Contingent Decision of Corporate Environmental Responsibility Based on Uncertain Economic Policy

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Received: 5 October 2020; Accepted: 21 October 2020; Published: 24 October 2020

Abstract: Using 522 nonfinancial listed companies on the Chinese A-share Market during 2008–2016 as the sample, this paper studies the discretion of corporations to fulfill their environmental responsibilities in the face of economic policy uncertainty (EPU) through a panel regression model and a panel quantile regression model. Additionally, the sample is classified and the heterogeneity is analyzed based on the equity nature, the financing constraints and the economic region in which the corporations are located. The conclusions are as follows. First, faced with EPU, the corporations are willing to actively undertake environmental responsibilities, but their marginal propensity to these responsibilities shows a downward trend. Second, under the premise of EPU, the decision-making behavior of different types of corporations to fulfill their environmental responsibilities is heterogeneous, which is embodied in the equity nature, financing constraints and economic region. Third, through the stepwise regression method, this paper further studies the impact mechanism, and finds that the enterprise’s leverage ratio plays a partial mediating role in the relationship between EPU and environmental responsibility of nonfinancial corporations. Our paper provides important policy implications for the government. In the process of requiring corporations to fulfill their environmental responsibilities, relevant government organizations should fully consider the impact of EPU on the corporations’ development, and the level of environmental responsibilities should be controlled based on the type of the corporation. We further suggest that the requirement should be imposed on the corporations to disclose high-quality and reliable environmental protection information. Finally, we recommend that the corporations should adhere to the route of sustainable development.

Keywords: economic policy uncertainty (epu); corporate environmental responsibility (cer); heterogeneity; mediation effect

1. Introduction

There are significant differences between the factors of corporate social responsibility (CSR) and the consistency in maximizing shareholders’ economic value. The core elements of CSR include employees, consumers and the environment. In view of the evolution of CSR, it has obvious commercial purposes. However, from the perspective of practical effects, the social responsibility undertaken by corporations on employees can not only attract labor resources, enhance the corporate competitiveness and stimulate them to create more value, but also build a good corporate image and gain reputation and trust, such that the corporations can realize their long-term business objectives. The long-term responsibility to consumers undertaken by the corporations is beneficial to enhance corporate competitiveness and
establish good reputations and images, such that they can give good impressions to the stakeholders and strengthen the confidence of investors. Corporate environmental responsibility (CER) is an important dimension of CSR, which originates from the demand of the industrial revolution [1]. Industrial civilization has caused disastrous effects on the natural environment. The corporations play major roles in the pollution and consumption of the natural environment. As social citizens, the corporations have the inescapable responsibility for the sustainable development of resources and environment. The CER requires the corporations to reduce environmental pollution from their production, or invest on various technical innovations, or even build environmental protection facilities together with the community and so on. Accordingly, the relevance of CER to corporate economic objectives is much weaker than the relevance to employees and consumers.

Government intervention in the market aims to achieve macroeconomic goals [2] or respond to temporary shocks, which results in economic policy uncertainty (EPU) and influences corporate behaviors [3,4]. After the 2008 financial crisis, governments have stepped up their intervention in the financial markets and the real economy by frequently adjusting the economic policies. The continuous introduction of relevant policies by various countries has eased the global economic downturn [5]. However, it has also increased the degree of EPU. In order to maximize shareholders’ value, corporations have had to adjust their corresponding behaviors based on their own economic goals. The impact of EPU on corporate behaviors can be reflected from different perspectives. For instance, Wang et al. [6] and Gulen and Ion [7] found that the rise in the level of EPU will significantly inhibit the corporations’ investment behavior. Moreover, for corporations with higher levels of investment irreversibility and those more dependent on government spending, the impact is stronger. With regard to the effect of EPU on innovation, Xu [8] thought that a higher level of EPU impedes innovation not only through the traditional channel of irreversible investment, but also through the channel of cost of capital. In addition, Ross et al. [9] and Vo and Le [10] pointed out that, based on the strategic growth choice theory and the real option theory, corporations will increase their investment in research and development (R&D) as well as innovation when faced with a higher level of policy uncertainty. In terms of the effect of EPU on cash holdings, Duong et al. [11] and Demir and Ersan [12] found that corporations are willing to hold more cash when the level of EPU rises. In addition, they thought that cash holding is an important channel to mitigate the negative impact of policy uncertainty on real economic activities.

Policies affect economic environment, and the overall level of risk derived from the economic policies will directly or indirectly affect corporate behavior. Many studies have focused on the impact of EPU on enterprises’ micro activities, but most of them did not consider the impact on CER. As an important part of business activities, CER will be affected by EPU to a large extent. When faced with EPU, due to the increase in the external financing costs and management conservatism, corporations would reduce their risk-taking behavior [13] and prefer to operate with lower levels of risk. In addition, the research of Vural-Yavas [14] shows that in the period with higher levels of EPU, the social practice performance, environmental performance and governance performance of corporations are higher. In the period with high levels of EPU, corporations engaged in the above-mentioned three practical activities not only to reduce the level of their risk-taking, but also to follow the law of capital growth. CER can not only reduce the operational risk [15], improve their financial performance and enterprise value [1], but also reduce the negative impact of external environment uncertainty on corporations to a large extent. Therefore, the decision-making behavior of corporations on environmental responsibility will be affected by EPU.

Faced with EPU, there is a higher level of heterogeneity in terms of corporate behavior. The corporations’ internal characteristics are different, and the sensitivity of corporations to the policy changes may be different. Wang et al. [6] studied the effects of EPU on corporate investment and found that non-state-owned enterprises are less sensitive to EPU compared with the state-owned enterprises when there is a higher level of EPU. Meanwhile, the corporate decisions to undertake CSR will be influenced by the nature of the equity. Zeng et al. [16] thought that the state-owned enterprises are more dependent on government support. The corporate administers are inclined to
follow the practices encouraged by the government. Hence, the state-owned enterprises are more likely to undertake CSR by disclosing the information of environmental responsibility. In terms of the external environment, corporate financing constraints greatly affect the sensitivity of EPU. He et al. [17] suggested that corporations with lower financing constraints are more likely to receive loans when the level of EPU increases. Hence, compared with the corporations with higher financing constraints, EPU affects the corporations with lower financing constraints in a more significant way. Corporations are located in economic regions with different degrees of economic development, where the levels of CSR fulfillment will also vary. Liu and Anbumozhi [18] verified that the listed companies on the east coast, compared with the ones in the north, central and west, are more likely to disclose information related to social responsibility. Information disclosure reflects the level of CSR. China is still an economy in transition, and the main source of financing in the market is from bank loans [19]. Bank lending is extremely sensitive to the changes in government policies. Therefore, the uncertainty of the external environment has a great relationship with the capital structure of corporations. Some relevant studies have suggested that the leverage ratios of Chinese corporations are negatively correlated with EPU [20]. The underlying mechanism of this effect is the deterioration of the external financing environment caused by policy uncertainty [21]. In addition, financial leverage is one of the most difficult issues faced by managers when making decisions. The decision-making behavior of corporations to fulfill their social responsibilities is closely related to the enterprise leverage ratios [22]. Some existing studies suggest that corporations with higher leverage ratios have lower levels of CSR due to the consideration that the CSR fulfillment will cause some financial burdens [16,23].

CER, as part of CSR, has the weakest consistency with the economic value maximization of the corporations. When facing EPU, the corporations decide to undertake CER by watching for a chance. Therefore, this paper studies the influence of EPU on corporations to make contingent decisions on undertaking CER by using the Chinese listed companies as the sample and testing both the degree and direction of EPU’s effects. Meanwhile, we investigate the marginal effect of EPU on corporations to undertake their environmental responsibilities and explore the channels and mechanisms of EPU’s effects on CER. The contributions of this paper are summarized as follows. First, the corporations faced with EPU will actively undertake CER. However, the margin of CSR shows a downtrend. The existing empirical studies have verified that there is a positive effect of EPU on CSR. Theoretical analysis focuses on the significant effects of corporate responsibility to employees and consumers on corporate brands. However, these studies failed to consider each dimension, especially the effect on CER. Second, this paper studies the heterogeneity of CER facing the same level of EPU. Due to the difference in the internal attributes and external environment faced by the corporations, both the corporate sensitivity to EPU and the levels of CER appear different in the corporations. Accordingly, this paper divides the sample on the basis of the equity nature, financing constraints and the economic region in which the corporations operate and analyze the heterogenous effect. The empirical results suggest that when facing EPU, both the level and variation tendency of CER show significant differences with respect to equity nature, financing constraints and the economic region in which the corporations operate. Third, based on the effect of EPU on CER, the paper further explores the transmission channels between them. The empirical results found that when facing EPU, the enterprise’s leverage ratio explains the variation of CER in a way, which suggests that there is an intermediate role played by the leverage ratio in explaining the relationship between the EPU and CER.

The rest of the paper is organized as follows. Section 2 analyzes the effect of EPU on corporations to make contingent decisions on undertaking CER by adopting appropriate econometric models. In Section 3, we explore the heterogeneous effects of EPU on CER, which is addressed by the internal attributes and external environment faced by the corporations, considering the different types of corporations and different sensibilities to the external environment. In Section 4, we analyze the influencing mechanism of EPU on corporations to undertake their CER by testing the intermediate effects of the enterprise’s leverage ratio in the relationship between CER and EPU. Section 5 presents the conclusions. The framework of the paper is shown in Figure 1.
2. The Effect of EPU on Corporations to Make Contingent Decisions on Undertaking CER

2.1. Methodology

2.1.1. Panel Regression Model

When facing the same level of EPU, the corporations will make decisions based on their nature and the macro environment. Therefore, the CER levels undertaken are significantly different between different time periods and between companies with different characteristics. The internal characteristics of corporations, including the operational scale and equity nature, are quite different, which results in different effects of EPU and different inputs on CER. The financial situations and development stages of corporations are also different. If the corporations are in the early stage of development, there would be a higher level of demand on capital. An increase in the level of EPU will lead to an increase in the external financing constraints faced by the corporations. The corporations will have less money at their disposal, such that they have to reduce the level of engagement in CER. In the mature stage of development, corporations pay more attention to the brand effect and sustainable development and will more actively fulfill their social responsibilities. In terms of the external environment, the macroeconomic development, relevant policies, laws and regulations may also vary between different time periods. These variations have changed the requirements of the nation on corporate development, which has an impact on the management decisions and development plans of the corporations. Hence, there are different relationships between EPU and CER in different time periods. To analyze the corporate decision behavior when facing an increase in the level of EPU, we carried out an econometric test on the effects of EPU on corporations to make a contingent decision on undertaking CER by using the following panel data model (Equation (1)):

\[
CER_{it} = \beta_0 + \beta_1 EPU_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 FP_{it} + \beta_5 OC_{it} + industry + year + \epsilon_{it}
\]  

(1)

where the subscript \(i\) and \(t\) represent the specific corporation operating at a specific time point. CER is the dependent variable, representing the levels of CER, EPU is the independent variable. Meanwhile,
we introduce some control variables including corporate size (SIZE), leverage ratio (LEV), financial performance (FP) and ownership concentration (OC), which are the corporate characteristics that are supposed to influence the level of CER. In addition, in order to control for the effects of industry heterogeneity and period feature on corporate innovation as well as R&d, in this paper, we also consider the industry effect (industry) and period effect (year). We define 16 virtual variables related to the industry and 9 virtual variables related to the time to eliminate the effect of industry characteristics that do not change over time and the macroeconomic environment that changes over time.

2.1.2. Panel Quantile Regression Model

The mean regression reflects corporate decision behavior on their environmental responsibility when facing an increase in the level of EPU. However, it cannot reflect the marginal effects of EPU for different levels of CER. Hence, we adopt the panel quantile regression method to capture the variation tendency of the marginal effects of EPU. Quantile regression is a generalized form of regression based on traditional regression. It gives one a complete picture of the conditional distribution. In addition, the quantile regression is robust to outliers, heteroscedasticity and skewness [24]. Different from the traditional quantile regression, the panel quantile regression takes into account the effect of unobservable individual heterogeneity. However, many scholars assume that the individual effect is just a positional shift without any influence on the overall distribution. More importantly, these methods cannot handle models with endogenous variables. To solve these problems, Machado and Silva [25] proposed a panel quantile regression model based on moment. According to the existing studies, CER has a significant impact on corporate financial performance [26,27]. Considering that there may be a causal relationship between CER and financial performance, as well as the fact that there would be a possible omission of variables in the model, all these factors will lead to the endogeneity problem of the model. So, in this paper, we adopt the fixed-effect moment quantile regression (MMQR) method, proposed by Machado and Silva [25]. This method allows individual effects to affect the entire distribution, solves the influence of individual heterogeneity which is not observed in the model, and alleviates the endogenous problem to a certain extent. By estimating the relationship between conditional quantile of CER and EPU, we analyzed the marginal effects of EPU at different quantiles. This, to some extent, includes the information of the sample and more accurately reflects the relationship between EPU and CER. Following Machado and Silva [25], we consider the following Equation (2):

\[ CER_i = \alpha_i + X_i'\theta + \sigma(\delta_i + Z_i'\gamma)U_{it} \]  

with \( P(\sigma(\delta_i + Z_i'\gamma) > 0) = 1 \). The individual \( i \) fixed effect is designated by parameters \( (\alpha_i, \delta_i) \), \( i = 1, \ldots, n \), and \( Z \) is a k-vector of known differentiable transformations of \( X_i \). The sequence \( [X_{it}] \) is independently and identically distributed for any fixed firm \( i \) and across time \( t \). \( U_{it} \) are independent and identically distributed across firm \( i \) and time \( t \). Specially, \( U_{it} \) are characterized by satisfying the moment conditions:

\[ E(U) = 0, E(|U|) = 1 \]  

from Equation (2), we can obtain

\[ Q_{CER}(\tau|X_{it}') = \alpha_i + X_i'\theta + \sigma(\delta_i + Z_i'\gamma)q(\tau) \]  

For \( \sigma(\cdot) \) being the identity function and \( Z \) equaling to \( X \), Equation (4) is simplified to

\[ Q_{CER}(\tau|X_{it}') = (\alpha_i + \delta_iq(\tau)) + X_i'(\theta + \gamma q(\tau)) \]  

where \( i \) and \( t \) represent firm \( i \) and year \( t \). \( Q_{CER}(\tau|X_{it}') \) represents the quantile distribution of the explained variable. The scalar coefficient \( \alpha_i(\tau) = \alpha_i + \delta_iq(\tau) \) represents the fixed effect of quantile \( \tau \) for firm \( i \), or the distributional effect at \( \tau \). The distributional effect represents the effect of time-invariant
individual characteristics which are allowed to have different impacts on different regions of the conditional distribution of CER. \( X'_t \) stands for explanatory variables, including SIZE, LEV, FP and OC. EPU stands for economic policy uncertainty, SIZE is firm size, LEV represents the enterprise’s leverage ratio, FP is corporate profitability and OC indicates ownership concentration. \( q(\tau) \) represents the \( \tau \)-th sample quantile.

2.2. Variables and Data

2.2.1. Dependent Variable-The Measurement of CER

The corporate CER level needs to be measured from many aspects. First, whether the mode adopted by the corporation in the production process will cause environmental pollution, and whether the operation and management conform to the environmental concept. Second, whether the corporations violate relevant environmental protection laws or regulations. In addition, it is also necessary to assess from the perspective of society, that is, whether the behavior of corporations in protecting the environment are praised and recognized by the people. According to the above 3 aspects and the empirical studies [1,28,29], this paper measures the CER level of corporations through 5 dimensions, including legal consciousness, social evaluation, eco-friendly production, low-carbon technology and green management [30]. Referring to the measurement method proposed by Li et al. [1], 2–4 questions are set for each dimension, as shown in Table 1. Then, the answer for each question according to the relevant information is disclosed in the annual social responsibility report of the listed company. For each question, if the answer is yes, 1 point will be given; otherwise, 0 points will be recorded. In order to ensure the objectivity, each indicator takes the same weight. Therefore, the final result of the corporation CER level is the sum of the values of all the indicators.

| Dimensions           | Indicator Name                                                                 |
|----------------------|-------------------------------------------------------------------------------|
| Legal consciousness  | 1. Whether it follows the guide of sustainable development reporting from GRI  |
|                      | 2. Whether it discloses environmental and sustainable development               |
|                      | 3. Whether it is subjected to environmental penalties                          |
| Social evaluation    | 1. Whether it receives environmental awards                                     |
|                      | 2. Whether it has other environmental advantages                               |
| Eco-friendly production | 1. Whether it adopts a circular economy                                           |
|                      | 2. Whether it has engaged in green production (measurement to decrease three waste) |
| Low-carbon technology | 1. Whether it saves energy                                                       |
|                      | 2. Whether it generates environment-friendly products                           |
|                      | 1. Whether it has been verified by a third party                               |
|                      | 2. Whether it has vision in relation to environmental responsibility           |
| Green management     | 3. Whether it has environment recognition                                       |
|                      | 4. Whether it uses environmentally protected offices                           |

2.2.2. Explanatory and Control Variables

Baker et al. [3] point out that EPU is reflected by the EPU index. To construct the monthly data of China’s EPU index through the content of news reports, South China Morning Post of Hong Kong is selected as the news report retrieval platform and the text mining technology is applied. South China Morning Post is the most influential English newspaper with the largest circulation in Hong Kong. Its follow-up report on China’s economy is very timely. Using it as the news report retrieval platform can largely guarantee the comprehensiveness of the retrieval scope and the accuracy of the retrieval content. By identifying the articles about China’s EPU published each month, and dividing the number of articles identified each month by the total monthly number of articles published in the South China Morning Post, the monthly EPU index of China’s economic policy is finally obtained. The initial index value is from January 1995 and set to 100. In this paper, the annual arithmetic mean value is used to convert the monthly EPU into the annual EPU which is then divided by 100 to obtain the final EPU value.

In the process of modeling, many factors would affect CER. According to relevant theoretical and empirical studies, enterprise scale, financial situation and governance structure are 3 important
variables [18,22,31]. When studying the influence of EPU on CER, it is necessary to assume that other influencing factors remain unchanged, that is to say, other main influencing factors need to be controlled and set as the control variables. After systematically summarizing the relevant empirical studies and combining the characteristics of the listed companies in China, this paper selects the following 4 control variables: (1) enterprise scale measured by the natural logarithm of total assets; (2) leverage ratio measured by the proportion of total liabilities to total assets; (3) financial performance measured by the return on assets (ROA); (4) equity concentration measured by the proportion of shares held by the first largest shareholder.

2.2.3. Data and Descriptive Statistics

This paper selected the A-share nonfinancial listed companies in China from 2008 to 2016 as the sample. In order to ensure the continuity of the sample distribution, some listed companies from the financial industry, special treatment (ST), particular transfer (PT) and those with massive missing data are excluded. The “Massive missing data are excluded” does not mean that a large amount of data is discarded, but that some firms with missing variable data are not statistically analyzed in the sample. The reason for excluding the financial listed companies is that the main business of such corporations is related to finance, and their implementation of CER is significantly different from that of the nonfinancial listed companies, which is also inconsistent with the goal of this research. Both ST and PT companies have the issue of continuous loss and insufficient capability of sustainable operation, and do not have the general characteristics of financial asset allocation, so they are excluded. Through the above elimination rules, under the constraints of time and type, 522 China A-share listed companies with 4968 annual observations data met the research conditions. The research sample included the companies from the following industries:

1. agriculture; forestry, animal husbandry, fishery;
2. mining;
3. manufacturing;
4. power, heat, gas and water production and supply;
5. construction;
6. wholesale and retail;
7. transportation, warehousing and postal services;
8. accommodation and catering;
9. information transportation, software and information technology services industry;
10. real estate
11. leasing and business services industry;
12. scientific research and technical services industry;
13. water conservancy, environment and public facility management industry;
14. resident service, repair and other service industry;
15. culture, sports and entertainment industry;
16. public management, social security and organization.

Data for EPU is from the China’s monthly EPU index promulgated on the policy uncertainty website (http://www.policyuncertainty.com). The financial data are from the financial statements of the enterprises in CSMAR (China Stock Market and Accounting Research Database) database. The information required by the CER index comes from the CSR report issued by the listed companies which discloses the relevant information about CSR (including CER). The CER index can also be obtained from the CSMAR database and the China research data service platform (CNRDS). After all the sample data are obtained, the financial data and the EPU index are winsorized at 1% level to eliminate the influence of extreme values.
Table 2 presents the description statistics of all the variables. Overall, the minimum, maximum and average of CER are 1, 12 and 4.843, respectively, which indicates that the overall level of CER of the Chinese listed companies is not high. In terms of the EPU, the minimum, maximum and average are 0.989, 3.648 and 1.782, respectively, which indicates that EPU varies greatly in the annual interval and is at a relatively high level in general. In addition, the paper also presents the descriptive statistics of the subsamples based on equity nature, financing constraints and economic region where the corporation is located. In all the subsamples, the minimum and maximum of CER are same, which are 1 and 12, respectively, but there are significant differences for the mean level. There is no significant difference in the minimum, maximum and average of EPU. Compared with the non-state-owned enterprises, the average value of CER of the state-owned enterprises is higher based on the nature of the equity. In terms of the financing constraints, the average value of CER of the corporations operating in the eastern area is higher than that with high financing constraints. In the group of economic regions, the average CER of eastern corporations is higher than that of the ones in the midwestern region. It shows that the relationship between EPU and CER will be affected by different equity nature, different financing constraints and different economic regions in which the corporation operates.

Table 2. Descriptive statistics.

| Variable         | Obs | Mean   | Std.Dev. | Min | Max |
|------------------|-----|--------|----------|-----|-----|
| Full sample      |     |        |          |     |     |
| CER              | 4968| 4.843  | 2.596    | 1.000| 12.000|
| EPU              | 4968| 1.782  | 0.784    | 0.989| 3.648|
| SIZE             | 4968| 9.912  | 0.624    | 8.609| 11.622|
| LEV              | 4968| 0.514  | 0.195    | 0.079| 0.928|
| FP               | 4968| 0.047  | 0.057    | −0.142| 0.234|
| OC               | 4968| 0.389  | 0.161    | 0.089| 0.780|
| CER              | 3444| 5.027  | 2.605    | 1.000| 12.000|
| EPU              | 3444| 1.781  | 0.782    | 0.989| 3.648|
| SIZE             | 3444| 10.021 | 0.632    | 8.766| 11.738|
| LEV              | 3444| 0.528  | 0.192    | 0.086| 0.927|
| FP               | 3444| 0.041  | 0.054    | −0.152| 0.204|
| OC               | 3444| 0.419  | 0.155    | 0.107| 0.767|
| CER              | 1524| 4.426  | 2.528    | 1.000| 12.000|
| EPU              | 1524| 1.785  | 0.787    | 0.989| 3.648|
| Non-state-owned enterprise |
| SIZE             | 1524| 9.668  | 0.540    | 8.368| 11.049|
| LEV              | 1524| 0.482  | 0.197    | 0.066| 0.942|
| FP               | 1524| 0.061  | 0.061    | −0.091| 0.281|
| OC               | 1524| 0.322  | 0.153    | 0.075| 0.780|
| CER              | 2484| 5.723  | 2.470    | 1.000| 12.000|
| EPU              | 2484| 1.860  | 0.847    | 0.989| 3.648|
| SIZE             | 2484| 10.415 | 0.439    | 9.860| 11.798|
| LEV              | 2484| 0.584  | 0.168    | 0.141| 0.886|
| FP               | 2484| 0.045  | 0.048    | −0.094| 0.215|
| OC               | 2484| 0.423  | 0.167    | 0.093| 0.825|
| CER              | 2484| 3.963  | 2.415    | 1.000| 12.000|
| EPU              | 2484| 1.704  | 0.707    | 0.989| 3.648|
| Low financing constraints |
| SIZE             | 2484| 9.410  | 0.313    | 8.367| 9.841|
| LEV              | 2484| 0.445  | 0.197    | 0.066| 1.016|
| FP               | 2484| 0.050  | 0.065    | −0.179| 0.246|
| OC               | 2484| 0.356  | 0.148    | 0.086| 0.718|
| CER              | 3681| 4.887  | 2.652    | 1.000| 12.000|
| EPU              | 3681| 1.782  | 0.784    | 0.989| 3.648|
| High financing constraints |
| SIZE             | 3681| 9.927  | 0.655    | 8.539| 11.725|
| LEV              | 3681| 0.512  | 0.196    | 0.081| 0.922|
| FP               | 3681| 0.048  | 0.053    | −0.136| 0.232|
| OC               | 3681| 0.391  | 0.163    | 0.083| 0.780|
| CER              | 1287| 4.717  | 2.425    | 1.000| 12.000|
| EPU              | 1287| 1.782  | 0.784    | 0.989| 3.648|
| East |
| SIZE             | 1287| 9.871  | 0.536    | 8.817| 11.001|
| LEV              | 1287| 0.520  | 0.193    | 0.075| 0.944|
| FP               | 1287| 0.044  | 0.061    | −0.152| 0.241|
| OC               | 1287| 0.386  | 0.156    | 0.103| 0.825|

Notes: CER means corporate social responsibility, EPU stands for economic policy uncertainty, SIZE is firm size, LEV represents enterprise leverage ratio, FP is corporate profitability and OC indicates ownership concentration.
2.3. Empirical Results

In order to test the influence of EPU on the corresponding measures taken by the corporations to undertake their environmental responsibility, the parameters of the benchmark model were estimated by using the least square estimation after the stability test of each related variable. This paper also changed the estimation method to test the robustness of the results of the parameter estimation. In order to deal with the issue of endogeneity, a panel regression model with fixed effect was used for the parameter estimation. In addition, in order to explore the changing trend of the marginal effect of EPU under different CER levels, the panel quantile regression model with fixed effect was also used in this paper. The estimation results of corresponding parameters are shown in Table 3.

Table 3. Parameter estimation for marginal effect of EPU under different CER levels.

| variables | (1) Pool OLS | (2) FE | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
|-----------|-------------|--------|-----|------|-----|------|-----|
| EPU       | 1.122 ***   | 1.189 *** | 1.363 *** | 1.293 *** | 1.189 *** | 1.089 *** | 1.008 *** |
|           | (0.0731)    | (0.0961) | (0.148) | (0.11) | (0.0821) | (0.11) | (0.155) |
| SIZE      | 1.734 ***   | 1.485 *** | 1.033 *** | 1.214 *** | 1.484 *** | 1.745 *** | 1.954 *** |
|           | (0.0623)    | (0.229) | (0.304) | (0.226) | (0.169) | (0.227) | (0.319) |
| LEV       | −1.105 ***  | −1.236 *** | −0.874 | −1.019 *** | −1.236 *** | −1.445 *** | −1.612 *** |
|           | (0.211)     | (0.463) | (0.567) | (0.42) | (0.314) | (0.423) | (0.595) |
| FP        | −0.294      | −0.882 | −2.273 * | −1.715 * | −0.883 | −0.0796 | 0.564 |
|           | (0.614)     | (0.891) | (1.256) | (0.932) | (0.696) | (0.938) | (1.318) |
| OC        | −0.754 ***  | −0.77 *** | −0.735 * | −0.749 ** | −0.770 *** | −0.79 ** | −0.806 * |
|           | (0.208)     | (0.663) | (0.839) | (0.623) | (0.465) | (0.627) | (0.881) |
| Constant  | −15.12 ***  | −12.39 *** | −0.564 | (2.069) |
| industry  | Yes         | No     | no   | no   | no   | no   | no   |
| year      | Yes         | yes    | yes  | yes  | yes  | yes  | yes  |
| individual| No          | yes    | yes  | yes  | yes  | yes  | yes  |
| Observations | 4.968     | 4.968 | 4.968 | 4.968 | 4.968 | 4.968 | 4.968 |
| R-squared | 0.315       | 0.282 | 0.552 | 0.552 | 0.552 | 0.552 | 0.552 |

Notes: Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 3 gives the results of the parameter estimation. The regression results in model (1) show that the coefficient of EPU is 1.122. The model (2) gives the estimation results of the parameters from the panel regression model with fixed effect. The sign of the estimated parameter is consistent with that of model (1) with a slight difference in the size of the coefficient, which indicates that the estimation results are robust. The table further shows that for all the different models we used, the regression coefficients of EPU pass the 1 percent significance level and show the positive effects. The results show that the corporations will actively fulfill their environmental responsibilities faced with the rise in the level of EPU. The reasons can be explained as below: on the one hand, the information asymmetry between borrowers and creditors will become more serious when the level of EPU rises [22]. Studies have shown that corporations can benefit from the reduction in the level of information asymmetry. For example, a close bank-enterprise relationship can provide more useful information for the banks and reduce the level of information asymmetry. Such measures can not only help the corporations recover faster when facing financial difficulties, but also improve their financing conditions [32] and increase the loan quotas. Through the disclosure of information to reduce the level of information asymmetry, the transaction costs and estimation errors can be reduced and finally, the cost of capital can be saved [33]. In order to alleviate the degree of information asymmetry and reduce the agency costs, the corporations will actively disclose their corporate social responsibility information [34–36] and fulfill relevant environmental responsibilities. On the other hand, the rise in the level of EPU increases the operational risks of corporations, and the banks and investors will be forced to ask for more compensations to take on these risks. Therefore, EPU increases the external financing cost and the financing difficulty [17]. Of course, the corporations focusing on social responsibility will be overvalued.
and the level of risk faced by them will be reduced [37], this is attributed to fact that the improvement in the level of CER will bring a good reputation to the corporations, improve their competitiveness and alleviate their financing difficulties. All in all, the improvement in the level of EPU has an incentive effect on the decision-making behavior of CER.

Model (3) in Table 3 presents the results of the parameter estimation based on the panel quantile regression model with fixed effect, which shows that the marginal effect of EPU varies with different CER levels. With the increase in the quantile of CER, the marginal effect of EPU shows a decreasing trend, that is, faced with the same level of EPU, the corporations with higher CER levels undertake lower levels of environmental responsibility. The reason can be explained by the fact that, although CER reduces the level of risk and brings higher levels of reputations and more competitive advantages for the corporations [15], the implementation of CER is not strictly regulated considering the cost of economy, manpower, time, etc. In addition, the economic benefits brought by CER cannot be directly reflected in the short term, and the consistency with corporations’ pursuit of economic efficiency maximization is weak. Therefore, corporations are not willing to undertake additional environmental responsibilities after completing their own quotas. Based on this, with the rising level of CER, the corporations faced with EPU would take a negative response to the implementation of their environmental responsibility. From the perspective of the control variables, the scale coefficient is significantly positive, that is, the larger the corporation’s scale, the higher level of environmental responsibility undertaken by the corporation. The coefficient of the enterprise’s leverage ratio is negative, indicating that the enterprise’s leverage ratio has a restraining effect on the implementation of CER. It can also be concluded from Table 3 that financial performance has a negative impact on corporate environmental responsibility, but the coefficient has not passed the significance test. The coefficient of ownership concentration is negative, showing that the higher the ownership concentration, the lower level of environmental responsibility that will be undertaken.

3. Heterogeneous Impact of EPU on Decision-Making Behavior of Corporations in Environmental Responsibility

3.1. The Heterogeneity in Different Types of Corporations

Although the above empirical results explained the impact of EPU on corporations to undertake their environmental responsibilities from a macro perspective, the differences in the relationship for different types of corporations and different external environments were not investigated. Because of the differences in the nature of the equity, the level of financial constraints, as well as the economic region in which the company operates, the corporations’ decision-making behavior in undertaking the environmental responsibility will be varied based on the same level of EPU.

First, the nature of the corporate equity plays an important role in affecting the relationship between EPU and CER. Corporations with different characteristics may show different sensitivities to the policy changes [38]. Under the special market system environment in China, the state-owned enterprises are closely related to the policies issued by the government in their manufacture and operation. Therefore, the attitude of corporations to the change of economic policy varies with the equity nature [39]. In addition, there is a strong correlation between the equity nature and business behavior, and the impact of economic policies on CER will be different based on different ownership types. The controlling shareholder of the state-owned enterprises is mainly the government. The state-owned enterprises are better protected by the government, and they enjoy implicit or explicit loan guarantees, which enables them to borrow at preferential interest rates [40]. Therefore, when the level of EPU rises, compared with the non-state-owned enterprises, it is easier for the state-owned enterprises to obtain financial supports to fulfill their environmental responsibilities. Due to the difference in the equity nature, there will be significant differences in the performance level of CER when facing the same level of EPU.

Second, in addition to its own internal attributes, the external economic environment also leads to the heterogeneity of the corporate decision-making behavior. The level of CER varies with the
financing constraints faced by the corporations. When the level of EPU increases, it will not only influence the capital and credit markets, but also increase the probability of bankruptcy, as well as the external financing costs for the corporations. The funds that corporations can freely control are affected by the financing constraints to a large extent. Meanwhile, it is not mandatory for the corporations to fulfill their environmental responsibilities, which will increase the cost of the corporations [41,42]. Therefore, after fulfilling the environmental responsibilities required by relevant laws, corporations with high financing constraints will not choose to invest money to avoid a further increase in financial difficulties. Therefore, when the level of EPU rises, the degree of financing constraints faced by the corporations is different, and the degree of enthusiasm for the corporations to fulfill their environmental responsibilities is different.

The economic region where the corporations are located will also affect the relationship between EPU and CER. China is a developing country with unbalanced regional economic development, and the heterogeneity among different areas can be reflected by the differences from various perspectives including the economic development, social economy, cultural environment, policy and law. First, compared with the corporations located in the central and western areas, those located in the eastern area have a higher degree of marketization, better economic development, stronger strategic alliances and more advanced R&D capabilities. All these advantages enable the corporations to respond to the market changes quickly. Second, the corporations operating in the eastern region are superior to the ones in the central and western regions in terms of the level of scientific and technological innovation. Higher innovation abilities are conducive in improving the production efficiency, efficiently deal with pollutants generated in the production process and promote the corporations to fulfill their environmental responsibility. Finally, the public environmental awareness in the eastern region is relatively higher, and the corporations are more willing to show the society that their pollutant emissions meet the national environmental standards. To sum it up, the corporations located in different economic regions would have the different decision-making behavior related to their environmental responsibility. Therefore, it is necessary to divide the whole sample into different subsamples for further research and discussion.

3.2. Empirical Results

Based on the above theoretical analysis, the whole samples were divided into subsamples according to the equity nature, the degree of financing constraints and the economic region where the corporations are located. Among them, according to the equity nature, the samples were divided into state-owned enterprises and non-state-owned enterprises. For the level of financing constraints, the corporations scale was defined as the proxy variable to measure the intensity of financing constraints [43,44]. The reason is that, compared with the larger corporations, the small ones have shorter listing times and smaller total assets, so their reputation will be questioned by the outside world, and their loan collateral value is usually lower. In addition, due to China’s special institutional background, the banks have an obvious discrimination against the smaller companies in their lending policies. In other words, the smaller scale corporations have higher financing constraints and the larger scale ones have lower financing constraints. According to the median size of corporations, the corporations scale was arranged from small to large. The top 50% of the corporations show high financing constraints, and the latter 50% have low financing constraints. According to the geographical distribution of China’s economic regions, the samples were divided into three groups including eastern area, central area and western area. Ordinary least square (OLS) was used to estimate the parameters for all the subsamples, as shown in Table 4.
Table 4. Regression results of mean value of subsamples.

| Variables         | State-Owned Enterprise | Non-State-Owned Enterprise | Low Financing Constraints | High financing Constraints | East | Central and West |
|-------------------|------------------------|-----------------------------|---------------------------|---------------------------|------|------------------|
| EPU               | 1.217 ***              | 0.900 ***                   | 1.359 ***                 | 0.965 ***                 | 1.199 *** | 0.972 ***       |
| (0.088)           | (0.132)                | (0.116)                     | (0.099)                   | (0.084)                   | (0.150)      |                  |
| SIZE              | 1.706 ***              | 1.751 ***                   | 1.673 ***                 | 1.817 ***                 | 1.722 *** | 1.482 ***       |
| (0.070)           | (0.146)                | (0.104)                     | (0.142)                   | (0.071)                   | (0.138)      |                  |
| LEV               | −1.018 ***             | −1.022 **                   | −1.422 ***                | −1.050 ***                | −0.903      | −1.401 ***       |
| (0.255)           | (0.399)                | (0.383)                     | (0.252)                   | (0.256)                   | (0.396)      |                  |
| FP                | 0.112                  | −1.135                      | −1.158                    | −0.106                    | 0.247       | −1.693          |
| (0.762)           | (1.129)                | (1.121)                     | (0.756)                   | (0.731)                   | (1.156)      |                  |
| OC                | −0.620 **              | −0.880 **                   | −1.050 ***                | −0.382                    | −1.226      | 0.683           |
| (0.259)           | (0.403)                | (0.297)                     | (0.292)                   | (0.232)                   | (0.465)      |                  |
| Constant          | −15.21 ***             | −14.44 ***                  | −14.81 ***                | −15.61 ***                | −15.14      | −12.82 ***       |
| (0.646)           | (1.240)                | (1.085)                     | (1.287)                   | (0.633)                   | (1.215)      |                  |
| industry          | yes                    | yes                         | yes                       | yes                       | yes         |yes               |
| year              | yes                    | yes                         | yes                       | yes                       | yes         |yes               |
| Observations      | 3444                   | 1524                        | 2484                      | 2484                      | 3681        | 1287             |
| R-squared         | 0.322                  | 0.306                       | 0.232                     | 0.238                     | 0.339       | 0.274            |

Notes: Standard errors in parentheses *** p < 0.01, ** p < 0.05.

Table 4 presents the estimated results regarding the impact of EPU on CER based on the nature of the equity, the financial constraints, as well as the economic regions in which they operate. In terms of the nature of the equity, the regression coefficients of EPU are 1.217 and 0.900, respectively, which pass the significance level of 1%. The main reason why the state-owned enterprises are more active engaged in fulfilling their environmental responsibilities faced with EPU can be explained by the fact that, unlike the non-state-owned enterprises, they receive more attention from the outside world. If there is a lack of social responsibility, it would cause more negative public opinions on the state-owned enterprises. Moreover, the state-owned enterprises have the advantage in obtaining bank loans. They also have relatively more sufficient capital and are more capable of fulfilling the environmental responsibilities. Therefore, even if the level of EPU rises, the state-owned enterprises will actively fulfill their environmental responsibilities. With regard to the financing constraints, the regression coefficients of EPU are 1.359 and 0.965, respectively, both of which pass the 1% significance level. For the corporations with lower levels of financing constraints, EPU will induce the corporations to fulfill their environmental responsibilities more actively. The main reason is that when the level of EPU rises, the financing constraints faced by corporations could be further deepened. It will be more difficult for those corporations with higher financing constraints to obtain debt financing, and the fulfillment of environmental responsibility will increase their burden, which is not helpful to their development. In comparison, the corporations with low financing constraints will receive more financial support to undertake the environmental responsibility under the guarantee of normal production and operation. Finally, in terms of the economic regions in which the corporations operate, the regression coefficients of EPU are 1.199 and 0.972, respectively, which also passes the 1% significance level. For the corporations operating in the eastern region, EPU has a significantly positive impact on the fulfillment of environmental responsibilities. The main reason is that the eastern region has a high level of marketization and better economic development, which provides a good economic environment for undertaking the CER. Moreover, the public awareness of environmental protection is relatively higher.

This study further tests the heterogeneity of the marginal effect in different levels of CER for the same level of EPU. The parameter estimation results of the fixed-effect panel percentile of EPU and CER for corporations with different equity nature, financing constraints and economic regions are shown in Table 5. In each subgroup, the trend of EPU marginal effect is heterogeneous. Specifically, for the state-owned enterprises located in the eastern region with lower financing constraints, the change of marginal effect of EPU tends to decrease. The marginal effect of EPU for the non-state-owned
and midwestern enterprises shows a horizontal trend. In the case of higher financing constraints, the marginal effect of EPU is only significantly positive at 0.75 quantile. These results show that for the state-owned enterprises located in the eastern region with lower financial constraints, the higher the level of CER, the lower the level of environmental responsibility will be undertaken for the same level of EPU. CER is regarded as a commercial purpose, which is more prominent in these corporations. The above analysis further verifies the view of this paper, that is, in the face of EPU, the corporate decision-making behavior related to environmental responsibility is affected by different equity nature, financing constraints and economic regions.

Table 5. Panel quantile regression results under subsamples.

| Variables               | CER   | CER   | CER   | CER   | CER   |
|-------------------------|-------|-------|-------|-------|-------|
| state-owned enterprises |       |       |       |       |       |
| EPU                     | 1.513*** | 1.413*** | 1.261*** | 1.124*** | 1.017*** |
| Observations            | 3444  | 3444  | 3444  | 3444  | 3444  |
| non-state-owned enterprises |     |     |     |     |     |
| EPU                     | 1.060*** | 1.049*** | 1.034*** | 1.017*** | 1.004**  |
| Observations            | 1524  | 1524  | 1524  | 1524  | 1524  |
| low financing constraints |     |     |     |     |     |
| EPU                     | 1.890*** | 1.797*** | 1.669*** | 1.543*** | 1.449*** |
| Observations            | (0.359) | (0.263) | (0.172) | (0.198) | (0.277) |
| high financing constraints |     |     |     |     |     |
| EPU                     | 0.968  | 0.957  | 0.941  | 0.924*** | 0.912  |
| Observations            | (2.859) | (2.190) | (1.147) | (0.233) | (0.700) |
| East                    |       |       |       |       |       |
| EPU                     | 1.496*** | 1.404*** | 1.266*** | 1.144*** | 1.039*** |
| Observations            | (0.170) | (0.126) | (0.093) | (0.121) | (0.172) |
| Central and West         |       |       |       |       |       |
| EPU                     | 1.032*** | 1.017*** | 0.992*** | 0.965*** | 0.943*** |
| Observations            | (0.297) | (0.227) | (0.174) | (0.247) | (0.343) |

Notes: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$.

4. The Mediation Effect between EPU and CER

4.1. Intermediary Effect Model

Faced with EPU, the corporate decision-making behavior to undertake environmental responsibility is also affected by the enterprise’s leverage ratio. First, the impact of EPU on the enterprise’s leverage ratio is mainly due to the demand and supply of capital [21]. On the one hand, when the level of EPU rises, the prediction of future economic prospects and the decision-making behavior from the corporations’ managers would be affected. In order to avoid the risks caused by the EPU, risk-averse managers will make more prudent investment decisions [45]. Based on the real option theory, the increase in the level of uncertainty would increase the marginal investment cost of the corporations by increasing the value of the options, thus inhibiting the corporations’ investment behavior. The decrease in the investment scale could reduce the financing demand and the leverage ratio. On the other hand, with the increase in the level of EPU, the information asymmetry between the lender and the borrower will be further intensified, which increases the difficulty of banks to assess the risk level of corporate loans. As a result, the rise in the level of EPU will reduce the willingness of banks to approve the loan applications. An increase in the standard of bank loans will restrain bank credits, which will lead to a rise of external financing cost for the corporations, an increase in the financing constraints and a reduction in the leverage ratio [46].

There is a complex relationship between leverage ratio and CER. On the one hand, from the perspective of the contract theory, corporations should not only be responsible for shareholders, but also meet the corresponding needs of their creditors. In the case of higher enterprise’s leverage ratios, in order to prove to creditors that the business behavior complies with the laws and regulations, and obtain the trust of creditors and stakeholders, the corporations will tend to undertake more environmental
responsible [47]. Therefore, the higher the leverage ratio, the more likely the corporations will fulfill their environmental responsibility and disclose relevant environmental information [22]. On the other hand, the higher debt ratios mean that a corporation needs to pay higher volumes of principal and interest, which is more likely to lead to a debt crisis and the reduction of the enterprise’s income. In addition, the performance of CER requires a certain cost, and the benefits and returns brought by CER to the corporations cannot be reflected in a short period of time. Therefore, when the leverage ratio is high, the corporations would not undertake more environmental responsibilities.

Based on the above analysis, it could be concluded that the leverage ratio may play an intermediary role in the relationship between EPU and CER. This paper adopted a stepwise regression algorithm to test the intermediary effect of the leverage ratio. First, referring to Equation (6), the total effect of EPU on CER was tested without adding the intermediate variables to the benchmark model. Second, with the intermediary variable as the explained variable and the EPU as the core explanatory variable, we identified whether the EPU has an impact on the intermediary variable. The constructed model is shown in Equation (7). Finally, the intermediary variables are incorporated into Equation (6) to test whether EPU impacts on CER through the enterprise’s leverage ratio, and the final model form is shown in Equation (8).

\[
CER_{it} = \theta_0 + \theta_1 \text{EPU}_{it} + \theta_2 \text{SIZE}_{it} + \theta_3 \text{FP}_{it} + \theta_4 \text{OC}_{it} + \text{industry} + \text{year} + \epsilon_{it}
\]  \hspace{1cm} (6)

\[
\text{LEV}_{it} = \delta_0 + \delta_1 \text{EPU}_{it} + \delta_2 \text{SIZE}_{it} + \delta_3 \text{FP}_{it} + \delta_4 \text{OC}_{it} + \text{industry} + \text{year} + \epsilon_{it}
\]  \hspace{1cm} (7)

\[
CER_{it} = \beta_0 + \beta_1 \text{EPU}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{LEV}_{it} + \beta_4 \text{FP}_{it} + \beta_5 \text{OC}_{it} + \text{industry} + \text{year} + \epsilon_{it}
\]  \hspace{1cm} (8)

where the subscripts \( i \) and \( t \) in Equation (6) and Equation (7) represent a specific corporation operating at a specific year, and the meanings of the remaining variables are completely consistent with the previous variable descriptions.

If the coefficient \( \theta_1 \) is significant, the intermediary effect test is performed. If the estimated coefficients \( \delta_1, \beta_1 \) and \( \beta_3 \) are significant, it indicates that there are some intermediary effects. If the coefficients \( \delta_1 \) and \( \beta_3 \) are significant but \( \beta_1 \) is not significant, there is a complete intermediary effect. If the coefficients \( \delta_1 \) and \( \beta_3 \) are not significant, there is no intermediary effect. As long as one between the coefficients \( \delta_1 \) and \( \beta_3 \) is not significant, further inspection is required.

### 4.2. Empirical Results

Table 6 shows the estimated results of the regression parameters. The coefficient \( \theta_1 \) is 1.176, which passes the significance level of 1% and indicates that the intermediary effect can be further explored. The coefficients \( \delta_1, \beta_1 \) and \( \beta_2 \) are \(-0.0495, 1.122\) and \(-1.105\), respectively, which passes the 1% significance level and indicates that the leverage ratio has part of the intermediary effect in the relationship between EPU and CER. According to the empirical results, there is a significant and positive correlation between EPU and CER, the total effect is 1.176, this indicates that EPU encourages the corporations to fulfill their environmental responsibilities. The direct effect of EPU on CER is 1.122, so the intermediary effect of EPU on CER through the leverage ratio is

\[
\delta_1 \times \beta_2 = (-0.0495) \times (-1.105) = 0.054
\]  \hspace{1cm} (9)

which is equal to \( \theta_1 \) minus \( \beta_1 \). Therefore, EPU induces an increase in the level of CER through the reduction in the leverage ratio. The reason is that the corporate financial indicators are highly concerned by the managers, and their decision-making behavior will be affected by the capital structure. When the EPU rises, the business risk brought by the uncertainty leads to the reduction of corporate funds on both the demand and supply sides. The reduction of corporate investment scale and the rise in the financing cost aggravate the financing constraints, which leads to a reduction in the enterprise’s leverage ratio. At the same time, the decrease in the leverage ratio reduces the financial crisis to a certain extent. The increased willingness of managers to invest in environmental responsibility could raise the level of
CER. Such measures will increase the value of corporations, improve their competitiveness, reduce their operation risks and promote sustainable development. Therefore, under the premise of EPU, the decrease in the leverage ratio will promote the fulfilment of CER.

Table 6. Intermediate effect test results.

| Variables | CER  | LEV  | CER  |
|-----------|------|------|------|
| EPU       | 1.176 *** | −0.0495 *** | 1.122 *** |
|           | (0.0721) | (0.005) | (0.0731) |
| LEV       | −1.105 *** |      |      |
|           | (0.211) |      |      |
| OC        | −0.701 *** | −0.0479 *** | −0.754 *** |
|           | (0.208) | (0.0136) | (0.208) |
| SIZE      | 1.590 *** | 0.130 *** | 1.734 *** |
|           | (0.0561) | (0.00416) | (0.0623) |
| FP        | 1.264 ** | −1.409 *** | −0.294 |
|           | (0.531) | (0.0477) | (0.614) |
| Constant  | −14.47 *** | −0.594 *** | −14.01 *** |
|           | (0.55) | (0.044) | (0.573) |

industry  yes yes yes
year      yes yes yes
Observations 4968 4968 4968
R-squared 0.311 0.453 0.312

Notes: Standard errors in parentheses *** p < 0.01, ** p < 0.05.

5. Conclusions

Based on the samples of 522 nonfinancial listed companies in the Chinese A-share market during 2008–2016, this paper studies the discretion of corporations to fulfill their environmental responsibilities when faced with EPU through a panel regression model and a panel quantile regression model. The main conclusions are as follows:

First, the corporations faced with EPU will actively fulfill their environmental responsibilities, but the marginal propensity of undertaking the environmental responsibilities tends to decline. What kind of decision-making behavior corporations faced with EPU will take in terms of environmental responsibility has not been determined at present. This study used the listed companies in China as the sample and found that the corporations faced with EPU actively undertook environmental responsibility. The reasons for this positive effect can be summarized as the following: when the level of EPU rises, the market information asymmetry intensifies, and the business risk of corporations increases. In order to alleviate the financing constraints and reduce the agency costs, the corporations actively undertake environmental responsibilities and disclose relevant information. These positive measures show the legitimacy of their business behavior and would be helpful to obtain a good reputation to reduce their business risk. However, it would take a certain amount of money to undertake environmental responsibilities. In order to pursue greater economic benefits, the corporations with higher CER levels are not willing to undertake more environmental responsibilities, and their marginal propensity to undertake environmental responsibilities tends to decline.

Second, in terms of the environmental responsibility, the corporate decision-making behavior faced with EPU is heterogeneous based on the nature of their equity, the financing constraints as well as the economic region in which they operate. The results from the panel regression model showed that the positive impact of EPU on CER was significant in each subsample, but for the state-owned enterprises located in the eastern region with low financing constraints, EPU induced the corporations to undertake more environmental responsibilities. The findings from the quantile regression model showed that among the state-owned enterprises located in the eastern region with low financing constraints, the marginal tendency of corporations with higher CER levels to environmental responsibility showed a downward trend, while among the non-state-owned enterprises located in
the central and western regions, the marginal propensity of environmental responsibility was on the horizontal trend. For the high financing constraints, the marginal effect of EPU was only significant and positive at the 0.75 quantile.

Finally, the leverage ratio plays an intermediary effect in the relationship between EPU and CER. Faced with the rise of EPU, not only the investment scale of the corporation is reduced, but also the financing cost is increased, which intensifies the financing constraints, thus leading to the reduction in the leverage ratio. The decrease in the leverage ratio reduces the financial crisis for the corporations to a certain extent. Considering that the increase in CER level will increase the corporate value, improve their competitiveness, and promote their sustainable development, the willingness of managers to invest in environmental responsibility would increase. Therefore, the leverage ratio plays an intermediary effect in the impact of EPU on CER.

The results of the current study generate important policy implications. First, although the research results of this paper showed that the corporations faced with EPU actively undertake environmental responsibilities, the rise of EPU will also bring negative impact on corporations, which is not helpful to the achievement of sustainable development for the economy, for example, EPU will inhibit corporation investment. Therefore, when relevant departments frequently introduce or adjust economic policies, they should balance the impact of EPU on different economic activities, and try to make the new and old policies smoothly connect. Second, for different types of corporations, relevant government departments should formulate structural and differentiated policies based on the corporation’s heterogeneity, and strive to build a good external economic environment, so as to help corporations with high financing constraints or those located in central and western regions better fulfill their environmental responsibilities under the increase in the level of EPU. For example, relevant government departments can promote the development of the financial market, reduce the internal and external financial constraints, provide more development opportunities for the corporations in the central and western regions, and create a good economic system environment for the corporations to fulfill their environmental responsibilities. Third, not only do the corporations need to raise awareness of environmental protection, but also suppliers and creditors should enhance their consciousness of sustainable development and encourage the corporations to disclose more high-quality information on environmental protection. Only the joint efforts of stakeholders can achieve sustainable economic and social development.

The current study suffers from a number of limitations First, the CER data used in this paper was based on the scoring results of the CSR reports disclosed by the listed companies. These reports were compiled by the enterprises themselves, and it is questionable whether they truly reflect the environmental responsibility of the enterprises; second, we did not investigate the impact of external pressure exerted by the stakeholders on the enterprises’ environmental protection measures. In addition, due to the difficulty of data acquisition, the different maturity levels of companies located in different regions were not considered when analyzing the relationship between EPU and CER in different regions.

Considering these limitations, future research should find some more realistic ways to measure corporate environmental responsibility, so as to generate more convincing conclusions. Further study should also explore the impact of key stakeholders over time and the incentive factors considered in this study. Finally, further research should also consider the impact of company maturity levels in different regions and the development level of different provinces.

Author Contributions: Conceptualization, J.Y., P.L. and Y.T.; methodology, J.Y. and P.L.; software, J.Y.; validation, J.Y., P.L. and Y.T. formal analysis, J.Y., P.L. and Y.T.; investigation, J.Y. and P.L.; resources, J.Y. and P.L.; data curation, J.Y. and P.L.; writing—original draft preparation, J.Y., P.L. and Y.T.; writing—review and editing, J.Y., P.L. and Y.T.; visualization, J.Y. and P.L.; supervision, J.Y., P.L. and Y.T.; project administration, J.Y. and P.L.; funding acquisition, J.Y. and P.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Office of Philosophy and Social Sciences, grant number 19BGL050.

Acknowledgments: Authors would like to thank for the efforts of anonymous reviewers and editors.
**Conflicts of Interest:** The authors declare no conflict of interest.

**References**

1. Li, Z.; Liao, G.; Albitar, K. Does corporate environmental responsibility engagement affect firm value? The mediating role of corporate innovation. *Bus. Strat. Environ.* **2019**, *29*, 1045–1055. [CrossRef]

2. Bahmani-Oskooee, M.; Saha, S. On the effects of policy uncertainty on stock prices: An asymmetric analysis. *Quant. Financ. Econ.* **2019**, *3*, 412–424. [CrossRef]

3. Baker, S.R.; Bloom, N.; Davis, S.J. Measuring Economic Policy Uncertainty. *Q. J. Econ.* **2016**, *131*, 1593–1636. [CrossRef]

4. Liu, Y.; Zheng, Y.; Drakeford, B.M. Reconstruction and dynamic dependence analysis of global economic policy uncertainty. *Quant. Financ. Econ.* **2019**, *3*, 550–561. [CrossRef]

5. Ntarmah, A.H.; Kong, Y.; Gyan, M.K. Banking system stability and economic sustainability: A panel data analysis of the effect of banking system stability on sustainability of some selected developing countries. *Quant. Financ. Econ.* **2019**, *3*, 709–738. [CrossRef]

6. Wang, Y.; Chen, C.R.; Huang, Y.S. Economic policy uncertainty and corporate investment: Evidence from China. *Pac. Basin Financ. J.* **2014**, *26*, 227–243. [CrossRef]

7. Gulen, H.; Ion, M. Policy Uncertainty and Corporate Investment. *Rev. Financ. Stud.* **2015**, *29*, 523–564. [CrossRef]

8. Xu, Z. Economic policy uncertainty, cost of capital, and corporate innovation. *J. Bank. Financ.* **2020**, *111*, 105698. [CrossRef]

9. Ross, J.-M.; Fisch, J.H.; Varga, E. Unlocking the value of real options: How firm-specific learning conditions affect R&D investments under uncertainty. *Strat. Entrep. J.* **2017**, *12*, 335–353. [CrossRef]

10. Van Vo, L.; Le, H.T.T. Strategic growth option, uncertainty, and R&D investment. *Int. Rev. Financ. Anal.* **2017**, *51*, 16–24. [CrossRef]

11. Duong, H.N.; Nguyen, J.H.; Nguyen, M.; Rhee, S.G. Navigating through economic policy uncertainty: The role of corporate cash holdings. *J. Corp. Finance* **2020**, *62*, 101607. [CrossRef]

12. Demir, E.; Ersan, O. Economic policy uncertainty and cash holdings: Evidence from BRIC countries. *Emerg. Mark. Rev.* **2017**, *33*, 189–200. [CrossRef]

13. Tran, Q.T. Economic policy uncertainty and corporate risk-taking: International evidence. *J. Multinatl. Financ. Manag.* **2019**, *100605*. [CrossRef]

14. Vural-Yavaş, Ç. Economic policy uncertainty, stakeholder engagement, and environmental, social, and governance practices: The moderating effect of competition. *Corp. Soc. Responsib. Environ. Manag.* **2020**. [CrossRef]

15. Cai, L.; Cui, J.; Jo, H. Corporate Environmental Responsibility and Firm Risk. *J. Bus. Ethics* **2015**, *139*, 563–594. [CrossRef]

16. Zeng, S.X.; Xu, X.D.; Yin, H.T.; Tam, C.M. Factors that Drive Chinese Listed Companies in Voluntary Disclosure of Environmental Information. *J. Bus. Ethics* **2011**, *109*, 309–321. [CrossRef]

17. He, F.; Ma, Y.; Zhang, X. How does economic policy uncertainty affect corporate innovation?—Evidence from China listed companies. *Int. Rev. Econ. Finance* **2020**, *67*, 225–239. [CrossRef]

18. Liu, X.; Anbumozhi, V. Determinant factors of corporate environmental information disclosure: An empirical study of Chinese listed companies. *J. Clean. Prod.* **2009**, *17*, 593–600. [CrossRef]

19. Ayyagari, M.; Demirguc-Kunt, A.; Maksimovic, V. Formal versus Informal Finance: Evidence from China. *Rev. Financ. Stud.* **2010**, *23*, 3048–3097. [CrossRef]

20. Li, Z.; Zhong, J. Impact of economic policy uncertainty shocks on China’s financial conditions. *Financ. Res. Lett.* **2020**, *35*, 101303. [CrossRef]

21. Zhang, G.; Han, J.; Pan, Z.; Huang, H. Economic policy uncertainty and capital structure choice: Evidence from China. *Econ. Syst.* **2015**, *39*, 439–457. [CrossRef]

22. Ortas, E.; Gallego-Alvarez, I.; Etxeberria, I. Álvarez Financial Factors Influencing the Quality of Corporate Social Responsibility and Environmental Management Disclosure: A Quantile Regression Approach. *Corp. Soc. Responsib. Environ. Manag.* **2014**, *22*, 362–380. [CrossRef]

23. Cormier, D.; Magnan, M. Corporate Environmental Disclosure Strategies: Determinants, Costs and Benefits. *J. Account. Audit. Financ.* **1999**, *14*, 429–451. [CrossRef]

24. Koenker, R.; Hallock, K.F. Quantile Regression. *J. Econ. Perspect.* **2001**, *15*, 143–156. [CrossRef]

25. Machado, J.A.; Silva, J.S. Quantiles via moments. *J. Econ.* **2019**, *213*, 145–173. [CrossRef]
26. Lioui, A.; Sharma, Z. Environmental corporate social responsibility and financial performance: Disentangling direct and indirect effects. *Ecol. Econ.* 2012, 78, 100–111. [CrossRef]

27. Li, D.; Cao, C.; Zhang, L.; Chen, X.; Ren, S.; Zhao, Y. Effects of corporate environmental responsibility on financial performance: The moderating role of government regulation and organizational slack. *J. Clean. Prod.* 2017, 166, 1323–1334. [CrossRef]

28. Kim, H.; Park, K.; Ryu, D. Corporate Environmental Responsibility: A Legal Origins Perspective. *J. Bus. Ethics* 2015, 140, 381–402. [CrossRef]

29. Reyes-Rodriguez, J.F.; Ulhøi, J.P.; Madsen, H. Corporate Environmental Sustainability in Danish SMEs: A Longitudinal Study of Motivators, Initiatives, and Strategic Effects. *Corp. Soc. Responsib. Environ. Manag.* 2014, 23, 193–212. [CrossRef]

30. Li, Z.; Liao, G.; Wang, Z.; Huang, Z. Green loan and subsidy for promoting clean production innovation. *J. Clean. Prod.* 2018, 187, 421–431. [CrossRef]

31. Chen, Z.; Hamilton, T. What is driving corporate social and environmental responsibility in China? An evaluation of legacy effects, organizational characteristics, and transnational pressures. *Geoforum* 2020, 110, 116–124. [CrossRef]

32. Berger, A.N.; Udell, G.F. Relationship Lending and Lines of Credit in Small Firm Finance. *J. Bus.* 1995, 68, 351. [CrossRef]

33. Verrecchia, R.E. Essays on disclosure. *J. Account. Econ.* 2001, 32, 97–180. [CrossRef]

34. Harjoto, M.A.; Jo, H. Legal vs. Normative CSR: Disentangling capabilities, resources and ownership structure. *Strat. Manag. J.* 2015, 35, 142–162. [CrossRef]

35. Dhaliwal, D.S.; Li, O.Z.; Tsang, A.; Yang, Y.G. Voluntary Nonfinancial Disclosure and the Cost of Equity Capital: The Initiation of Corporate Social Responsibility Reporting. *Account. Rev.* 2011, 86, 59–100. [CrossRef]

36. Cheng, B.; Ioannou, I.; Serafeim, G. Corporate social responsibility and access to finance. *Strat. Manag. J.* 2013, 35, 1–23. [CrossRef]

37. El Ghoul, S.; Guedhami, O.; Kwok, C.C.; Mishra, D.R. Does corporate social responsibility affect the cost of capital? *J. Bank. Financ.* 2011, 35, 2388–2406. [CrossRef]

38. Baker, S.R.; Bloom, N.; Canes-Wrone, B.; Davis, S.J.; Rodden, J. Why Has US Policy Uncertainty Risen Since 1960? *Am. Econ. Rev.* 2014, 104, 56–60. [CrossRef]

39. Su, X.; Zhou, S.; Xue, R.; Tian, J. Does economic policy uncertainty raise corporate precautionary cash holdings? Evidence from China. *Account. Financ.* 2020, 26. [CrossRef]

40. Dewenter, K.L.; Malatesta, P.H. State-Owned and Privately Owned Firms: An Empirical Analysis of Profitability, Leverage, and Labor Intensity. *Am. Econ. Rev.* 2001, 91, 320–334. [CrossRef]

41. Escrig-Olmedo, E.; Muñoz-Torres, M.J.; Fernández-Izquierdo, M.; Ángeles; Rivera-Lirio, J.M. Measuring Corporate Environmental Performance: A Methodology for Sustainable Development. *Bus. Strat. Environ.* 2015, 26, 142–162. [CrossRef]

42. Darnall, N.; Edwards, D. Predicting the cost of environmental management system adoption: The role of capabilities, resources and ownership structure. *Strat. Manag. J.* 2006, 27, 301–320. [CrossRef]

43. Cleary, S. The Relationship between Firm Investment and Financial Status. *J. Financ.* 1999, 54, 673–692. [CrossRef]

44. Almeida, H.; Campello, M.; Weisbach, M.S. Corporate financial and investment policies when future financing is not frictionless. *J. Corp. Financ.* 2011, 17, 675–693. [CrossRef]

45. Bloom, N.; Bond, S.; Van Reenen, J. Uncertainty and Investment Dynamics. *Rev. Econ. Stud.* 2007, 74, 391–415. [CrossRef]

46. Bordo, M.D.; Duca, J.V.; Koch, C. Economic policy uncertainty and the credit channel: Aggregate and bank level U.S. evidence over several decades. *J. Financ. Stab.* 2016, 26, 90–106. [CrossRef]

47. Orlitzky, M.; Benjamin, J.D. Corporate Social Performance and Firm Risk: A Meta-Analytic Review. *Bus. Soc.* 2001, 40, 369–396. [CrossRef]

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