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# Climate Risk Disclosure, Environmental Regulation and Debt Financing Costs

Xiaoyan Chen

School of Accountancy, Anhui University of Finance and Economics, Bengbu 233000, China

## Abstract

**The situation of global warming is severe. After the "double carbon" goal was proposed, climate risks have attracted more and more attention from investors and creditors. In my country's underdeveloped capital market, debt financing is the main channel for corporate financing in my country. Therefore, whether disclosing climate risks can reduce corporate debt financing costs is a topic that needs urgent research. Based on the information asymmetry theory, this article analyzes the possible impact and mechanism of corporate climate risk information disclosure on debt financing costs, selects data from A-share listed companies from 2007 to 2021, and empirically tests the impact of corporate climate risk disclosure on debt financing costs. The study found that climate risk disclosure can reduce corporate debt financing costs, especially among state-owned enterprises, and that disclosure of chronic risks and transition risks has a significant effect on reducing debt financing costs. The mechanism behind this is that disclosing climate risks can increase the intensity of environmental regulation, thereby improving environmental performance and reducing debt financing costs. To this end, it is recommended to further encourage companies to actively disclose climate risks, accelerate the establishment of a climate risk disclosure system, improve the quality of corporate climate risk information disclosure, reduce corporate debt financing costs, and help companies develop high-quality development.**

## Keywords

**Climate Risk Disclosure; Environmental Regulation; Debt Financing Cost.**

## 1. Introduction

In November 2021, General Secretary Xi Jinping pointed out at the 26th World Leaders Summit of the Conference of the Parties to the United Nations Framework Treaty on Climate Change: "The adverse effects of climate change are increasingly apparent, and the urgency of global action continues to rise." As a responsible major country , China attaches great importance to the issue of climate change. Under the guidance of the new development concept, it not only elevates the steady and orderly promotion of "double carbon" governance to the level of national strategy, but also regards it as an intrinsic requirement to promote high-quality development. Enterprises are the cells of national macroeconomic activities and are also the core subjects of climate risk response. Therefore, it is necessary to clarify the impact and mechanism of disclosure of climate risks on corporate operations, and on this basis, explore a climate risk prevention and control governance system that is in line with China's national conditions. of great significance. The information asymmetry between shareholders and management causes management to proceed from their own interests and use information advantages to manipulate or hide information to maximize their own interests, resulting in insufficient motivation for voluntary disclosure (Luo Wei and Zhu Chunyan, 2010). Due to the asymmetry of information inside and outside the enterprise, investors are unable to make accurate judgments on the key information of the enterprise. Investors will seek price protection mechanisms, such as increasing the necessary rate of return, or attaching various

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restrictive clauses to investments, in order to protect themselves from the risks they bear. To compensate for risks, these will lead to an increase in corporate debt financing costs.

So, if companies actively disclose climate risks, can the impact of climate risks on corporate financing costs be mitigated? With the disclosure of climate risk information, can environmental regulations be strengthened? Will the strengthening of environmental intensity bring good environmental performance to enterprises and reduce debt financing costs? In order to clarify the above issues, this article starts from climate risk disclosure, based on stakeholder theory and information asymmetry theory, studies the relationship between climate risk disclosure and corporate debt financing costs, and examines the potential impact mechanism from the perspective of environmental regulation intensity. Empirical tests have found that climate risk disclosure can reduce corporate debt financing costs, and this relationship is particularly prominent in state-owned enterprises, and that disclosure of chronic risks and transformation risks has a significant effect on reducing debt financing costs.

## 2. Retical Analysis and Research Hypotheses

### 2.1. Climate Risk Disclosure and Corporate Debt Financing Costs

Disclosing climate risk information can establish an information exchange medium between enterprises and creditors in the capital market, reduce the information gap between the two parties in the capital transaction process, and enable enterprises to establish a good image and gain financing competitiveness. Extreme weather changes have a great impact on business operating costs, such as direct costs (including the reduction in inputs such as capital and labor leading to a decrease in output), indirect costs (including the impact of disruption of goods and services on other economic entities), intangible costs (including External factors such as physical and mental health and environmental pollution) and post-disaster reconstruction costs (Meyer et al., 2013), all of which will lead to a decline in corporate profitability and cash flow, and whether the information related to the interests of creditors is disclosed depends entirely on corporate management.

When there is an information gap, the information-advantaged party will proactively send signals to the information-deficient party, in order to show the company's good sense of social responsibility. Close information exchange can also ease the relationship between the company and its stakeholders, and gain access to the outside world. Highly recognized (Tang Yongjun, Ma Wenchao and Xia Li, 2021). The potential positive impacts of disclosing climate risk information are as follows: First, in order to mitigate the adverse impact of climate risks on financing, companies actively fulfill their environmental social responsibilities, and voluntary disclosure of climate risk information can enable the outside world to understand the company's ability to cope with climate risks (He & Loftus, 2014 ), transmit value signals and integrity signals to the outside (Stiglitz, 1981), thereby establishing a positive image of corporate green environmental protection (Denis & Michel, 2015), and improving corporate green credit through reputation mechanisms (Song Xiaohua et al., 2019; Wang Xia et al., 2013; Ye Kangtao et al., 2010), influence social cognition, improve the recognition of enterprises in the capital market, thereby reducing financing costs; second, enhancing information transparency helps reduce the degree of information asymmetry between enterprises and creditors (Healy and Palepu, 2001), It enhances the creditworthiness of enterprises in obtaining bank loans, thereby reducing their debt financing costs (Li Zhijun and Wang Shanping, 2011). High-quality climate risk disclosure is conducive to investors' comprehensive assessment of corporate non-financial risks and uncertainties, and improves investment confidence. , it is helpful for enterprises to handle the relationship between them and stakeholders and obtain more low-cost financing channels (Zhang Jiaoning et al., 2021). Based on the above analysis, hypothesis 1 of this article is proposed:

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H1: There is a significant negative relationship between climate risk disclosure and corporate debt financing costs, that is, corporate disclosure of climate risks will reduce debt financing costs.

### 2.2. Climate Risk Disclosure, Environmental Regulation and Corporate Debt Financing Costs

The connotation of environmental regulation is very broad. As the public's awareness of environmental protection continues to increase, the subject of environmental regulation has developed from a single government to the government, enterprises or organizations, and the public (Zhang Xiaomin et al., 2021). The constraints of non-governmental forces are a complement to the refinement of environmental regulations (YuX&WangP, 2021). Zhao Yumin et al. (2009) classify environmental regulations into explicit and invisible. Invisible environmental regulations refer to invisible environmental protection behaviors, environmental protection concepts and environmental awareness. And the enterprise's environmental governance willingness and ability directly affect the environmental governance effect (Zhang Qi and Zou Mengqi, 2022). Therefore, enterprises actively disclose climate risk information, which is an intangible environmental protection behavior that strengthens non-governmental forces and thereby enhances environmental regulation; Dasgupta, S. et al. (2011) found that environmental regulation can significantly improve the environmental performance of enterprises. As an important indicator of investor investment, good environmental performance will inevitably reduce financing costs. Xu Songtao and Wan Hongyan (2011) believe that environmental regulations can greatly improve the financing constraints of central state-owned enterprises. Li Hong (2016) believes that an individual's perception of risk can affect their behavior. Creditors perceive different corporate risks, and their required yields to maturity are also different. The stronger the environmental regulation, the better the corporate environmental performance, the lower the costs caused by environmental accidents, the lower the corporate risks perceived by creditors, and good environmental performance brings an improvement in reputation, thereby reducing the cost of debt financing. Therefore, this article proposes hypothesis 2:

H2: Climate risk disclosure reduces debt financing costs by increasing environmental regulations.

## 3. Empirical Research Design

### 3.1. Data Sources and Sample Selection

Since my country's listed companies have begun to implement new corporate accounting standards since 2007, this article selects the annual reports of China's A-share listed companies from 2007 to 2021 as a research sample, and obtains climate risk disclosure data through text analysis and machine learning. Use Python to crawl the original work report documents from the local government website, organize the report text into panel data, perform word segmentation processing on the government work report, and collect statistics on 15 keywords related to environmental regulation in the prefecture-level municipal government work report to construct the intensity of environmental regulation. Indicators, other data come from Guotai'an database. In order to ensure the accuracy of the data, the more special financial and insurance industries, "special treatment" (ST) enterprises, and industries with fewer observations in some years were eliminated. The continuous variables were shrunk by 1%, and finally the total was obtained. 22,780 firms-annual observations.

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## 3.2. Variable Definition

### 3.2.1. Corporate Debt Financing Costs

The explained variable, based on the research of Zhou Kaitang et al. (2017), uses the proportion of corporate interest expenses in the average long- and short-term liabilities of the year to calculate debt financing costs. Among them, short-term liabilities are short-term borrowings in the balance sheet, and long-term liabilities include long-term borrowings due within one year, long-term borrowings, bonds payable, long-term payables and other long-term liabilities. The data comes from the WIND database.

### 3.2.2. Climate Risk Disclosure

The explanatory variables and proxy variables of climate risk disclosure are based on the original foreign research (Li et al., 2020), drawing on the practice of Du Jian et al. (2023), and downloading the annual reports of all A-share listed companies from 2007 to 2020 through the Juchao Information Network. By manually reading more than 600 annual reports, the text information mentioning climate risks was analyzed, combined with the information disclosed by the National Meteorological Science Data Center, the "China Meteorological Disaster Yearbook" and Lietal. (2020) research, developed a dictionary related to “climate risk” in annual reports, and the final “climate risk” word set contains 98 words. Subsequently, climate risk disclosure indicators were obtained by calculating the ratio of the total word frequency of the "climate risk" expanded word set to the total word frequency of the annual report.

### 3.2.3. Mediating Variables

Environmental regulation, drawing on the research of Chen Shiyi (2018), Deng Huihui (2019), and Yin Lihui (2021), uses the proportion of word frequency of words related to the word "environmental protection" in local government reports to the total word frequency of the full text as the intensity of environmental regulation As a proxy variable, the higher the frequency of environmental words in government reports, the higher the intensity of environmental regulation is indirectly reflected.

### 3.2.4. Control Variables

Based on previous relevant research and existing literature, this article selects company size (Size), net interest rate on total assets (ROA), asset-liability ratio (Lev), operating income growth rate (Growth), cash flow Ratio (Cashflow), company establishment age (FirmAge), whether state-owned holding (SOE) and other financial indicators and company characteristic variables that may affect the company's performance are used as control variables. In addition, we also considered Tobin's Q value (TOBIN), independent directors Ratio (Indep) and the shareholding ratio of the largest shareholder (Top1), the industry classification adopts the Guotai'an classification method. Except for the manufacturing industry, which is detailed to the second-level classification, other industries use the first-level classification. The relevant variables are described in Table 1:

## 4. Model Construction

In order to test the correlation between climate risk disclosure and corporate debt financing costs, this article constructed model (1) for research. The specific model is as follows:

$$Cost_{i,t}=\alpha_0+\alpha_1 Climaterisk_{i,t}+\alpha_2 Control_{i,t}+Ind+Year+\varepsilon_{i,t} \tag{1}$$

Among them, the subscripts i and t represent the enterprise and year respectively, Costi,t is the debt financing cost of enterprise i in year t, Climateriski, t is the climate risk disclosure of enterprise i in year t, Controllit is a set of a series of control variables, , Ind is the industry fixed

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effect, and Year is the year fixed effect. Among them, $\alpha_1$ is the regression coefficient of the variable of interest in this article. If the coefficient $\alpha_1$ is significantly positive, it can be inferred that corporate climate risk disclosure can reduce corporate debt financing costs, supporting the expectations of this article's theory.

# 5. Analysis of Empirical Results

## 5.1. Descriptive Statistics

Table 1 reports the descriptive statistical results of the main variables. Among them, the mean value of Cost is 0.057, the minimum value is 0, and the maximum value is 0.54, which shows that there are large differences in the debt financing costs of sample companies. From the perspective of climate risk disclosure, the minimum value is 0, the maximum value is 0.009, and the mean value is 0.002, indicating that some companies have actively disclosed climate risks, while some companies have not disclosed them, and the differences between companies are large. The minimum value of environmental regulation intensity is 0 and the maximum value is 0.019, which shows that the intensity of environmental regulation is different in different places. The average company size is 22.341, the average net interest rate on total assets is 0.041, and the average asset-liability ratio is 0.453. The descriptive statistical results are basically consistent with the current literature. This paper conducts a multicollinearity test on the main control variables. The results show that there is no multicollinearity problem and subsequent regression analysis can be carried out.

**Table 1.** Descriptive statistics

| VarName | Obs | Mean | SD | Min | Median | Max |
|---|---|---|---|---|---|---|
| Cost3 | 22780 | 0.057 | 0.058 | 0 | 0.050 | 0.540 |
| Climaterisk | 22780 | 0.002 | 0.002 | 0 | 0.001 | 0.009 |
| Acuterisk | 22780 | 0.000 | 0.000 | 0 | 0 | 0.003 |
| Chronicrisk | 22780 | 0.000 | 0.000 | 0 | 0 | 0.002 |
| Tranistrisk | 22780 | 0.002 | 0.002 | 0 | 0.001 | 0.018 |
| ER1 | 22780 | 0.009 | 0.002 | 0 | 0.009 | 0.019 |
| Size | 22780 | 22.341 | 1.311 | 19.406 | 22.131 | 26.452 |
| ROA | 22780 | 0.041 | 0.060 | -0.382 | 0.038 | 0.255 |
| Lev | 22780 | 0.453 | 0.194 | 0.027 | 0.450 | 0.927 |
| Growth | 22780 | 0.186 | 0.394 | -0.653 | 0.122 | 3.894 |
| Cashflow | 22780 | 0.050 | 0.068 | -0.224 | 0.048 | 0.283 |
| Dual | 22780 | 0.245 | 0.430 | 0.000 | 0.000 | 1.000 |
| Indep | 22780 | 0.373 | 0.054 | 0.250 | 0.333 | 0.600 |
| TobinQ | 22780 | 1.942 | 1.212 | 0.802 | 1.563 | 16.647 |
| Top1 | 22780 | 0.352 | 0.148 | 0.081 | 0.334 | 0.758 |

## 5.2. Baseline Regression Results

Table 2 reports the results of the baseline regression of climate risk disclosures on debt financing costs. All regressions control for firm-level idiosyncrasies and industry and year fixed effects. Column (1) of Table 2 shows that the Climaterisk coefficient is -1.0795 and is significant at the 5% level, indicating that climate risk disclosure significantly reduces corporate debt financing costs, which also provides preliminary empirical evidence for the theoretical hypothesis of this article. . In order to mitigate the impact of endogeneity on the results, this paper also verifies the relationship between climate risk disclosure and debt financing costs in one lagged period. The results are shown in column (2) of Table 2. The coefficient is -0.8908,

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which is significant at the 1% level. The above results show that climate risk disclosure is significantly negatively related to corporate debt financing costs, and hypothesis 1 is established.

**Table 2.** Baseline regression results

| | (1) | (2) |
|---|---|---|
| | Cost | Cost |
| Climaterisk | -1.0795** | |
| | (-2.3331) | |
| L.Climaterisk | | -0.8908* |
| | | (-1.8235) |
| Size | -0.0077*** | -0.0066*** |
| | (-7.9329) | (-6.3205) |
| ROA | -0.0456*** | -0.0470*** |
| | (-5.2627) | (-5.2887) |
| Lev | -0.0057 | -0.0028 |
| | (-1.4277) | (-0.6681) |
| Growth | 0.0059*** | 0.0057*** |
| | (6.0988) | (5.4528) |
| Cashflow | 0.0202*** | 0.0232*** |
| | (3.1297) | (3.4526) |
| Dual | 0.0006 | 0.0012 |
| | (0.4705) | (0.9209) |
| Indep | -0.0069 | -0.0134 |
| | (-0.6816) | (-1.2804) |
| TobinQ | -0.0002 | 0.0002 |
| | (-0.3481) | (0.4781) |
| Top1 | 0.0050 | 0.0101 |
| | (0.8623) | (1.6391) |
| _cons | 0.2354*** | 0.2236*** |
| | (9.8928) | (8.2773) |
| industry effect | Yes | Yes |
| time effect | Yes | Yes |
| N | 22780 | 18977 |
| r2_a | -0.1162 | -0.1251 |
| F | 10.8647 | 10.4542 |

## 6. Robustness Test

### 6.1. Replace Key Explanatory Variables

In the baseline regression, climate risk information disclosure is characterized by the ratio of the total word frequency of the word "climate risk" to the total word frequency of the annual report. This article refers to the approach of Du Jian et al. (2023) to further replace the measurement method and chooses to add 1 to the frequency of sentences related to climate risk information disclosure and take the natural logarithm to measure climate risk information disclosure. Column (1) of Table 5 reports the regression results of replacing the explanatory variable measurement. It can be seen from this that the regression coefficient of climate risk

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disclosure on debt financing costs is still significantly negative, consistent with the baseline regression, and the regression results of this article are still robust.

## 6.2. Reduce Sample Size

In order to exclude samples with 0 debt financing costs that may bias the regression results, samples with negative debt financing cost observations were eliminated for testing. The results in column (2) of Table 5 show that the coefficient of Climaterisk is significantly negative, which is consistent with the above conclusion.

## 6.3. Change the Sample Interval

Since 2019, the COVID-19 epidemic has led to a significant increase in uncertainty in the external environment of enterprises, and the risks faced by enterprises have increased. In order to test the robustness of the conclusions, this article changes the sample interval and re-runs the regression. Column (3) of Table 3 shows the regression results excluding the 2019 and 2020 samples. The results show that after changing the sample interval, the impact of climate risk on debt financing costs still remains significantly negative at a 5% confidence level. further supports the conclusions of this article.

**Table 3.** Robustness check

| | (1) | (2) | (3) |
|---|---|---|---|
| | Cost | Cost | Cost |
| Climaterisk | | -1.1115** | -1.0947** |
| | | (-2.3956) | (-2.1279) |
| Climaterisk2 | -1.0830** | | |
| | (-2.3324) | | |
| Size | -0.0077*** | -0.0086*** | -0.0083*** |
| | (-7.9329) | (-8.7017) | (-7.6386) |
| ROA | -0.0456*** | -0.0429*** | -0.0427*** |
| | (-5.2628) | (-4.9296) | (-4.1522) |
| Lev | -0.0057 | -0.0129*** | -0.0077* |
| | (-1.4277) | (-3.1982) | (-1.7472) |
| Growth | 0.0059*** | 0.0056*** | 0.0059*** |
| | (6.0987) | (5.6736) | (5.6065) |
| Cashflow | 0.0202*** | 0.0278*** | 0.0162** |
| | (3.1297) | (4.2533) | (2.2670) |
| Dual | 0.0006 | 0.0005 | -0.0002 |
| | (0.4705) | (0.3884) | (-0.1114) |
| Indep | -0.0069 | -0.0082 | -0.0058 |
| | (-0.6816) | (-0.7977) | (-0.5129) |
| TobinQ | -0.0002 | -0.0004 | -0.0004 |
| | (-0.3481) | (-0.9398) | (-0.7677) |
| Top1 | 0.0050 | 0.0033 | 0.0028 |
| | (0.8623) | (0.5579) | (0.4233) |
| _cons | 0.2354*** | 0.2739*** | 0.2518*** |
| | (9.8930) | (11.1435) | (9.4998) |
| industry effect | Yes | Yes | Yes |
| time effect | Yes | Yes | Yes |
| N | 22780 | 21497 | 18361 |
| r2_a | -0.1162 | -0.1252 | -0.1492 |
| F | 10.8646 | 9.5438 | 10.5716 |

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## 7. Heterogeneity Test

Considering that the climate risk disclosure system of state-owned enterprises is more stringent and standardized than that of non-state-owned enterprises, the impact of climate risk disclosure on corporate debt financing costs may vary depending on the nature of property rights. Therefore, this article conducts group tests on state-owned enterprises and non-state-owned enterprises. , further revealing the impact of climate risk disclosure on the debt financing costs of companies with different ownership properties. Table 4 shows that among state-owned enterprises, the estimated coefficient of climate risk disclosure is -1.5719, which is significant at the 1% level, while among non-state-owned enterprises, the estimated coefficient of climate risk disclosure is not significant. This is because state-owned enterprises in order to actively respond to the national Disclose climate risk information in accordance with the requirements of policies, laws and regulations, and shape a good image of the company through active disclosure of climate risks in order to obtain sustained and stable economic returns, improve corporate financial performance, and reduce debt financing costs. Private enterprises, on the other hand, are in a passive wait-and-see stage during the implementation process. The disclosure of climate risk information is not highly standardized, and financial institutions have strict restrictions on the financing process. Private enterprises are more inclined not to disclose climate risk information. Therefore, compared with state-owned enterprises, non-state-owned enterprises have lower incentives to disclose climate risk information, which leads to differences in the impact of climate risk information disclosure on debt financing costs depending on the nature of corporate property rights.

**Table 4.** Heterogeneity test: Property rights heterogeneity

| | non-state-owned enterprises | state-owned enterprises |
|---|---|---|
| | Cost | Cost |
| Climaterisk | -0.1454 | -1.5719*** |
| | (-0.2075) | (-2.6840) |
| Size | -0.0094*** | -0.0069*** |
| | (-6.4276) | (-5.1775) |
| ROA | -0.0471*** | -0.0232* |
| | (-4.0755) | (-1.7191) |
| Lev | -0.0137** | 0.0048 |
| | (-2.3757) | (0.8715) |
| Growth | 0.0060*** | 0.0064*** |
| | (4.2417) | (5.1216) |
| Cashflow | 0.0183* | 0.0200** |
| | (1.9282) | (2.3948) |
| Dual | 0.0004 | -0.0008 |
| | (0.2508) | (-0.3944) |
| Indep | 0.0245 | -0.0238* |
| | (1.5368) | (-1.9312) |
| TobinQ | -0.0002 | -0.0014* |
| | (-0.3269) | (-1.8955) |
| Top1 | 0.0031 | 0.0114 |
| | (0.3376) | (1.4967) |
| _cons | 0.2543*** | 0.2174*** |
| | (6.3490) | (6.9388) |
| N | 13377 | 9403 |
| r2_a | -0.1599 | -0.0760 |
| F | 6.3480 | 7.5196 |

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## 8. Mechanism Inspection

This article uses the intermediary effect test method to study the mechanism by which climate risk disclosure affects corporate debt financing costs proposed in the theoretical analysis section above. Referring to Jiang Ting (2022)'s intermediary effect analysis suggestions in causal inference research, the intermediary variables selected in this article The causal relationship between the corporate debt financing cost of the explained variable is relatively clear and intuitive, focusing on the impact of the explanatory variable (climate risk disclosure) on the mediating variable. Therefore, based on the benchmark regression model (1), this article sets model (2) to test the mediating effect:

$$ER_{i,t}=\beta_0+\beta_1 Climaterisk_{i,t}+\beta_3 Control_{i,t}+Ind+Year+\varphi_{i,t} \quad (2)$$

**Table 5.** Mechanism Test

| | (1) | (2) | (3) |
|---|---|---|---|
| | ER | ER | ER |
| Climaterisk | 0.2560*** | 0.1960*** | 0.1112*** |
| | (19.7454) | (14.2047) | (7.2998) |
| Size | | 0.0003*** | -0.0000 |
| | | (16.3967) | (-0.6299) |
| ROA | | -0.0015*** | 0.0009*** |
| | | (-4.4505) | (3.2112) |
| Lev | | -0.0018*** | -0.0002* |
| | | (-13.8749) | (-1.6558) |
| Growth | | 0.0000 | 0.0000 |
| | | (1.1516) | (0.4364) |
| Cashflow | | -0.0010*** | 0.0001 |
| | | (-4.0984) | (0.6647) |
| Dual | | 0.0001*** | -0.0000 |
| | | (3.3659) | (-0.0491) |
| Indep | | 0.0014*** | 0.0007** |
| | | (3.7943) | (2.1562) |
| TobinQ | | 0.0001*** | -0.0000 |
| | | (5.5068) | (-0.6517) |
| Top1 | | -0.0003* | 0.0006*** |
| | | (-1.8883) | (3.1540) |
| _cons | 0.0086*** | 0.0015*** | 0.0062*** |
| | (236.6671) | (3.4229) | (7.8665) |
| industry effect | No | No | Yes |
| time effect | No | No | Yes |
| N | 22780 | 22780 | 22780 |
| r2_a | | | 0.3414 |
| F | | | 365.3427 |

Among them, the definition and measurement method of explanatory variables and control variables are consistent with the benchmark regression, and ER is the intermediary variable. Referring to Chen Shiyi (2018), Deng Huihui (2019) and Yin Lihui (2021), we used to capture the environmental regulations related to government reports. Word frequency as a proxy

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indicator of the intensity of environmental regulation. The results of the analysis of the research hypothesis show that climate risk information disclosure can enhance corporate environmental regulation. Therefore, the estimated coefficient β1 of climate risk information disclosure is expected to be negative; as shown in Table 5, column (1) is a univariate test As a result, the estimated coefficient of Climaterisk is significantly positive at the 1% level, but the estimation result at this time has a large omitted variable bias. In order to solve this problem, this article adds a series of control variables in column (2) , on this basis, column (3) further controls the firm, year and industry fixed effects. The final results still show that the estimated coefficient of Climaterisk is significantly positive at the 1% level, which means that climate risk disclosure enhances the government's environmental regulations, thereby reducing corporate debt financing costs.

## 9. Conclusion and Policy Suggestions

Using data from A-share listed companies from 2007 to 2021, this paper empirically tests the impact of corporate climate risk disclosure on debt financing costs. In view of the status and characteristics of my country's listed companies as state-owned enterprises, this paper further examines the impact of the nature of property rights on the relationship between climate risk disclosure and corporate debt financing costs. Through analysis, this article reaches the following conclusions:

1) Climate risk disclosure can reduce corporate debt financing costs, which shows that climate risk disclosure cannot just be regarded as a cost that reduces corporate profits, but should be used as a means of reducing debt financing costs. Companies actively disclosing climate risk information can establish a medium for information exchange with creditors, reduce information gaps caused by information asymmetry, thereby establishing an environmental image of companies actively fulfilling social responsibilities, improving corporate reputation, gaining social recognition, reducing financing competition, and reducing debt financing. cost.

2) The mechanism behind it is that environmental regulation is essentially the sum of government actions and other binding actions. Disclosing climate risks can enhance the environmental awareness of enterprises, enable enterprises to participate in environmental protection, and strengthen the non-governmental power of environmental regulation, thereby strengthening environmental regulation and improving corporate environmental performance, thereby improving environmental performance and reducing corporate financing costs.

Through the previous research and analysis, this article puts forward the following policy recommendations:

1) Suggestions to government regulatory authorities. First, regulatory authorities can improve the information disclosure system of corporate climate risks and standardize and clarify its measurement methods, explore a climate risk prevention and control governance system that is in line with China's national conditions, and at the same time help meteorological departments promote related work. Although TCFD provides a relatively comprehensive climate risk analysis framework, my country has not yet introduced laws and regulations requiring listed companies to compulsorily disclose climate-related financial risks. Empirical research has also found that except for large state-owned enterprises, other companies have insufficient motivation to disclose climate risks, and the quality of climate risk information disclosed is poor. Therefore, relevant government departments can consider mandating listed companies to regularly disclose climate risk information. At the same time, they should strengthen and deepen the management of climate risk information disclosure rules, requiring companies to enhance hard disclosure of information and reduce soft disclosure, especially to avoid ambiguity, The ambiguous language of climate risk messages. Second, strengthen environmental protection supervision. Government regulatory authorities can implement

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encouraging policies, provide tax and credit concessions to companies that actively disclose climate risks, increase regulatory penalties for companies that violate environmental protection regulations, and use both administrative and economic levers to mobilize companies to improve environmental performance and disclose Climate risk information positivity. In addition, we must actively promote environmental audits, strengthen the supervision and review of climate risk information disclosed by companies, and prevent issues such as climate risk data falsification.

2) Suggestions for listed companies. Listed companies should shoulder the responsibility of protecting the environment and fully, transparently and reliably disclose corporate climate risk information, which can help companies reduce debt financing costs. State-owned enterprises should play a leading role in demonstrating climate risks. They should not only make corresponding climate risk disclosures in response to environmental regulations from governments, non-governmental organizations and other entities, but also improve management incentive mechanisms and guide management to voluntarily disclose climate risk information, so as to Meet the information needs of creditors.

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