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Research on the Impact of Green Bonds on the Financing Efficiency of Enterprises

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Abstract

As an important component of green financial tools, the financing efficiency of green bonds directly affects the investment decisions and value creation capabilities of enterprises. Therefore, the financing efficiency of enterprises can be used as an important indicator to evaluate the micro-effects of green bonds. Taking the Chinese green bond market as the research object, based on the green bond issuance data and enterprise financial data from 2012 to 2023, the DEA model was used to calculate the financing efficiency of enterprises, and an empirical analysis was conducted on the impact of green bonds on the financing efficiency of enterprises. The research found that the issuance of green bonds significantly promoted the financing efficiency of enterprises. The research results provide empirical support for the policy-making and market development of green bonds, and also offer theoretical basis and suggestions for improving the financing efficiency of enterprises.

Keywords

Green Bonds; Enterprise Financing Efficiency; Green Debt Financing Vehicles.

1. Introduction

In recent years, with the rapid development of the global green financial system, as an important financial tool for promoting the green transformation of the economy, the cultivation and improvement of the green bond market have been included in the key tasks of the national financial system reform[1]. Since the official launch of China's green bond market in 2016, the state has successively issued a series of policy documents, aiming to standardize the issuance standards of green bonds, optimize the efficiency of fund allocation, and guide more social capital to flow into green and low-carbon fields[2]. These policies have not only promoted the large-scale development of the green bond market, but also significantly enhanced the financing efficiency of green projects.

2. Theoretical Analysis and Research Hypotheses

The funds raised from green bonds must be used for green projects such as renewable energy, pollution control, and ecological protection that comply with international standards (such as the "Green Bond Principles"). Financing efficiency is defined as the ratio between the benefits obtained by an enterprise in its financing activities and the costs it incurs (including time cost, capital cost, risk cost, etc.). Research has found that the green attribute of bonds significantly reduces the financing costs of enterprises by 6.7 to 16.3 basis points (Zhang Xiaoqi et al., 2023). The latest research by scholars Wu Xinyue et al. (2022) indicates that Shandong Gold Mining Co., Ltd. has achieved significant financing optimization effects through the issuance of green bonds. Its financial expense ratio decreased by 0.24 percentage points compared with

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operating income. Meanwhile, thanks to the rapid approval mechanism of green bonds, the raised funds timely supplemented the enterprise's liquidity, effectively improved the short-term debt-paying ability, and thereby enhanced the overall financing performance.Therefore, the following hypotheses are proposed:

H:The issuance of green bonds can enhance the financing efficiency of enterprises

3. Empirical Analysis

3.1. Sample Selection and Data Sources

Select the financial information of listed companies that have disclosed green bond information from the CSMAR database of Guotai 'an from 2012 to 2023.

3.2. Build Models and Define Variables

3.2.1. Construction of the Financing Efficiency Evaluation System

The Data Envelopment Analysis Method (DEA) was used to measure the relative financing efficiency level of enterprises. In the selection of input-output indicators, the research results of scholars such as Lei Hui were drawn upon[3]. The specific indicator system is shown in Table 1.

Table 1. Index System of Enterprise Financing Efficiency

Classification	Name	Description
Input indicator	Owner's equity	Reflect the utilization efficiency of the enterprise's equity capital
	Total assets	Reflect the financing scale of the enterprise
	Total liabilities	Reflect the utilization efficiency of capital raised by enterprises through liabilities
	Asset-liability ratio	Reflect the capital structure of the enterprise
	Current ratio	Reflect the debt-paying ability of the enterprise
	Interest expense	The cash cost paid by an enterprise for raising funds
Output indicator	Main business income	Reflect the utilization efficiency of the funds integrated by the enterprise
	Current asset turnover ratio	Reflect the operational capacity of the enterprise
	Profit margin of main business	Reflect the profitability of the enterprise
	Growth rate of operating income	Measure the operational efficiency and development status of the funds integrated by the company or enterprise

To ensure the applicability of Data Envelopment Analysis (DEA), referring to the research methods of scholars such as Xu Ke, the input-output indicators were standardized[4]. All the observed values were transformed to the standardized interval of [0.2, 1] by using the linear transformation method. The specific functional form of the standardized transformation is as follows:

$$X' = 0.2 + 0.8 \times \frac{X_i - \min(X)}{\max(X) - \min(X)} \quad (1)$$

In Model (1), X_i is the i-th observation of variable X. min(X) and max(X) are the minimum and maximum values of variable X respectively, and X' is the dimensionless data. Using the processed data, the financing efficiency of each enterprise is calculated according to the DEA-BCC model.

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3.2.2. Construction of Regression Model

To study the impact of issuing green bonds on the financing efficiency of enterprises, the following model is constructed:

$$STE_{i,t} = \beta_0 + \beta_1 GB_{i,t} + \gamma Control_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (2)$$

In Model (2), the enterprise financing efficiency ($STE_{i,t}$) calculated by using Model (1) is taken as the explained variable. Whether an enterprise issues green bonds ($GB_{i,t}$) is the explanatory variable. If enterprise i publicly issues green bonds in year t, the value of this variable is 1; otherwise, it is 0. $Control_{i,t}$ represents the control variable. The specific calculation method can be found in Table 2. Model (2) also includes individual fixed effects μ_i and time fixed effects λ_t, as well as the random error term $\varepsilon_{i,t}$.

Table 2. Variable Table

Type	Name	Symbol	Definition
Explained variable	Enterprise financing efficiency	STE	The relative efficiency calculated by the DEA model
Explanatory variable	Green bond	GB	When an enterprise issues green bonds, it takes 1; otherwise, it takes 0
Control variable	Company size	Size	Total assets, take the logarithm
	Asset-liability ratio	Lev	Total liabilities/Total assets
	Cash flow from the company's operating activities	Cashflow	Net cash flow from operating activities/total assets
	Growth rate of operating income	Growth	(Current year's operating income - previous year's operating income)/Previous year's operating income
	Total asset turnover rate	ATO	Operating income/Total average assets
	Whether there is a loss	Loss	Set the net profit as 1 if it is negative; otherwise, set it as 0
	Return on assets	ROA	Net profit/Total assets

3.3. Descriptive Statistics

Table 3. Analysis Table of Descriptive Statistical Results

Variables	Obs	Mean	SD	Min	Median	Max
STE	25571	0.967	0.043	0.601	0.997	1.000
GB	25571	0.015	0.123	0.007	0.000	1.000
Size	25571	22.210	1.296	19.585	22.000	26.455
Lev	25571	0.393	0.194	0.056	0.383	0.918
Cashflow	25571	0.050	0.066	-0.207	0.055	0.274
Growth	25571	0.159	0.367	-0.665	0.115	4.025
ATO	25571	0.641	0.421	0.065	0.558	2.897
Loss	25571	0.094	0.293	0.001	0.000	1.009
ROA	25571	0.044	0.064	-0.373	0.047	0.254

The descriptive statistical results of the relevant variables are shown in Table 3. Among them, the mean value of STE is 0.9672, the minimum value is 0.6, and the maximum value is 1. It can be seen that the financing efficiency of different enterprises in the sample does not vary much. The average value of GB is as low as 0.0154, which further confirms that China's green bond

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market is still in an immature development stage. Therefore, China urgently needs to enhance policy guidance and commit to establishing and improving relevant market mechanisms and regulations.

3.4. Regression Analysis

Table 4. Regression Results of the total sample

Variables	(1) STE	(2) STE	(3) STE	(4) STE
GB	0.068***	0.069***	0.057***	0.062***
	(3.388)	(3.327)	(4.290)	(4.102)
Size			0.0217***	0.217***
			(1.302)	(1.302)
Lev			0.565***	0.564***
			(4.145)	(4.753)
Cashflow			0.253***	0.258***
			(8.680)	(8.875)
Growth			0.028***	0.027***
			(5.587)	(5.459)
ATO			0.066***	0.067***
			(5.287)	(5.489)
Loss			0.045***	0.040***
			(6.494)	(5.432)
ROA			0.132***	0.144***
			(3.641)	(3.316)
_cons	0.682***	0.704***	1.646***	1.641***
	(3.903)	(9.902)	(4.709)	(4.424)
N	29239	29239	25571	25571
adj. R2	0.538	0.539	0.624	0.624
id	NO	YES	NO	YES
year	NO	YES	NO	YES

Notes: The values in parentheses represent robust standard errors,* p < 0.1, ** p < 0.05, *** p < 0.01.

According to the above model, the regression results are shown in Table 4. In column (1) of Table 4, the relationship between enterprise financing efficiency and green bonds was directly analyzed. Corresponding control variables were added in columns (2) and (3). In the analysis presented in column (4), all control variables were comprehensively included, and individual fixed effects and year fixed effects were carefully considered. At this point, the regression coefficient between the financing efficiency of enterprises and green bonds is positive. This discovery strongly proves that even after strictly controlling for other individual characteristics that may interfere with the financing efficiency of enterprises, the issuance of green bonds still has a positive and significant positive effect on the financing efficiency of enterprises.

3.5. Robustness Test

3.5.1. Replace the Independent Variable

In the selection of measurement methods for enterprise financing efficiency, the academic community mainly adopts two paradigms: Data Enveloping Analysis (DEA) and financial indicator method. Drawing on the research methods of scholars such as Fang Fang, the financial indicator method was adopted to construct the evaluation system of enterprise financing

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efficiency. The financing performance of enterprises was evaluated by constructing the ratio index of "enterprise financing efficiency = Return on investment/cost of capital rate", and a regression analysis was conducted. The specific results are shown in Column (1) of Table 5, among which the coefficient of GB shows statistical significance at the significance level of 1%. It is highly consistent with the benchmark regression estimation results shown in Table 4, supporting the reliability of the research conclusion.

3.5.2. Narrow the Sample Interval

In 2016, the Shanghai Stock Exchange officially issued the green bond guidance document. By establishing unified issuance standards and trading norms, it provided institutional guarantees for the standardized development of the green bond market. In order to better assess the impact of issuing green bonds on the financing efficiency of enterprises, the research time span was shortened to 2016-2023. According to the regression results in column (2) of Table 5, there is a significant positive correlation between green bonds and the financing efficiency of enterprises, with a significance level of 1%, indicating that the benchmark regression results in Table 4 are robust.

Table 5. Results of robustness tests

Variables	(1) STE	(2) STE
GB	0.056*** (4.151)	0.057*** (4.222)
Size	0.218*** (3.202)	0.218*** (-3.202)
Lev	0.058*** (4.426)	0.058*** (4.758)
Cashflow	0.242*** (7.400)	0.229*** (6.554)
Growth	0.032*** (6.322)	0.034*** (5.846)
ATO	0.061*** (2.841)	0.058*** (3.610)
Loss	0.034*** (4.190)	0.032*** (3.553)
ROA	0.180*** (4.303)	0.188*** (4.494)
_cons	1.693*** (3.494)	1.492*** (3.771)
N	22140	20292
adj. R2	0.682	0.623
id	YES	YES
year	YES	YES

Notes: The values in parentheses represent robust standard errors,* p < 0.1, ** p < 0.05, *** p < 0.01

4. Conclusion and Suggestions

Green bonds, as an innovative financing tool with both positive environmental externalities and financial benefits, can attract more investors for enterprises during the financing process through mechanisms such as signal transmission effects, optimization of investor structure, and

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transmission of policy incentives, reduce the financing costs of enterprises, and significantly improve the financing efficiency of enterprises. Based on the data of China's green bond market from 2012 to 2023, an empirical study was conducted on the impact of green bonds on the financing efficiency of enterprises. Research has found that the issuance of green bonds significantly reduces the financing costs of enterprises, extends the financing period, and improves the financing efficiency of enterprises.

Enterprises should establish a standardized ESG information disclosure system, introduce third-party green certifications (such as CBI standards), reduce the cost of investor information screening, and at the same time innovate the "green bond + derivatives" combined financing model, explore the design of floating rate bonds linked to carbon quotas, incorporate the funds raised from bonds into the environmental accounting system, and implement full life cycle carbon footprint tracking. The market should establish liquidity support tools for green bonds (such as the central bank's special rediscount policy), develop green bond indices and ETF products, attract long-term institutional investors (such as pension funds and sovereign funds), and thereby enhance the financing efficiency of enterprises. Future research can focus on the identification technology of "greenwashing" of green bonds, the heterogeneity of financing efficiency in different industries, and the impact of the green transformation of monetary policy on bond pricing. Through multi-dimensional institutional collaborative innovation, green bonds are expected to evolve from a financing tool to a core financial infrastructure for enterprises' low-carbon transformation.

References

[1] Zhiyong Li, Ying Tang et al. “The Interest Costs of Green Bonds: Credit Ratings, Corporate Social Responsibility, and Certification.” Emerging Markets Finance and Trade(2019).

[2] 39. Yunfeng Zhao, Yi-ding Yue et al. “Financing Advantage of Green Corporate Asset-Backed Securities and its Impact Factors: Evidence in China.” Frontiers in Energy Research(2021).

[3] 40. Сергей Анатольевич Смирнов, Андрей С. Булгаков. “The Efficiency of Environmental Project Financing with Green Bonds in the Energy Sector: Evidence from EU Countries.” Journal of Corporate Finance Research / Корпоративные Финансы | ISSN: 2073-0438(2022).

[4] 41. Kexian Zhang, Xiaoying Liu et al. “Discretionary Effort on Green Technology Innovation: How Chinese Enterprises Act when Facing Financing Constraints.” PLoS ONE(2021).