Impact of Corporate Environmental Responsibility on Investment Efficiency: The Moderating Roles of the Institutional Environment and Consumer Environmental Awareness

Shihong Zeng [1,2,3,4], **Yujia Qin** [1,3] **and Guowang Zeng** [5,*]

1   Applied Economics Department, College of Economics and Management, Beijing University of Technology, Beijing 100124, China
2   Beijing City Sub-Center Institute, Beijing University of Technology, Beijing 100124, China
3   Finance and Economics Development Research Center, College of Economics and Management, Beijing University of Technology, Beijing 100124, China
4   Beijing Modern Manufacturing Development Research Base of Beijing Philosophy and Social Sciences, Beijing University of Technology, Beijing 100124, China
5   Applied Management and Computer Science, Management Department, LUISS University, 00197 Rome, Italy
*   Correspondence: zeng.guowang@studenti.luiss.it; Tel.: +39-33-8183-9922

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Abstract: The increasingly serious destruction of the natural environment represents a great threat to the sustainable development of human beings and the earth. Under pressure from the government and public opinion, companies must assume environmental responsibility; however, there is no conclusion on whether corporate environmental responsibility is beneficial to companies. From the perspective of investment efficiency, this paper collects panel data from Chinese listed companies from 2011 to 2016 to discuss the impact of corporate environmental responsibility on investment efficiency and the moderating role of the institutional environment and consumer environmental awareness. The results show that corporate environmental responsibility can significantly positively affect investment efficiency, but this effect is not a short-term effect; it needs time to play a role. Second, in regions with a good institutional environment, corporate environmental responsibility has a more significant impact on improving investment efficiency. Finally, with the improvement of consumer environmental awareness, companies that assume environmental responsibility can address underinvestment. The research in this paper supports stakeholder theory, indicating that corporate environmental responsibility is not "selfless dedication". In addition, the research results of this paper are robust and not subject to endogenous influences.

1. Introduction

Corporate environmental responsibility (CER), as an area of corporate social responsibility (CSR), refers to an enterprise's active reduction of environmentally adverse behaviors and participation in environmentally beneficial activities in its daily business activities [1,2]. In the past 100 years, human beings have plundered and destroyed the natural environment for economic development and their immediate interests, such as the threat of global warming [3]. The deterioration of the environment makes the society pay more and more attention to the sustainable development of natural environment [4].

Governments have promulgated a series of policies, laws, and regulations to protect the environment. For example, in 1979, China passed its first environmental protection law, the Environmental Protection Law of the People's Republic of China (trial). In addition, the act of damaging the environment was included in criminal law. The environmental protection law passed in 2014 has been described as the "toughest" law in China's history [1].

In addition, as an important component of economic society, enterprises are required by the public to assume environmental responsibility. However, conclusions on the impact of CER on corporate interests have not been consistent. Is corporate environmental responsibility a win–win situation or at the expense of corporate value? According to stakeholder theory [2,5–7], it is in line with stakeholders' expectation for enterprises to undertake environmental responsibility to obtain their support and improve financial performance, which may lead to good investment efficiency. On the other hand, the trade-off and management opportunism hypothesis holds that CSR (including CER) will occupy the company's resources, thus putting it in a disadvantaged competitive position. In addition, managers may obtain more private support through environmentally responsible investment, which may lead to an improper use of corporate resources and cause corporate profit losses. Therefore, the impact of corporate environmental responsibility (CER) on corporate economic benefits has become a research hotspot.

At present, similar studies focus mainly on the impact of CER on business performance or income direction or the impact of CSR on investment efficiency [1,2,8,9]. CER can not only improve the natural environment and form positive externalities to benefit enterprises but also provide better access to external financing, improving corporate financial transparency to some extent and reducing the abuse of corporate free cash flow. Compared with non-environmentally friendly enterprises, enterprises with environmental risk management have easier access to project financing [7]. Companies that commit to environmental investment programs can gain more profit from competition [10].

In contrast to previous studies [7,9,11,12], we focus on the impact of CER on investment efficiency. Although studies have proven that CSR can effectively improve the efficiency of enterprise investment, CSR as a general concept is not completely the same as CER. The research results of Aguado and Holl [13], who compared the environmental responsibility of SMEs in Spain and Norway, show that in the market environment with effective environmental regulation and strong environmental protection advocacy, enterprises will voluntarily assume higher environmental responsibility. In other words, regions with better institutional environments have less corruption, less excessive government intervention (for example, officials interfere in the allocation of corporate resources for their own benefit), and more developed financial markets, all of which are conducive to improving the environmental performance of enterprises and giving full play to the effect of CER. In addition, the increase in consumers' environmental awareness makes environmentally friendly enterprises more favored by consumers [14,15]. Therefore, this paper focuses on the impact of CER on investment efficiency and the moderating role of the institutional environment and consumer environmental awareness in this impact. As far as we know, there is little research on this field. Our results help enterprises and government regulators better understand the effects and working conditions of CER and contribute to policy formulation and corporate managers' investment decisions in environmental responsibility activities.

The structure of this paper is as follows: Section 2 presents a literature review; Section 3 shows the model design and data; Section 4 offers the empirical results; and Section 5 provides the conclusion.

2. Literature Review

2.1. The Influencing Factors of Investment Efficiency

According to the theory of capital structure independence, in a complete capital market, the only factor that companies consider when making investment decisions is investment opportunities [16]. A company will invest in all projects with positive net present value until the marginal benefit of its investment equals its marginal cost [17]. However, the friction existing in the actual capital

market will cause companies to deviate from optimal investments [18], resulting in overinvestment or underinvestment. Two of the most important frictions are agency conflicts caused by free cash flow and information asymmetry.

According to information asymmetry theory [19,20], the information asymmetry between managers and shareholders will affect corporate financing, which may force the company to give up some profitable investment projects, resulting in underinvestment. For example, the empirical results of Mansour [21] showed that companies with higher information asymmetry had higher investment–cash flow sensitivity. For the agency problem mentioned by Jensen and Meckling [22], there is a conflict of benefits between shareholders and managers, which may lead selfish managers to overuse the company's resources for their own benefit, thus causing overinvestment. Managers may also overinvest with free cash flows to gain market share and build a business empire [23]. On this basis, the various existing channels can help to alleviate information asymmetry and agency conflicts among various stakeholders. For example, high-quality financial reports can reduce information asymmetry and further improve investment efficiency [24].

2.2. The Role of CER

The influence of CSR on corporate value has been discussed widely in previous literature [5,6,25,26]. However, CSR is an overall concept that includes activities responsible for shareholders, employees, consumers, the environment, and society. Its overall impact will cover the specific impact of CER, so scholars have gradually studied the latter.

For example, Li et al. [1] believed that environmental protection is not unrewarding and that companies with higher environmental responsibility have more financial performance. Nandy and Lodh [11] noted that environmentally friendly enterprises are more likely to obtain better bank loans, environmentally responsible companies are more likely to reduce the risk of bank default, and society may also benefit. Similarly, Sharfman and Fernando [8] proved that environmentally friendly enterprises are better able to reduce the volatility of the company's stock, thus reducing the cost of the companies' equity and possibly improving business performance. Bartolacci et al. [12] argued that the voluntary assumption of environmental responsibility by companies is helpful to improve the competitiveness of enterprises. Lončar et al. [27] found that the environmental awareness of a company's board will help enterprises incorporate environmental protection in its processes and operations and attract more consumers to buy green products. Santos et al. [28] found that manufacturers' adoption of green supply chain management for suppliers and/or customers can improve their operational performance and their benefits from it.

Therefore, CER enables enterprises to further obtain external financial support and obtain intangible assets, such as reputational assets [29]. Companies are more likely to abandon some profitable investment projects due to financial constraints, resulting in underinvestment [9]. CER activities are likely to improve financial performance and operating income [2] by changing the enterprises' financing situation and attracting the attention of consumers, thus increasing companies' available resources and improving the underinvestment phenomenon. The research results of El Ghoul et al. [30] show that environmentally friendly companies have easier access to financing and reduce their equity costs.

In addition, CSR disclosure is an important type of non-financial information disclosure. CSR information disclosure includes information about corporate activities of stakeholders, including corporate charitable donations, resources paid for a better environment and employee welfare, etc. This information is not reflected in financial information reports, but it can better explain the whereabouts of some company resources and help investors and other information users to have a comprehensive understanding of the company's financial information. Therefore, to some extent, CSR disclosure can effectively improve the transparency of corporate financial information as an alternative to financial information reports [31]. Lopatta et al. [26] provided evidence on CSR's role in improving corporate information quality: CSR activities can improve the level of information disclosure and

financial transparency, thus reducing information asymmetry. In addition, CSR performance can limit the amount of free cash flow available and reduce agency conflict problems. Harjoto and Jo [32] found that companies can use CSR participation to solve conflicts between managers and stakeholders. Cho et al. [25] found that both positive and negative CSR can help reduce information asymmetry. Therefore, CSR contributes to the improvement of investment efficiency [5,9].

In summary, we believe that as a part of CSR, CER's role in improving corporate financial transparency and reducing information asymmetry is consistent with the impact of CSR. Cai et al. [33] believed that CER activities can reduce enterprise risks by improving information transparency. CER can also improve corporate information disclosure, help in obtaining external support and government subsidies, and further improve investment inefficiency. In addition, the company's disclosure of environmental responsibility activities is usually given in the annual report, which allows investors and the outside world to know that CER information is often the environmental responsibility content of the previous year. Thus, the effect of environmental responsibility on investment efficiency may have a time delay. Based on the above speculation, we propose the first hypothesis of this paper:

Hypothesis 1. (H1) *The CER of the lag period can improve investment efficiency and reduce investment inefficiency.*

2.3. The Moderating Role of the Institutional Environment

The government can cause greater and more direct pressure on enterprises [34]. Generally, institutionalists believe that the greatest pressure on companies comes from government regulation. In a strict system environment, the punishment for breaking the law is much higher than the cost of complying with the law [35]. The government formulates strict laws and regulations on environmental responsibility to regulate enterprises' environmental behavior, such as the Environmental Protection Law of China and Methods of Corporate Environmental Credit Rating. A strict regulatory system will force companies to engage in environmentally responsible activities and actively engage in green practices. In an environment with more perfect laws and more comprehensive system development, enterprises engaging in environmental responsibility can obtain more commendations, financial support, and subsidies from the government. Strict laws and regulations can promote the development of technological innovation to better replace non-environmental technologies so that companies can also promote innovative growth from within and increase their competitive advantages while undertaking environmental responsibilities [2]. Additionally, a good external environment makes environmentally friendly companies more competitive [36].

In contrast, in regions where the institutional environment is weak and government officials do not act, corporate managers may use their political connections to obtain government support while avoiding CER [37]. For example, companies may bribe local officials to obtain undeserved funds and subsidies. Especially for countries with transitional economies, the phenomenon of excessive government intervention in economic activities is widespread. Excessive government intervention destroys the allocation of resources in the free economic market, resulting in low-efficiency resource allocation [38]. Therefore, in regions with underdeveloped financial markets, weak legal supervision, and strong government intervention, the effect of environmental responsibility on investment efficiency may be relatively weak. Local government officials may over-promote gross economic growth and neglect environmental protection for their official promotion [39].

Finally, Wong et al. [2] found that CER's impact on operating income in eastern regions with a strong institutional background was positively and significantly correlated, while in western regions with a weak institutional background, CER showed an adverse impact on operating income. Therefore, the quality of the institutional environment may positively affect the impact of environmental responsibility. Therefore, we propose the second hypothesis of this paper:

Hypothesis 2. (H2) *The institutional environment can positively moderate the impact of environmental responsibility on investment efficiency.*

2.4. The Moderating Role of Consumer Environmental Awareness

Finally, the environmental pressure faced by enterprises comes not only from the government but also from consumer demand. Environmentally responsible companies are more in line with consumer preferences. Lončar et al. [27] found that consumers are more likely to buy "green" products, which makes them feel connected to environmental protection. Niu et al. [40] studied the attitudes of airline passengers in the aerospace industry and found that passengers are more inclined to choose environmentally friendly companies and that young people support the environmental protection activities of companies more than those of other groups. It can be argued that with the improvement of consumers' green consciousness, increasing numbers of consumers tend to choose environmentally friendly products, although environmentally friendly products may be more expensive [15], and more consumers are not willing to spend money on polluting products [41]. Schill et al. [42] found that consumers' increased attention to the environment can effectively influence consumers' willingness to buy environmentally friendly smart home products. Jahanshahi and Brem [43] found that customers are an important factor for enterprises to make environmental commitments, and enterprises with long-term relationships with customers will make more commitments to the environment. Kardos et al. [4] also found a relationship between consumers' environmental awareness and companies' green behaviors: a high level of environmental awareness has a significant impact on environmental responsibility behaviors and green procurement. Finally, the research results of Ting et al. [14] reached a similar conclusion: with the improvement of consumer environmental awareness, environmentally responsible green hotels are more favored by consumers.

In summary, it can be concluded from the above literature that environmentally friendly companies are more likely to win the support of consumers, and green consumers are willing to pay more for environmentally friendly products. Pressure from green consumers makes companies participate more in environmentally responsible activities. As a result, environmentally friendly companies can occupy a larger market share and obtain more revenue and available resources. To some extent, this can improve the problem of underinvestment in companies. For overinvestment, the moderating effect of consumer environmental awareness on CER may be an empirical problem, which depends on the interaction between the increase of free cash flow caused by the increasing revenue and the higher financial transparency. Thus, the third hypothesis is put forward here:

Hypothesis 3. (H3) *Consumer environmental awareness can positively moderate the impact of CER on underinvestment.*

3. Variable Definitions and Data

3.1. Variable Definitions

3.1.1. Dependent Variable: Investment Inefficiency

In the research process of this paper, the dependent variable is investment inefficiency. By definition, investment efficiency is an enterprise's ability to achieve a positive net present value for all projects [44]. The investment inefficiency is represented by the deviation between the actual investment and the expected optimal investment. Therefore, using regression residuals to measure investment inefficiency is accepted by most scholars. For example, Mo and Lee [45] used the deviation (represented by residuals) between the actual number of employees and the expected number of employees to represent the low efficiency of labor investment. Similarly, Oh et al. [46] used the residual measurement method to construct investment inefficiency. A firm's level of investment is a function of its growth opportunities. In previous articles [5,18,24,44], most scholars use the Tobin's Q value or sales growth rate of the previous year as the only index of companies' growth opportunity. In addition, we believe that the growth rate of net profit is also an important factor affecting companies' investment decisions, which can affect their future investments. Thus, the investment inefficiency measurement model is set as follows:

$$Inv_{i,t} = \beta_0 + \beta_1 TOB\_Q_{i,t-1} + \beta_2 Net\_Pro_{i,t-1} + \mu_i + \varepsilon_{i,t} \tag{1}$$

The dependent variable (Inv) in the above model refers to the new investment expenditure of the company, which is expressed by the percentage of the difference between the cash paid for the fixed assets, intangible assets, and other long-term assets and the cash recovered from the disposal of fixed assets, intangible assets, and other long-term assets in the total assets. Tobin's Q (TOB_Q) represents growth opportunities for the business, expressed as the equity value of the business plus the total liabilities divided by the total assets. Net profit growth rate (Net_Pro) is expressed by the difference between the net profit in the current year and the net profit in the previous year divided by the net profit value in the previous year. To avoid the influence of outliers, the above continuous variables were winsorized.

We used panel OLS regression to estimate Model (1). Compared with OLS regression, panel regression can solve the problem of missing variables caused by unobservable individual differences or "heterogeneity". The disturbance term consists of $(\mu_i + \varepsilon_{i,t})$, where μ_i represents unobservable individual heterogeneity and residual $\varepsilon_{i,t}$ is the disturbance term that changes with individuals and time, namely, the dependent variable of investment inefficiency (Inv_InEff) in Models (2–4). Finally, we used the clustered robust standard error to solve the possible heteroscedasticity and autocorrelation problems in all regressions.

3.1.2. Independent Variable

In this study, the independent variable of the model was CER. Most western scholars use the data indicators published by Kinder, Lydenberg, and Domini (KLD) when constructing CER, but the database does not include data from developing countries. To better measure CER, we chose the index that was scored by the third party according to the environmental activities disclosed in each company's annual report: the environmental responsibility index in the HeXun social responsibility score of listed companies. Tang and Yang [47] used the data from this website to study the relationship between environmental protection and enterprise development.

The HeXun CER score was extracted from the social responsibility reports and annual reports published by enterprises in Shanghai and Shenzhen stock exchanges and scored according to five aspects: environmental awareness, environmental management system certification, the amount of environmental protection investment, the types of pollutant emissions, and the types of energy saving. The numerical index obtained the score according to the data center computing model, while the logical index obtained the score according to whether the social responsibility report disclosed the index and details of the disclosure.

3.1.3. Moderating Variables

Institutional environment (In_env): First, according to the research of other scholars [48,49], we chose the "marketization total index score" published by Wang et al. [50] to represent the institutional environment. This index includes the relationship between government and market, the development of the non-state-owned economy, the development of the product market, the development of the factor market, and the development of market intermediary organizations. The higher the score for this index, the better the institutional environment. In addition, most of our empirical research ended in 2016, while this index was published only until 2014. Previous scholars all believed that the degree of marketization and government regulation in different regions were relatively stable, so the institutional environment in different regions had certain continuity. Therefore, referring to the previous practices, we used the marketization total index score in 2014 to replace the institutional environment of the two years from 2015 to 2016.

Consumer environmental awareness (CEA): We chose the number of green consumers from 2011 to 2015 in the China Green Consumer Report published by Alibaba research institute in 2016 and

divided it into levels 1, 2, 3, and 4. The report was made by the Alibaba research institute, which collects big data and defines consumers who buy more than five types of green basket goods as green consumers.

3.2. Empirical Model Design

To verify Hypothesis 1, we set the empirical Model (2) as follows:

$$
\begin{aligned}
Inv\_InEff_{i,t} &= \beta_0 + \beta_1 CER_{i,t-1} + \beta_2 Tobin\_Q_{i,t} + \beta_3 Cash_{i,t} + \beta_4 LEV_{i,t} \\
&+ \beta_5 Size_{i,t} + \beta_6 LOSS_{i,t} + \beta_7 Age_{i,t} + \beta_8 Sh\_Ratio_{i,t} + \mu_i + \varepsilon_{i,t}
\end{aligned}
\tag{2}
$$

Among them, the dependent variable, investment inefficiency (Inv_InEff), is the absolute residual value estimated by Model (1) after winsorizing treatment. The higher the value is, the higher the deviation degree of the enterprise's expected investment and the lower the investment efficiency. When the residual value is less than 0, it indicates that the enterprise underinvests, and otherwise, it overinvests.

According to previous studies, our model also contains a series of control variables. The remaining variables of the estimation Model (2) are the control variables that may affect the investment efficiency, which are specifically defined as follows: Tobin's Q (TOB_Q) is represented by company growth opportunities; free cash flow (Cash) is expressed as the ratio of cash flow generated from business activities to total assets; leverage (LEV) is given as the ratio of long-term liabilities to total assets; the size (Size) of the company is expressed as the natural logarithm of the total assets; and the loss (LOSS) of an enterprise is a virtual two-valued variable. If the company's net profit is negative, LOSS takes a value of 1; otherwise, it takes a value of 0. Company age (Age) is the number of years from company listing to the observation year. Finally, ownership concentration is expressed by the sum of the shareholding ratios of the top ten shareholders (Sh_Ratio).

To verify Hypothesis 2, we set empirical Model (3) as follows:

$$
\begin{aligned}
Inv\_InEff_{i,t} &= \beta_0 + \beta_1 CER_{i,t-1} + \beta_2 CER_{i,t-1} * In\_env_{n,t} + \beta_3 In\_env_{n,t} + \beta_4 Tobin\_Q_{i,t} + \beta_5 Cash_{i,t} \\
&+ \beta_6 LEV_{i,t} + \beta_7 Size_{i,t} + \beta_8 LOSS_{i,t} + \beta_9 Age_{i,t} + \beta_{10} Sh\_Ratio_{i,t} + \mu_i + \varepsilon_{i,t}
\end{aligned}
\tag{3}
$$

To verify Hypothesis 3, we set empirical Model (4) as follows:

$$
\begin{aligned}
Inv\_InEff_{i,t} &= \beta_0 + \beta_1 CER_{i,t-1} + \beta_2 CER_{i,t-1} * CEA_t + \beta_3 CEA_t + \beta_4 Tobin\_Q_{i,t} + \beta_5 Cash_{i,t} \\
&+ \beta_6 LEV_{i,t} + \beta_7 Size_{i,t} + \beta_8 LOSS_{i,t} + \beta_9 Age_{i,t} + \beta_{10} Sh\_Ratio_{i,t} + \mu_i + \varepsilon_{i,t}
\end{aligned}
\tag{4}
$$

In addition, before using the panel OLS to estimate the empirical model, we carried out the Hausman test on whether the fixed effect or random effect should be used. The results supported OLS regression with fixed effects. Therefore, all empirical models in this paper use panel regression with fixed effects.

3.3. Data Sources and Preprocessing

The research samples of this paper mainly include data on the listed companies on the Shanghai and Shenzhen stock exchanges for the years 2011 to 2016. CER comes from the HeXun social responsibility report of listed companies, which has published the environmental responsibility score of listed companies since 2010. As mentioned above, the impact of CER on investment efficiency may have a time lag. We choose CER in the previous year as the independent variable, so most of our studies began in 2011 and took the current year's CER as the control regression. Institutional environment data came from Wang et al. [50]. Data on consumer environmental awareness were those released by the Alibaba research institute in 2016. Other data at the company level were all from the CSMAR (China Stock Market & Accounting Research Database) database.

Finally, according to previous research, this paper carried out the following preprocessing of the original data. (1) Since the investment behavior of companies in the financial industry was different from that of other companies, this paper excluded financial companies (companies with industry code initials J). (2) The sample observations with missing values were eliminated. (3) Since the investment behavior and operation behavior of enterprises with abnormal financial status (ST) were different from those with normal operation, companies with ST during the sample period were excluded. (4) To better include the characteristics of business continuity, we only kept samples of companies with data for at least 4 years. Finally, the company–year panel data containing 9732 sample observations were obtained, including the unbalanced panel data of 1898 companies for 6 years. In addition to the ratio data, the asset variables (the net cash recovered from the disposal of fixed assets, intangible assets, and other long-term assets; cash paid for fixed assets, intangible assets, and other long-term assets; and total assets and net cash flow from operating activities) in this paper were deflated by the consumer price index to the price level in 2010. The definitions of all variables used in this article are shown in Appendix A.

4. Empirical Results

4.1. Descriptive Statistics of the Variables

The descriptive statistics for the variable data used in this paper are shown in Table 1. The descriptive statistics in Table 1 showed the following: (1) The minimum value of the inefficient investment level of China's listed companies was only 0.0002, the maximum value was 39.94, and the average value was 4.87. It can be said that the investment efficiency of different listed companies in China varied greatly and that the problem of investment inefficiency generally existed. (2) The minimum value of the CER score was 0, the maximum value was 30, and its average value was only 3.19. In general, there was a large gap in the environmental responsibility undertaken by listed companies, many enterprises did not participate in environmentally friendly activities, and the company management awareness of environmental responsibility was still insufficient. (3) The minimum value of the institutional environment was −0.3, the maximum value was 9.95, and the average value was 8.05. This finding shows that the institutional environment in most regions was not too bad, although there were large differences between regions (variance was 1.65). Finally, the descriptive statistics for the seven control variables selected in this paper are also shown in Table 1.

Table 1. The descriptive statistics for the seven control variables selected in this paper.

Variable	Obs	Mean	Std.	Min	Max
Inv_InEff	9732	4.869615	5.265714	0.0002479	39.94103
CER_{t-1}	9732	3.188163	6.45116	0	30
In_env	9732	8.045247	1.646102	−0.3	9.95
CEA	8141	2.888834	1.115911	1	4
TOB_Q	9732	2.496995	1.765982	0.7016603	28.75948
Cash	9732	0.0626415	0.1996517	−1.553472	1.736415
LEV	9732	0.0776755	0.1069138	−0.0359539	0.7406508
Size	9732	22.1708	1.286579	18.89816	28.385
LOSS	9732	0.075113	0.2635872	0	1
Age	9732	10.61478	6.213751	1	26
Sh_Ratio	9732	56.83423	15.53282	1.32	98.551

At the end of this section, we report multicollinearity between variables. The Pearson correlation coefficient and variance inflation factor (VIF) were used to test multicollinearity, and the results are shown in Tables 2 and 3. The correlation coefficient between CER and investment inefficiency, as seen in Table 2, was negative, which preliminarily verifies our hypothesis that CER can reduce investment inefficiency. In addition, the correlation coefficients between the variables in Table 2 were all below

0.45, and the mean value of VIF shown in Table 3 was 1.27, indicating that our variables were not affected by multicollinearity.

Table 2. The Pearson correlation coefficient between variables.

	Inv_Eff	CER_{t-1}	**In_env**	**CEA**	**TOB_Q**	**Cash**	**LEV**	**Size**	**LOSS**	**Age**	**Sh_Ratio**
Inv_InEff	1										
CER_{t-1}	−0.0438	1									
In_env	−0.0449	−0.0763	1								
CEA	−0.1068	−0.0785	0.3298	1							
TOB_Q	0.0853	−0.1536	0.1037	0.1421	1						
Cash	0.0732	0.0578	−0.0064	0.0258	0.0476	1					
LEV	0.0183	0.143	−0.13	−0.012	−0.3034	−0.0088	1				
Size	−0.1309	0.3274	−0.0039	0.0641	−0.4173	0.0584	0.484	1			
LOSS	0.012	−0.0251	−0.0589	0.0365	−0.0362	−0.0883	0.0727	−0.0261	1		
Age	−0.1939	0.0515	−0.0654	0.0831	−0.174	0.0247	0.2466	0.308	0.0675	1	
Sh_Ratio	0.0369	0.0713	0.056	−0.013	0.0062	0.0971	0.0494	0.2135	−0.0829	−0.2764	1

Table 3. The variance inflation factor (VIF) of variables.

Variable	**VIF**	**1/VIF**
Size	1.88	0.53074
LEV	1.38	0.726612
Age	1.34	0.745315
TOB_Q	1.28	0.782228
Sh_Ratio	1.26	0.793527
CEA	1.19	0.841913
lcsr_evn	1.17	0.851392
In_env	1.17	0.857417
Cash	1.03	0.970821
LOSS	1.03	0.971401
Mean VIF	1.27	

4.2. CER and Investment Inefficiency

To test Hypothesis 1, we used a panel OLS regression to estimate the impact of CER on investment efficiency, and the specific regression results are shown in Table 4. Model (1) in Table 4 reported the regression results of this year's CER with a series of control variables and investment inefficiency. The regression results show that the estimated coefficient of CER in the current period was positive and not statistically significant, which indicates that current CER had little impact on investment inefficiency. On the other hand, the regression results of the impact of lagged CER on investment inefficiency were reported in Model (2) of Table 4. Compared with the regression results of current CER, the regression coefficient of lagged CER was −0.0312, which was statistically significant: it passed the significance test at the level of 1%. The results of Model (2) show that the CER in the lagged period could significantly reduce the level of investment inefficiency. In other words, the higher the level CER was in the previous year, the lower the level of investment inefficiency in the current year, and the higher the level of investment efficiency could be. In general, the above two empirical results confirmed the previous conjecture: the CER effect is not immediate but has a time lag. Compared with the current year's CER, the previous year's CER could improve the company's investment efficiency. It can be said that enterprises should not only undertake environmental responsibility for "selfless dedication" or participation under external pressure but also actively participate in environmental protection activities for the sake of their own interests.

Table 4. The impact of CER on investment efficiency are reported.

Variables	(1) Total	(2) Total	(3) Overinvestment	(4) Underinvestment
CER_t	0.00308			
	(0.00888)			
CER_{t-1}		−0.0312 ***	0.00746	−0.0332 ***
		(0.00909)	(0.0213)	(0.0120)
TOB_Q	0.110 ***	0.107 ***	0.220 *	0.0399
	(0.0405)	(0.0404)	(0.122)	(0.0626)
Cash	−0.0832	−0.0852	0.119	0.0299
	(0.259)	(0.259)	(0.513)	(0.328)
LEV	1.479 *	1.501 *	5.530 ***	−3.609 ***
	(0.893)	(0.892)	(1.846)	(1.245)
Size	0.0511	0.0938	0.00705	0.616 ***
	(0.159)	(0.159)	(0.449)	(0.214)
LOSS	0.0174	0.00353	−0.892 **	0.528 **
	(0.191)	(0.191)	(0.414)	(0.220)
Age	−0.124 ***	−0.146 ***	−0.448 ***	0.278 ***
	(0.0299)	(0.0300)	(0.0746)	(0.0418)
Sh_Ratio	0.0278 ***	0.0268 ***	0.0436 ***	−0.00388
	(0.00655)	(0.00656)	(0.0165)	(0.00888)
Constant	3.033	2.494	6.304	−11.91 ***
	(3.271)	(3.281)	(9.267)	(4.452)
Observations	9732	9732	4317	5415
Number of N_code	1898	1898	1898	1898
R-squared	0.006	0.008	0.031	0.051
F-statistic	7.01	8.02	9.26	18.44

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

In Model (2) of Table 4, in addition to finding the lagged CER, we obtained some control variables that had a significant impact on investment inefficiency. First, Tobin's Q (TOB_Q), which represented the growth opportunity of the company, had a positive impact on investment inefficiency, indicating that enterprises with greater growth opportunities were more likely to face a higher level of investment inefficiency. Companies with greater growth opportunities may have had more investment opportunities, which may have led to the problem of overinvestment, which could explain why the regression coefficient of the Tobin's Q value (TOB_Q) was positive. Second, the regression coefficient of the leverage ratio (LEV), which represents the company's debt level, was positive and significant at the 10% level, indicating that a company with larger debt would reduce its investment efficiency. Then, the company's age (Age) could significantly reduce the level of investment inefficiency. The longer an enterprise was listed, the more likely the manager was to have experience in investment, grasp investment opportunities and directions more accurately, and improve the investment efficiency of the company. Finally, the higher the shareholding ratio (Sh_Ratio) of the top ten shareholders representing the ownership concentration, the more likely it was that the company would face a low level of investment efficiency.

Finally, Models (3) and (4) in Table 4 report the effects of lagged CER and a series of control variables on two types of investment inefficiencies: overinvestment and underinvestment. The dependent variable—overinvestment—is represented by the positive residuals in the investment inefficiency calculation model, while the underinvestment is represented by the absolute value of negative residuals in the model. The regression results of Model (3) in Table 4 show that in the case of overinvestment, the impact of CER on investment inefficiency was positive but not significant. On the one hand, CER could reduce overinvestment caused by corporate free cash flow abuse to a certain extent, but at the same time, external support (such as bank loans and government subsidies) could increase the company's available resources, which may have caused a certain distortion of investment efficiency. The mutual offset of the two may explain why the effect of CER on investment inefficiency was not obvious in the case of overinvestment. In contrast, the regression results of Model (4) in Table 4 show

that CER had a negative impact on underinvestment and passed the statistical test, indicating that lagged CER could promote underinvestment and thus improve investment efficiency.

4.3. The Moderating Role of the Institutional Environment on CER's Influence on Investment Inefficiency

In the previous section, we discussed mainly the lagged effect of CER on the inhibition of investment inefficiency. According to Hypothesis 2 above, the institutional environment can affect the impact of environmental responsibility on investment efficiency. This section studies mainly the moderating role of the institutional environment, and the regression results are shown in Table 5. Model (1) in Table 5 reports the moderating effect of the institutional environment in the overall sample, Model (2) shows the moderating impact of institutional environment in the samples of over-invested companies, and finally, Model (3) reports the moderating effect of the institutional environment in the samples of under-invested companies. It can be obtained from the regression results in Table 5 that in the overall sample (Model (1)), the regression coefficient of the cross term of lagged CER and the marketization total index was positive and significant at the 10% level; in the overinvestment sample (Model (2)), the regression coefficient of this cross term was also positive, but it did not seem to be statistically significant. Finally, in the sample regression of underinvestment (Model (3)), the regression coefficient of the cross term was also positive and passed the significance test at the 5% level.

Table 5. The moderating role of the institutional environment.

Variables	(1) Total	(2) Overinvestment	(3) Underinvestment
CER_{t-1}	−0.108 **	−0.0607	−0.157 ***
	(0.0484)	(0.116)	(0.0603)
$CER_{t-1} * In\_env$	0.00968 *	0.00856	0.0155 **
	(0.00574)	(0.0135)	(0.00707)
In_env	−0.160 ***	−0.223	−0.0643
	(0.0510)	(0.150)	(0.0667)
TOB_Q	0.110 ***	0.226 *	0.0446
	(0.0405)	(0.122)	(0.0627)
Cash	−0.0870	0.128	0.0316
	(0.259)	(0.512)	(0.329)
LEV	1.434	5.400 ***	−3.579 ***
	(0.893)	(1.848)	(1.238)
Size	0.108	0.0234	0.644 ***
	(0.159)	(0.451)	(0.214)
LOSS	0.0138	−0.847 **	0.512 **
	(0.191)	(0.417)	(0.219)
Age	−0.104 ***	−0.382 ***	0.278 ***
	(0.0346)	(0.0842)	(0.0469)
Sh_Ratio	0.0265 ***	0.0437 ***	−0.00470
	(0.00654)	(0.0164)	(0.00888)
Constant	3.027	7.026	−11.99 ***
	(3.268)	(9.186)	(4.458)
Observations	9732	4317	5415
Number of N_code	1898	1898	1898
R-squared	0.009	0.032	0.053
F-statistic	7.52	7.64	15.02

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

In general, the institutional environment could positively moderate the inhibiting effect of CER on investment inefficiency. In regions with a better institutional environment, CER played a more significant role in reducing the level of investment inefficiency, and a good institutional environment provided a fairer background for CER to play its role. For samples with overinvestment, the regression results showed that the moderating effect of the institutional environment was almost not obvious. In contrast, for companies with underinvestment, the positive moderating effect of institutional environment was more significant. The regression results obtained in the previous section showed

that for overinvestment, the impact of CER on investment inefficiency was not obvious, which may be the reason why the institutional environment played a less significant role in the overinvestment sample: for enterprises with overinvestment, CER had no significant effect on the improvement of investment efficiency, resulting in no significant positive adjustment effect of the institutional environment. In conclusion, the above results verify the previous hypothesis. In an institutional environment with strict laws and strict politics, it is almost impossible for companies to obtain external support through bribery or other unfair competition. Therefore, companies that undertake environmental responsibilities are more likely to face greater investment opportunities and improve the investment inefficiency that may exist in enterprises.

4.4. The Moderating Role of Consumer Environmental Awareness on CER's Influence on Investment Inefficiency

In Model (1), (2), and (3) of Table 6, the moderating effect of consumer environmental awareness on CER and investment inefficiency under different investment inefficiencies is shown. According to Model (1), the regression coefficient of the cross term between consumer environmental awareness and lagged CER in the overall regression sample was positive, indicating that with the increase of consumer environmental awareness, enterprises undertaking environmental responsibility could improve investment efficiency, but unfortunately, this finding was not statistically significant. The results in Model (2) show that in the case of overinvestment, the regression coefficient of the cross term was negative but not significant. Finally, the results in Model (3) show that in the samples with underinvestment, the regression coefficient of this cross term was positive and passed the statistical test at the 10% level.

Table 6. The moderating role of consumer environmental awareness on investment inefficiency.

Variables	(1) Total	(2) Overinvestment	(3) Underinvestment
CER_{t-1}	−0.00584	0.0562	−0.0538 **
	(0.0177)	(0.0410)	(0.0226)
$CER_{t-1} * CEA$	0.000887	−0.00506	0.0148 *
	(0.00689)	(0.0148)	(0.00825)
CEA	−1.181 ***	−1.217 ***	−0.945 ***
	(0.163)	(0.379)	(0.201)
TOB_Q	0.0636	0.139	0.0640
	(0.0460)	(0.133)	(0.0658)
Cash	0.0419	−0.0889	0.224
	(0.296)	(0.567)	(0.385)
LEV	3.641 ***	6.754 ***	−2.032
	(1.033)	(2.163)	(1.301)
Size	−0.476 **	−0.833*	0.574 **
	(0.193)	(0.449)	(0.285)
LOSS	0.0600	−1.047 **	0.567 **
	(0.214)	(0.483)	(0.253)
Age	0.569 ***	0.510	0.743 ***
	(0.130)	(0.328)	(0.166)
Sh_Ratio	0.0292 ***	0.0591 ***	−0.0113
	(0.00756)	(0.0185)	(0.0108)
Constant	10.69 ***	17.74 **	−13.14 **
	(3.945)	(9.045)	(5.872)
Observations	8141	3901	4240
Number of N_code	1898	1866	1865
R-squared	0.038	0.050	0.034
F-statistic	24.56	9.45	7.64

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

As consumers become greener, environmentally friendly companies will signal to society that they are willing to take environmental responsibility. Consumers are more willing to buy environmentally friendly products, and their preference for CER enterprises may increase these companies' sales

revenue and lead to the increase of available resources. Therefore, these enterprises are more likely to solve the problem of underinvestment and improve investment efficiency. The interaction between the moderation of overinvestment and the moderation of underinvestment may make the overall moderation effect not significant. In general, with the increase in consumers' awareness of environmental protection, CER plays a more significant role in alleviating underinvestment.

4.5. Robustness

4.5.1. Alternative Dependent Variable

To test the robustness of the above model, we adjusted the investment inefficiency measurement model. According to the models of previous scholars [5,24,44], we adjusted the estimation Model (1) in Section 3 and added the sales growth rate (Sales) as the only determinant of investment expenditure into the model. The new model is shown as follows:

$$Inv_{i,t} = \beta_0 + \beta_1 Sales_{i,t-1} + \mu_i + \varepsilon_{i,t} \tag{5}$$

where the sales growth rate (Sales) is expressed as the operating income of the current period minus the operating income of the previous period divided by the operating income of the previous period. The new absolute residuals are used to replace the original residuals in the dependent variable of investment inefficiency, and the regression of the empirical model is carried out again. The results are shown in Table 7.

Table 7. The results of alternative dependent variable.

Variables	(1) Total	(2) Total	(3) Total	(4) Underinvestment
CER_{t-1}	−0.0308 ***	−0.113 **	−0.00479	−0.0470 **
	(0.00915)	(0.0482)	(0.0179)	(0.0229)
$CER_{t-1} * In\_env$		0.0104 *		
		(0.00572)		
In_env		−0.165 ***		
		(0.0510)		
$CER_{t-1} * CEA$			0.000783	0.0146 *
			(0.00692)	(0.00837)
CEA			−1.156 ***	−0.902 ***
			(0.163)	(0.200)
TOB_Q	0.0843 **	0.0872 **	0.0542	0.0310
	(0.0405)	(0.0406)	(0.0463)	(0.0688)
Cash	−0.0792	−0.0810	0.0511	0.0912
	(0.261)	(0.261)	(0.298)	(0.383)
LEV	1.533*	1.464	3.589 ***	−1.647
	(0.892)	(0.893)	(1.035)	(1.312)
Size	0.131	0.146	−0.500 ***	0.474 *
	(0.159)	(0.159)	(0.193)	(0.282)
LOSS	0.00702	0.0174	0.0681	0.425 *
	(0.191)	(0.191)	(0.215)	(0.254)
Age	−0.152 ***	−0.109 ***	0.555 ***	0.726 ***
	(0.0300)	(0.0347)	(0.130)	(0.168)
Sh_Ratio	0.0268 ***	0.0266 ***	0.0267 ***	−0.0199 *
	(0.00662)	(0.00660)	(0.00758)	(0.0106)
Constant	1.791	2.338	11.48 ***	−10.29 *
	(3.283)	(3.270)	(3.944)	(5.810)
Observations	9732	9732	8141	4280
Number of N_code	1898	1898	1898	1863
R-squared	0.008	0.009	0.037	0.028
F-statistic	8.19	7.77	23.80	6.15

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

The regression results show that in the overall sample, lagged CER had a significant negative impact on alternative investment inefficiency. The institutional environment could positively

moderate the effect of CER on investment inefficiency. The greater the consumers' environmental awareness was, the more significant the improvement of corporation's environmental responsibility for underinvestment. This finding is consistent with the above regression conclusion, indicating that the results of this study are robust.

4.5.2. Add Control Variable

Furthermore, in order to better test the robustness of empirical model and ensure the effectiveness of the impact of corporate environmental responsibility on investment efficiency, we added new control variables that may affect investment efficiency on the basis of the original empirical model: Return on Assets (ROA), Current Ratio (Cur_Ratio), and Board Size, where the board size is replaced by the number of board directors, and the missing value is replaced by the number of board directors in the previous year, and a dummy variable (Boa_Size) is constructed. If the number of board directors is larger than the average number, the value is 1, otherwise, the value is 0. The regression results are shown in Table 8. The regression results were consistent with the previous results, which further indicates the validity of the empirical results in this paper.

Table 8. The results of add control variable.

Variables	(1) Total	(2) Total	(3) Total	(4) Underinvestment
CER_{t-1}	−0.0311 ***	−0.109 **	−0.00619	−0.0523 **
	(0.00909)	(0.0485)	(0.0177)	(0.0225)
$CER_{t-1} * In\_env$		0.00982 *		
		(0.00575)		
In_env		−0.157 ***		
		(0.0511)		
$CER_{t-1} * CEA$			0.00172	0.0139 *
			(0.00690)	(0.00821)
CEA			−1.221 ***	−0.924 ***
			(0.162)	(0.201)
TOB_Q	0.0896 **	0.0929 **	0.0315	0.0811
	(0.0405)	(0.0407)	(0.0448)	(0.0673)
Boa_Size	−0.0857	−0.0797	−0.118	0.112
	(0.148)	(0.148)	(0.172)	(0.187)
ROA	4.501 *	4.378	7.618 **	−4.244
	(2.701)	(2.706)	(3.071)	(3.624)
Cur_Ratio	0.00941	0.00952	0.00679	−0.00145
	(0.00808)	(0.00807)	(0.00843)	(0.00674)
Cash	−0.178	−0.177	−0.102	0.320
	(0.260)	(0.259)	(0.299)	(0.381)
LEV	1.623 *	1.553 *	3.838 ***	−2.073
	(0.892)	(0.893)	(1.028)	(1.306)
Size	0.0734	0.0888	−0.515 ***	0.600 **
	(0.162)	(0.161)	(0.194)	(0.289)
LOSS	0.141	0.147	0.283	0.453 *
	(0.205)	(0.205)	(0.232)	(0.266)
Age	−0.133 ***	−0.0921 ***	0.626 ***	0.714 ***
	(0.0316)	(0.0357)	(0.131)	(0.168)
Sh_Ratio	0.0254 ***	0.0251 ***	0.0275 ***	−0.0111
	(0.00658)	(0.00656)	(0.00751)	(0.0108)
Constant	2.813	3.315	11.08 ***	−13.49 **
	(3.315)	(3.301)	(3.938)	(5.888)
Observations	9732	9732	8141	4240
Number of N_code	1898	1898	1898	1865
R-squared	0.008	0.009	0.039	0.035
F-statistic	6.09	5.97	19.14	5.97

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

4.5.3. The Moderating Role of the Interaction of Institutional Environment and Consumer Environmental Awareness on CER Effect

In order to better understand the moderating effect of institutional environment and consumer environmental awareness between CER and investment efficiency, we added the cross term of institutional environment, consumer environmental awareness, and CER on the basis of the original empirical results, and the regression results are shown in Table 9. It can be obtained that the regression coefficient of the cross term (In_env*CER*CEA) was positive and significant at the level of 1%. The results show that the better the institutional environment was and the stronger the consumer environmental awareness was, the more significant the impact of corporate environmental responsibility on investment inefficiency was. The results further verify the positive moderating effect of institutional environment and consumer environmental awareness on CER.

Table 9. The results of the interaction of institutional environment and CEA on CER.

Variables	(1) Total	(3) Overinvestment	(3) Underinvestment
CER_{t-1}	0.0186	−0.102	−0.178 *
	(0.0662)	(0.149)	(0.0994)
$CER_{t-1} * In\_env$	−0.00268	0.0229	0.0179
	(0.00873)	(0.0200)	(0.0131)
$CER_{t-1} * CEA$	−0.0777 ***	−0.0254	0.0251
	(0.0266)	(0.0485)	(0.0348)
$CER_{t-1} * In\_env * CEA$	0.00958 ***	0.00127	−0.00221
	(0.00324)	(0.00625)	(0.00450)
In_env	−0.106 *	−0.292	0.0720
	(0.0619)	(0.181)	(0.0781)
CEA	−1.185 ***	−1.276 ***	−0.911 ***
	(0.163)	(0.379)	(0.203)
TOB_Q	0.0555	0.132	0.0679
	(0.0458)	(0.134)	(0.0661)
Cash	0.0536	−0.0886	0.233
	(0.296)	(0.567)	(0.386)
LEV	3.580 ***	6.620 ***	−2.075
	(1.032)	(2.156)	(1.296)
Size	−0.473 **	−0.818 *	0.593 **
	(0.193)	(0.454)	(0.285)
LOSS	0.0801	−1.013 **	0.537 **
	(0.215)	(0.483)	(0.253)
Age	0.614 ***	0.678 **	0.684 ***
	(0.135)	(0.337)	(0.175)
Sh_Ratio	0.0296 ***	0.0590 ***	−0.0109
	(0.00752)	(0.0183)	(0.0107)
Constant	11.01 ***	18.24 **	−13.66 **
	(3.941)	(9.121)	(5.872)
Observations	8141	3901	4240
Number of N_code	1898	1866	1865
R-squared	0.040	0.052	0.036
F-statistic	20.19	7.68	6.25

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

4.6. Endogeneity

There may be another relationship in the impact of CER on investment efficiency. Companies with high investment efficiency may have more available resources than those with low investment efficiency, which leads to a reverse causal relationship between the impact of CER on investment efficiency. Companies with high investment efficiency are more willing to devote resources to environmental

responsibility activities. To avoid the deviation of previous empirical results caused by the existence of endogeneity, we conduct an endogeneity test on the model in this section.

First, we used the instrumental variable method (IV) to conduct a two-stage OLS (2SLS) and the generalized method of moments (GMM) estimation of the model. In the first stage, two instrumental variables and control variables were first regressed on the lagged CER. In the second stage, the estimated CER value obtained in the first stage and a series of control variables were regressed on the investment inefficiency. This approach could avoid the deviation in results caused by endogeneity to some extent. The most important step in using IV is to select the appropriate instrumental variable. Based on previous studies by scholars [5,51], we selected the industry–year average and region–year average of lagged corporation environmental responsibility as instrumental variables. The regression results of the second stage of 2SLS and GMM are respectively reported in Tables 10 and 11. Both regression results showed that the improvement effect of lagged CER, the positive moderating effect of the institutional environment on investment efficiency, and the positive adjustment effect of consumer environmental awareness on underinvested companies were all significant.

Table 10. The regression results of the second stage of 2SLS.

Variables	(1) Total	(2) Total	(3) Total	(4) Underinvestment
CER_{t-1}	−0.203 ***	−1.627 ***	−0.158	−0.393 **
	(0.0305)	(0.364)	(0.107)	(0.178)
$CER_{t-1} * In\_env$		0.189 ***		
		(0.0431)		
In_env		−0.812 ***		
		(0.168)		
$CER_{t-1} * CEA$			0.0409	0.115 **
			(0.0286)	(0.0525)
CEA			−1.137 ***	−1.062 ***
			(0.185)	(0.211)
TOB_Q	0.0915 **	0.167 ***	0.102 *	0.130 *
	(0.0412)	(0.0457)	(0.0570)	(0.0692)
Cash	−0.104	−0.0560	−0.00211	0.204
	(0.295)	(0.313)	(0.338)	(0.400)
LEV	1.632 *	1.420	3.761 ***	−2.068
	(0.919)	(0.974)	(1.077)	(1.303)
Size	0.301*	0.452 **	−0.289	1.015 ***
	(0.163)	(0.188)	(0.246)	(0.337)
LOSS	−0.0751	−0.0592	0.0469	0.543 **
	(0.195)	(0.207)	(0.217)	(0.248)
Age	−0.254 ***	−0.165 ***	0.365 *	0.448 **
	(0.0396)	(0.0452)	(0.210)	(0.227)
Sh_Ratio	0.0216 ***	0.0175 **	0.0240 ***	−0.0216 *
	(0.00693)	(0.00759)	(0.00895)	(0.0113)
Constant	−0.0855	2.058	9.009 **	−18.49 ***
	(3.263)	(3.443)	(4.431)	(5.719)
Observations	9732	9732	8141	4240
Number of N_code	1898	1898	1898	1865

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

Second, to further test the endogeneity of the empirical results, we also introduced the PSM model. Compared with the instrumental variable method, the advantage of the PSM model is that it does not need to select other instrumental variables, the choice of which has a great impact on the results of IV. Therefore, testing endogeneity with PSM may be simpler and more effective than the instrumental variable method. Before performing PSM, we needed to build a virtual two-valued variable for CER (CER_Vir). When the lagged CER was greater than 0, the value was assigned to 1;

otherwise, the value was assigned to 0. The probit model was then used to regress the same control variable as above on the CER dummy variable. Then, we matched a CER with a value of 1 to a value of 0. To better match, we chose four matching methods: one-to-one matching, one-to-four matching, caliper matching, and kernel matching. The results in Table 12 showed that the inhibition of CER on investment inefficiency was not affected by endogeneity.

Table 11. The regression results of GMM.

Variables	(1) Total	(2) Total	(2) Total	(4) Underinvestment
CER_{t-1}	−0.203 ***	−1.696 ***	−0.155 *	−0.393 **
	(0.0286)	(0.365)	(0.0943)	(0.180)
$CER_{t-1} * In\_env$		0.197 ***		
		(0.0431)		
In_env		−0.850 ***		
		(0.168)		
$CER_{t-1} * CEA$			0.0406	0.115 **
			(0.0255)	(0.0536)
CEA			−1.155 ***	−1.068 ***
			(0.169)	(0.207)
TOB_Q	0.0916 **	0.180 ***	0.0994 *	0.129 *
	(0.0465)	(0.0490)	(0.0555)	(0.0753)
Cash	−0.109	−0.0742	0.00744	0.215
	(0.271)	(0.286)	(0.308)	(0.405)
LEV	1.619 *	1.309	3.719 ***	−2.100
	(0.959)	(1.008)	(1.107)	(1.339)
Size	0.298 *	0.481 **	−0.273	1.016 ***
	(0.180)	(0.198)	(0.248)	(0.367)
LOSS	−0.0769	−0.0720	0.0647	0.546 **
	(0.196)	(0.213)	(0.218)	(0.260)
Age	−0.254 ***	−0.166 ***	0.383 **	0.453 **
	(0.0398)	(0.0462)	(0.185)	(0.231)
Sh_Ratio	0.0215 ***	0.0159 *	0.0240 ***	−0.0217 *
	(0.00768)	(0.00816)	(0.00913)	(0.0125)
Observations	9732	9732	8138	3883
Number of N_code	1898	1898	1895	1508

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

Table 12. The inhibition of CER on investment inefficiency.

Variables	(1) One to One	(2) One to Four	(3) Caliper Matching	(4) Kernel Matching
CER_Vir	−0.418 **	−0.459 ***	−0.443 ***	−0.453 ***
Observations	9732	9732	9732	9732

*** is a significant level of 1%. ** is a significant level of 5%. * is a significant level of 10%.

5. Conclusions

Due to scholars' long-standing debate on CSR, there is still no conclusion on whether enterprises should sacrifice some resources to pay for the environment. Scholars have chosen different perspectives to deeply analyze the impact of CSR on corporate value [5,6,25,26,32]. With air pollution and the gradual deterioration of the natural environment, it has deeply affected human health and future development. Scholars began to study the effect of CER on corporate profits from different perspectives, such as business performance, operating income, and external financing [2,27,30]. This paper focuses on a less-discussed aspect: investment efficiency. Based on the government's and business environment's great restrictions on enterprises and the current trend of popularizing environmental protection,

this paper discusses the influence of corporation environmental responsibility on investment efficiency, as well as the moderating effect of institutional environment and consumer environmental awareness.

The research samples in this paper are data samples for listed companies in China from 2011 to 2016. After nearly 40 years of reform and opening up, the country's rapid economic development has transformed China from a country where people were struggling for subsistence to the world's second largest economy. The damage to the environment has been enormous. In addition, China is still a developing country. Compared with developed countries, the growth of the stock market in emerging markets is accompanied by the increase of carbon emissions, which means that listed companies in developing countries lack environmental protection [52]. Therefore, this study can further enrich the literature on emerging markets and provide some evidence for whether it is beneficial for enterprises in a developing state to assume environmental responsibilities.

First, we discuss the impact of CER on investment efficiency. The results show that CER has a negative impact on investment efficiency in the short term because it occupies some available resources, but the impact is not significant. In the long run, CER can effectively improve investment efficiency and promote underinvestment.

Second, we analyze the moderating effect of the institutional environment on the CER effect. The results show that the better the institutional environment the company is in, the more significant the inhibiting effect of CER on the investment inefficiency and the better the investment efficiency.

Finally, we study the influence of consumer environmental awareness on the CER effect. The results show that with the improvement of consumers' environmental awareness, CER can more significantly inhibit the phenomenon of underinvestment.

The research results of this paper are of great significance to corporate environmental responsibility literature, and policy and investment decision-making of enterprises. Chinese companies' awareness of environmental responsibility is still insufficient, considering that the average score of Chinese listed companies' environmental responsibility is only 3.19. The conclusion of this paper shows that the cost of companies participating in environmentally responsible activities is far less than the benefits it brings, and this effect has a long-term effect. This means that corporate environmental responsibility is of great significance to the sustainable development of enterprises. As corporate managers, they should give proper consideration to green investment, not only for moral or legal reasons, but also to improve the investment efficiency. In addition, the institutional environment plays an important role in the corporate environmental responsibility effect. The government of China should make efforts to improve the institutional environment as much as possible; it should also help develop the local financial market, promote healthy competition among enterprises, and clean up the corruption of government officials; it is also necessary to include the development of regional environmental protection activities in the government performance examination, so as to provide a good external environment for the corporate environmental responsibility to play its role. The increase of consumer environmental awareness is also conducive to the role of corporate environmental responsibility. The Chinese government should follow the example of the Norwegian government [18,50] and increase the publicity of environmental protection, so as to combine environmental awareness with Chinese culture and cultivate people's environmental awareness.

The empirical study in this paper also has some limitations. First of all, this paper only considers the direct impact of corporate environmental responsibility on investment efficiency, ignoring the possible indirect impacts (such as reducing free cash flow, improving information asymmetry and other channels). In addition, the impact of corporate environmental responsibility on investment efficiency may not only be linear, but also nonlinear. Finally, different regions have different economic development, and the impact of corporate environmental responsibility may have different results, which are worth further study in the future.

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

Appendix A

Table A1. The variable definitions used in this article.

Variable Name	Variable Definition
New investment expenditure	(cash paid for the fixed assets, intangible assets, and other long-term assets—cash recovered from the disposal of fixed assets, intangible assets, and other long-term assets) *100/total assets
Tobin's Q	(equity value + total liabilities)/total assets
Net profit growth rate	(net profit in the current year-net profit in the previous year)/net profit in the previous year
Investment inefficiency	the absolute residual value estimated by Model (1)
Corporate environmental responsibility	the environmental responsibility index in the HeXun social responsibility score of listed companies
Institutional environment	"marketization total index score" published by Wang et al. [50]
Consumer environmental awareness	the number of green consumers from the China Green Consumer Report published by Alibaba research institute and divided it into levels 1, 2, 3, and 4.
Free cash flow	cash flow generated from business activities/total assets
Leverage	long-term liabilities/total assets
size	the natural logarithm of the total assets
Loss	If the company's net profit is negative, Loss takes a value of 1; otherwise, it takes a value of 0
Age	the number of years from company listing to the observation year.
Ownership concentration	the sum of the shareholding ratios of the top ten shareholders
Sales growth rate	(operating income of the current period-operating income of the previous period)/operating income of the previous period
Board Size	If the number of board directors is larger than the average number, the value is 1, otherwise, the value is 0.
Return on Assets	net profit/average total assets
Current Ratio	current assets/current liabilities

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