



Environmental Information Disclosure Quality and Cost of Debt: Evidence from A-Share Listed Companies in China

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Abstract. This study examines the influence of the quality of environmental information disclosure on the cost of debt for A-share listed companies in Shanghai, Shenzhen, and Beijing from 2014 to 2019, amidst the rapid expansion of the Chinese economy and its resultant environmental challenges. The research aims to address the societal demand for a low-carbon economy and sustainable practices. By concentrating on China's distinctive governance framework, this study explores the role of transparency in environmental performance in optimizing interactions within capital markets, offering both theoretical and practical implications for corporate governance and policy-making in developing economies. The findings indicate that the higher quality of corporate environmental information disclosure correlates with reduced costs of debt. In addition, the study explores the moderating and mediating role of government regulation and internal control in this relationship. Results demonstrate that government regulation strengthens the negative correlation between environmental information disclosure quality and financing costs, while robust internal controls further contribute to reducing these costs.

Keywords: Environmental Information Disclosure Quality, Cost of Debt, Government Regulation, Internal Control

1 Introduction

The late 20th century marked a period of accelerated global economic modernization, during which enterprises in various countries have impacted the environment to varying degrees while generating material wealth [1]. The pursuit of sustainable development has, therefore, emerged as a universal objective. Notably, numerous developed nations have successfully integrated environmental protection into every facet of their economic and social frameworks, thereby cultivating a pervasive awareness of ecological responsibility [2]. Conversely, in several developing countries, the imperative for economic advancement often temporarily outweighs environmental considerations (Ibid). As a rapidly evolving economy, China is at a pivotal juncture of transformation. Its unique regulatory system and corporate culture have had a profound impact on

environmental quality requirements, striving to promote harmonious coexistence between humans and nature while maintaining economic growth. This endeavor serves as a potential reference for other developing nations in Asia seeking to reconcile environmental and economic priorities. Specifically, within the modern market economy, enterprises function as micro entities that consume substantial natural resources throughout their production and operational activities, inevitably imposing adverse environmental impacts [3]. Consequently, examining the quality of environmental information disclosure by Chinese enterprises and its influence on cost of debt is of considerable scholarly significance.

There are mainly two types of financing methods for enterprises, one is debt financing, and the other is equity financing. Due to the inherent defects of long cycle and high risk in equity financing, debt financing has become the main way for enterprises to raise funds [4]. Therefore, what impact does the quality of environmental information disclosure have on the cost of corporate debt financing, and to what extent, has become a hot topic of concern for scholars.

The research uses the *PMANDATA* database to calculate and organize the environmental information disclosure quality score. Based on the annual financial data of A-share listed companies in Beijing, Shanghai, and Shenzhen from 2014 to 2019, it empirically studies the specific impact of environmental information disclosure quality on the cost of corporate debt financing. In fact, previous scholars' research on this topic has mostly focused on the impact of overall ESG performance or information disclosure quality, with little emphasis on the mechanism by which environmental quality affects debt financing. Therefore, this article contributes to the existing body of research by further supplementing and enriching studies on the evaluation system of environmental information disclosure level in developing countries. In addition, the paper categorizes enterprises into state-owned and non-state-owned entities, exploring the impact of different types of enterprises on their relationship. And by introducing two variables, government regulation and internal control, to consider the specific mechanism through which the quality of environmental information disclosure affects corporate cost of debt. This approach not only broadens the research perspective, but also provides a theoretical basis for the effective constraint of corporate governance behavior through the exercise of external and internal forces, enabling the development of empirical research on the level of environmental information disclosure and its economic outcomes, and providing a new approach for future research.

2 Theoretical Analysis and Research Hypotheses

2.1 The Relationship between the Quality of Corporate Environmental Information Disclosure and Cost of Debt

According to Signaling Theory, in the case of information asymmetry, enterprises must transmit their internal information to the outside world through a series of signals to reduce the negative impact of information asymmetry [5]. Common signals include profit declarations, dividend declarations, and financing declarations. These signals can help external stakeholders, such as investors and creditors, better assess the true

condition and prospects of the enterprise (Ibid). However, with the increasing attention to environmental issues, the quality of environmental information disclosure has gradually become another important way of signal transmission. In fact, the concerns of creditors and shareholders are not the same. Shareholders are mainly concerned about the long-term profitability and stock price appreciation of the enterprise, while creditors are more concerned about whether the principal can be recovered on time and whether the interest can be paid on time [6]. Therefore, creditors will be particularly concerned about risk factors that may have a negative impact on the company's future cash flow and debt repayment ability. The quality of environmental information disclosure is particularly important in this context. High-quality environmental information disclosure mitigates information asymmetry, enabling investors, especially creditors, to assess a company's environmental risks and long-term sustainable development capabilities more accurately, thereby reducing uncertainty. Specifically, if a company discloses detailed and consistent environmental information, creditors will be able to assess the company's environmental risks and understand its efforts and measures in environmental protection more accurately. This transparency not only reduces creditors' concerns about environmental risks for the company, but also increases their confidence in the company's debt paying ability, thereby reducing the company's costs of debt. Based on this analysis, the paper proposes the following hypothesis:

Hypothesis 1: The higher the quality of a corporation's environmental information disclosure, the lower its cost of debt.

2.2 Moderation Effect: The Impact of Government Regulation on the Relationship between Environmental Disclosure Quality and Financing Costs

The Theory of Economic Externalities holds that the activities carried out by certain economic entities to maintain their own operations may directly or indirectly affect the economic entities inside and outside, but they have not paid corresponding fees or received corresponding rewards for them [7]. Environmental pollution is a typical external uneconomical behavior, and companies usually do not need to pay sufficient costs for their environmental impact. Therefore, it is necessary to constrain corporate behavior through external pressures such as government regulation, in order to improve the environmental performance and information disclosure quality of enterprises.

During the research period of this article (2014-2019), China issued several laws and regulations at the national, industry, and provincial levels to promote the quality of corporate environmental information disclosure. For example, The State Council promulgated the 'Measures for the Disclosure of Environmental Information (Trial Implementation)' in 2007, and further promulgated the 'Measures for the Disclosure of Environmental Information of Enterprises and Institutions' in 2014 [8]. These policy regulations not only require companies to improve the transparency of environmental information disclosure, but also include clear provisions on penalties for failure to meet standards. These laws and regulations have a strong deterrent and impact on enterprises, prompting them to actively improve environmental performance and enhance the quality of information disclosure. In contrast, numerous countries, particularly those within

the developing world, exhibit relatively weaker legislative and regulatory frameworks concerning environmental information disclosure, alongside challenges in enforcement. Mertzanis et al. (2020) highlight that many developing countries display suboptimal performance in environmental information disclosure due to insufficient institutional infrastructures and regulatory enforcement, resulting in an insignificant impact of environmental performance on financing costs [9]. Consequently, the enhancement of China's environmental regulatory mechanisms, in terms of both the quantity and enforcement of regulations, establishes a definitive legal framework for enterprises. This compels them to enhance the quality of their environmental information disclosure, which is a phenomenon of relative uniqueness on a global scale. Based on the above theory and policy background, hypothesis 2 is proposed.

Hypothesis 2: Government regulation amplifies the negative correlation between the quality of environmental information disclosure by Chinese enterprises and their cost of debt.

2.3 Mediating Effect: The Impact of Internal Control on the Relationship between Environmental Disclosure Quality and Financing Costs

The Agency Theory states that a company is composed of a series of contracts, including contractual relationships between providers of capital (shareholders and creditors, etc.) and operators of capital (management authorities) [10]. Internal managers of enterprises have an advantage in information, but may disregard environmental protection and harm the interests of creditors and other stakeholders. High-quality internal control can constrain the self-interest behavior of management and ensure the transparency and authenticity of environmental information disclosure.

Shao's (2019) study finds that high-quality internal controls help ensure more accurate and timely disclosure of environmental information, thereby reducing business risks and lowering debt financing costs [11]. Thus, hypothesis 3 is proposed.

Hypothesis 3: Improving the quality of internal control helps to strengthen the role of environmental information disclosure quality in reducing the cost of corporate debt financing.

3 Empirical Testing

3.1 Sample Selection and Data Sources

This article selects the annual data of A-share listed companies in Beijing, Shanghai, and Shenzhen from 2014 to 2019 as the initial research sample. The data sources include *Choice Financial Terminal* and *PIMANDATA* public database. Since the publicly available data sources for crawling the government regulation index are only up to 2019, the sample size for this study is as of 2019. To ensure the reliability of the research results, the initial samples were screened as follows: (1) samples with missing variable data were excluded; (2) financial listed companies were excluded; (3) companies classified as ST and *ST during the sample period, indicating abnormal status,

were omitted. After the above processing, 3844 sample company data were finally obtained for analysis.

3.2 Variable Definition and Measurement

3.2.1 Explained Variable – Cost of Debt (*Cost*). There are various methods for measuring the cost of debt, among which the more popular ones include debt rating measurement, interest expense indicator method, financial expense indicator method, and net financial expense indicator method. This study refers to the research method of Zheng et al. (2013) and adopts the interest expense indicator method to measure the debt financing cost of enterprises [12]. Specifically, this method reflects the cost of debt by calculating the ratio of a company's financial expenses to its total liabilities at the end of the period. This calculation method can accurately demonstrate the economic burden that a company needs to bear in order to maintain its debt level during a specific period. The specific formula is:

$$\text{Cost of debt} = \frac{\text{The financial expenses of the enterprise for the next year}}{\text{The total liabilities at the end of the period}} \quad (1)$$

Through this ratio, it can not only demonstrate the costs incurred by the enterprise in the financing process, but also reveal the efficiency of its financing structure and financial strategy (Ibid).

3.2.2 Explanatory Variable - Quality of Environmental Information Disclosure (*EDI*). This article adopts the content analysis method commonly used by most domestic experts and scholars to evaluate the quality of environmental information disclosure. According to the relevant requirements for environmental information disclosure in Chapter 2 of the 'Guidelines for Environmental Information Disclosure of Listed Companies (Draft for Comments)' published by the Environmental Protection Bureau in 2010, combined with the environmental information disclosure quality evaluation system designed by scholars such as Gou (2021), a total of 30 indicators for specific disclosure items were finally determined [13]. These items encompass five major dimensions: Environmental information disclosure carriers, Environmental management disclosure, Environmental supervision and certification disclosure, Environmental liability disclosure, and environmental performance and governance disclosure. Scoring criteria for each indicator are based on undisclosed / qualitative disclosure / quantitative disclosure, with a score assigned as 0 / 1 / 2. Therefore, regarding the scoring of the quality of corporate environmental information disclosure, the scores of various indicators were added together, and then the logarithm was taken after adding 1 to obtain the enterprise environmental information disclosure quality index (*EDI*).

3.2.3 Mediating Variable - Internal Control (*IC*). Referring to the research of Song (2023), the DIB Internal Control Index for listed companies released by Shenzhen Dib Company was adopted. This evaluation system is based on the specific implementation of each internal control objective. The results quantitatively reflect the overall internal

control level of the company, offering a representation that closely aligns with the actual conditions and carries substantial professional authority, thus enjoying widespread acceptance [14]. Building on this foundation, this study uses the DIB internal control index covering the period from 2014 to 2019 to measure the internal control quality of sample enterprises. To enhance the economic interpretability of the data, the empirical analysis involves dividing the DIB internal control index by a factor of 100.

3.2.4 Moderator Variable - Government Regulation (*PITI*). Referring to Li's (2020) measurement of government regulatory variable, the Pollutants Information Transparency Index (*PITI*) was used [15]. The *PITI* index is currently the most accurate and objective data for evaluating the government's environmental information disclosure management of enterprises in China. Therefore, this article uses the *PITI* index to measure the strength of government regulation.

3.2.5 Control variables. The article identifies the selected control variables as follows: cash flow (*CF*, defined as the ratio of operating cash flow to total assets at the beginning of the year), firm size (*A*), leverage ratio (*LEV*), fixed asset ratio (*FA*), return on total assets (*ROA*), corporate innovation (*RC*, measured by the ratio of R&D investment to operating income), company growth (*GROWTH*, measured by the year-over-year growth rate of operating income), firm age (*AGE*), and executive shareholding ratio (*MANAGER*).

3.3 Empirical Model

Based on the research hypotheses established above, a multiple regression model is constructed to test the effect of environmental information disclosure quality on cost of debt, and the regression Formula 2 is as follows:

$$Cost_{i,t} = \alpha_0 + \alpha_1 EDI_{i,t-1} + \alpha_2 ControlVar_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where *Cost* denotes the cost of debt, *EDI* denotes the quality of corporate environmental disclosure, *ControlsVar* includes all the control variables, α_0 is the intercept term, and ε is the random perturbation term. If the coefficient α_1 is negative, hypothesis H1 is validated.

On the basis of initial model, Formula (3) is set to test the moderating effect of government regulation.

$$Cost_{i,t} = \beta_0 + \beta_1 EDI_{i,t-1} + \beta_2 PITI_{i,t-1} + \beta_3 EDIP_{i,t-1} + \beta_4 ControlVar_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

Among them, *PITI* means government regulation, *EDIP* is the intersection of *PITI* and *EDI*, and other variables are set the same as the first model. If β_3 is significant, it shows that the government regulation plays a moderating effect between the quality of enterprise environmental information disclosure and the cost of debt.

Meanwhile, to further verify the path of environmental information disclosure quality on cost of debt, Formula (4) and (5) are set up based on initial model to test the mediating effect of the internal control.

$$IC_{i,t} = \mu_0 + \mu_1 EDI_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

$$Cost_{i,t} = \gamma_0 + \gamma_1 EDI_{i,t-1} + \gamma_2 IC_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

where, IC represents internal control and other variables are set in the same way as the initial model. Formula (4) tests the impact of environmental information disclosure quality on the mediating variable, and Formula (5) tests the impact of environmental information disclosure quality on cost of debt after adding the mediating variable IC . If μ_1 is significant, it proves that the quality of environmental information disclosure has a significant impact on IC , and the next test could be carried out; otherwise, the test is terminated; If γ_1 and γ_2 are both significant, and the absolute value of γ_1 is lower than that of α_1 , it indicates that internal control plays a partial mediating effect between the quality of environmental information disclosure and the cost of debt. If γ_1 is not significant, it indicates that internal control plays a complete mediating effect.

4 Research Results and Analysis

4.1 Descriptive Analysis

The research performed a descriptive statistical analysis of the variables involved, with the results presented in Table 1.

As evidenced by the findings: (1) The average value of cost of debt ($Cost$) is 0.0098 and the standard deviation is 0.0365, indicating that the costs of debt of various enterprises are relatively concentrated, but there is still a certain range of fluctuation; (2) The mean value of environmental information disclosure quality (EDI) is 1.6515 and the standard deviation is 0.7450, indicating that the quality of environmental information disclosure varies greatly among different enterprises. After taking the natural log of this index, the gap between the maximum value and the minimum value can still reach about 3, which shows the significant difference. In addition, on the whole, considering that the full score of environmental disclosure quality is about 4.11, it can be seen that the information disclosure quality of the sample enterprises is at a low level; (3) The mean value of government supervision ($PITI$) is 60.3986, and the standard deviation is 11.8925, indicating that there are obvious differences in the intensity of environmental supervision by local governments; (4) The mean value of internal control (IC) is 6.5012 and the standard deviation is 0.9635, indicating that the overall difference of internal control quality in the samples is not large. While the quality of internal control in the majority of samples is relatively high, there remain a number of samples exhibiting low levels of internal control quality. Notably, there are instances where companies have been assigned an internal control index of zero; (5) The distribution of other variables is within a reasonable range.

Table 1. Descriptive statistical results.

Variable	Sample number	Average value	Standard deviation	Minimum value	Median	Maximum
<i>Cost</i>	3844	0.0098	0.0365	-0.7267	0.0141	0.1652
<i>EDI</i>	3844	1.6515	0.7450	0.6931	1.3863	3.6109
<i>PITI</i>	3844	60.3986	11.8925	15.6000	64.0000	78.1000
<i>IC</i>	3844	6.5012	0.9635	0.0000	6.6380	9.0177
<i>ROA</i>	3844	4.7091	5.4258	-46.8424	4.2758	40.2221
<i>RC</i>	3844	4.9747	5.6262	0.0003	3.7075	125.9092
<i>A</i>	3844	22.1305	1.2064	17.8061	21.9320	27.9617
<i>LEV</i>	3844	38.7197	19.3732	1.3990	37.0479	97.8663
<i>CF</i>	3844	4.7378	6.5687	-40.6480	4.4697	66.1238
<i>FA</i>	3844	20.3965	13.9776	0.0673	17.7976	89.8867
<i>GROWTH</i>	3844	18.4580	54.7060	-91.8341	10.8467	1731.7594
<i>MANAGER</i>	3844	16.9330	19.2055	0.0000	7.8172	83.0017
<i>AGE</i>	3844	17.4724	5.3320	4.0000	17.0000	61.0000

4.2 Correlation Analysis

In order to preliminarily determine whether there is a large correlation among variables, correlation analysis was carried out. It shows that the absolute values of the correlation coefficients among the variables are all lower than 0.7, meaning that there is no obvious collinearity. In addition, the VIF value of each variable is lower than 10, and all variables can be retained.

4.3 Panel Regression Analysis

Based on the research hypotheses, the whole sample, sample of state-owned enterprises and non-state-owned enterprises were tested respectively. Table 2 shows the main multiple regression results.

According to the regression results of the whole sample, (1) Column (a) shows that the coefficient of environmental information disclosure quality (*EDI*) is negative and significant at 1% significance level. The coefficient means that for each unit improvement of environmental information disclosure quality, the cost of debt will decrease by 0.0043 units. When the quality of environmental information disclosure increases by one standard deviation, the company's cost of debt will decrease by about 32.7%. This indicates that the disclosure of high-quality environmental information can effectively meet the creditors' demand for information on corporate environmental performance, thereby reducing the estimated risk of creditors' investment and enabling enterprises to obtain debt financing at a lower cost; (2) Column (b) shows that after the addition of control variables, *EDI* still maintains a negative coefficient and is significant at the significance level of 5%. Hence, H1 holds.

In addition, the paper makes grouping regression according to the nature of the sample enterprises. Comparing the regression results of the samples of state-owned and non-state-owned enterprises, we can see that: (1) in the column (a) of state-owned enterprises group, the *p* value of *EDI* is not significant, while in the column (a) of non-state-owned enterprises, the coefficient of *EDI* is negative and significant at the significance level of 1%; (2) after adding control variables, column (b) of state-owned enterprises sample shows that the *p* value of *EDI* is still not significant, while column (b) for non-state-owned enterprises sample shows that *EDI*'s coefficient is negative and significant at the 1% significance level. It means the negative correlation between the quality of corporate environmental information disclosure and the cost of debt in the full sample is mainly contributed by non-state-owned enterprises.

Table 2. Regression results for Hypothesis 1.

	Full Sample		State-owned Enterprises		Non-state-owned Enterprises	
	(a)	(b)	(a)	(b)	(a)	(b)
<i>EDI</i>	-0.0043**	-0.0040**	0.0032	0.0036	-0.0077***	-0.0074***
<i>A</i>		-0.0033		0.0019		-0.0066*
<i>LEV</i>		0.0004***		0.0003***		0.0005***
<i>ROA</i>		0.0001		-0.0002		0.0002
<i>RC</i>		0.0009		0.0014		0.0008
<i>CF</i>		-0.0002**		0.0000		-0.0003**
<i>FA</i>		0.0001		0.0000		0.0001
<i>GROWTH</i>		0.0000		0.0001		0.0000
<i>MANAGER</i>		-0.0003		0.0001		-0.0003
<i>AGE</i>		-0.0036		-0.0068**		-0.0030
<i>Year</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>F</i>	59.8700	14.5460	6.2045	2.4669	57.9020	13.5420
<i>R-squared</i>	0.0495	0.0653	0.0173	0.0375	0.0678	0.0860
<i>N</i>	3844	3844	1193	1193	2651	2651

Note: The data in the table are regression coefficients of each variable, and ***, **, and * are significant at the significance level of 1%, 5% and 10% respectively.

The above results indicate that improving the environmental information disclosure quality by enterprises can effectively reduce the cost of debt, that is, high-quality environmental information disclosure can improve the transparency of enterprises, so that investors and creditors can better understand the efforts of enterprises in environmental management and sustainable development. Such transparency reduces information asymmetry, thus reducing creditors' concerns about corporate environmental risks. Overall, creditors prefer enterprises with high quality environmental information disclosure and give them loan benefits such as low interest rate.

At the same time, the negative correlation between the environmental information disclosure quality of non-state-owned enterprises and cost of debt is more obvious than that of state-owned enterprises. The possible explanation is that non-state-owned enterprises often do not have the implicit guarantee like state-owned enterprises, and their credit rating may be lower or it is more difficult for them to obtain financing. Therefore, they need to improve their corporate image and credit level through high-quality environmental information disclosure, so as to reduce financing costs. State-owned enterprises, on the other hand, may be less dependent on environmental information disclosure due to their background and higher credit ratings.

4.4 Moderating Effect - Government Regulation

The data presented in Table 3 shows that the coefficient of the interaction term *EDIP* between *EDI* and *PITI* is negative and statistically significant at the 5% level. This finding suggests that government regulation amplifies the negative relationship between *EDI* and *Cost*. Consequently, companies are likely to increase their environmental investments under the external pressure of government regulations, thereby enhancing the quality of environmental information disclosure to gain favor with external stakeholders. This finding supports the validity of Hypothesis 2 in this study.

Table 3. Regression results for Hypothesis 2.

	Full Sample	
	(a)	(b)
<i>EDI</i>	0.0153**	0.0160**
<i>PITI</i>	0.0007**	0.0007**
<i>EDIP</i>	-0.0003***	-0.0003**
<i>A</i>		-0.0039
<i>LEV</i>		0.0004***
<i>ROA</i>		0.0001
<i>RC</i>		0.0009
<i>CF</i>		-0.0003**
<i>FA</i>		0.0001
<i>GROWTH</i>		0.0000
<i>MANAGER</i>		-0.0002
<i>AGE</i>		-0.0035
<i>Year</i>	Yes	Yes
<i>Industry</i>	Yes	Yes
<i>F</i>	34.0580	13.6540
<i>R-squared</i>	0.0559	0.0719
<i>N</i>	3844	3844

Note: The data in the table are regression coefficients of each variable, and ***, **, and * are significant at the significance level of 1%, 5% and 10% respectively.

If the cost of environmental protection investment is large, the expenditure of environmental equipment and the cost of environmental maintenance hence might be high, thus affecting the profits. Therefore, enterprises might be reluctant to actively engage in environmental responsibilities and may also be hesitant to disclose their environmental performance to the public. In this context, government regulation can improve the standards and authenticity of environmental information disclosure by enterprises, reduce the likelihood of companies embellishing their environmental information. This enhancement in disclosure reliability fosters increased market trust in the information provided by companies, thereby diminishing risk perception among investors and creditors. As a result, the risk premium requirements for enterprises are lowered, leading to reduced financing costs.

4.5 Mediating Effect — Internal Control

According to the three-step test method of mediating effect, the influence of *EDI* on *IC* was tested first. The *EDI*'s coefficient is 0.0853, and the *p* value is 0.0865, which is significant at 10% level. Secondly, the mediating variable and the independent variable were put into the regression model to test the influence of the mediating variable on the dependent variable *Cost*. The obtained *IC*'s *p* value is 0.0152 and the coefficient is -0.0017, which significantly affects the dependent variable. At the same time, *EDI*'s coefficient is -0.0041 and *p* value is 0.0304, which is significant at the 5% level. Compared with the *EDI*'s coefficient without integrating the mediating variable *IC*, its absolute value decreases from 0.0043 to 0.0041, indicating that the internal control of enterprises plays a partial intermediary role between the quality of environmental information disclosure and the cost of debt. The analysis results support the Hypothesis 3.

The possible explanation is that high-quality internal control can guarantee the quality of environmental information disclosure of enterprises, and improve the accuracy and consistency of disclosure through standardized information management and disclosure process. A good internal control system enhances the reliability of corporate information in the market, thus reducing the risk of default and reducing the cost of debt financing.

4.6 Robustness Test

In this study, all three hypotheses employed cluster robust standard errors, which account for the correlation of errors within groups. This approach permits the possibility that observation errors within the same population are correlated due to clustering. To address the issue of heteroskedasticity among individuals, a robustness test was conducted using heteroskedasticity-robust standard errors as an alternative. This method assumes that the error of each observation is independent, thereby emphasizing individual differences rather than correlations at the industry level. This substitution ensures that the estimates remain robust even if the variance of the errors between different observation points is not constant.

The final regression results show that after adding control variables, the regression coefficient of environmental information disclosure quality is -0.0040, while the p value is 0.0347, which is significant at 5% level, consistent with the conclusion of the main hypothesis, and proves the robustness of the model.

5 Conclusion

This study utilizes data from A-share listed companies located in Shanghai, Shenzhen, and Beijing, spanning the years 2014 to 2019. It investigates the inverse relationship between the quality of environmental information disclosure and the cost of debt, while also examining how this relationship varies among different types of firms. Furthermore, the study empirically assesses the moderating effect of governmental regulation and the mediating role of internal control. The findings confirm support for all three hypotheses posited in this paper.

Therefore, based on the conclusions of the research and the context of China, the following implications are proposed.

(1) Considering company management: Enterprise managers should correctly understand the role of environmental information disclosure in the capital market and improve the quality of their own environmental information disclosure. Enterprise managers should establish environmental awareness, strengthen the internal resource allocation and environmental management, actively fulfill the responsibility of environmental protection, and strive for a win-win situation between business performance and environmental protection. For example, enterprises could incorporate environmental benefits into the assessment system of corporate performance, so as to improve the initiative and reliability of environmental information disclosure.

(2) Considering the government departments: Government departments need to further improve the relevant system of environmental disclosure and relevant laws and regulations, continuously strengthen supervision, and gradually strengthen the positive role of the quality of environmental information disclosure in the capital market. When formulating the relevant environmental information disclosure system, the government should issue specific rules, regulations and disclosure guidelines, so that enterprises have a basis for disclosure, and regulatory departments have laws to follow in implementation and review.

(3) Considering investors: When making investment decisions, in addition to evaluating the profits and operating conditions of enterprises, investors should also comprehensively consider the environmental performance and environmental information disclosure status of enterprises. At the same time, investors should pay attention to the quality of internal control of the enterprise. By thoroughly understanding these controls, investors can comprehensively assess the operational risks and developmental potential of enterprises. This understanding facilitates more informed investment decisions, thereby enhancing the efficiency of resource allocation.

(4) Considering academic research: In terms of enhancing the quality of environmental information disclosure, existing studies predominantly concentrate on initiatives at the corporate level. The Chinese context offers a unique lens, given China's relatively

stringent policies on environmental information disclosure and regulation, coupled with its transition from rapid economic growth to a sustainable development paradigm. Within this framework, the experiential practices of Chinese enterprises serve as significant references and inspirations for other developing nations. Future research endeavors could investigate the contribution and impact of the Chinese context by comparing the institutional frameworks governing environmental information disclosure in China with those abroad. This comparative analysis would aid academics, policymakers, and businesses in comprehending the intricate dynamics of environmental information disclosure, while also fostering the development of effective improvement strategies on a global scale.

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