enterprises need to consider controlling shareholders' interests. It is also essential to consider the wishes of stakeholders other than shareholders and utilize them to gain access to more resources to improve the enterprise [41,42].

Regarding the total factor productivity measurement methods of enterprises, there are several standard methods such as the least squares method (OLS), fixed effects model (FE), Olley–Pakes method (OP method), Levinsohn–Petrin method (LP method), and GMM method. Using the least squares method, Qu et al. (2019) empirically demonstrated that industrial agglomeration in most industries significantly promotes green total factor productivity [43]. Jin et al. (2006) discussed that the introduction of technology cannot effectively promote total factor productivity [44]. Sheng et al.(2020) demonstrated a significant positive correlation between firms' asset-light operations and total factor productivity using a fixed-effects model [45], Lai et al.(2022), based on the provincial panel data of China from 2004 to 2019, showed the media attention can strengthen the environmental regulation and thus the promotion effect on green total factor productivity [46]; Tian and Liu (2021) used LP semiparametric method and ACF method to measure the total factor productivity of listed digital economy enterprises in China from 2013 to 2018 [47]; Zhang et al. (2007) used enterprise survey data from 1999 to 2003 to estimate the total factor productivity of enterprises using the OP method [48]; Yang (2015) relied on the database of Chinese industrial enterprises from 1998 to 2009 to calculate corporate total factor productivity at the enterprise level based on the LP and OP methods in order to examine in detail the dynamic change of total factor productivity of Chinese manufacturing enterprises [49]. Chen et al.(2021) measured total factor productivity based on data from listed companies using the LP and OP methods [50].

3. Mechanism Analysis

3.1. Corporate Social Responsibility and Total Factors Productivity

Corporate social responsibility (CSR) affects total factor productivity (TFP) mainly from both internal and external perspectives. Internally, CSR is reflected in the responsibility to stakeholders such as stockholders, employees, and consumers. It affects corporate TFP through improving corporate governance, employee relations, product strengths, and diversity within the firm.

Firstly, CSR impacts TFP through corporate governance. Equity liberalization has a positive impact on corporate TFP, which is reinforced by indirect management effects [51]. Moreover, as corporate social responsibility status improves, enterprises can increase CEO risk-taking incentives by adjusting compensation contracts aimed at responding to risky environments associated with CSR status [52]. Changes in CEO risk-taking incentives have an impact on enterprise productivity. An appropriate mix of incentives can contribute to an increase in TFP [53]. In addition, CSR behaviors can effectively guide the allocation of factors within the enterprise, enhancing the efficiency of resource allocation and TFP [54].

Secondly, employee relations also affect corporate total factor productivity in different ways. Corporate culture can unite different members of an organization and improve employee dedication and productivity [55], thus increasing corporate total factor productivity. In addition, employee share ownership schemes increase TFP by easing corporate financing constraints, reducing employee turnover, motivating employees to invest in human capital, and improving the efficiency of corporate decision-making and execution [56].

Thirdly, product superiority may have a positive impact on corporate TFP. Enterprises mainly improve product quality through technological R&D expenditures, and investment in CSR will increase the investment in technological innovation, enhancing TFP [19]. Kumbhakar et al. (2010) argued that enterprises should pay attention to R&D in the high-technology sector and support R&D in the medium-technology sector to a certain extent to improve TFP [57]. As for the low-technology sector, increased R&D investment may have a negligible impact on productivity, but it can encourage investment in fixed assets, which may indirectly affect TFP.

Finally, diversity within the enterprise can also significantly impact corporate TFP. Board diversity, such as the presence of female members on the board, may increase corporate TFP. However, this effect is more pronounced in low-productivity firms and has a lesser impact on high-productivity firms. In addition, the diversity of firm ownership, particularly the presence of foreign ownership, plays a vital role in increasing productivity.

Externally, first, corporate social responsibility can use philanthropic volunteering as an incentive lever to increase corporate TFP by increasing social incentives [58,59]. Second, changes in the external environment may affect the effects of corporate social responsibility. Weak environmental regulation can lead to lower environmental costs for enterprises, which reduces their incentives to fulfill their environmental responsibilities and weakens the motivation for technological innovation. As a result, TFP may decrease [60]. When environmental regulation is raised to a reasonable range, enterprises may promote corporate TFP through innovative strategies [61].

However, the fulfillment of corporate social responsibility may increase operating costs and add to the financial burden of the enterprise, resulting in the enterprise not having sufficient funds to invest in technological innovation, thus lowering its productivity. In the short term, enterprises' actions, such as improving employee welfare, reforming internal structures, and investing in product research and development, have a long payback period, and the results are not necessarily proportional to the investment.

Hypothesis 1a. *Corporate social responsibility is positively correlated with total factors productivity.*

Hypothesis 1b. *Corporate social responsibility is negatively correlated with total factors productivity.*

3.2. Corporate Social Responsibility, Environmental Regulation and Total Factors Productivity

Environmental regulation is considered as a measure to combat pollution and protect the environment. Environmental taxes are mandatory environmental regulations imposed by the government on enterprises, which internalize the costs of environmental damage into production costs and market prices by charging enterprises for their negative externalities [21] to achieve a rational allocation of resources through the market mechanism. Environmental subsidies are policies led by the Ministry of Finance and local governments to help enterprises improve environmental protection equipment and processes [62]. By compensating the production costs of green enterprises, they are incentivized to carry out green innovation and technological upgrading.

In short, environmental regulation effectively compensates the R&D expenses and pollution control costs of enterprises in green technological innovation by increasing the illegal costs of polluters and giving additional incentives and financial support to environmental protectors, which motivates enterprises to increase the R&D of green technologies, improve the efficiency of resource utilization, and, in turn, increase the productivity of enterprises.

However, environmental regulations may reduce entrepreneurial risk-taking, and entrepreneurs may choose to obtain financial support by increasing CSR, thus neglecting to upgrade technology and improve resource allocation. The imposition of environmental taxes may also impose additional costs on firms, thus reducing their investment in innovation. In addition, the implementation of environmental subsidies by the government may lead to subsidy cheating and rent-seeking by firms, which may result in policy failure and waste of public resources [63]. Several of the above scenarios may lead to a reduction in corporate total factor productivity.

Therefore, regarding the regulatory effect of environmental regulations on the relationship between corporate social responsibility and total factor productivity, the hypothesizes are proposed as follows:

Hypothesis 2a. *Environmental regulation positively moderates the role of corporate social responsibility in the total factor productivity.*

Hypothesis 2b. *Environmental regulation negatively moderates the role of corporate social responsibility in the total factor productivity.*

The research framework is presented in Figure 1.

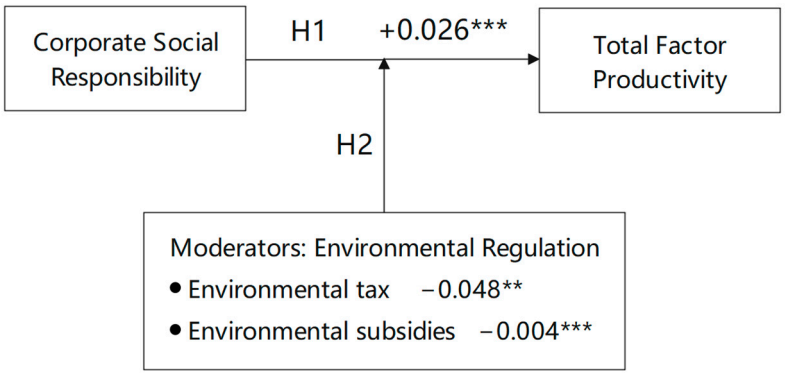

Figure 1. Research framework. Notes: *** and ** indicate significance at the 1% and 5% levels, respectively.

4. Methodology

4.1. Model Setting

Based on the above theoretical analysis, this paper chose a panel data model to test the impact of CSR on total factor productivity. The panel data model was set as follows:

$$TFP_{it} = \beta_0 + \beta_1 CSR_{it} + \theta X_{it} + \vartheta_k + \tau_t + \varepsilon_{it}$$

where TFP_{it} represents the total factors productivity of corporate i in year t; CSR_{it} is the corporate social responsibility of corporate i in year t. X_{it} represents a vector of control variables. I chose corporate size, leverage, liquidity ratio, Tobin Q, shareholding concentration, and management incentives. ∂_k and τ_t refer to the fixed-industry effect and fixed-time effects. ε_{it} means the error term. β_0 is the constant term. β_1 represents the coefficient of the corporate social responsibility, which is the focus of my study, reflects the impact of corporate social responsibility on total factors productivity. If β_1 is positive, Hypothesis 1a is supported, and if not, Hypothesis 1b is supported.

To test Hypothesis 2 by including a cross-term for the corporate social responsibility and the total factors productivity, I then established the model as follows:

$$TFP_{it} = \beta_0 + \beta_1 CSR_{it} + \beta_2 ER_{it} + \beta_3 CSR * ER_{it} + \theta X_{it} + \vartheta_k + \tau_t + \varepsilon_{it}$$

where $CSR * ER_{it}$ denotes the cross-term of the corporate social responsibility and environmental regulation, and β_3 is the critical coefficient for testing the moderating effects. If β_3 has the same sign as $\beta_1(\beta_2)$, it means ER strengthens the relationship between CSR and TFP. If β_3 is positive, Hypothesis 2a is supported, and if not, Hypothesis 2b is supported.

4.2. Variable Description

4.2.1. Explained Variable: Total Factors Productivity (TFP)

Currently, there are four main methods of TFP measurement. Among them, the OP method, which is divided into two main steps, involves initially establishing a link between a company's current capital stock and its investment levels. It then forms the inverse of the optimal investment function based on current period investment determinants. This inverse function is integrated into the production function estimation equations. The resulting equations consider the contributions of both labor and capital. The capital stock-related polynomials are redefined into a new function for substitution. The method subsequently provides a consistent and unbiased estimate of the labor term coefficients. Finally, the

capital stock coefficients are estimated using non-linear least squares, as in the previous step, ensuring consistency of the capital stock across current and lagged periods [64].

4.2.2. Explanatory Variable: Corporate Social Responsibility (CSR)

Corporate social responsibility (CSR) is an expression of corporate managers' sense of social responsibility [65] and is influenced by stakeholders [66]. Subsequently, scholars such as Donaldson and Preston (1995) and Mitchell et al. (1997) have enriched and improved the theories of stakeholders and CSR, and CSR, which has an externality [41,67], and have received widespread attention as a mandatory or due obligation of enterprises [4].

Different scholars have proposed different measurement dimensions for the measurement of CSR. For example, Maignan and Ralston (2002) proposed 11 dimensions of CSR from the five aspects of society, customers, employees, shareholders, and suppliers [68]; Clarkson (1995), from the perspective of stakeholders, proposed shareholders, employees, consumers, suppliers, communities, and the responsibility in six dimensions of environment [69]. Based on the research of several scholars, this paper decomposed CSR into four main dimensions: shareholder responsibility, employee responsibility, supplier–customer and consumer responsibility, and environmental responsibility [67,70].

Shareholders' responsibility is mainly reflected in the transparency of corporate information, prevention of corruption in transactions, and improvement of corporate governance structure [71]. Employee responsibility is reflected in the wages and benefits paid to employees, as well as the provision of a comfortable working environment and attention to employees' career development [72]. The responsibility to supplier–customers, and consumers is one of the most influential and robust social responsibilities [73], in which the responsibility to suppliers can be reflected in the turnover ratio of accounts payable. The higher the turnover ratio is, the shorter the time of payment is to suppliers, the lower the degree of occupying their funds, and the more the interests of the suppliers are taken care of. Responsibility to consumers is mainly reflected in the quality of products and after-sales service [72]. Environmental responsibility is mainly reflected in controlling pollution, environmental restoration, energy saving, recycling waste materials, and ensuring that the products are environmentally friendly.

In this paper, I calculated CSR from the sum of 4 dimensions: supplier–customers and consumers, shareholders, employees, and environment, most of which are measured by CNRDS.

4.2.3. Moderating Variable: Environmental Regulations (ER)

Different scholars have different measures of environmental regulation. For example, formal and informal environmental regulations are used to measure it [74]. In addition, some scholars measure environmental regulation by mandatory and induced environmental regulation [75]. However, indicators such as formal environmental regulation and mandatory environmental regulation are not clearly defined and depend on the perception of the authorities, and it is not easy to obtain data. Considering the indicators comprehensively, it is found that the government plays a crucial role in environmental regulation: On 1 January 2018, the Environmental Protection Tax Law of the People's Republic of China was formally implemented, and China began to collect environmental protection tax, and at the same time, environmental subsidies were issued to incentivize enterprises to improve their green innovation ability; therefore, considering the availability of data and the reasonableness of the indicators, this paper selected the indicators of environmental tax and environmental subsidy as the two primary indicators [76].

4.2.4. Control Variables

To avoid omitted variable bias, this paper included some relevant control variables in the model, mainly divided into three aspects: operating, financial, and governance. Specifically, the operating variables were selected as firm size; the financial variables were categorized into gearing ratio, liquidity ratio, and Tobin Q; and the governance variables

were categorized into the shareholding ratio of the firm's largest shareholder and the managerial shareholding ratio. In addition, the paper incorporated two dummy variables, company number and year, to exclude the effects within different companies and years using a double fixed effects model. Table 1 presents the variable definitions.

Table 1. Variable definition.

Variable	Symbol	Definition
Total factors productivity	TFP	Total factors productivity measured using the OP methodology
Corporate social responsibility	CSR	The sum of the ratings for the four dimensions of supplier–customers and consumers, shareholders, employees, and environment
Environmental tax	Ertax	The natural logarithm of the annual environmental tax paid by each company
Environmental subsidy	Sub	The natural logarithm of the annual environmental subsidy received by each company
Corporate size	size	Total assets of each company divided by 10,000,000,000
Leverage	LEV	The ratio of total liabilities to total assets of each company
Liquidity ratio	LIQ	The ratio of current assets to current liabilities of each company
Tobin Q	TQ	The ratio between the market value of a company's stock and its asset replacement cost
Shareholding concentration	SC	The ratio of the largest shareholder/Shareholding of the company's first largest shareholder in a year
Management incentives	MI	Top 10 holder rate/Shareholding ratio of corporate executives

4.3. Data Sources

This paper is devoted to studying the impact of CSR on corporate total factor productivity. In total, 4167 firms were selected from the CSMAR and CNRDS databases as observation samples from 2011 to 2021. The data of CSR were obtained from Hexun, and the original data of TFP were sourced from CSMAR. For the robustness test, I additionally selected the CSR data provided by CNRDS. The conceptual labels include 34 variables such as assets, gearing, current ratio, etc. Subsequently, excluding some of the missing data and removing extreme values, I standardized all continuous indicators to zero mean and 1-variance values. To control for the potential influence of extreme values, the entire continuous variables of this study were subjected to an upper and lower 1% Winsorise treatment.

The descriptive statistics of variables are presented in Table 2.

Table 2. Descriptive statistics of variables (2011−2021).

Variable	Obs	Mean	Std. Dev.	Min	Max
TFP	4167	6.71	0.825	2.569	10.007
CSR	4167	21.668	14.877	−11.77	85.55
Ertax	4080	12.446	3.069	6.816	17.059
Sub	4167	3.190	5.570	0	16.594
SIZE	4167	1.427	3.878	0.009	84.853
LEV	4167	0.461	0.236	0.016	3.63
LIQ	4167	2.220	9.558	0.1	598.65
TQ	4167	2.172	1.912	0.687	52.082
SC	4167	34.797	14.522	4.080	89.99
MI	4167	3.286	9.445	0.000	67.88

Notes: Obs means observations and Std. Dev. denotes standard deviation. The data set covers 11 years from 2011 to 2021.

5. Empirical Results Analysis

This section discusses the regression results concerning the relationship between corporate social responsibility, environmental regulation, and total factors productivity. First, I analyze the effect of corporate social responsibility on total factor productivity in Section 5.1. Then, I investigate the moderating impact of environmental regulation on corporate social responsibility and total factors productivity in Section 5.2. Furthermore, the endogeneity test and robustness test were conducted in Sections 5.3 and 5.4, respectively.

5.1. Effect of Corporate Social Responsibility on TFP

First, I examined the impact of corporate social responsibility on the total factor productivity of the sample companies. Table 3 presents the benchmark regression results of the impact of corporate social responsibility on TFP in the period 2011–2021. Columns (1) in Table 3 present the impact of corporate social responsibility on TFP without control variables. Column (2) includes operational variables represented by corporate size. Furthermore, financial variables are considered, including leverage, liquidity ratio, and Tobin Q, as shown in Column (3). Finally, I introduced control variables representing governance structure, such as leverage and liquidity ratios, shareholding concentration, and management incentives, in Columns (4).

Table 3. Impact of corporate social responsibility on TFP.

	(1) **TFP**	**(2)** **TFP**	**(3)** **TFP**	**(4)** **TFP**
CSR	0.082 ***	0.034 ***	0.025 ***	0.026 ***
	(0.014)	(0.008)	(0.007)	(0.007)
SIZE		0.823 ***	0.856 ***	0.862 ***
		(0.042)	(0.040)	(0.039)
LEV			−0.134	−0.130
			(0.107)	(0.106)
LIQ			0.064	0.064
			(0.042)	(0.041)
TQ			14.110 ***	14.063 ***
			(2.198)	(2.219)
SC				−0.025
				(0.020)
MI				0.005
				(0.006)
_cons	−0.366 ***	−0.024	0.109 ***	0.117 ***
	(0.034)	(0.028)	(0.027)	(0.028)
year	YES	YES	YES	YES
ind	YES	YES	YES	YES
N	4167	4167	4167	4167
R-sq	0.243	0.732	0.750	0.750

Notes: (1) Explained variable TFP is defined as total factors productivity. The explanatory variable CSR is corporate social responsibility. (2) The data set covers from 2011 to 2021. (3) Standard errors are presented within parentheses. (4) *** indicates significance at the 1% levels. (5) All regressions control for the year and industry fixed effects, and all variables are defined in Table 1. (6) All variables are standardized.

Corporate social responsibility plays a significantly positive impact on the TFP of the sample companies. Table 3 shows that for total factors productivity, the coefficients of the CSR are significantly positive. For the direct impact of corporate social responsibility on TFP, Column (1) only controls year and industry-fixed effects. The coefficient of corporate social responsibility (CSR) is 0.082, which is significantly positive at a 1% statistical level. This suggests that when corporate social responsibility is higher, the total factors productivity will be higher. To further confirm whether this positive relationship holds robustly, in Column (2)–(4), I included a series of control variables in the regression. The regression coefficient of CSR is 0.034, 0.025, and 0.026, respectively, which is still significantly positive at the 1% statistical level.

From the economic point of view, on average, an increase of one standard deviation (14.877) in corporate social responsibility leads to an increase of TFP equivalent to 46.9% (=0.026 × 14.877/0.825) of the sample standard deviation. Both statistically and economically, corporate social responsibility has a significant positive relationship with TFP. Simultaneously, the coefficient of control variables confirms that an increase in corporate size, the liquidity ratio, Tobin Q, and management incentives facilitate corporate total factor productivity. However, leverage and the shareholding concentration have negative effects on the total factor productivity.

The results suggest that corporate social responsibility strengthens stakeholder relationships by protecting shareholders' interests, enhancing employees' job satisfaction, safeguarding the quality of products and services, assuming responsibility for the governance of environmental and ecological issues [71], and paying suppliers as soon as possible [72] to enhance the productivity of firms. Therefore, Hypothesis 1a is supported, while Hypothesis 1b is rejected.

5.2. Moderating Effect of Environmental Regulations on TFP

Then, this section examines the moderating role of environmental regulation between CSR and corporate total factor productivity. Table 4 presents the results for the period 2011–2021. Columns (1) and (3) show the moderating effects of environmental taxes and environmental subsidies, ignoring the control variables. Columns (2) and (4) demonstrate the moderating impact of environmental regulations after accounting for control variables.

Table 4. Impact of environmental regulations on TFP.

	(1)	**(2)**	**(3)**	**(4)**
	TFP	TFP	TFP	TFP
CSR	0.086 ***	0.059 ***	0.115 ***	0.084 ***
	(0.014)	(0.012)	(0.018)	(0.015)
ER1	0.015 **	−0.001		
	(0.007)	(0.006)		
CSR × ER1	−0.056 **	−0.048 **		
	(0.025)	(0.022)		
ER2			0.003 *	0.002
			(0.002)	(0.002)
CSR×ER2			−0.005 ***	−0.004 ***
			(0.001)	(0.001)
Controls	NO	YES	NO	YES
YEAR	YES	YES	YES	YES
ID	YES	YES	YES	YES
N	4080	4080	4167	4167
R-sq	0.251	0.408	0.250	0.407
adj. R-sq	0.249	0.406	0.248	0.404

Notes: (1) Explained variable TFP is defined as total factors productivity, and the explanatory variable CSR is corporate social responsibility, while the moderating variable ER1 is environmental tax, and the moderating variable ER2 is environmental subsidies. (2) The data set covers from 2011 to 2021. (3) ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. (4) All regressions control for the year and industry-fixed effects, and all variables are defined in Table 1.

The moderating effect of environmental regulations on corporate social responsibility and corporate total factor productivity is negative. Column (1) shows the statistical significance of the interaction factor coefficient of 5 percent for the effect of environmental taxes negatively modifying the promotional impact of CSR on total factor productivity, and column (3) shows the statistical significance of the interaction factor coefficient of 1 percent for the effect of environmental subsidies negatively modifying the promotional impact of CSR on total factor productivity. Columns (2) and (4) show that the moderating effect of environmental regulations on CSR and corporate total factor productivity is mitigated after accounting for the control variables that may have an effect, but there is still a significant negative effect.

This suggests that ER negatively moderates the relationship between CSR and TFP. The positive impact on TFP is most pronounced when enterprises operate under low environmental regulations and high CSR. Therefore, Hypothesis 2b is supported, and Hypothesis 2a is rejected.

5.3. Endogeneity Test

The baseline regression in this paper uses a two-way fixed effects regression model, which can partially solve the endogeneity problem due to missing explanatory variables. However, many dimensions of factors affect corporate total factor productivity, so there may be an omitted variable problem in the baseline regression. In addition, an increase in corporate total factor productivity may facilitate the fulfillment of CSR. This implies that there may be a bidirectional causal relationship between the two.

In Columns (1) and (2), I used the lagged mean value of CSR in the same industry and city with a firm representing instrumental variables named L.CSR, which is highly correlated with the explanatory variables but uncorrelated with the residual term. In Columns (3) and (4), I addressed endogeneity using urban green space area as the instrumental variable. The urban environment can influence a company's motivation to fulfill CSR. The poorer the urban greening is, the more intense the demands for CSR from employees, management, and the public are, meeting the relevance condition. The degree of greening is determined by innate conditions such as geographical location and is not affected by the production of individual companies. Typically, companies' production decisions do not consider local greening conditions, satisfying the exogeneity condition.

To eliminate the possible effects of inappropriate choice of instrumental variables, the two-stage least squares regression (2SLS) method was utilized to further account for potential endogeneity problems. Table 5 presents the results of the endogeneity tests. The results in Columns (1) and (3) are significant, leading us to reject the null hypothesis of weak instruments and confirming that the selected instrumental variables are related to the explanatory variables. The results in Columns (2) and (4) remain positive and significant. Therefore, the research findings are robust and reliable, with endogeneity not substantially influencing the study's outcomes.

Table 5. Endogenous test of the impact of CSR on the TFP.

	(1) **First Stage**	**(2)** **Second Stage**	**(3)** **First Stage**	**(4)** **Second Stage**
	CSR	TFP	CSR	TFP
CSR_tool	0.280 *** (0.027)		−0.026 ** (0.010)	
CSR		0.201 *** (0.040)		0.432 *** (0.153)
controls	YES	YES	YES	YES
year	YES	YES	YES	YES
ID	YES	YES	YES	YES
N	2944	4167	3708	3708
R-sq	0.239	0.403	0.200	0.378
adj. R-sq	0.235	0.401	0.196	0.375

Notes: *** and ** indicate significance at the 1% and 5% levels, respectively.

5.4. Robustness Test

A robustness test is also needed to ensure the credibility of the results, and the results are presented in Table 6. In Columns (1) and (2), total factor productivity (TFP) calculated by the Levinsohn–Petrin (LP) method and the GMM method is used as the dependent variable, respectively, and the sign and significance of the coefficients are the same as those in the baseline regression results. In Column (3), a sub-sample regression is used, and sample data from four cities, namely Beijing, Shanghai, Guangzhou, and Shenzhen, are selected for the regression. In Column (4), a multidimensional fixed model is used, with

industry-fixed effects, and the results show that they are still robust. In Column (5), the CSR scores provided by CNRDS are used for robustness checks. The measure of CSR scores is the frequency of words that appear on each page of the CSR in the annual report of the enterprise.

Table 6. Robustness test.

	(1)	(2)	(3)	(4)	(5)
	TFP_LP	TFP_GMM	TFP	TFP	TFP
CSR	0.047 ***	0.058 ***	0.055 ***	0.059 ***	
	(0.010)	(0.011)	(0.012)	(0.011)	
CSR_alter					0.022 *
					(0.013)
Controls	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES
ID	YES	YES	YES	YES	YES
IND	NO	NO	NO	YES	NO
N	4167	4167	3743	4008	1143
R-sq	0.484	0.186	0.408	0.935	0.337
adj. R-sq	0.482	0.183	0.405	0.912	0.327

Notes: (1) The data set covers from 2011 to 2021. (2) *** and * indicate significance at the 1% and 10% levels, respectively. (3) All regressions control for the year and industry-fixed effects, and all variables are defined in Table 1.

6. Discussion

6.1. Heterogeneity Analysis of Corporate Social Responsibility

This section will focus on the heterogeneity of CSR. Corporate social responsibility encompasses a variety of types, such as shareholder responsibility, employee responsibility, supplier–customer and consumer responsibility, environmental responsibility, etc. Different types of CSR act on different subjects and environments and may have different impacts on corporate total factor productivity. In the benchmark regression, I explore the impact of corporate social responsibility without distinguishing between different types of corporate social responsibility. Further, I distinguish the different impacts of the four types of corporate social responsibility. In this paper, I run separate regressions for several types of social responsibility, with corporate total factor productivity as the dependent variable. Ratings of shareholder responsibility, employee responsibility, supplier–customer and consumer responsibility, and environmental responsibility are the independent variables, and the results are displayed in Columns (1)–(4) of Table 7, respectively. Column (1) shows that shareholder responsibility has a positive and significant effect on corporate total factor productivity, while Column (2) presents a positive and non-significant effect on TFP. It demonstrates that the shareholder responsibility effect of CSR is significantly better than that of employee responsibility, probably because shareholders are in a better position to decide on corporate development strategies compared to employees, and therefore, shareholder social responsibility is more conducive to corporate management and technological advancement, which, in turn, enhances productivity.

However, as can be seen from columns (3) and (4), the coefficients of supplier–customer and consumer responsibility and environmental responsibility are negative and non-significant. I infer that suppliers may not influence resource allocation through CSR and thus have no effect on corporate TFP, while consumers may not influence the TFP with technology choice through reputation mechanisms [77]. Moreover, it is difficult for corporate environmental protection to influence the internal production process and resource allocation, thus having no effect on corporate total factor productivity.

Table 7. Heterogeneity of corporate social responsibility.

	(1)	(2)	(3)	(4)
	TFP	TFP	TFP	TFP
Shareholder Responsibility	0.017 ***			
	(0.002)			
Employee Responsibility		0.005		
		(0.003)		
Supplier–Customer and Consumer Responsibility			−0.000	
			(0.003)	
Environmental Responsibility				−0.000
				(0.002)
Controls	YES	YES	YES	YES
YEAR	YES	YES	YES	YES
ID	YES	YES	YES	YES
N	4167	4167	4167	4167
R-sq	0.433	0.391	0.390	0.390
adj. R-sq	0.431	0.389	0.388	0.388

Notes: *** indicate significance at the 1% levels.

6.2. Heterogeneity Analysis of the Enterprises

After examining the heterogeneity of CSR, the following will further regress the heterogeneity of enterprises in groups based on differences in enterprise types. In this paper, I mainly consider two types of enterprises, state-owned enterprises (SOEs) and non-state-owned enterprises (NSOEs), the main reason for which is that the differences in enterprise characteristics may affect the contribution of corporate social responsibility to total factor productivity. State-owned and non-state-owned enterprises differ in resource availability, company size, and sense of social responsibility, leading to differences in their attitudes and recognition of social responsibility. These differences affect the utilization of corporate resources and the attitudes of stakeholders, which have a differential impact on the improvement of corporate total factor productivity.

Given the above analyses, the paper divides the sample into SOEs and non-SOEs based on the type of firms. The results are displayed in Table 8. Comparing the results of Column (1) and Column (4), it can be found that CSR positively impacts TFP in non-state-owned enterprises. Possible explanations are that non-state-owned enterprises are less susceptible to government intervention, allowing top management to make decisions based on the actual development situation of the company, which is conducive to the effective allocation of resources. The regulation of non-state-owned enterprises is less stringent, and external investors often have limited insight into the company's operations. Consequently, the fulfillment of CSR by non-state-owned enterprises is more likely to bring about social recognition and attract more financing, which leads to a significant increase in corporate total factor productivity. In addition, the starting point of SOEs' operations is not simply the pursuit of profit maximization but also the need to comply with social public interests and particular social objectives. In contrast, non-SOEs' direct objective is often to maximize profits and, therefore, have a greater incentive to promote corporate productivity by fulfilling corporate social responsibility [78].

The results in columns (2) and (5) show that environmental taxes have negative and significant moderating effects on SOEs, while the effects on non-SOEs are insignificant. The possible reason is that SOEs are more strictly regulated. Since the government is the controlling shareholder of SOEs, SOEs are more sensitive to the government's environmental tax policy and comply more strictly with the government's policy to pay taxes, thus affecting corporate total factor productivity. Non-SOEs are less susceptible to government intervention, and the top management can make decisions independently without the threat of any political pressure [79]. Thus, the effect of environmental taxes on non-SOEs is also insignificant. The results in columns (3) and (6) show that environmental subsidies

have negative and significant moderating effects on both SOEs and non-SOEs, where the effect is more significant for non-SOEs, but the overall difference is not significant.

Table 8. Heterogeneity of ownership.

	(1)	(2)	(3)	(4)	(5)	(6)
	State-owned enterprises			Non-state-owned enterprises		
	TFP	TFP	TFP	TFP	TFP	TFP
CSR	0.044 ***	0.050 ***	0.065 ***	0.080 ***	0.079 ***	0.112 ***
	(0.013)	(0.013)	(0.015)	(0.023)	(0.023)	(0.030)
ER1		−0.001			0.003	
		(0.009)			(0.008)	
CSR × ER1		−0.053 **			−0.045	
		(0.025)			(0.040)	
ER2			0.001			0.002
			(0.002)			(0.003)
CSR × ER2			−0.003 **			−0.005 **
			(0.001)			(0.002)
Controls	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
ID	YES	YES	YES	YES	YES	YES
N	1762	1743	1762	2405	2337	2405
R-sq	0.367	0.371	0.370	0.413	0.421	0.418
adj. R-sq	0.360	0.364	0.363	0.409	0.416	0.414

Notes: *** and ** indicate significance at the 1% and 5% levels, respectively.

6.3. Heterogeneity Analysis of Regions

Considering the differences in regional policies and business environments, this section will analyze heterogeneity mainly according to the region where the firms are located. Differences in policy maturity, urbanization level, and talent resources between eastern and central-western regions [78] may have different impacts on the effects of corporate social responsibility. Therefore, the sample can be divided into two groups: eastern and central-western regions, according to the geographic location of the firms. The results of the heterogeneity test are shown in Table 9.

Table 9. Heterogeneity of regions.

	(1)	(2)	(3)	(4)	(5)	(6)
	Eastern Region			Central-Western Region		
	TFP	TFP	TFP	TFP	TFP	TFP
CSR	0.057 ***	0.061 ***	0.097 ***	0.056 ***	0.057 ***	0.071 ***
	(0.016)	(0.016)	(0.020)	(0.016)	(0.016)	(0.020)
ER1		−0.005			0.005	
		(0.008)			(0.011)	
CSR × ER1		−0.038			−0.064 *	
		(0.032)			(0.033)	
ER2			0.005 ***			−0.001
			(0.002)			(0.003)
CSR × ER2			−0.006 ***			−0.002
			(0.001)			(0.002)
Controls	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
ID	YES	YES	YES	YES	YES	YES
N	2427	2354	1726	1740	1726	1740
R-sq	0.417	0.428	0.397	0.393	0.397	0.394
adj. R-sq	0.413	0.423	0.390	0.387	0.390	0.388

Notes: *** and * indicate significance at the 1% and 10% levels, respectively.

The results of columns (1) and (4) show that the effect of corporate social responsibility on total factor productivity is more significant in the eastern region but similar to the central-western regions. The possible reasons are that the eastern region has a favorable geographical location, an early start in development, a high degree of openness to the outside

world, a relatively developed economy, a relatively sound policy system, substantial human resources, and a good business environment and talent base, which is more conducive to the effective allocation of corporate resources and the enhancement of the productivity of enterprises. In contrast, the central-western regions, which have seen later development, face challenges due to immature policies and insufficient support and protection measures. This results in a less favorable business environment for enterprises. Additionally, the business philosophy of top management in these regions tends to be less advanced. There may be a tendency to overlook social responsibility and long-term sustainable development. Such neglect hinders effective resource allocation and does not improve TFP.

The results in columns (2) and (5) indicate that in the eastern region, environmental taxes have no significant effect on the effect of CSR. In the central-western regions, environmental tax has a negative and significant moderating effect on the effect of CSR. In the eastern region, the policies are well developed, the business environment is standardized, and the economic development of the enterprises is relatively benign. The enterprises can pay the tax on time voluntarily following the law, so the effect of an environmental tax on the enterprises in the eastern region is not significant. The economic condition of the central-western regions is more backward, and development is more difficult. To promote development, enterprises may sacrifice environmental protection. The coercion of taxation increases business costs, compresses profit margins, and reduces business performance, which, in turn, weakens total factor productivity [80].

The results in columns (3) and (6) indicate that environmental subsidies have a negative and significant moderating effect on the effect of CSR in the eastern region. In contrast, in the central and western regions, environmental subsidies do not have a significant effect on the effect of CSR. The possible reason is that environmental subsidies reduce the entrepreneurial risk-taking spirit, weaken the rational allocation of resources, and put enterprises in the eastern region in an unfavorable position in the fierce competition, thus reducing the effect of CSR. Conversely, in the central and western regions, where the economy is more backward, and the pressure on environmental protection is lower, environmental subsidies can reduce the financial burden for local enterprises and motivate enterprises to increase their investment in innovation, thus increasing corporate total factor productivity.

6.4. Heterogeneity Analysis of Marketization

Considering the different degrees of marketization of the regions in which the enterprises are located, I divided the enterprises into two groups [81], high marketization and low marketization. The results of the heterogeneity analysis are shown in Table 10, from which it can be concluded that the effect of corporate social responsibility playing a role is more robust in the regions with low degrees of marketization. The possible reason for this is that regions with low marketization are less competitive, and there is more room for companies to fulfill their social responsibilities. Companies may pay more attention to corporate social responsibility, the easier it is to form a reputation and then a monopoly trend, and therefore, the effect of corporate social responsibility on productivity enhancement is more prominent. At the same time, regions with low marketization may have lower financing constraints, meaning there is more room to attract external financing. By fulfilling their social responsibilities, enterprises tend to draw more external attention. This helps attract a variety of resources and ensures their optimal allocation, thereby increasing the TFP.

The results in Column (2) and Column (5) show that environmental tax does not have a significant effect on regions with high marketization but has negative and significant moderating effects on regions with low marketization. In regions with high marketization, the upstream and downstream industry chain is complete, and enterprises do not bear all the negative impacts of environmental taxes, but there is tax sharing, so environmental taxes do not have a significant impact on them. The results in columns (3) and (6) show that

environmental subsidies have negative and significant moderating effects on both high- and low-marketization regions, and the difference is not significant.

Table 10. Heterogeneity of marketization.

	(1)	(2)	(3)	(4)	(5)	(6)
	High marketisation area			Low marketisation area		
	TFP	TFP	TFP	TFP	TFP	TFP
CSR	0.053 ***	0.057 ***	0.071 ***	0.057 ***	0.062 ***	0.090 ***
	(0.020)	(0.019)	(0.022)	(0.013)	(0.014)	(0.018)
ER1		−0.008			0.004	
		(0.010)			(0.008)	
CSR × ER1		0.001			−0.064 **	
		(0.037)			(0.026)	
ER2			0.004 **			0.002
			(0.002)			(0.002)
CSR × ER2			−0.004 **			−0.004 ***
			(0.002)			(0.001)
Controls	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
ID	YES	YES	YES	YES	YES	YES
N	1762	1430	1483	2405	2650	2684
R-sq	0.367	0.476	0.466	0.413	0.397	0.396
adj. R-sq	0.360	0.469	0.459	0.409	0.393	0.392

Notes: *** and ** indicate significance at the 1% and 5% levels, respectively.

6.5. Heterogeneity Analysis of Disclosure

Considering whether enterprises are mandatorily disclosing their corporate social responsibility, I categorized enterprises into two groups: mandatory CSR disclosure and voluntary CSR disclosure. The classification is based on the presence of CSR information in the annual reports versus other corporate reports. Enterprises that disclosed CSR information solely in their annual reports, without additional disclosures in other reports, were classified as having mandatory CSR disclosure; otherwise, they were classified as voluntary CSR disclosure enterprises. Table 11 presents the results of the heterogeneity analysis, revealing that mandatory CSR disclosure has a significantly positive effect on total factor productivity. The possible reason is that mandatory CSR disclosure has a positive effect on enterprise innovation, which can substantially increase the TFP of the enterprise [82].

Table 11. Heterogeneity of disclosure.

	(1)	(2)	(3)	(4)	(5)	(6)
	Mandatory disclosure of CSR			Voluntary disclosure of CSR		
	TFP	TFP	TFP	TFP	TFP	TFP
CSR	0.167 ***	0.171 ***	0.180 ***	0.048 ***	0.047***	0.062 ***
	(0.028)	(0.029)	(0.029)	(0.012)	(0.013)	(0.015)
ER1		−0.002			−0.005	
		(0.008)			(0.009)	
CSR × ER1		−0.025			−0.006	
		(0.045)			(0.028)	
ER2			0.001 **			0.002
			(0.002)			(0.003)
CSR × ER2			−0.003 **			−0.002
			(0.003)			(0.001)
Controls	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
ID	YES	YES	YES	YES	YES	YES
N	2697	2628	2697	1470	1452	1470
R-sq	0.430	0.439	0.432	0.385	0.385	0.387
adj. R-sq	0.427	0.435	0.428	0.378	0.377	0.379

Notes: *** and ** indicate significance at the 1% and 5% levels, respectively.

7. Conclusions and Implication

7.1. Conclusions

This paper employs the data and regression model of the Chinese listed companies with fixed effects to investigate the effect of corporate social responsibility on TFP while integrating the moderating effects of environmental regulation into this study. The main conclusions are as follows.

First, corporate social responsibility has a positive effect on total factor productivity, mainly because the fulfillment of corporate social responsibility may reconcile the interests of various stakeholders, thus promoting productivity. Second, in general, environmental regulation has a negative moderating effect on the effect of CSR through the adoption of mandatory taxation and incentive subsidies for enterprises. The imposition of environmental taxes increases enterprises' financial burden and operating costs, which could not be conducive to their investment in innovation. Environmental subsidies can reduce entrepreneurial risk-taking spirit and affect enterprises' judgment of production decisions and effective allocation of various resources, thus affecting corporate total factor productivity. Thirdly, after analyzing the heterogeneity of corporate social responsibility, enterprise, region, and marketization, their effects on corporate total factor productivity were found. (i) From the heterogeneity of the indicators of CSR, shareholder responsibility and employee responsibility have more significant effects on productivity, and the effect of shareholder responsibility is more significant, which indicates that shareholders' decisions play a greater role in technological advancement and resource allocation in enterprises and are more conducive to the progress of enterprises. Supplier–customer and consumer responsibility and environmental responsibility have little impact, suggesting that it is difficult for suppliers, consumers, and the environment to impact an enterprise's productivity through the reputational mechanism. (ii) Considering corporation heterogeneity, CSR has a more positive impact on the TFP in non-state-owned enterprises than state-owned enterprises. Because state-owned enterprises are highly regulated, contribute to public services, and pay taxes following the law, the negative effect of environmental regulations on productivity is more pronounced. (iii) According to the heterogeneity of the regions where the enterprises are located, CSR has more influence on the CTFP in the eastern region, but the overall difference is not significant. In the central and western regions, the negative moderating effect of environmental taxes on the CSR effect is more significant, while in the eastern region, the role of environmental subsidies is more significant. In the eastern region, the relatively developed economy and standardized business environment are more conducive to enterprise productivity, but environmental subsidies will reduce entrepreneurial risk-taking spirit and weaken the productivity of enterprises. Environmental tax will bring a financial burden to enterprises in the central and western regions, which is not conducive to enterprise productivity improvement. (iv) In terms of heterogeneity of marketization, low marketization has a more significant impact on enterprise productivity, and environmental taxes have a negative and significant moderating effect. It is inferred that in regions with high marketization, the upstream and downstream industry chains are complete, and there is tax sharing, so environmental taxes have little impact on them.

7.2. Policy Implications

This paper provides some insights based on the conclusions. From a managerial standpoint, firstly, corporate social responsibility is the embodiment of enterprise value. Through the responsibility for stakeholders, the enterprise coordinates resource allocation, enhances the enterprise's labor and technical productivity, and promotes improving enterprise productivity. However, at present, the focus of enterprises on enterprise productivity is relatively narrow, and enterprises tend to pay too much attention to product quality, competitive advantage, and eagerly pursue short-term economic benefits while neglecting the external environment, suppliers, and other stakeholders. Enterprises should have a long-term vision, fulfill their responsibilities to all stakeholders, and pay attention to the long-term benefits of corporate social responsibility. Secondly, environmental regulation

increases enterprises' production costs, indirectly affecting their investment in technological innovation, and thus reducing their corporate total factor productivity. Therefore, the government should appropriately relax the regulation of enterprises to alleviate the financial pressure on enterprises and give them more room for development. However, this does not mean the abolition of environmental regulations. It requires the government to take appropriate measures, such as environmental taxes and other mandatory policies. The government should adjust the tax rate promptly depending on the situation. In addition, the government can use public monitoring and information disclosure to guide enterprises in raising their social awareness and consciously fulfilling their social responsibilities. Thirdly, the contribution of corporate social responsibility to productivity is more significant in non-state-owned enterprises. I should loosen the administrative control over state-owned enterprises so that they can invest more in production and development. From a policy standpoint, on the one hand, the government should guide enterprises in making CSR disclosures to satisfy the demand of stakeholders for corporate social responsibility information. On the other hand, the government should formulate relevant environmental protection policies according to the actual situation to ensure reasonable environmental regulation. In conclusion, the mechanism of CSR to enhance TFP needs to be jointly maintained by enterprise managers and policymakers to bring into play the function of enterprise reputation mechanism in resource allocation and technological progress.

7.3. Limitations

This paper has some limitations, which provide suggestions and directions for future research. Firstly, while my research reveals the heterogeneity of CSR's impact on TFP and analyzes CSR practices among enterprises of different types and regions, it does not delve into the internal mechanisms of specific industries. Future research could focus on CSR practices within particular industries to uncover more nuanced mechanisms of impact. Secondly, environmental regulations come in various forms, including mandatory and non-mandatory measures such as emission standards and legal statutes. Future studies could broaden the understanding of how different environmental regulations moderate the relationship between CSR and TFP. Thirdly, this paper concentrates on the positive impact of CSR on TFP, with limited discussion on the environmental and governance dimensions. Future research could provide a more comprehensive assessment of the impact of Environmental, Social, and Governance (ESG) factors on TFP.

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