The impact of issuing green bonds on enhancing enterprise value

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Abstract: Based on panel data of 479 listed non-financial companies from 2015 to 2019, in which the companies with green bond issuance were taken as the processing group while the companies without green bond issuance were taken as the control group, the policy time-inconsistent DID model was used to explore the impact of green bond issuance on corporate value enhancement. The study shows that the issuance of green bonds by sample companies can significantly enhance corporate value, and this conclusion has passed the robustness test. Meanwhile it can also reduce the financing cost of the enterprise and promote the green transformation and upgrading of the whole economy. In addition, it is also found that the control variables at the enterprise level may affect the role of green bonds. It showed that the enhancement of enterprise value will be affected by the scale of the enterprise, the management capability of the enterprise, and the solvency of the enterprise after an enterprise issues green bonds. In turn, these factors will directly affect the enterprise value. Therefore, control variables added to the regression process is very necessary. Limitations of this paper are as follows: some companies have not yet been listed or listed on A-shares among all the companies issuing green bonds, so this paper does not consider the impact of green bond issuance on themselves. In the future, the data of non-listed companies can be used to further study the impact of issuing green bonds on their business performance.

Keywords: green bonds; enterprise value; listed companies; double-difference model

1. Introduction

Green bonds refer to the commitments issued by issuers to investors to pay interest and repay the principal based on agreed conditions, which consistent with other bonds. While it stressed that the funds raised should ultimately be invested in eligible green projects [1], this is the crucial difference from other bonds. From the perspective of national response to climate change, in the case of serious shortage of funds to deal with climate change, issuing green bonds will become an effective way to improve the shortage of funds [2]. From the perspective of corporate development, the issuance of green bonds can not only reflect the company's social responsibility but also reduce corporate investment risks. From the point of the country's transformation of the economic development mode, the issuance of green bonds improves the financial system and provides sufficient financial support for the transformation of a low-carbon economy [3].

The findings of this paper contribute to the analysis of the impact of ESG behavior on corporate value of the literature, the results of the study are applicable to investors with environmental, social and governance investment needs and decision-making standards, and as part of socially responsible investment, the results of this paper will help business managers to choose the best source of financing in terms of company valuation.

2. Literature Review and Theoretical Hypotheses

Tang et al. (2020)[4] suggested that green bonds could increase shareholder wealth; Baulkaran (2019)[5] believed that green bonds had a positive effect on the stock market; Reboredo (2020) [6] found that the relationship between the green bond market and the stock markets is not close through empirical research; Lebelle et al. (2020)[7] believed that the market response to green bond issuance was negative; Reboredo (2018)[8] used the international green bond index data to conclude that the price of green bonds might be overflowed by the prices of corporate bonds and government bonds.

Based on the above analysis, it can be basically concluded that the issuance price of green bonds is higher than that of traditional bonds, and third-party certification can increase the issuance price of green bonds. The above literatures have made important contributions to the research on the price of green bonds, but they have not paid attention to the impact of issuing green bonds on the value of issuing com-

panies. According to the above arrangement, it can be concluded that the issuance of green bonds can significantly enhance the value of enterprises. Therefore, this paper draws on the research conclusions of most scholars and puts forward the basic assumption of this paper from the perspective of the impact of green bonds on corporate value:

H1: The issuance of green bonds by enterprises can significantly enhance the value of enterprises.

3. Empirical design

3.1 Sample selection and data interpretation

In order to explore the impact of corporate green bond issuance on corporate value, this paper selects the data of listed companies from 2015 to 2019, and uses the method of double difference to conduct empirical analysis. Screening is mainly carried out by the following methods: According to the consistent practice of scholars, financial enterprises and ST enterprises are excluded from the initial listed company sample database.

According to the CSRC's "Introduction of Industry Classification of Listed Companies" and selects manufacturing, information transmission, software and information technology services, scientific research and technical services, water conservancy, environment and public facility management, which are subdivided into 20 categories. Based on this, listed companies that do not belong to the above categories are excluded. After the sample range is determined, the listed company data and other data come from the Wind database (WIND) and the RIS database. Following classification and careful screening, we have identified a total of 42 companies that issued green bonds during the observed years.

3.2 Variable description

(1) Explained variables. The explained variable in this paper is mainly the market value of the company. The calculation method is the sum of enterprise equity market value and net debt market value/total assets.

(2) Explanatory variables. The core explanatory variables studied in this paper are the dummy variables. Green and Time of corporate green bond issuance.

(3) Control variables. In order to control the influence of factors other than explanatory variables on the regression results as much as possible and improve the validity of the regression results, five control variables including enterprise scale, profitability, operating ability, solvency and cash ratio are selected by drawing on the control variable indicators selected by other scholars in the research process and combining with the actual research of this paper.

3.3 Empirical model

In order to overcome the possible endogeneity problems of hybrid OLS regression and consider the different time points of corporate green bond issuance for deeply analyzing the impact of corporate green bond issuance on corporate value, this paper refers to the time-point inconsistent DID method proposed by Abadie (2005)[9]and established the following regression model:

$$TbQ_{i,t} = \beta_0 + \beta_1 Green + \beta_2 Time_{i,t} + \beta_3 DID_{i,t} + \beta_4 IC_{i,t} + \delta_i + \gamma_t + \varepsilon_{i,t} \qquad (1)$$

Among them, represents the enterprise value of the i-th enterprise in the t-th year. is the intercept term of the model, is the dummy variable indicating whether the i-th enterprise has a record of issuing green bonds during the experimental period. is the dummy variable of the issuance time node for the enterprises having a record of issuing green bonds during the experimental period, the current and subsequent years of green bonds issuance are assigned as 1, and the years before the issuance are assigned as 0. Represents the multiplication term of the group of companies issuing green bonds and the issuance time. If the i-th company in the processing group issues green bonds in the t-th year, will be 1 from the t-th year, and 0 before the t-th year. In the control group, companies have not issued green bonds, will be taken as 0 all the time. indicates the net effect of the green bond issuance by enterprises on the value of the enterprise, which is also the coefficient that this paper focuses on. If is significantly positive, it means that the issuance of green bonds by enterprises has significantly promoted

the improvement of the enterprise value. If it is significantly negative, then it shows that the issuance of green bonds by enterprises does not promote the promotion of enterprise value. represents a collection of a series of control variables. Abadie (2005) [23] believes that when using a double difference model, adding control variables to the model can help reduce various interference factors of the model, so as to satisfy the "common trend" condition. Therefore, this paper considers many aspects affecting the value of the enterprise, and tries to control the various factors that affect the value of the enterprise as much as possible. is the enterprise fixed effect, is the time fixed effect, and is the random noise term of the model.

3.4 Exogenous shock test

An important premise of using the DID method is the exogenous shock of "policy". When using the double difference model (DID) to estimate the impact of the introduction of a certain policy, a very important condition is to ensure that the measured "policy" is exogenous, otherwise it is impossible to really distinguish whether the test result is influenced by the policy impact, that is, the net effect of the introduction of the policy. After reviewing the relevant literatures, this paper uses the enterprise value (TbQ) as an explanatory variable to test whether the behavior of issuing green bonds is exogenous. If the coefficient of enterprise value is significant, it indicates that the change of enterprise value can affect the timing of the issuance of green bonds. At this point, the exogenous assumption cannot be established. The test results are shown in the following table:

Table 3 The results of exogenous shock test

	(1)	(2)	(3)
TbQ	0.216 (1.09)	0.205 (0.89)	0.154 (1.15)
Constant	12.091*** (2.27)	12.184*** (2.69)	11.690*** (2.56)
Control	No	Yes	Yes
Fixed effects	No	No	Yes

Note: *** indicates that the coefficients are significant at the 1% significance level.

From the regression results, it can be seen that the coefficient of enterprise value (TbQ) is not significant in the three models including model 1 without control variables and models 2-3 with control variables and fixed effects, showing that the green bond issuance policy measured in this paper is exogenous, and the double difference model (DID) can be used to measure its impact on enterprise value.

4. Analysis and discussion of empirical results

Table 2 shows the result of two regression models. Model 1 explores the impact of corporate issuance of green bonds on corporate value without control variables. The fitting value is 0.84, and the regression coefficient is 0.218, indicating that the issuance of green bonds by enterprises can increase the value of enterprises. The results are consistent with the hypothesis above and verify the validity of H1.

Model 1 explores the impact of corporate issuance of green bonds on corporate value with control variables at the enterprise level. The fitting value is 0.91. The regression coefficient is 0.422 and is significantly established, indicating that corporate issuance of green bonds can enhance corporate value. The results verify the establishment of H1 again.

Table 2 Regression results of the impact of green bond issuance on enterprise value

Name	Model 1	Model 2
DID	0.218*** (2.89)	0.422*** (3.01)
Size		-1.412*** (-7.92)
Pro		0.054*** (5.35)
Ope		0.034** (1.95)

		0.001*** (4.25)
Sol		0.001*** (4.25)
Cas		0.016* (2.19)
Year	Control	Control
Cons	0.57*** (6.92)	2.804*** (10.04)
R2	0.84	0.91
N	2390	1335

Note: t-values in brackets, *, **, *** indicate that they passed the 10%, 5%, and 1% significance tests, respectively.

5.Conclusions and recommendations

This study is based on the panel data collected from 479 listed non-financial enterprises over the period of 2015 to 2019. According to whether there are green bond issuance records during the study period, the sample enterprises are divided into two parts, and the issued enterprises are the focus of this paper as the processing group, and the enterprises that have not been issued are used as the control group. Using a policy time-inconsistent DID model, empirical evidence is analyzed to explored the impact of corporate issuance of green bonds on the enhancement of corporate value. The study found that the issuance of green bonds by sample companies can significantly enhance corporate value, and this conclusion has passed the robustness test. Furthermore, it is observed that the control variables at the enterprise level affect the role of enterprises in issuing green bonds. According to the main research conclusions of the paper, the following targeted policy recommendations are put forward:

It is recommended to encourage companies issuing green bonds and to engage in third-party certification. This can be achieved by enhancing the existing green bond certification system in China, developing comprehensive and standardized certification standards, and strengthening the involvement of professional rating agencies, so as to increase the proportion of third-party certification for companies issuing green bonds. This will provide convenience for the issuance of green bonds and it can also prevent or decrease the occurrence of greenwashing. Furthermore, it is crucial to expand the range of policy support measures for green bonds, prioritize green bond approvals and streamline the approval process.

This study has some limitations, which can also be directions for future study. First of all, green bond is a new financial instrument, especially in China it had a very short history. Meanwhile the financial enterprises are the main participants in the issuance of green bond, however we only analyze the non-financial companies, so this analysis is based on a relatively small number of observations. As more date become available, the future study can enlarge the scope of samples.

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