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BANKING & FINANCE | RESEARCH ARTICLE

The choice of green bond financing instruments

Xiangsheng Dou¹ and Shuxiu Qi^{1*}

Abstract: Green bonds, as one of the main tools of green finance, have become an important choice of enterprises in green industries. Therefore, it has become an important theoretical and practical hot topic whether to select and what factors affect a choice to issue labeled green bonds for enterprises that meet the standards of green bonds. This paper employs the Logit model to demonstrate the impact of policy difference on the choice of green bond financing instruments. The results indicate that the type of bonds and the purpose of raising funds are the important factors affecting enterprises to issue labeled green bonds under policy difference caused by “multi-sector supervision” on China’s bond markets. The government must make full use of these key factors to formulate relevant policies to promote the development of green bond financing market.

Subjects: Industrial Economics; Corporate Finance; Investment & Securities

Keywords: green bonds; green bond financing; debt financing; labeled green bonds; non-labeled green bonds

JEL CLASSIFICATION: G11; G31; G32; G38

1. Introduction

In recent years, the issuance of China’s green bonds for serving green industries is booming to deal with the problem of funds in green economy development. In January 2016, Shanghai Pudong Development Bank issued China’s first green financial bond under the impetus of a series of policies, which marked the formal launch of labeled green bonds in China. Relevant policies issued by China’s central and local government authorities are important factors driving green bond market development in China, which is different from the spontaneous formation of international green bond markets.

Green bond is a special kind of bond to raise funds for green industries or projects. In practice, some countries and international organizations have formulated different green bond recognition

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PUBLIC INTEREST STATEMENT

Green bonds, as one of the main tools of green finance, have become an important choice of firms in green industries. However, firms will face two issuing choices of labeled green bonds or ordinary bonds, meeting the standards of green bonds. This paper employs the Logit model to analyze the impact of policy difference on the choice of green bond financing instruments. The results show that the type of bonds and the purpose of raising funds are the important factors affecting whether enterprises issue labeled green bonds under policy difference caused by “multi-sector supervision” on China’s bond markets.

standards according to the actual objective to better identify and standardize green bonds and to define the scope of green industries. At present, the recognition standards of worldwide recognized green bonds are “the Green Bond Principles” (GBP) and “the Climate Bonds Standard” (CBS). However, in China, except that green enterprise bonds follow the “Green Bond Issuance Guidelines” promulgated by the China’s National Development and Reform Commission (NDRC), green financial bonds, corporate bonds, and debt financing instruments all follow the cognitive criteria of “the Green Bond Support Project Catalogue” compiled by the China Green Finance Commission. In addition, China’s green bond policy also stipulates some relevant supporting measures, such as rapid approval channels, project information disclosure, and external certification and assessment.

Green bonds recognized by Chinese officials have reached 238 billion yuan (\$36.2 billion), 248.6 billion yuan (\$37.1 billion) and 282.6 billion yuan (\$42.8 billion) from 2016 to 2018, respectively. They include green bonds issued by Chinese issuers of both inside and outside of China and green panda bonds. Because the definition of green bonds in China is not exactly the same as international definition, the 33%, 38% and 26% of the green bonds issued by China from 2016 to 2018 did not meet the international definition. International definitions exclude some projects such as fossil fuels and that at least 95% of funds must be allocated to green projects, but they are not stipulated in China’s relevant policies. Nevertheless, even if excluding the parts that did not conform to international definition, China’s green bonds still accounted for 30%, 15% and 18% of global issuance from 2016 to 2018, ranking the first, the third and the second in the world, respectively.¹

The bonds that meet the requirements of China’s relevant policies and named “green bonds” are called labeled green bonds. It is generally believed that the financing costs of labeled green bonds are lower than that of conventional bonds (non-labeled green bonds). Because the environmental risks of projects from green bonds are relatively low, there is low default risk and low-risk premium. On the other hand, although the issuance of labeled green bonds has received the relevant support and incentive policies of the government, there are still a large number of non-label green bonds that meet green bond recognition standards but follow general bond issuance system.

The enterprises that meet green bond recognition standards are undoubtedly beneficial if they can raise funds with low financing costs that come from labeled green bonds. However, in practice, many enterprises still choose to issue conventional bonds (non-labeled green bonds). It indicates that financing costs are not only an important factor affecting and deciding the choice of enterprises. In fact, there are some problems in China’s labeled green bond market system and some obstacles in the choice of enterprises to issue labeled green bonds. Therefore, it is of great significance to study the choice of green bond financing instruments for enterprises to improve relevant policies and system, to better serve green enterprises in financing, and to promote sustainable and healthy development of green bond markets.

The goal of this paper is to explore the key factors that affect the choice of green bond financing instruments by building a Logit model. The remainder of the paper is organized as follows. Section 2 reviews related literature. Section 3 analyzes the choice of labeled and non-labeled green bonds. Section 4 conducts factor analysis and research hypothesis. Section 5 describes empirical design. Section 6 is the descriptive statistical analysis of relevant variables. Section 7 is results and discussion. The final section is conclusion.

2. Literature review

The related research is becoming more and more abundant with the development of China’s green bond markets. The existing literature is mainly about the definition of green bonds, issuance market situation, development trends, external certification, and international experience (Huang & Yue, 2018; Li & Zhu, 2017; Wang & Cao, 2016; Wang & Xu, 2016; Zhan, 2016). The relevant empirical researches focus on exploring green bond prices and financing costs (Chen, 2018; Gong, Teng, Sai, &

He, 2018; Qu, 2017; Yao, 2017). However, research on whether and what factors affect the choice of green bond financing instruments for Chinese enterprises is relatively scarce.

Relevant theoretical research is abundant in modern enterprise financing instrument choice or capital structure. Although the famous MM theory has proved that enterprise value was not related with capital structure, there is a huge difference between the reality and the assumptions of the MM theory, meaning that capital structure has an important impact on enterprise value (Li, 2009).

2.1. The choice of equity instruments and debt instruments

Research on the choice of financing instruments of enterprises early focused on the choice of enterprises between equity and debt. The existing theories have mainly trade-off theory, agency cost theory, pecking order theory, signaling theory and market timing theory (Li, 2003; Xiao, 2004). These theories have obtained some meaningful conclusions.

Myers and Majluf (1984) thought that companies would choose internal financing firstly when financing for new projects, followed by bond financing, and equity financing finally. Jensen (1986) believed that managers had the moral hazard of using cash flow freely for private benefits, and the pressure of repayment of principal and interest resulting from debt issuance creates constraints to reduce agency costs.

2.2. The choice of debt maturity structure

On the choice of debt maturity structure, scholars put forward debt agency cost theory, asymmetric information theory, tax hypothesis and liquidity risk hypothesis (Cao, 2009; Chen & Zhou, 2004; Xiao, 2015). These theories analyzed the impact of different factors on debt maturity from different perspectives, such as company quality, free cash flows, transaction costs, and tax rates. Kane, Marcus, and McDonald (1985) concluded that the higher the transaction costs of bond issuance, the longer the debt maturity through simulation analysis. Flannery (1986) and Kale and Noe (1990) argued that debt maturity could convey the signals of corporate quality to investors in the case of asymmetric information, so that company anticipates that company value will be underestimated in the case of long-term debt issuance. Therefore, they concluded that high-quality companies will choose to issue short-term debt under specific assumptions.

Generally, there are two ways to measure the debt maturity structure. One is “the balance sheet method” expressed as the proportion of long-term liability to total liability. Another is the “increment method” expressed as the maturity of new debt financing instrument (Cao, 2009; Xiao, 2015). A large number of empirical studies have analyzed the impact of different factors on the debt maturity structure (Lei & Zeng, 2019; Shen, 2019).

2.3. The choice of debt instruments

The study of debt financing has gradually focused on the choice of debt financing instruments for companies with deepening research. In particular, most studies explore the choice between bank loans and bond issuance for companies. Some foreign scholars believed that this choice depends mainly on the degree of asymmetric information related to loans and bonds, the efficiency of renegotiation and the debt agency costs (Li, 2011).

Most scholars in China make research from financial institutions and financial management. Chen and Zhou (2004) thought that banks have a significant advantage on participating in corporate governance and supervision, while bond financing has advantage on restraining debt agency costs. Li (2011) and Cao (2013) studied the impact of external governance environment and financial regulation on the choice between bank loans and bond in Chinese companies. They explained that the paradox that Chinese companies in developed financial regions prefer to bank loans was caused by the different degree of the regulation of the two instruments from Chinese financial regulatory authorities.

However, because of the existence of “multi-sector supervision” on China’s bond markets, there is a choice of specific bond instruments for Chinese firms. Scholars in China have conducted empirical researches on this theme, but there is still a lack of in-depth theoretical analysis. Based on the questionnaire, Li (2009) analyzed the outcomes through using several debt financing instruments such as bank loans, financial supports, financial leasing and bonds by means of Friedman test, Wilcoxon symbolic test and K-S test. The results show that companies prefer to use short-term debt instruments and company characteristics have effects on the choice of debt instruments, while companies in China have difficulty in long-term debt financing.

Xu (2014) studied the impact of firm and debt tool characteristics on the choice between corporate bonds and medium-term notes of listed companies and the choice between enterprise bonds and medium-term notes of non-listed companies in China. Li (2016) made a comprehensive and systematic analysis of the international bond market and its development, the supervision and trading platform comparison of China’s bond market and the financing demand of listed companies for issuing bonds, and empirically studied the financing choices of listed companies by the Probit model, such as stocks and bonds, bank loans and bonds, medium-term notes and corporate bonds.

In the empirical study of the choice of debt instruments, the variables of corporate characteristics and bond characteristics are generally included. Li (2003) believed that various theoretical hypotheses related to capital structure were analyzed from the perspective of a specific company characteristic, thus the variables that reflect company characteristics in these theories had a specific impact on the financing choice of companies.

In terms of the impact of bond characteristics on the choice of financing instruments, Cao (2013) argued that the choice of debt financing instruments for companies was consistent with the governance mechanism of debt contract. As for the effect of debt maturity on the choice of issuing corporate bonds or medium-term notes, Li (2016) believed that the maturity of corporate bonds was longer than that of medium-term notes. Therefore, the longer the debt maturity of the company was, the more likely it was to issue corporate bonds. Regarding the choice of bank loans or bond issuance, Cao (2013) concluded that interest rates were negatively correlated with the choice of bond issuance, that is, the interest rate of corporate bonds was lower than that of bank loans.

Due to the short time of green bonds’ emergence and development in China, there is no relevant theory or empirical research on the choice of labeled green bond and ordinary bond (non-labeled green bond²). Based on the method of the existing literature on the choice of financing instruments, this paper studies the effects of policy differences, company characteristics and bond characteristics on the choice of companies according to the difference between labeled green bonds and ordinary bonds in issuance system and makes further analysis through empirical tests.

3. The choice of labeled and non-labeled green bonds

3.1. Financing theory and instrument choice

As for the choice of financing instruments, it is generally discussed from the perspective of asymmetric information, agency costs, and signaling with the actual characteristics of specific instruments. For example, when analyzing the financing choice of stock and debt, an enterprise can make a decision by comparing the agency costs of stock and debt (Chen & Zhou, 2004). When analyzing the choice of bank loans and the issuance of enterprise bonds, it is generally believed that banks are more effective than bond investors in supervising enterprises. Therefore, the higher the degree of asymmetric information, the more inclined the enterprises are to choose bank loans (Cao, 2013).

The main difference between labeled and non-labeled green bonds is the scope of financing projects and related policies. For the enterprises whose financing projects do not meet green bond recognition standards, they can only issue ordinary bonds. Therefore, the enterprises, specifically the enterprises that difference between the choice of labeled green bonds and ordinary bonds

comes mainly from specific policies and supporting measures of labeled green bonds, have to conform to green bond recognition standards.

However, the current theories seem to be difficult to explain the reason why companies choose to issue labeled green bonds or ordinary bonds. Based on the method of the existing researches about the choice of financing instruments and considering actual policy difference between labeled green bonds and ordinary bonds, this paper does theoretical analysis and empirical study to verify it.

3.2. The choice of enterprise

In China, companies that issue labeled green bonds must not only meet the green bond recognition standards but also meet other policies that are different from the ordinary bond issuance system. Green bond policies in China usually provide rapid approval channels, and meanwhile, other requirements are also made.

Before the issuance of labeled green bonds, enterprises need generally green certification or assessment opinions from an external agency. It requires enterprises to disclose the specific information of financing projects in detail, especially information on environmental benefits. After issuance, enterprises are encouraged to continuously disclose the user information of raised funds and environmental information every year. However, environmental impact information needs professional assessment according to specific industries and projects, which is difficult for ordinary enterprises.

Enterprises that choose to issue labeled green bonds have to spend a certain amount of labor, capital and time costs on certification and assessment. Although the design of such a supporting system is relatively cumbersome, it can reduce the negative impact on green bond investors due to asymmetric information to reduce the possibility of issuance failure. Moreover, it can reduce the interest costs of bond financing.

Enterprises must make the advantages of issuing labeled green bonds (e.g. reducing issuing interest rate, rapid approval, etc.) against additional costs compared with issuing ordinary bonds (e.g. certification, assessment, the disclosure of environmental information, etc.). However, because actual situation faced by different enterprises is different, it affects the financing decision of enterprises, resulting in different results of enterprises meeting the definition of green industry on issuing labeled or non-labeled green bonds.

4. Factor analysis and research hypothesis

4.1. The selection of factors

China's labeled green bond system is based on an ordinary bond system. Because China's bond market is under the "multi-sector supervision", green bond policies for different types of bonds are also different. Therefore, it is necessary to analyze the policy difference between labeled green bonds and ordinary bonds according to a specific type. This paper chooses three kinds of bonds, for example, medium-term notes, corporate bonds (under the supervision of China's Securities Commission) and enterprise bonds (under the supervision of China's National Development and Reform Commission). The reason is that their issuers are all non-financial enterprises, and the maturity of bonds is medium and long term, which has certain similarity and comparability.

It is generally believed that binary selection depends on two kinds of factors. One is the attribute of the object to be selected, and another is the attribute of decision-maker. The existing literature usually employs company characteristic and bond characteristic variables in empirical research (Cao, 2013; Li, 2016; Xu, 2014). This paper divides possible factors into three categories such as

policy difference factors, company characteristic factors, and bond characteristic factors to demonstrate how enterprises choose to issue labeled green bonds or ordinary bonds.

4.2. Policy difference

Green bonds issued by non-financial enterprises in China are mainly green enterprise bonds under the supervision of the NDRC, green corporate bonds under the supervision of China Securities Regulatory Commission (CSRC), and green debt financing instruments (including commercial papers, medium-term notes, etc.) under the supervision of the People’s Bank of China (PBOC) and the National Association of Financial Market Institutional Investors (NAFMII). There are some differences in green bond policies issued by different regulatory authorities, as shown in Table 1. This paper chooses the type of bond and the purpose of raising funds to describe the impact of policy difference on the choice of enterprises through the comparative analysis of specific policy requirements.

4.2.1. The type of bonds

There is a great difference in the issuance procedure of corporate bonds, corporate bonds, and medium-term notes. Although the NDRC has gradually simplified the procedures for the examination and approval of enterprise bonds in recent years, it is generally acknowledged that the “endorsement system” is more stringent than the “approval system” and “registration system”. Therefore, the issuance of enterprise bonds is more difficult than that of corporate bonds and medium-term notes.

Table 1. The comparison of different green bond systems

	Enterprise bonds	Corporate bonds	Debt financing instruments
Authority	NDRC	CSRC	PBOC NAFMII
Issuance system	Endorsement system	Approval system	Registration system
Green bond policy	“Green Bond Issuance Guidelines”	“Guidance on Supporting the Development of Green Bonds”	“Business Guidelines for Green Debt Financing Instruments for Non-financial Enterprises”
Application procedure	Based on complete procedures and debt repayment safeguard measures, green bonds adopt “speeding up and simplifying audit” bond audit procedures.	The acceptance and auditing of green corporate bond adopt “Special auditing” and “Immediate auditing of declaration” policy.	For green debt financing instruments, open a green channel for the registration review, strengthen the registration service and unify the identification of acceptance of registration notice.
Purpose of raising funds	Enterprises are allowed to use no more than 50% of raising funds to repay bank loans and supply working capital.	The funds raised by green corporate bonds can be used for the construction, operation, acquisition of green industrial projects, or repayment of bank loans of green industrial projects.	Enterprises should use green debt financing tools to raise funds for the construction, operation and supplement of supporting liquidity of green projects, or repay green loans.
Other policy	Adjust some access conditions of the existing audit policies and relevant provisions for enterprise bonds.	Fulfill the obligation of information disclosure, encourage external certification or assessment, and open special account for fund raising.	Disclose specific information on green projects, establish fund-raising supervision account, and encourage external evaluation opinions

Note: Collate and arrange them according to relevant policy information.

It can be seen from Table 1 that the convenience of the review procedure is given in green policy introduced by the three. In addition, the NDRC also lowers some of the access conditions for green enterprise bonds. Therefore, green bond policy is so convenient that the attraction and incentive of issuing green enterprise bonds are greater compared with corporate bonds and medium-term notes. As a result, the paper makes the following research assumptions.

Hypothesis 1: If bonds issued are enterprise bonds, then enterprises prefer to issue labeled green bonds compared with other types.

4.2.2. *The purpose of raising funds*

The purpose of raising funds is to use them for the construction of projects, the supplement of working capital, the repayment of bank loans or the replacement of debt. Internationally, at least 95% of the funds must be allocated to green projects, but it is not stipulated in China's relevant policies.

The original intention for green bonds is to raise funds for green projects to attract green investors. When allowed for other purposes, if investors find that most of the funds of bonds are not used for green projects, they will reduce the "green" recognition of the bonds, or even lower bond valuation. However, the issuer always anticipates this reaction from investors. If the issuer needs to use a higher proportion of funds for other purposes, interest costs reduced through issuing green bonds will not cover additional transaction costs, such as external certification or assessment costs. As a result, if the proportion of funds used for green projects is high, the issuer prefers to issue labeled green bonds, or conversely tends to issue ordinary bonds.

However, considering China's specific issuance system of different bonds, it is not fully applicable. There is no mandatory regulation about the purposes of the construction of projects and the supplement of working capitals for corporate bonds and medium-term notes, and thereby issuers may make a decision on the basis of their needs. However, the relevant policies on enterprise bonds specify the use of funds, such as "allowing enterprises to use no more than 40% of raised funds for working capital"³. And the "Green Bond Issuance Guidelines" specifies that "enterprises are allowed to use no more than 50% of raised funds to repay bank loans and supply working capital". Therefore, companies issuing enterprise bonds may be more inclined to issue green corporate bonds for the purpose of supplying working capital.

In view of the above analysis, the following assumptions are given.

Hypothesis 2: No considering policy enforcement, the higher the proportion of funds used for green project construction, the more likely the company will be to issue labeled green bonds. In other words, labeled green bonds issued by company have a positive correlation with the construction of green projects.

Hypothesis 3: For the issuance of ordinary firm bonds, the higher the proportion of funds used for working capitals but not for green project construction, the more likely the firm will be to issue labeled green bonds. In other words, the labeled green bonds issued by ordinary enterprises have a positive correlation with working capitals (non-green project construction).

4.3. *Company characteristics*

Based on the existing literature about the impact of company characteristics on the tool selection, this paper chooses the following two types of factors to study the impact of company characteristics on the choice of issuing labeled green bonds.

4.3.1. *Listed or non-listed company*

The issuance of bonds for listed companies will usually cause fluctuations in their stock prices. From the perspective of asymmetric information, cash flows and agency costs, some scholars theoretically believe that the events of bond issuance will cause negative impacts on stock markets, while the conclusions of relevant empirical studies are inconsistent. In addition, other studies suggest that it will take a positive influence when financing event is related to social responsibility (Cui, 2017; Fu, Wang, & Zhang, 2010).

For the events of green bond issuance from listed companies, some empirical studies show that these events would significantly increase their stock prices, which means a positive announcement effect (Liang, 2018). Therefore, in order to avoid the possible negative impact of bond issuance on stock prices or prefer to the positive effect of social responsibility information, listed companies tend to issue labeled green bonds.

4.3.2. *Financial situation*

Usually, company characteristics have a certain impact on the choice of financing modes for companies (Li, 2003). However, the effects of financing characteristics of companies are not obvious for the choice between labeled green bonds and ordinary bonds.

From the perspective of asymmetric information, it can be considered that the degree of asymmetric information of labeled green bonds is lower than that of ordinary bonds due to increase in the institutional arrangement including the disclosure of project environmental information, external certification or assessment, and establishment of special accounts. The issuance of labeled green bonds will be more conducive to the rational pricing of the bonds for the companies with good financial condition (or quality). On the contrary, they are unwilling to issue a reasonable but higher financing cost bond but tend to choose ordinary bonds for companies with poor quality.

This paper concludes that companies with good financial situation always prefer to issue labeled green bonds.

4.4. *Bond characteristics*

As for the impact of bond characteristics on the choice of specific debt instruments for companies, scholars' explanation is mostly based on the actual characteristics of alternative debt instruments (Li, 2016; Xu, 2014). According to the thought that the choice of debt instruments is consistent with contract governance mechanism (Cao, 2013) because the financing costs of labeled green bonds are lower than that of ordinary bonds, companies tend to choose labeled green bonds in the anticipation of the low interest rates of issuance. However, as there is no difference in issuance maturity and scale between labeled green bonds and ordinary bonds, so the two factors can not affect the choice for enterprises.

However, from the perspective of asymmetric information, the degree of asymmetric information of labeled green bonds is lower than that of ordinary bonds due to relevant institutional arrangements. Therefore, if enterprises expect their financing costs (interest rates) to be higher before issuing bonds, they prefer to choose labeled green bonds to reduce costs. On the contrary, when financing costs are expected to be low, considering additional transaction costs such as certification fees for issuing labeled green bonds, the preference of enterprises for issuing labeled green bonds will be reduced. As for the maturity and scale of bonds, the longer the maturity and the larger the scale of issuance, the more sensitive the uncertainty effects caused by asymmetric information will be. Therefore, when the maturity is longer and the scale of bonds is larger, companies prefer to choose labeled green bonds.

According to the analysis of above two aspects, the interest rate, maturity, and scale of bonds are the factors affecting the choice of enterprise, but the effects are uncertain.

5. Empirical study

5.1. Objectives

It is relatively complicated for enterprises to make a decision in issuing which kind of bonds. As for the choice between labeled green bonds and ordinary bonds, the impact of policy difference is more specific and direct, but the impact of company characteristics and bond characteristics is not clear.

Although this paper has analyzed the impact of company characteristics and bond characteristics on the choice of issuing labeled green bonds or ordinary bonds from the perspective of asymmetric information, there are some problems. This is because: firstly, the information disclosure of labeled green bonds mainly increases the project environmental information relative to ordinary bonds. In theory, environmental risks will affect the business and financial risks of enterprises, but it does not directly reduce the degree of asymmetric information in financial information. Secondly, bonds are priced through public bidding or book building after issuing announcement (this paper only studies the bonds issued publicly) and enterprises cannot determine the interest rate of bonds in advance.

This paper makes an empirical study based on hypothesis 1 to 3, taking policy difference as core explanatory variables, and company characteristics and bond characteristics as control variables to examine the impact of policy difference on the choice of green bond financing instruments.

5.2. Variable selection

5.2.1. Dependent variable

This paper sets a dummy variable “Y”, which means “whether to choose labeled green bonds”, as dependent variable. When enterprise issues labeled green bonds, “Y” is given the value “1”. However, when the bonds are ordinary, the value of “Y” is “0”.

5.2.2. Core explanatory variables

The paper takes two variables of “proportion of project use” and “type of bond” to study the impact of policy difference on company choice.

a. The proportion of project use

In order to analyze the purpose of raising funds on the choice of enterprises, this paper employs the explanatory variable of “proportion of project use”, which is the proportion of funds used for project construction to the total amount of issuance. It is presented by the symbol “Use” and the expected sign of its coefficient is positive.

b. The type of bonds

This paper builds the dummy variables “Debt_{*i*}” (*i* = 1, 2, 3) to analyze the choice of three major bonds (medium-term notes, corporate bonds, and enterprise bonds) for non-financial firms. When the bond is a medium-term note, the value of “Debt₁” is “1” and otherwise “0”, and its expected coefficient sign is negative. When the bond is a corporate bond, the value of “Debt₂” is “1” and otherwise “0”, and its expected coefficient sign is also negative. When the bond is an enterprise bond, the value of “Debt₃” is “1”, and otherwise “0”. In order to verify hypothesis 3, this paper builds the cross term “Debt₃ × Use”, and its expected coefficient sign is negative.

5.2.3. Control variables

In order to control the effect of company characteristics and bond characteristics on the choice of company, this paper sets the control variables of “corporate characteristics” and “bond characteristics” with “ENT_{*k*}” (*k* = 1, 2, ..., 5) and “Bond_{*s*}” (*s* = 1, 2, 3) respectively, as shown in Table 2.

Table 2. The selection of variables

Variable	Name	Symbol	Explanation of meaning	
Dependent variable	Whether to choose labeled green bonds	Y	It is "1" when the bonds issued by enterprises are labeled green bonds, and otherwise "0".	
	Proportion of project use	Use	It equals the proportion of funds used for project construction to the total amount of issuance.	
	Medium-term note	Debt ₁	It is "1" when the bond is a medium-term note, and otherwise "0".	
Core explanatory variables	Corporate bond	Debt ₂	It is "1" when the bond is a corporate bond, and otherwise "0".	
	Enterprise bond	Debt ₃	It is "1" when the bond is an enterprise bond, and otherwise "0".	
	Listed or non-listed company	ENT ₁	It is "1" when the companies are listed companies, and otherwise "0".	
	Company scale	ENT ₂	It equals the firm's logarithm of the total asset in the previous year.	
	Debt maturity	ENT ₃	It equals the firm's proportion of long-term liabilities to total liabilities in the previous year.	
	Profitability power	ENT ₄	It equals the firm's rate of return on equity in the previous year	
	Growth power	ENT ₅	It represents the firm's rate of net asset growth in the previous year	
	Issuing interest rate	Bond ₁	It represents the coupon rate at the time of issuance of the bond	
	Bond maturity	Bond ₂	It represents the maturity at the time of issuance of the bond	
	Issuance scale	Bond ₃	It represents the funds raised by the bond	
Control variables	Policy differences			
	Company characteristics			
	Bond characteristics			

5.3. Model

The paper takes the result of the company's choice between labeled green bonds and ordinary bonds as the dependent variable and employs the Logit model for binary choice. In the Logit model, the dependent variable in this paper can be understood as the logarithm of the odds ratio of choosing to issue labeled green bonds to ordinary bonds.

According to the research assumption and the selection of variables in this paper, the following model is set.

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 \text{Use}_i + \beta_2 \text{Debt}_{1i} + \beta_3 \text{Debt}_{2i} + \beta_4 \text{Debt}_{3i} \times \text{Use}_i + \sum_{k=1}^5 \alpha_k \text{ENT}_{ki} + \sum_{s=1}^3 \gamma_s \text{Bond}_{si} + \mu_i \quad (1)$$

where β_0 is the constant, β_1, \dots, β_4 is the coefficient of core explanatory variables, respectively, α_k ($k= 1, 2 \dots 5$) and γ_s ($s= 1, 2, 3$) is the coefficient of control variables, respectively, and μ_i is white noise series.

5.4. Sample and data

5.4.1. Sample selection

As China's labeled green bond market began in 2016, so this paper selects the bonds issued publicly in China during 2016–2018, which meets green bond recognition standards of labeled green bonds and non-labeled green bonds. Usually, the business characteristics, the purpose of issuing bonds and the financial indexes of financial firms are different from those of ordinary firms. Therefore, this paper only chooses green bonds issued by non-financial firms.

Labeled green bond reveals the meaning of “green bond”. First of all, 444 labeled green bonds are picked out from the RESSET database, including 85 enterprise bonds, 71 corporate bonds, and 23 medium-term notes. According to the green bond database of China Financial Information Network, it is found that seven medium-term notes are also considered as labeled green bonds in 2016, but their bond names are not indicated. It is possible that relevant policies are officially introduced in 2017, thus the issuance of green medium-term notes has not yet been standardized. Moreover, as some enterprise bonds are issued across two markets, so 39 duplicate bonds are excluded.

At present, there is no relevant database or recognized statistics to determine which bonds are non-labeled green bonds, which is a major difficulty in selecting the sample. Theoretically, we can gather the information about bond issuance, and then judge and pick out non-labeled green bonds on the basis of the criteria including CBS, GBP, “Green Bond Issuance Guidelines” and “Catalogue of Green Bond Support Projects”, but its workload and difficulty are huge. Therefore, this paper refers to the component bonds of the “China Bond China Green Bond Index”, and thereby picks out 354 non-labeled green enterprise bonds, corporate bonds and medium-term notes in total.

As their maturity and bond credit rating appear relatively in the cluster according to the characteristics of selected green bonds, so a few bonds with a large difference are excluded, for example, the bonds of 3, 5 and 7 years in maturity and “AA”, “AA+” and “AAA” in credit rating. The sample consists of 104 labeled green bonds and 204 non-labeled green bonds, and thereby 408 observations are selected.

5.4.2. Data sources

The variable of the proportion of project use is calculated according to the information about the purpose of raising funds in the bond prospectus issued publicly by each sample bond. And the relevant data of company characteristics and bond characteristics variables of companies are collected from the RESSET database.

6. Descriptive statistical analysis

6.1. Descriptive statistical analysis of dependent variable

Table 3 shows sample points under different classifications. The mean value of the dependent variable “Y” is 0.2549, which means that 25.49% of bonds (104) in the sample are labeled green bonds. It also indicates that the frequency of choosing to issue labeled green bonds in the sample is 25.49%, implying that most of the enterprises that meet the issuing conditions of green bonds prefer to issuing ordinary bonds.

Both the proportion of medium-term notes, corporate bonds, and enterprise bonds and the proportion of labeled green bonds, ordinary bonds, and the whole sample are relatively balanced. The proportion of choosing labeled green bonds on condition that the companies issue corporate bonds is the largest, reaching 34.16%.

The proportion of listed companies to non-listed companies is close to 3:7, but the proportion of choosing labeled green bonds from listed companies with 29.46% is higher than that from non-listed companies with 23.98%. However, the longer the bond maturity in the sample, the smaller the proportion of choosing labeled green bonds, which is contrary to expectations.

6.2. Descriptive statistical analysis of independent variables

Table 4 shows the descriptive statistical analysis results of each variable, respectively. In terms of the purposes of raising funds, the 0.66 mean of the proportion of project use of labeled green bonds is significantly larger than that of ordinary bonds with 0.39. This is in line with the expectations of the foregoing. However, the maximum and minimum of them are equal, that is, there are cases where the funds raised are entirely used for the project or not used for the project. At the same time, the 0.71 proportion of project use of enterprise bonds is the highest among the three types of bonds according to Table 5. It is related to the institutional provisions of enterprise bonds and consistent with the previous analysis.

In terms of company characteristics, the companies choosing to issue labeled green bonds have larger scale, shorter debt maturity, and stronger profitability power from the perspective of sample mean, which is accord with the expectation, but they have not a significant difference in growth power compared with the companies choosing ordinary bonds.

In terms of bond characteristics, the issuing interest rate of labeled green bonds is lower than that of ordinary bonds in each statistic in the sample, which shows the low interest rate

Table 3. Sample distribution

		Labeled green bond	Ordinary bond	Total	Conditional mean of Y
Type of bonds	Medium-term note	28	111	139	0.2014
	Corporate bond	41	79	120	0.3416
	Enterprise bond	35	114	149	0.2348
Listed or non-listed company	Listed	33	79	112	0.2946
	Non-listed	71	225	296	0.2398
Bond maturity	3-year	34	73	107	0.3177
	5-year	42	116	158	0.2658
	7-year	28	115	143	0.1958
	Total	104	204	408	0.2549

Table 4. Descriptive statistics of variables under the classification of Y

Variable	Y	Mean	Minimum	Median	Maximum	Std. Dev.
Use (proportion of project use)	0	0.3921	0.0000	0.3500	1.0000	0.4113
	1	0.6632	0.0000	0.6000	1.0000	0.3183
	All	0.4612	0.0000	0.5000	1.0000	0.4069
ENT ₂ (company scale)	0	5.7892	3.2493	5.5192	11.0423	1.3550
	1	6.4201	3.4747	5.9852	10.3441	1.5032
	All	5.9500	3.2493	5.7093	11.0423	1.4193
ENT ₃ (debt maturity)	0	0.5604	0.0466	0.6079	0.9245	0.2282
	1	0.5070	0.0511	0.5367	0.8961	0.2015
	All	0.5469	0.0466	0.5878	0.9245	0.2227
ENT ₄ (profitability power)	0	0.0562	-0.0942	0.0352	0.3507	0.0598
	1	0.0724	0.0010	0.0547	0.2314	0.0572
	All	0.0603	-0.0942	0.0409	0.3507	0.0595
ENT ₅ (growth power)	0	0.2096	-0.8332	0.1480	1.7865	0.2497
	1	0.2076	-0.0216	0.1542	1.4387	0.2350
	All	0.2090	-0.8332	0.1491	1.7865	0.2458
Bond ₁ (issuing interest rate)	0	5.3357	2.9500	5.2000	8.8000	1.3479
	1	5.0813	2.8000	5.0000	7.5000	1.1004
	All	5.2709	2.8000	5.1550	8.8000	1.2928
Bond ₂ (bond maturity)	0	5.2763	3.0000	5.0000	7.0000	1.5509
	1	4.8846	3.0000	5.0000	7.0000	1.5474
	All	5.1765	3.0000	5.0000	7.0000	1.5575
Bond ₃ (issuance scale)	0	12.5622	0.5000	10.0000	200.0000	16.4311
	1	12.6077	1.0000	10.0000	50.0000	10.2117
	All	12.5738	0.5000	10.0000	200.0000	15.0793

characteristics of labeled green bonds. Although the mean of maturity of labeled green bonds is shorter, there is no significant difference. Although the minimum and maximum of the issuance scale of labeled green bonds and ordinary bonds differ greatly, there is no significant difference between two mean values. Therefore, the bond characteristic variables of the sample are generally consistent with the expectation.

As for standard deviation, the standard deviation of the variables ENT₂ (company scale), Bond₁ (issuing interest rate) and Bond₂ (bond maturity) are all greater than 1, but less than 2. The standard deviation of the variable Bond₃ (issuance scale) is larger, and all above 10. The standard deviation of other variables is less than 0.5, which is relatively small (see Table 4). The standard deviation of the variable “proportion of project uses of different types of bonds” is small, which indicates that the financing of different bond types has little change in the use of green projects (see Table 5).

7. Results and discussion

7.1. Results

This paper employs the maximum likelihood estimation method to estimate the model, and two types of control variables are added step by step. Equation (5) is finally established according to AIC (Akaike information criterion) and SC (Schwarz criterion). The regression results are reported in Table 6.

Table 5. Proportion of project uses of different types of bonds

Type of bond	Mean	Minimum	Quant.0.25	Median	Quant.0.75	Maximum	Std. Dev.	Obs.
Medium-term note	0.3660	0.0000	0.0000	0.0000	1.0000	1.0000	0.4435	139
Corporate bond	0.2617	0.0000	0.0000	0.0000	0.5000	1.0000	0.4038	120
Enterprise bond	0.7107	0.0000	0.6000	0.6333	0.9250	1.0000	0.1932	149
Total	0.4612	0.0000	0.0000	0.5000	0.8565	1.0000	0.4069	408

Table 6. Empirical results of green debt financing instruments selection

	(1)	(2)	(3)	(4)	(5)
Constant term	4.1551*** (3.3220)	2.5613* (1.7038)	8.1903*** (4.2378)	3.8330 (1.4633)	3.1243** (2.3084)
Core explanatory variables (policy differences)					
Use	3.7821*** (7.6894)	4.0662*** (7.5316)	3.7299*** (7.4969)	3.9567*** (7.2792)	3.8091*** (7.4173)
Debt ₃ XUse	-12.0240*** (-5.7414)	-11.4033*** (-5.7549)	-12.017*** (-6.2287)	-11.3393*** (-5.7400)	-11.5845*** (-5.8386)
Debt ₁	-7.7185*** (-5.7946)	-8.1374*** (-6.1738)	-8.8511*** (-6.4270)	-8.5813*** (-6.0419)	-8.0468*** (-6.1531)
Debt ₂	-5.9119*** (-4.6135)	-6.4190*** (-5.0532)	-6.9843*** (-5.3123)	-6.8591*** (-5.0155)	-6.1965*** (-4.9517)
Control variables (company characteristic)					
ENT ₁		0.5226 (1.2651)		0.4011 (0.9366)	
ENT ₂		0.3501*** (3.0031)		0.4896*** (2.9859)	0.3660*** (3.2639)
ENT ₃		-1.4439* (-1.8812)		-1.4531* (-1.8018)	-2.0292*** (-2.8753)
ENT ₄		4.5829 (0.1188)		4.6672 (1.5303)	
ENT ₅		-0.8085 (0.2538)		-0.8556 (-1.1818)	
Control variables (bond characteristic)					
Bond ₁			-0.2811** (-2.0229)	-0.1131 (-0.7302)	
Bond ₂			-0.3331** (-2.5053)	-0.1321 (-0.8933)	
Bond ₃			-0.0081 (-0.5667)	-0.0387 (-1.6891)	
McFadden R ²	0.2865	0.3374	0.3061	0.3478	0.3248
LR-statistic	132.6994***	152.5400***	141.7774***	157.2045***	147.9158***
Akaike info criterion	0.8345	0.7987	0.8270	0.8021	0.7996
Schwarz criterion	0.8837	0.8985	0.9056	0.9318	0.8692

Notes: a. Z-statistics are reported in parentheses; b. *, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.

Equation (1-5) pass all the likelihood ratio tests at the 1% significance level and are statistically significant. Meanwhile, the values of McFadden R^2 are acceptably high, which implies that the equations are good in the goodness of fits. In Equation (1-5), all the core explanatory variables pass the Z-statistic test at 1% significance level, which indicates that explanatory variables have significant impacts on the choice of company. However, the results of control variables in each equation are different.

7.2. The test of hypothesis 1

In Equation (1-5), the coefficients of the dummy variables of medium-term notes ($Debt_1$) and corporate bonds ($Debt_2$) are significantly negative, indicating that the factor type of bonds has a significant impact on whether companies choose to issue labeled green bonds. Further, medium-term note or corporate bond will weaken the tendency of companies to issue labeled green bonds, and the weakening effect of medium-term notes is greater. It confirms the previous analysis on the supervision degree of issuance and the convenience strength of green bond policy of the three bonds. Therefore, hypothesis 1 holds.

7.3. The test of hypothesis 2

In Equation (1-5), the coefficient of the variable for the proportion of project use (Use) is significantly positive, suggesting that the higher the proportion of funds to be used for green project construction, the more inclined to issue labeled green bonds for companies. Therefore, hypothesis 2 holds.

7.4. The test of hypothesis 3

In Equation (1-5), the cross term " $Debt_3 \times Use$ " has a significantly negative coefficient, indicating that the lower the proportion of funds intended for green project construction, the more likely the companies that issue enterprise bonds are to issue labeled green bonds. It is consistent with the previous analysis of the rules of enterprise bond system in the use of fund-raising. Ordinary enterprise bonds may use no more than 40% of funds to supply working capital, while it is relaxed to 50% for green corporate bonds. When enterprises plan to use more proportion of capitals to supply working capital⁴, they will be more inclined to issue labeled green bonds.

Further, considering the coefficients of the variable "Use" and the cross term " $Debt_3 \times Use$ ", the sum of both is negative in all the equations. It implies that the higher the proportion of project use, the more likely the enterprises will be to choose an ordinary bond when the bond is enterprise one. Therefore, hypothesis 3 holds.

7.5. The discussion of the regression results of control variables

In terms of company characteristics, in Equations (2), (4) and (5), the variables of listed or non-listed company (ENT_1), profitability power (ENT_4), and growth power (ENT_5) fail in the Z-statistic tests, respectively, which means that they have no statistically significant impact on the choice of labeled green bonds. The variable of company scale (ENT_2) passes the Z test at 1% significance level and its coefficient is positive, which indicates that the larger the scale, the more inclined the companies will be to issue labeled green bonds. The variable of debt maturity (ENT_3) passes the Z test and its coefficient is negative, indicating that the lower the proportion of long-term debt, the more likely the companies will be to issue labeled green bonds.

In terms of bond characteristics, in Equation (3), the variable of issuing interest rate ($Bond_1$) passes the Z-statistic test at the significance level of 5% and its coefficient is negative, which indicates that the lower the rate, the more likely the companies will be to issue labeled green bonds. It is consistent with the conclusion of the previous analysis from the perspective of contract governance mechanism. The variable of bond maturity ($Bond_2$) passes the Z-statistic test at the significance level of 5% and its coefficient is negative, which indicates that the shorter the maturity, the more likely the companies will tend to issue labeled green bonds. However, the result is inconsistent with the previous analysis. It can be related to the fact that China's green bond market is not mature enough at the early stage of development. The

variable of issuance scale (Bond₃) fails in the Z-statistic test, which shows that it has no significant impact on the choice of companies. However, in Equation (4), bond characteristic variables all fail in the Z-statistic test, due to the multiple collinearity problems caused by correlation between bond characteristic variables and financial condition characteristic variables (Qi, 2019).

7.6. Robustness test

In order to test the robustness of the model, this paper replaces financial condition variables ENT₂, ..., ENT₅ for the data of the previous year with the average of the previous 3 years at the time of the issuance of green bonds. The Equations (6,7) are established, and the results are shown in Table 7.

To compare Equation (4–7) respectively, the results of McFadden R² and the likelihood ratio test do not change after replacing variable data. In addition, variables included in the final model have not changed, and the coefficient symbols of all variables have not changed, and the coefficients have hardly changed. On the whole, after replacing the indicators, the models have no significant difference. Therefore, the models are robust.

8. Conclusions

This paper analyses the choice of non-financial firms between labeled green bonds and ordinary bonds (non-labeled green bonds) in China. Based on the method of the existing research about the choice of financing instruments and considering the actual policy difference between labeled green bonds and ordinary bonds, this paper focuses on the analysis of the impact of policy difference on the choice of enterprise financing tools. In addition, this paper tests the effects of factors that impact the company's choice of green bond financing instruments through taking the proportion of project uses and the type of bonds as core explanatory variables and company characteristics and bond characteristics as control variables, and employing the Logit model for binary choice.

Table 7. The results of robustness test					
		(6)		(7)	
		Coefficient	z-Statistic	Coefficient	z-Statistic
Constant term	C	3.1103	1.1801	3.1820**	2.3782
Core explanatory variables (policy differences)	Use	4.2011***	7.2303	3.7911***	7.4201
	Debt ₃ × Use	-11.1001***	-5.4631	-11.6258***	-5.8413
	Debt ₁	-8.4428***	-5.7743	-8.1011***	-6.1635
	Debt ₂	-6.7405***	-4.7961	-6.2758***	-4.9775
Control variables (company characteristic)	ENT ₁	0.5464	1.1593		
	ENT ₂	0.5081***	2.9303	0.3846***	3.4769
	ENT ₃	-1.5403*	-1.8140	-2.1175***	-2.9676
	ENT ₄	4.5120	1.3731		
	ENT ₅	-0.1258	-0.3428		
Control variables (bond characteristic)	Bond ₁	-0.1206	-0.7471		
	Bond ₂	-0.0652	-0.4373		
	Bond ₃	-0.0397	-1.6790		
McFadden R ²		0.3672		0.3275	
LR statistic		153.9838***		148.7817***	
Akaike info criterion		0.8027		0.7985	
Schwarz criterion		0.9422		0.8684	

Note:*, ** and *** denote statistical significance at the 10%, 5% and 1%, respectively.

The results show that companies issuing enterprise bonds are more likely to issue labeled green bonds than those of issuing medium-term notes or corporate bonds. For companies issuing medium-term notes or corporate bonds, when the proportion of funds used for green project construction gets higher, they prefer to issue labeled green bonds. However, for companies issuing enterprise bonds, when the proportion of funds used for supplying working capital gets higher, they tend to choose labeled green bonds. In addition, the larger the company scale and the lower the proportion of long-term liabilities to total liabilities, the more likely the companies are to issue labeled green bonds.

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Notes

1. The data come from "China Green Bond Market" (2016–2018) prepared jointly by the Climate Bonds Initiative and the China Central Depository & Clearing Company.
2. The choice of labeled green bonds and non-labeled green bonds is mainly due to the differences in the policy system, rather than whether they meet the green bond recognition standards. Therefore, in order to highlight it, when ordinary bonds are not described below, they refer specifically to non-labeled green bonds.
3. In fact, in the sample, the funds raised by enterprise bonds are used only for project construction and supplying working capital, but not for repayment of loans or replacement of debts.
4. In fact, the funds raised through corporate bonds in the sample are only used for project construction and enterprise working capitals, but not for repayment of loans or replacement of debts.

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