



# The Quality of Environmental Information Disclosure, Ownership Type and the Cost of Green Bonds: An Empirical Study Based on Green Bonds Issued in China

Xinyuan Ye

Nanjing University of Aeronautics and Astronautics, Nanjing, 211000, China

\*Corresponding author Email: yuan\_eve11@163.com

**Abstract.** With the green bond market in China expanding rapidly, this study examines the relationship between environmental information disclosure and the cost of green bond. It showed that there was a negative relationship between environmental information disclosure and green bond financing cost. Further, green bonds issued by state-owned enterprises have lower financing costs. The research presented in this study has applications for developing a green financial system and further refining the architecture of the green bond information disclosure system.

**Keywords:** Environmental Information Disclosure Quality, Ownership Type, Green Bonds, Financing Cost

## 1 Introduction

How to better protect the environment has become a global concern for many scholars since the 21st century because of the rapid expansion of human society and the accelerated consumption of natural resources that has led to more serious ecological and environmental issues. Among them, green bonds can be seen as a helpful tool for financing environmental protection projects since they are a direct financing tool that match the funding requirements of environmental protection projects. Despite a late start, China's green bonds are growing quickly. In the context of the rapidly developing green bond market, problems such as information asymmetry and incomplete market supervision have been exposed one after another.

Currently, the green bond market offers guidelines on environmental information disclosure, while on the other hand, the government and relevant regulatory bodies regulate environmental information disclosure through mandatory measures. In order to give investors useful reference material, they can use and to support the smooth and quick growth of the bond market, this article looks into the mechanism of environmental information disclosure on the financing cost of green bonds.

The study of corporate environmental information disclosure is garnering more and more attention, which have a significant impact on the achievement of a better vision of sustainable human development. According to Tao et al. (2017), lower costs for cor-

porate debt financing can be achieved by using accounting data of higher quality <sup>[1]</sup>. In addition, the political affiliation possessed by the firm can weaken bond investors' demand for accounting information quality, thus reducing the financing cost of bond. Wu et al. (2016) used corporate bonds issued by highly polluting A-share listed companies from 2008 to 2014 as a research sample, combined environmental data with credit ratings and credit spreads in the same research framework, and included environmental disclosure information indicators as scores in the regression model <sup>[2]</sup>. The findings offer fresh empirical proof of the process by which corporate environmental disclosure affects debt cost. Environmental disclosure, according to Ying (2021) et al., reduces information asymmetry between firms and investors, lowers the level of uncertainty in asset pricing, and consequently dramatically lowers firm risk <sup>[3]</sup>. This shows that in sectors with rapid growth, environmental information sharing can lower personal risk. The following research hypotheses are suggested in this study based on the discussion above.

H1: The higher the environmental information disclosure index of green bonds, the smaller the cost of green bond financing.

In addition, some researchers have discovered that the type of ownership has an effect on this relationship. Garcia-Meca et al(2011) limit their study to Spain and discover that listed companies with state-owned ownership have lower bond financing costs <sup>[4]</sup>. State-owned ownership imposes implied guarantee, according to Fang et al (2013), which might greatly reduce the credit spread of corporate bonds by direct and indirect channels to default risk. Positive internal control assurance reports that listed firms voluntarily release to the public can serve as a signal to the public regarding enhanced information quality <sup>[5]</sup>. Due to the decreased information risk, investors will pay a higher price for corporate bonds issued by these listed businesses. Zhang Chen et al (2020) investigation into the potential impact of environmental information disclosure on bond financing costs discovered that state-owned businesses were more significantly affected by this effect than non-state-owned ones <sup>[6]</sup>.

On the basis of the analysis of the above research results, this paper puts forward the following hypotheses.

H2: When a state-owned company issues bonds as opposed to a non-state-owned company, the negative association between the environmental information disclosure index and bond financing costs is more significant.

## 2 Research Design

### 2.1 Variable Interpretation

#### **Explained variable: financing cost of green bond (CGB).**

In this study, the credit spread method is used to measure the financing cost of green bonds, which is the difference between the yield to maturity of bonds and the interest rate of treasury bonds of the same year and the same maturity. The yield to maturity of green bonds in China is equal to their coupon rate because they are often issued at par value. This paper adopts the linear interpolation method to construct the interest rate of treasury bonds of the same maturity in the same period.

CGB=Yield to Maturity of green bond(T)-Yield to Maturity of treasury bond(T), ‘(T)’ means the same issue period for the same period.

**Explanatory variable: environmental information disclosure index (EDI)**

This study adopts the content analysis method to quantify the degree of environmental information disclosure and sets the environmental information disclosure index EDI as the explanatory variable. Based on the 8 environmental information contents that should be disclosed by enterprises in environmental reports as per the *Guidelines for Information Disclosure of Listed Companies*, the 9 environmental information contents that are encouraged to be disclosed by enterprises in the *Measures for Environmental Information Disclosure (for Trial Implementation)* issued by the Environmental Protection Administration. Finally, this study selects 11 items. Further, the environmental information disclosure entries are shown in Table 1.

**Table 1.** Environmental Disclosure Entries and Scoring Criteria [Self-drawn]

Category	Disclosure Entries	N	AI	An
Nu- merical	①Pollution emission concentration, type, quantity	0	1	2
	②Total annual resource consumption and savings	0	1	2
	③Technology improvements and investment costs	0	1	2
	④Sewage treatment fee, greening fee, environmental protection cost	0	1	2
	⑤Environmental lawsuits, damages, fines, awards	0	1	2
	⑥Government grants, financial subsidies, tax incentives	0	1	2
De- scriptive	⑦Whether to obtain environmental system certification		Y=2, N=0	
	⑧Whether to disclose the concept and objectives of environmental protection		Y=2, N=0	
	⑨Whether to issue independent social responsibility report, environmental report, sustainable development report		Y=2, N=0	
	⑩Whether to state the use of funds		Y=2, N=0	
	⑪Availability of green bond certification bodies		Y=2, N=0	

N = Undisclosed, AI = Qualitative, An = Quantitative and qualitative.

The environmental disclosure index (EDI) is calculated by dividing the score of information actually disclosed by the company by the sum of the best scores of all entries to obtain the figure.

**Control variable and moderator variable**

Referring to related studies, 8 other variables are selected from the bond issuer level and bond project level in this paper, as detailed in Table 2.

**Table 2.** Variable Definition [Self-drawn]

Type	Name	Interpretation
Dv	The cost of green bond financing	Credit spreads (Detailed above)

Yv	Environmental disclosure index	Environmental Disclosure Index Value
Mv	State	1 for state-owned enterprises, 0 for non-state-owned enterprises
Cv	Profitability	ROE of the green bond issuer in the previous year
	Financial leverage	Green bond issuer's gearing ratio in the previous year
Cv	Shareholding Concentration	Shareholding ratio of the largest shareholder
	Credit Rating	Assign a score to the credit rating, when the enterprise rating contains 'AAA' assign 3, contains 'AA' assign 2, contains 'A' assign 1, empty is 0
	Third Party Certification	Debt with third-party certification 1; none 0
	Issue Period	Duration of Green Bond Issuance
	Issue size	The issue size of green bonds

*Dv = Explained variable, Yv = Explanatory variable, Mv = Moderator variable, Cv = Control variable*

## 2.2 Samples and Data Sources

### Sample Selection

This study collects all "green" labeled bonds issued in China from 2016 to 2021, including 955 bonds traded on the stock exchange and interbank market, excluding asset-backed securities, medium-term notes, ultra-short-term financing bonds and targeted instruments. And then this paper remove the duplicate-counted bonds traded on the different trading markets, leaving 590 unduplicated bonds. Finally, excluding the observations with large missing debt items, 443 green bonds were finally obtained, accounting for more than 75% of the total issuance.

### Data Sources

This study manually gathers social responsibility reports, environmental information disclosure reports, sustainability reports, and green certification evaluation reports from carbon neutral bonds in order to calculate the environmental information disclosure index. The above reports were found on company websites, SSE, SZSE, and the Wind database. The rest of the data are from WIND database.

## 3 Empirical Analysis

### 3.1 Descriptive Statistics

The outcomes of the descriptive statistics for the key variables are shown in Table III. As can be seen from Table 3, the maximum value of EDI is 0.82. The findings show that there is room for improvement in the overall standard of environmental information disclosure made by green bond issuers, and that there are significant differences between bonds. The bond financing cost (CGB) has a maximum value of 4.65 and a minimum value of -0.90, showing that there is a significant range in financing costs

amongst green bond projects and that issuing companies can lower the financing costs of their own bonds by using efficient strategies.

**Table 3.** Main Variables Descriptive Statistics [Self-drawn]

Variable	Mean	SD	Min	p50	Max	N
CGB	1.59	1.37	-0.90	1.30	4.65	443
EDI	0.23	0.18	0.09	0.18	0.82	443
STA	0.95	0.21	0.00	1.00	1.00	443

### 3.2 Analysis of empirical results

The main regression results of Table 4 show that the regression coefficient of the environmental information disclosure index (EDI) is significantly negative at the 1% level, supporting H1. It shows that high-quality environmental information disclosure can reduce the financing cost of green bond.

According to the Mod-STA results in Table 4, it can be seen that the regression coefficient of the cross-product term of environmental information disclosure index and property rights nature is significantly negative at the 1% level after adding STA, which supports hypothesis 2 of this paper, that is, the negative relationship between environmental disclosure index and green bond financing cost is more significant among state-owned enterprises.

Additionally, it is discovered that the regression coefficients of their cross-products are significantly negative at the 1% level. This finding suggests that enterprise size has no bearing on the relationship between the environmental disclosure index and the cost of green bond financing.

**Table 4.** Regression Analysis [Self-drawn]

Variable	Main Return	Mod-STA'
EDI	-1.230*** (-3.95)	-0.299 -0.48
EDI' STA'		-1.659*** (-2.81)
Constant	3.395*** (-8.53)	3.428*** (-8.68)
N	473	473
R <sup>2</sup>	0.463	0.472

t-statistics in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 4 Conclusions

Environmental information disclosure plays an important role in supervising the implementation of corporate social responsibility. In order to examine the effect of en-

vironmental information disclosure quality on the financing cost of green bonds, this study uses green bonds issued in China between 2016 and 2021 as the research object.

This paper also pays attention to the controlling effects of property rights ownership in this market. The quality of environmental information disclosure for green bonds has improved year over year thanks to ongoing bond market mechanism optimization, and some bond issuers are able to deliver a high-quality environmental disclosure information report. However, the overall disclosure quality of China's green bond market is still at a low level, with significant individual variations and issues like insufficient disclosure and cursory disclosure content.

The study finds low-cost bond financing can be achieved with excellent environmental information disclosure. Furthermore, it is discovered that property ownership affects how environmental information disclosure and bond financing costs are related. State-owned businesses are more affected by the negative correlation between the environmental information disclosure index and bond financing costs than non-state-owned businesses.

As a result, this paper draws the following implications. Firstly, the government should continue to improve the environmental information disclosure system and optimize the institutional arrangement of green bonds, so as to help achieve the dual carbon goals of "peak carbon and carbon neutrality". Secondly, for the debtors, especially for non-state enterprises, they should standardize the procedures and contents of environmental information disclosure, clarify the use of funds for investment projects, and improve the quality of environmental information disclosure, so as to reduce the degree of information asymmetry and improve investors' confidence in the debt, and thus reduce the cost of bond financing. Finally, for investors, they should establish the concept of green investment so as to promote the further development of the green bond market and help build a green financial system.

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