

Green Bond Issuance and Corporate Investment and Financing Level: Evidence from Chinese Listed Companies

Wansheng Yu *

Glorious Sun School of Business and Management, Donghua University, Shanghai 200051, China

* Corresponding Author Email: 15966593401@163.com

Abstract. After the formation of the Chinese green bond market in 2016, it rapidly developed. However, there have been relatively few studies in academia on the financial performance of enterprises after issuing green bonds. In order to promote the development of the green bond market and guide enterprises to improve their investment and financing decisions, this paper uses panel data of A-share listed companies and green bond issuing companies from 2012 to 2022 as samples to study the impact and mechanism of green bond issuance on the investment and financing behavior and maturity mismatch of enterprises. The conclusion drawn is that green bond issuance significantly promotes the improvement of enterprises' investment and financing capabilities, and it also reduces the degree of maturity mismatch for enterprises. This conclusion passes the parallel trends test and remains robust after controlling for the effects of corporate financial asset allocation, industry time trends, and excluding competitive hypotheses. Through mechanism research, it is found that green bonds can improve the level of enterprise investment and financing and the degree of maturity mismatch by reducing the degree of financing constraints on enterprises. They can also enhance enterprise investment and financing capabilities by changing market sentiment and alleviate the maturity mismatch of investment and financing.

Keywords: Green bonds, corporate financing, corporate investment, Maturity mismatch.

1. Introduction

In recent years, China has faced increasingly severe environmental challenges, and green transformation is urgently needed for economic development. The environmental pollution and resource constraints brought about by the extensive economic development model have severely affected social order, making it imperative to prioritize ecological and green, low-carbon development paths. Since the 18th National Congress of the Communist Party of China, under the guidance of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, China has adhered to the concept that green mountains and clear waters are as valuable as mountains of gold and silver. It has steadfastly pursued the path of ecological priority and green development, promoting comprehensive green transformation of economic and social development, and constructing a modernization where humans and nature coexist harmoniously.

The form of environmental regulation restricts the expansion of heavily polluting enterprises to a certain extent, but there are still significant limitations. It may even hinder the enhancement of companies' green innovation capabilities, creating a "negative incentive" for economic growth. Meanwhile, characteristics such as high input and strong uncertainty in green industries will still constrain their own development. Therefore, "green development" cannot rely solely on environmental laws and regulations. Developing green finance and constructing a green financial system are important measures for achieving green development.

The international green bond market has rapidly developed since 2007, providing long-term low-cost funding support for sustainable development projects in various countries (Wan, 2016). In 2008, the World Bank and the Swedish Nordic Investment Bank jointly issued the world's first green bond. Explosive growth in green bond issuance began in 2013, and in 2019, the issuance of green bonds exceeded \$100 billion for the first time, rapidly expanding the size of the green bond market. Internationally, the Green Bond Principles (GBP) initiated by the International Capital Market Association and the Climate Bond Standard (CBS) released by the Climate Bonds Initiative are currently the main standards for green bond certification.

Currently, empirical research on green bonds mainly focuses on studying the pricing of green bond issuance and the impact of issuing green bonds on corporate value. Regarding the pricing of green bond issuance, researchers have found that public issuance of green bonds is conducive to reducing financing costs, green policy support is a major factor influencing corporate financing, and third-party green certification and the financial condition of bond issuers do not significantly affect the cost of green debt financing (Yang et al., 2020). Gong et al. (2018) found that green bond prices in China are significantly undervalued based on a binomial tree model. Reboredo (2018) found that the price spillover effects of government bonds and corporate bonds have a serious impact on the pricing of green bonds. As for the impact of issuing green bonds on corporate value, Ma et al. (2020) found that issuing green bonds can significantly enhance corporate value and has dynamic sustainability; Flammer (2020) found that only bonds certified by third-party agencies have a positive impact on stock prices; Chen et al. (2023) found that issuing green bonds can significantly increase the excess returns of issuing companies' stocks and reduce the risk of stock price crashes. There is little literature discussing the impact of green bonds on corporate investment and financing levels. Therefore, it is very necessary and significant in both theoretical and practical terms to study the impact of green bond issuance on corporate investment and financing levels.

This paper mainly conducts empirical analysis to study the impact of green bond issuance on corporate investment levels, financing levels, and maturity mismatch. To this end, based on panel data of A-share listed companies and green bond issuing companies, this paper conducts regression analysis on the above three aspects separately by setting up a progressive double-difference two-way fixed-effects model. First, this paper constructs proxy variables that can represent corporate investment levels, financing levels, and maturity mismatch degrees. These three proxy variables are then separately incorporated into the regression model, and the conclusion is drawn that green bond issuance significantly improves the investment and financing capabilities of enterprises, and its role in alleviating the maturity mismatch of enterprises is also very obvious. Secondly, to ensure the validity of the regression results, this paper conducts robustness tests on the regression results in several ways, and the results show that the regression results are robust. Thirdly, in order to further study the mechanism of the impact of green bond issuance on corporate investment, financing, and maturity mismatch degrees, this paper designs a mediation effect model and uses a sequential testing method to analyze the transmission mechanism of the conclusions of this paper. The results show that the degree of financing constraints significantly affects the impact of green bond issuance on corporate investment and financing capabilities and the maturity mismatch of enterprises.

This paper contributes in three main aspects. First, it provides a detailed discussion on the market outcomes brought about by green bond issuance. Some studies have focused on the impact of green bond issuance on green environmental performance. For example, green bond issuance can promote corporate green transformation (Chen et al., 2021; Chen & Zhang, 2023), corporate environmental governance (Zhang & Xu, 2024), and green premiums (Qi & Liu, 2021; Zhang et al., 2021). In addition to environmental performance, the economic performance of companies is a key concern for investors. Previous research has shown that green bond issuance can bring about positive market incentive effects (Chen & Zhang, 2022), and it can enhance corporate value (Ma et al., 2020). However, it is not yet clear how corporate investment and financing behaviors respond under market incentives.

Second, this paper comprehensively considers corporate investment and financing behaviors and maturity. Previous studies have shown that corporate investment and financing behaviors are crucial for corporate performance (Wang et al., 2022). Many studies have been dedicated to finding ways to improve corporate investment and financing levels. For example, tax incentives can enhance corporate investment and financing capabilities (Yu & Yang, 2016). Corporate investment and financing maturity refers to the duration of continuous investment and financing by enterprises. Maturity mismatch in corporate investment and financing refers to the problem of using short-term financing to support long-term investments (Li & Di, 2023), often leading to the problem of "short-term debt and long-term investment," which is widespread among Chinese enterprises (Li, 2014).

There is considerable research on maturity mismatch in corporate investment and financing, with some studies focusing on external environmental factors, such as the minimum wage and corporate investment and financing maturity mismatch (Chen et al., 2021), inflation expectations and corporate investment and financing maturity mismatch (Li & Jiang, 2021), and local government debt governance and corporate investment and financing maturity mismatch (Liu et al., 2022). Some studies focus on internal corporate factors, such as corporate financial asset allocation and corporate investment and financing maturity mismatch (Shen & Chen, 2020), managers and board of directors, and corporate investment and financing maturity mismatch (Chen & Wu, 2014), and internal controls and corporate investment and financing maturity mismatch (Luo et al., 2021). This paper, from the perspective of green bond issuance, identifies methods to improve corporate investment, financing levels, and mitigate corporate investment and financing mismatch.

Third, this paper examines the mechanism of the impact of green bond issuance on corporate investment and financing capabilities and maturity mismatch. From the analysis of financing constraint channels, Chen (2009) concluded that corporate investment and financing maturity mismatch is related to the constraints of the financing system. Lu and Yang (2011) pointed out that the widespread phenomenon of investment and financing maturity mismatch in Chinese enterprises is related to the high degree of financial constraint system in China. The research results of this paper indicate that green bond issuance can alleviate corporate financing constraints, thereby improving corporate investment and financing capabilities and mitigating corporate investment and financing maturity mismatch. From the perspective of market sentiment channels, Dong (2023) confirmed that investor sentiment affects their investment decisions, and investor sentiment affects market sentiment; Chen (2022) concluded through the study of the relationship between investor sentiment and market and returns that investor sentiment has a significant impact on corporate stock investment, and stock investment is an important way for corporate investment and financing, which in turn affects the capital structure of enterprises; Yang and Luo (2023) found that investor sentiment has a significant impact on corporate investment and financing. The research results of this paper indicate that green bond issuance can affect investor sentiment, thereby forming a positive market sentiment, driving companies to influence corporate investment and financing levels and maturity mismatch through the stock market.

2. Literature Review and Theoretical Hypotheses

2.1. Literature review

2.1.1. Impact assessment study of green bond issuance

With the issuance of green bonds, the academic community is dedicated to assessing the policy effects of green bond issuance. Scholars' research in this area mainly focuses on the following aspects: First, research on green financial policies related to green bonds. In order to better understand financial policies, Chen et al. (2021) studied the effectiveness of green financial policies, especially the inclusion of green bonds in the central bank's guarantee policy, which provided a theoretical basis for improving financial policies. As financial policies continue to emerge and improve, scholars study and verify the effectiveness of policies. Zhu et al. (2020) conducted in-depth research on the effectiveness of green financial policies, and the results showed that there was no significant difference in stock returns between green bonds and ordinary bonds for companies, indicating that social investment is not necessarily more attracted to green factors. Qi et al. (2021) and Zhang et al. (2021) studied the pricing of green bonds and ordinary bonds, which has practical significance for the design and improvement of the green bond market system and the construction of a green financial system. These studies provide theoretical and practical support for the improvement and development of green financial policies.

Second, research related to the effects of green bond issuance. Chen et al. (2022) studied the incentive effect of green bond issuance on green governance transformation, and the results showed

that companies can obtain market incentives by using green bonds for green governance transformation, promoting corporate green transformation. Wang and Feng (2022) found that issuing green bonds can significantly enhance a company's level of green innovation. Ma et al. (2020) provided theoretical basis and practical approaches for the enhancement of corporate value through green bond issuance. Jiang and Fan (2022) studied the relationship between green bond issuance and green discount or premium, and found that issuing green bonds by companies may not necessarily result in a green premium and may bring "greenwashing" risks. Zhang and Xu (2024) studied the relationship between the issuance size of green bonds and the profits of companies and the environmental governance of local governments, indicating that the issuance size of green bonds has a significant positive promoting effect on the environmental governance of local governments.

2.1.2. Research on corporate investment and financing and maturity mismatch

Some scholars have conducted research specifically on corporate investment and financing. Zhang et al. (2021) studied the relationship between monetary policy and corporate investment and financing behavior, finding that when the central bank implements an accommodative monetary policy, enterprises with a more optimistic outlook on the macroeconomy will increase their investment and financing input, and state-owned enterprises are less susceptible to the impact of monetary policy. Yu and Yang (2016) studied the promotional effect of tax incentives on corporate investment and financing capabilities.

The academic community has conducted in-depth research from multiple perspectives on the mismatch of corporate investment and financing maturities. Some scholars focus on the mismatch of corporate investment and financing maturities and its influencing factors. Wang and He (2022) examined the relationship between the mismatch of corporate investment and financing maturities and corporate performance, finding a negative promotion effect of maturity mismatch on corporate performance. Sun (2019) argues that the fundamental reasons for maturity mismatch are irrational confidence of policies and managers, as well as the imperfection of the financing market. Bai et al. (2016) found that the root cause of the widespread maturity mismatch in Chinese enterprises is institutional defects in the Chinese financial market. Chen et al. (2021) studied the impact of minimum wage increases on the mismatch of investment and financing maturities, indicating a positive correlation between the two. Li and Jiang (2021) found that rising inflation expectations exacerbate the degree of mismatch between corporate investment and financing maturities. Shen and Chen (2020) conducted research on the relationship between corporate financial asset allocation and the mismatch of investment and financing maturities, finding that corporate financial asset allocation driven by speculative arbitrage motives exacerbates the degree of mismatch between corporate investment and financing maturities, but state-owned enterprises weaken this correlation.

From the above literature, it can be seen that scholars have researched corporate investment and financing capabilities and the mismatch of investment and financing maturities from various perspectives, but there is relatively less research specifically comparing green bond issuance with investment and financing capabilities.

2.2. Theoretical hypotheses

Corporate investment behavior refers to the act of allocating valuable assets owned by a company, such as capital, labor, intellectual property, etc., into specific projects or economic activities with the motive of maximizing value and expecting future investment returns. Corporate financing behavior, on the other hand, involves economic activities where companies raise necessary funds through internal accumulation or external investors and creditors based on their own production and operation conditions, funding needs, development requirements, or business strategies. The investment behavior and financing behavior of a company mutually influence each other, with investment levels often established on the basis of financing levels. Corporate investment and financing behaviors are crucial to the operation of a company and significantly impact its value.

Some scholars have found that investors with a sense of social responsibility and environmental awareness are willing to sacrifice returns to purchase green bonds (Baker et al., 2018; Karpf & Mandel,

2018), and environmentally conscious companies are more inclined to issue green bonds (Wang et al., 2020). Furthermore, the continuous strengthening of national green financial policies has promoted the issuance of green bonds (Chen et al., 2021). National financial policies provide tax incentives, policy subsidies, etc., for the issuance of green bonds, attracting financial institutions to participate. At the same time, policies are introduced to reduce the risks for financial institutions, provide low-interest loans, risk guarantees, strengthen the supervision of green projects, etc., ensuring the stable issuance of green bonds and enhancing investor confidence. This not only expands the financing channels for companies but also alleviates their financing pressure. Research indicates that tax incentive policies have a certain promoting effect on the investment and financing capabilities of enterprises, especially showing a positive effect on the investment and financing capabilities of small and medium-sized enterprises (Yu & Yang, 2016). Lastly, societal recognition of the investment value and long-term returns of green bonds has promoted their issuance. Additionally, companies issuing green bonds to meet investor demand also promote green innovation research (Wang & Feng, 2022), resolving funding issues for companies while benefiting society, creating a win-win situation. Currently, society, policies, and markets have created favorable conditions for the issuance of green bonds, attracting more investors and financial institutions to participate and providing more favorable conditions for corporate investment and financing.

Based on this, this paper proposes the following hypotheses:

Hypothesis 1: The issuance of green bonds can increase corporate investment levels.

Hypothesis 2: The issuance of green bonds can increase corporate financing levels.

Financial resource mismatch refers to the phenomenon where companies use short-term debt to fund long-term investments, resulting in a mismatch between the investment and financing periods, known as the "short borrowing, long investment" phenomenon. In China, the "short borrowing, long investment" behavior of enterprises serves as an alternative financing method, meeting short-term financing needs but hindering long-term development (Ma et al., 2018). The causes of this phenomenon are twofold: first, the imperfect capital market institutions fail to provide loans of different terms and categories for enterprises, especially small and medium-sized enterprises (SMEs) (Sun, 2019). Financial institutions tend to allocate financial resources to state-owned enterprises and large corporations, imposing strict conditions on SMEs, thereby increasing their difficulty in obtaining financing, forcing them to resort to "short borrowing, long investment" to sustain operations. Second, there exists a mismatch between the capital structure and investment-financing term structure of enterprises themselves (Li & Jiang, 2021), leading to a shortage of working capital and affecting normal operations. Allocating financial assets exacerbates the degree of investment-financing term mismatch (Shen & Chen, 2020). Serious financial resource mismatch will adversely affect enterprise risks. Investment-financing term mismatch actually leads to short-term financing and long-term investment, which may result in a situation where a large amount of debt needs to be repaid simultaneously in the future while investment profits and cash flow returns are long-term, causing slow fund recovery, significantly increasing the economic pressure on enterprises, and pushing their finances into distress (Bai, 2016). Investment-financing term mismatch is also influenced by the economic environment and the degree of marketization (Shen & Chen, 2020). External economic conditions and market changes may lead to a "short borrowing" flow interruption, investment failures, suspensions, and operating losses, which could directly lead to a fund flow break and bankruptcy for enterprises.

The issuance of green bonds can alleviate this phenomenon of investment-financing term mismatch to some extent. Empirical evidence from the bond market shows that green bonds significantly inhibit investment-financing term mismatch for enterprises (Ning & Wang, 2021). Research has found that green bonds suppress investment-financing term mismatch by alleviating financing constraints, particularly for small and medium-sized enterprises, highly polluting enterprises, and those with low credit ratings. Other researchers (Cheng et al., 2023) have found that the implementation of green lending policies can not only suppress term mismatch through financing

constraints but also effectively alleviate investment-financing term mismatch by increasing external supervisory pressure on enterprises.

Based on this, this paper proposes Hypothesis 3: The issuance of green bonds can mitigate enterprise investment-financing term mismatch.

3. Research design

3.1. Data sources

This study primarily utilizes data from A-share listed companies in China as the control group for this research. All A-share listed companies on the main board from 2012 to 2022 are initially selected as the sample. Data on repeated issuances of green bonds are excluded to eliminate the impact of issuance frequency. The observation values of companies that first issued green bonds are ultimately used as the initial research sample. Sample deletion follows the following principles: (1) Exclude financial companies such as banks, securities, and insurance companies; (2) Exclude ST*, ST companies; (3) Exclude samples with missing or outlier data. Through screening, there are a total of 2,893 A-share listed companies from 2012 to 2022. Since the treatment group companies chose to issue green bonds after 2012, the control group companies selected are those listed before 2012 and have issued ordinary bonds during this period. After selection, 1,193 companies are chosen to enter the control group, resulting in a total of 70,885 annual observations for the companies.

This study also utilizes data on companies' green bond issuance. Green bond data are sourced from the official website of the Shanghai and Shenzhen Stock Exchanges and obtained through manual collection and organization. Company data mainly come from the Wind database, CSMAR database, annual reports, and sustainable development reports disclosed by the Shanghai Stock Exchange and Shenzhen Stock Exchange. The data show that from 2012 to 2022, after excluding unqualified data using the same standards, a total of 342 companies issued green bonds, with 168 of them being A-share listed companies. These companies issued a total of 2,561 green bonds during the period. After merging with the data of A-share listed companies, and after manual inspection, exclusion, or repair, it is finally determined that 126 companies were listed on the A-share market and issued green bonds. The distribution of the first issuance of green bonds by each company is as follows: 9 companies in 2016, 16 companies in 2017, 12 companies in 2018, 15 companies in 2019, 11 companies in 2020, 26 companies in 2021, and 37 companies in 2022. In total, there are 2,893 observation values in the treatment group.

3.2. Variable selection

The dependent variables in this study are enterprise investment behavior, enterprise financing behavior, and the mismatch between enterprise investment and financing periods.

Firstly, this study measures enterprise investment behavior using the proportion of fixed asset investment, consistent with Zhang et al. (2021). The calculation method for the proportion of fixed asset investment is as follows:

Fixed Asset Investment Ratio (Investment) = Fixed Asset Investment / Beginning-year Total Assets

Secondly, this paper uses the leverage ratio of enterprises to measure their financing behavior. The calculation method for the enterprise leverage ratio is:

Enterprise Leverage Ratio (Leverage) = Total Liabilities / Total Assets at the Beginning of the Year

Third, this paper uses the Short-Term Borrowing for Long-Term Investment (SFLI) ratio to measure the maturity mismatch of corporate financing and investment, consistent with Ma et al. (2018). The dependent variable in the model is the Short-Term Borrowing for Long-Term Investment ratio (SFLI), following the measurement method for funding gaps adopted by Frank et al. (2014). SFLI is calculated using the formula:

$SFLI = [\text{Fixed asset and other investment cash outflow} - (\text{Increase in long-term loans} + \text{Increase in equity} + \text{Net cash flow from operating activities} + \text{Cash inflow from sale of fixed assets})] / \text{Total assets}$

Where total assets are used for standardization.

The core explanatory variable in this study is whether the company's industry has issued green bonds. Following the approach of Wu et al. (2022), we define the core explanatory variable as a variable that changes over time and across industries. Assuming a company issued green bonds in year t , the value for other companies in the same industry after year t is 1, and before year t is 0.

There are two types of control variables in this study. The first type consists of company characteristic control variables, including Tobin's Q value (Q), nature of the enterprise (SOE), ownership concentration (CR), and revenue growth rate (IRB). The second type consists of fixed-effect variables, including year variables (Year) and company variables (firm). The variable definitions are shown in Table 1.

Table 1. Definition of variables

Variable Types	Variable Names	Variable Symbols	Variable Definitions
Dependent Variables	Fixed Asset Investment Ratio	<i>Investment</i>	Fixed Asset Investment / Beginning-year Total Assets
	Enterprise Leverage Ratio	<i>Leverage</i>	Total Liabilities / Total Assets at the Beginning of the Year
	Long-Term Investment ratio	<i>SFLI</i>	[Fixed asset and other investment cash outflow - (Increase in long-term loans + Increase in equity + Net cash flow from operating activities + Cash inflow from sale of fixed assets)] / Total assets
Core Explanatory Variable	Whether the industry issues green bonds	$Green_i \times Post_t$	If a company issues green bonds publicly in year t , then the value for other companies in the same industry, denoted as i , is 1 in year t , otherwise it is 0
Control Variables for Firm Characteristics	Tobin's Q	Q	Market value of the firm (market value of stock - liabilities) / Replacement assets of the firm (book assets of the firm)
	Nature of business	<i>SOE</i>	State-owned enterprises take the value of 1, other enterprises take the value of 0
	shareholding concentration	CR	Percentage of shares held by the company's largest outstanding shareholder
	Revenue growth rate	<i>IRB</i>	(Increase in operating income/total operating income of the previous year) x 100%
Fixed Effect	Annual variable	<i>Year</i>	dummy variable
	Enterprise variable	<i>Firm</i>	dummy variable

Table 2 reports the descriptive statistics of the main variables. The results indicate that the proportion of fixed asset investment in companies is not significant. There is considerable variation in the asset leverage ratio among companies, but on average, the leverage ratio accounts for approximately 15.8% of total assets. There is significant variation in the mismatch of investment and financing terms among companies, which meets the requirements of this study.

Table 2. Descriptive statistics of main variables

Variables	Observations	Mean	Standard Deviation	Min	Max
Dependent Variables					
<i>Investment</i>	2329	0.347	0.243	0.001	0.921
<i>Leverage</i>	2414	0.158	0.126	0.000	0.820
<i>SFLI</i>	2231	-0.131	2.418	-15.319	0.682
Core Explanatory Variable					
<i>Green_i × Post_t</i>	2552	0.095	0.294	0.000	1.000
Control Variables					
<i>Q</i>	2411	1.336	0.552	0.711	8.143
<i>SOE</i>	2271	0.674	0.469	0.000	1.000
<i>CR</i>	2450	38.139	16.716	3.622	87.705
<i>IRB</i>	2447	0.453	4.232	-3.256	161.546

3.3. Modeling

This paper sets up a progressive double-difference two-way fixed effects model for analysis.

To analyze the impact of green bond issuance on corporate investment behavior, we set up the econometric model (1) as follows:

$$Investment_{it} = \alpha_0 + \alpha_1 Green_i \times Post_t + \sum \alpha_i Control_{it-1} + \delta_i + \theta_t + \varepsilon_{it} \quad (1)$$

Where $Investment_{it}$ is the dependent variable representing fixed asset investment, $Green_i \times Post_t$ is the core explanatory variable representing the "policy" treatment variable in the DID model (i.e., the double difference term). Here, $Green_i$ is a dummy variable for the treatment and control groups, taking a value of 1 if the company issued green bonds in its industry, and 0 otherwise. $Post_t$ is a time dummy variable; for treated group companies, if another company in the same industry issued bonds after year i , and $t > i$, then $Post_t$ takes a value of 1; otherwise, it takes a value of 0. For control group companies, $Post_t$ is always 0. Considering that the timing of green bond issuances varies across companies, we set lagged control variables, $Controls_{t-1}$, following the method of inconsistent timing of policy DID proposed by Beck et al. (2010). The control variables in Model (1) include Tobin's Q (Q), nature of the enterprise (SOE), ownership concentration (CR), and revenue growth rate (IRB). δ_i represents the dummy variable for the enterprise, θ_t represents the time dummy variable for the year, and $\varepsilon_{i,t}$ represents the random disturbance term, where i and t represent the enterprise and year, respectively.

To analyze the impact of green bond issuance on corporate financing behavior, we set up the econometric model (2) as follows:

$$Leverage_{it} = \beta_0 + \beta_1 Green_i \times Post_t + \sum \beta_i Control_{it-1} + \delta_i + \theta_t + \varepsilon_{it} \quad (2)$$

Where "Leverage" represents the corporate leverage ratio, and other variables are the same as in model (1).

To illustrate the impact of green bond issuance on the term mismatch of corporate investment and financing, we design the econometric model (3) as follows:

$$SFLI_{it} = \gamma_0 + \gamma_1 Green_i \times Post_t + \sum \gamma_i Control_{it-1} + \delta_i + \theta_t + \varepsilon_{it} \quad (3)$$

Where SFLI represents the dependent variable, the degree of short-term borrowing and long-term investment of the enterprise, and the control variables are the same as those in Model (1).

4. Empirical results

4.1. Baseline regression

Table 3 reports the impact of green bond issuance on enterprise investment, financing, and the degree of long-term borrowing and short-term investment. The research results indicate that green bond issuance increases the level of enterprise investment and financing while reducing the degree of short-term borrowing and long-term investment. Columns (1), (3), and (5) present the regression results without controlling for other variables, showing that after issuing green bonds, enterprise investment increases by an average of 27.8%, the leverage ratio decreases by 4.2%, indicating a significant improvement in enterprise financing capacity, and the degree of short-term borrowing and long-term investment decreases significantly by 27.5%. Columns (2), (4), and (6) present the results re-estimated after including all control variables, indicating that the estimated effects of green bond issuance on enterprise investment, financing, and the mismatch between investment and financing remain robust and are not affected by other characteristics of the enterprise.

Table 3. Green Bond Issuance and Enterprise Investment and Financing, Short-term Borrowing and Long-term Investment Degree: Baseline Regression Results

0	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Corporate Investment	Corporate Investment	Corporate Financing	Corporate Financing	Maturity Mismatch	Maturity Mismatch
Core Explanatory Variable						
$Green_i \times Post_t$	0.278*	0.283*	-0.042*	-0.043*	-0.275*	-0.295*
	(0.150)	(0.155)	(0.023)	(0.026)	(0.163)	(0.166)
Control Variables						
Q		-0.013		-0.010		-0.019
		(0.016)		(0.007)		(0.020)
SOE		0.109		-0.002		-0.059
		(0.071)		(0.018)		(0.094)
CR		0.011		-0.001		-0.013
		(0.008)		(0.000)		(0.008)
IRB		22.258***		-0.019		-250.178***
		(0.150)		(0.016)		(0.154)
Constant	0.389***	-0.113	0.162***	0.202***	-0.110***	0.508
	(0.012)	(0.380)	(0.002)	(0.027)	(0.013)	(0.378)
Observations	2,319	2,117	2,401	2,173	2,218	2,024
R ²	0.393	0.519	0.811	0.819	0.250	0.977
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

Note: The numbers in parentheses represent standard errors clustered at the enterprise level; *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. The same applies to the table below.

4.2. Parallel trend test

To determine the validity of the sample data and whether there is a trend deviation between the treatment group and the control group, this study employs dynamic heterogeneity analysis to conduct a parallel trend test on the data. Model (4) is represented as Equation (4) below. In the equation, $D_{it}^{-4} \dots D_{it}^5$ represent the lead and lag periods of green bond issuance, with a negative sign indicating the lead period and a positive sign indicating the lag period, and the numerical value representing the number of years. Here, i denotes a particular enterprise, t denotes the year, β_1 to β_{10} are the coefficients for the different periods, $Time_i$ and $Firm_i$ are the fixed effects for year and enterprise,

and Y represents the dependent variable, corresponding to enterprise investment, enterprise financing, and the mismatch between enterprise investment and financing terms.

$$Y = \alpha + \beta_1 D_{it}^{-4} + \beta_2 D_{it}^{-3} + \dots + \beta_{10} D_{it}^5 + Time_i + Firm_i + \varepsilon_{it} \quad (4)$$

Figures 1 to 3 illustrate the results of the parallel trend tests and the dynamic effects of green bond issuance on enterprise investment, enterprise financing, and the mismatch between enterprise investment and financing terms. The dashed lines in the figures represent the 95% confidence intervals. The figures indicate that the 95% confidence intervals for all three dependent variables before green bond issuance include the zero point, indicating no significant difference between the treatment and control groups before the issuance, thus meeting the parallel trend test criteria.

For enterprise investment, there is almost no change in the first year after green bond issuance, followed by a slight decrease in the second and third years. However, from the fourth year onwards, there is a sharp increase in enterprise investment levels, indicating that green bond issuance promotes enterprise investment but requires some time to accumulate. This is likely due to the cyclical nature of bond characteristics.

Regarding enterprise financing, the coefficient is significantly negative before green bond issuance, but becomes significantly positive after the issuance, indicating that green bond issuance promotes the improvement of enterprise financing capacity, although there may be fluctuations in the later stages.

Regarding the mismatch between enterprise investment and financing terms, the coefficient fluctuates around zero before green bond issuance, but becomes significantly positive after the issuance. This indicates that the issuance of green bonds by enterprises significantly alleviates the financing mismatch in enterprise investment and financing.

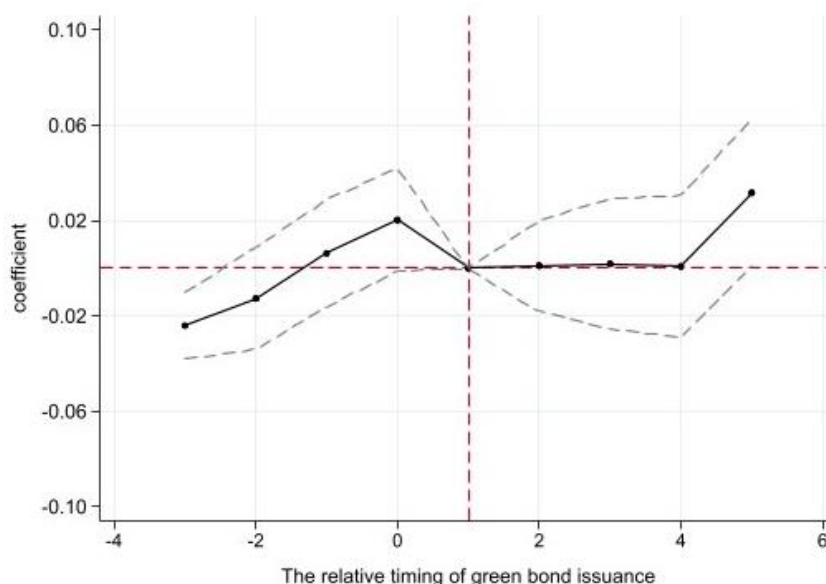


Figure 1. Dynamic Impact of Green Bond Issuance on Enterprise Investment

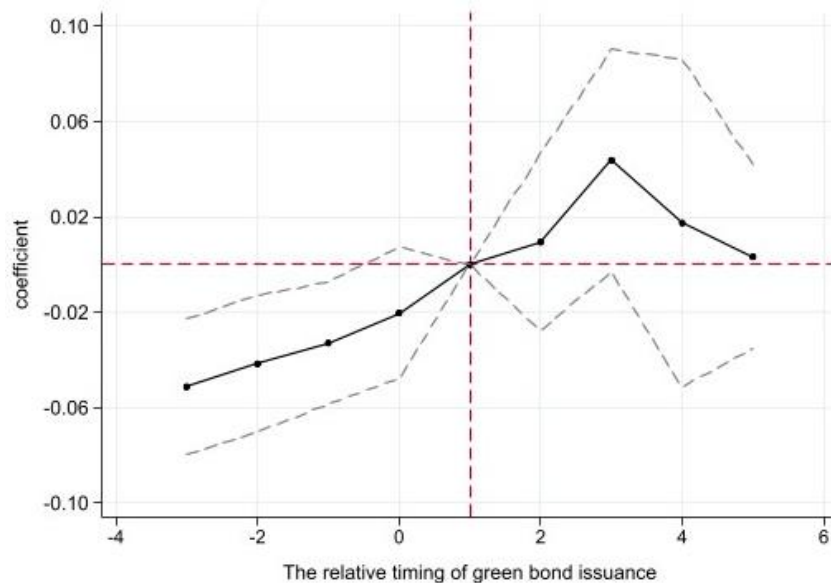


Figure 2. Dynamic Impact of Green Bond Issuance on Enterprise Financing

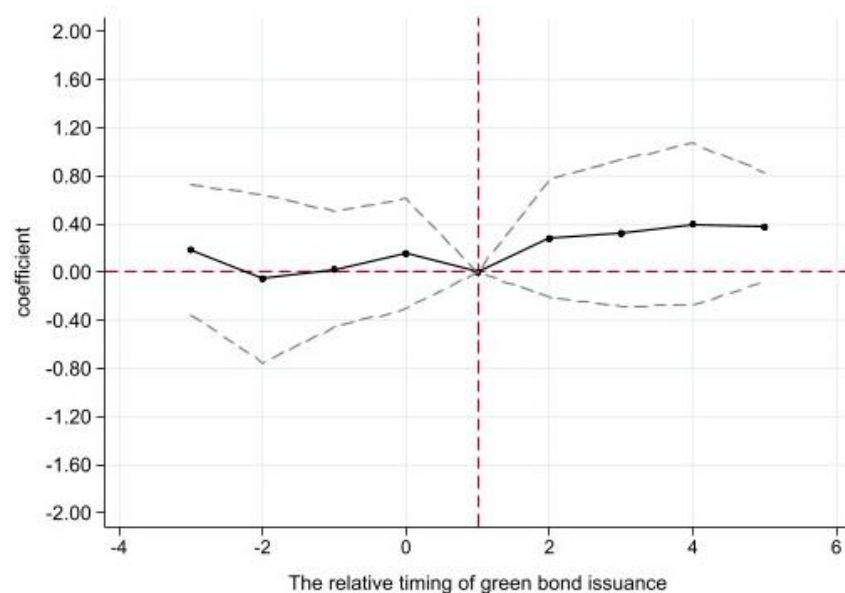


Figure 3. Dynamic Impact of Green Bond Issuance on Mismatch of Term

4.3. Robustness tests

4.3.1. Impact of excluding corporate financial asset allocation

The baseline regression shows that the issuance of green bonds has a significant impact on corporate investment, financing, and short-term borrowing behavior. However, other characteristics of firms in the course of their operations also affect their investment, financing, and short-term borrowing. The study by Shen and Chen (2020) indicated that firms' financial asset allocation (FIN) affects the degree of term mismatch in corporate investment and financing. However, there is no research result on whether the impact of green bond issuance on corporate investment, financing, and term mismatch is influenced by financial asset allocation. This study modified the original control variables by adding corporate financial resource allocation as a firm-level control variable to the regression based on the baseline regression. The regression results are presented in Table 4. The regression coefficients in Table 4 are all significant at the 10% level, slightly lower than before adding corporate financial resource allocation, but overall consistent with the baseline regression results. This indicates that the findings of this study are robust.

Table 4. Robustness tests: adding control variables for the basic regression

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Corporate Investment	Corporate Investment	Corporate Financing	Corporate Financing	Maturity Mismatch	Maturity Mismatch
Core Explanatory Variables						
$Green_i \times Post_t$	0.278*	0.283*	-0.042*	-0.043*	-0.275*	-0.295*
	(0.150)	(0.155)	(0.023)	(0.025)	(0.163)	(0.166)
Control variables						
Q		-0.013		-0.010		-0.019
		(0.016)		(0.007)		(0.020)
SOE		0.109		-0.003		-0.059
		(0.071)		(0.018)		(0.094)
CR		0.011		-0.001		-0.013
		(0.008)		(0.000)		(0.008)
IRB		22.264***		-0.019		-250.180***
		(0.146)		(0.016)		(0.151)
Enterprise Financial Asset Allocation		-0.134		-0.045		0.058
		(0.200)		(0.074)		(0.249)
Constant	0.389***	-0.108	0.162***	0.204***	-0.110***	0.506
	(0.012)	(0.380)	(0.002)	(0.027)	(0.013)	(0.379)
Observations	2,319	2,117	2,401	2,173	2,218	2,024
R ²	0.393	0.519	0.811	0.819	0.250	0.977
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

4.3.2. Control of time trends in the industry

The effectiveness of green bond issuance varies across different industries due to the characteristics of each industry. To control for the influence of industry changes over time on the effectiveness of green bond issuance, this study employed joint fixed effects of industry major and minor codes and years to control the regression results, eliminating differences in industry categories. The regression results under both joint effects are consistent with the baseline regression results. By retaining the original fixed effects and adding joint effect time trend terms, clustering was performed at both the firm and industry levels following the basic regression approach. Table 5 presents the regression results after modifying the model's fixed effects. The results indicate that the issuance of green bonds by firms still has a significant impact on corporate investment, financing, and short-term borrowing, demonstrating the robustness of the findings in this study.

Table 5. Robustness tests: fixed effects of changing models

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Corporate Investment	Corporate Investment	Corporate Financing	Corporate Financing	Maturity Mismatch	Maturity Mismatch
Core Explanatory Variables						
$Green_i \times Post_t$	0.281*	0.294*	-0.048**	-0.049*	-0.304*	-0.310*
	(0.149)	(0.152)	(0.022)	(0.025)	(0.169)	(0.161)
Control Variables						
Q		-0.022		-0.007		-0.013
		(0.015)		(0.007)		(0.019)
SOE		0.120		-0.005		-0.068
		(0.072)		(0.018)		(0.093)
CR		0.011		-0.001		-0.012
		(0.009)		(0.000)		(0.008)
IRB		22.261***		0.013		-250.261***
		(0.188)		(0.025)		(0.200)
Constant	0.389***	-0.186	0.162***	0.206***	-0.109***	0.633
	(0.012)	(0.394)	(0.002)	(0.028)	(0.013)	(0.392)
Observations	2,264	2,117	2,343	2,173	2,170	2,024
R ²	0.392	0.521	0.815	0.822	0.251	0.978
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES
Industry * Year Fixed Effects	YES	YES	YES	YES	YES	YES

4.3.3. Exclusion of the competitive hypothesis

In 2000, the government began gradually implementing the Western Development Strategy. With the implementation of various encouraging and preferential policies, the economy in the western regions started to accelerate, affecting corporate investment, financing, and term mismatch. To eliminate the influence of these policies on the conclusions of this study, observations from provinces involved in the Western Development Strategy were excluded from the regression analysis. There are a total of 12 provinces and three autonomous regions benefiting from the policy, including Sichuan, Shaanxi, Gansu, Qinghai, Yunnan, Guizhou, Chongqing Municipality, Guangxi, Inner Mongolia, Ningxia, Xinjiang, Tibet, Enshi Tujia and Miao Autonomous Prefecture in Hubei Province, Xiangxi Tujia and Miao Autonomous Prefecture in Hunan Province, and Yanbian Korean Autonomous Prefecture in Jilin Province. Table 6 presents the results after excluding the influence of policy incentives. The findings indicate that even after removing observations from regions benefiting from policy incentives, the regression results remain significant, suggesting that the impact of issuing green bonds on corporate investment, financing, and term mismatch is robust and not influenced by policy incentives.

Table 6. Robustness test: excluding the effect of tax policy incentives

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Corporate Investment	Corporate Investment	Corporate Financing	Corporate Financing	Maturity Mismatch	Maturity Mismatch
Core Explanatory Variables						
$Green_i \times Post_t$	0.279*	0.281*	-0.042*	-0.044*	-0.272*	-0.293*
	(0.150)	(0.154)	(0.023)	(0.026)	(0.163)	(0.165)
Control Variables						
Q		0.001		-0.014**		-0.032*
		(0.014)		(0.006)		(0.019)
SOE		0.117		-0.003		-0.067
		(0.072)		(0.018)		(0.096)
CR		0.012		-0.001		-0.013
		(0.009)		(0.000)		(0.008)
IRB		22.258***		-0.018		-250.191***
		(0.149)		(0.016)		(0.153)
Constant	0.382***	-0.156	0.158***	0.203***	-0.115***	0.542
	(0.011)	(0.384)	(0.002)	(0.026)	(0.011)	(0.384)
Observations	2,185	2,006	2,264	2,059	2,090	1,918
R ²	0.384	0.515	0.806	0.816	0.250	0.978
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

4.4. Impact mechanism studies

This study employs the sequential testing method proposed by Baron and Kenny (1986) to identify variables that potentially mediate the relationship between the dependent variable Y (including corporate investment, corporate financing, and term mismatch) and the issuance of green bonds (*treat_post*). The following steps are used to test for significant mediating effects:

Step 1: Validate the impact of the green bond issuance variable on corporate investment, financing, and term mismatch.

$$Y = \alpha_1 + \beta_1 \text{treat_post} + \sum \gamma_i \text{Control}_{it-1} + \text{Industry} + \varepsilon_{it} \quad (5)$$

Step 2: Validate the impact of the green bond issuance variable on the intermediary variable "Mediation".

$$\text{Mediation}_{it} = \alpha_2 + \beta_2 \text{treat_post} + \sum \gamma_i \text{Control}_{it-1} + \text{Industry} + \varepsilon_{it} \quad (6)$$

Step 3: Include the green bond issuance variable and the intermediary variable together as explanatory variables in the regression equation.

$$Y = \alpha_3 + \beta_3 \text{treat_post} + \beta_4 \text{Mediation}_{it} + \sum \gamma_i \text{Control}_{it-1} + \text{Industry} + \varepsilon_{it} \quad (7)$$

The determination of the significance of the intermediary variable is based on the following criteria: First, the significance of coefficient β_1 is initially tested. If β_1 is significant, the next step is considered; otherwise, intermediary variables are reconsidered. Second, the significance of coefficients β_2 and β_4 is examined. If both are significant, it can be concluded that the intermediary variable Mediation has a significant mediating effect. If, at the same time, β_3 is not significant or its

estimate is significantly smaller than β_1 , then the Mediation variable exhibits a strong mediating effect. Third, if either β_2 or β_4 is not significant, a Sobel test is conducted to determine whether the Mediation variable exhibits a mediating effect.

Drawing from the research conducted by Ma et al. (2020) on corporate investment and financing, as well as the work of Chen and Zhang (2023) on mismatching, this study selects the variable Financial Constraint Level (SA) as the intermediary variable to measure corporate investment, financing, and mismatching. The financial constraint level cannot be directly obtained from corporate data but needs to be derived from certain behavioral characteristics of the enterprise, such as investment-cash flow sensitivity, cash-cash flow sensitivity, or a linear combination of financial variables. The formula used in this study is based on the one proposed and developed by Hadlock and Pierce (2010), as follows:

$$SA = -0.737 \times \ln(\text{Total Assets}) + 0.043 * [\ln(\text{Total Assets})^2 - 0.040 * \text{Age of Listing}] \quad (8)$$

4.4.1. Based on financing constraints

(1) Mediating effect test of financing constraints on corporate investment

Table 7 presents the results of the intermediary effect test of the financial constraint level on corporate investment. Columns (1) to (3) show the results without incorporating control variables, while columns (4) to (6) show the results after including all enterprise-level control variables. From the data in columns (2) and (5), it can be observed that the test coefficient β_2 is significantly negative at the 5% level without control variables, indicating that issuing green bonds can significantly reduce a company's financial constraints and improve its financial situation. After incorporating control variables, the coefficient remains negative at the 10% significance level, albeit with a slight decrease in value, indicating that the inclusion of control variables affects the financial constraints of the company but does not affect the final results. Column (3) indicates that the test coefficient β_4 is significantly positive at the 5% level, suggesting that the financial constraint level increases the investment capacity of companies by 15.7% after issuing green bonds. Columns (3) and (6) show that both before and after including control variables, the investment capacity of companies is significantly positive at the 5% level, with a slight decrease after including control variables. This suggests that company characteristics affect investment capacity, but compared to the basic regression results in Table 3, the inclusion of financial constraints increases the investment capacity of companies by 2.3% (0.306-0.283). These results indicate that the financial constraint level plays a significant intermediary role between enhancing corporate investment capacity and issuing green bonds.

Table 7. Mechanism study of firms' investment based on financing constraint channels

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Corporate Investment	SA	Corporate Investment	Corporate Investment	SA	Corporate Investment
Core Explanatory Variables						
treat_post	0.278*	-0.326**	0.323**	0.258*	-0.295*	0.306**
	(0.150)	(0.157)	(0.149)	(0.141)	(0.158)	(0.138)
SA			0.157**			0.179**
			(0.070)			(0.086)
Control Variables	NO	NO	NO	YES	YES	YES
Constant	0.389***	6.785***	-0.679	-0.022	7.221***	-1.323
	(0.012)	(0.013)	(0.479)	(0.303)	(0.201)	(0.902)
Observations	2,319	2,441	2,319	2,279	2,391	2,279
R ²	0.393	0.960	0.405	0.526	0.966	0.540
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

(2) Mediating effect test of financing constraints on corporate financing

Table 8 presents the results of the intermediary effect test of the financial constraint level on corporate financing. Columns (1) to (3) show the results without incorporating control variables, while columns (4) to (6) show the results after including all enterprise-level control variables. From the data in columns (2) and (5), it can be observed that the test coefficient β_2 is significantly negative at the 5% level without control variables, indicating that issuing green bonds can significantly reduce a company's financial constraint level by 32.6%, thereby enhancing its financing capacity. After incorporating control variables, the coefficient remains negative at the 10% significance level, albeit with a slight decrease in value, indicating that the inclusion of control variables affects the financial constraints of the company but does not affect the final results. Data in column (3) of the table show that the test coefficient β_4 is significantly negative at the 1% significance level. Columns (3) and (6) show that both before and after including control variables, the financing capacity of companies is significantly negative at the 10% level of significance. These results indicate that the financial constraint level plays a significant intermediary role between enhancing corporate financing capacity and issuing green bonds.

Table 8. Mechanism study of corporate finance based on financing constraint channels

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Corporate Financing	SA	Corporate Financing	Corporate Financing	SA	Corporate Financing
Core Explanatory Variables						
treat_post	-0.042*	-0.326**	-0.032*	-0.046**	-0.295*	-0.037*
	(0.023)	(0.157)	(0.020)	(0.023)	(0.158)	(0.020)
SA			0.031***			0.033***
			(0.007)			(0.007)
Control Variables	NO	NO	NO	YES	YES	YES
Constant	0.162***	6.785***	-0.050	0.200***	7.221***	-0.039
	(0.002)	(0.013)	(0.045)	(0.019)	(0.201)	(0.050)
Observations	2,401	2,441	2,401	2,351	2,391	2,351
R ²	0.811	0.960	0.819	0.815	0.966	0.823
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

(3) Mediating effect test of financing constraints on corporate maturity mismatch

Table 9 presents the results of the intermediary effect test of the financial constraint level on the degree of financing mismatch in enterprises. Columns (1) to (3) represent the regression results without incorporating control variables, while columns (4) to (6) include enterprise-level control variables. The results in columns (2) and (5) show that the coefficient β_2 of treat_post is significantly negative at the 1% significance level without control variables, indicating that after the issuance of green bonds, the degree of financial constraint mismatch in enterprises decreases by 29.7%. After adding control variables, the coefficient remains significantly negative at the 5% significance level, suggesting that issuing green bonds significantly reduces the financial constraint level of enterprises and alleviates their financial crisis. In the results of columns (3) and (6), the coefficient β_4 of SA is significant at the 10% level. The coefficient β_3 of treat_post is significant at the 10% significance level. These results indicate that the financial constraint level plays a very significant intermediary role between issuing green bonds and enhancing enterprise value.

Table 9. Study on the mechanism of corporate investment and financing maturity mismatch based on financing constraint channels

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Maturity Mismatch	SA	Maturity Mismatch	Maturity Mismatch	SA	Maturity Mismatch
Core Explanatory Variables						
treat_post	-0.271*	- 0.297***	-0.305*	-0.246*	-0.318**	-0.279*
	(0.163)	(0.091)	(0.165)	(0.146)	(0.158)	(0.146)
SA			-0.131*			-0.147*
			(0.077)			(0.079)
Control Variables	NO	NO	NO	YES	YES	YES
Constant	-0.101***	7.283***	0.819	0.526*	7.134***	1.606*
	(0.015)	(0.012)	(0.546)	(0.297)	(0.198)	(0.855)
Observations	2,321	2,726	2,321	2,240	2,463	2,240
R ²	0.250	0.981	0.250	0.976	0.964	0.977
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

4.4.2. Based on market sentiment channels

Liu (2006) conducted an empirical study on the relationship between investor sentiment and securities market activity, demonstrating that investor sentiment significantly affects the sentiment of the investment and financing market and operates consistently. This fully illustrates that investor sentiment can be used as a substitute variable for market sentiment research. This paper speculates that investor sentiment is likely to become a mechanism variable for the issuance of green bonds and the mismatch between corporate investment and financing and term. This paper selects the stock market value circulation ratio to measure investor sentiment. The stock market value circulation ratio = the market value of the circulating shares of a stock / the total market value of the stock. This variable represents the level of volatility in the market's valuation of a company's stock. When this ratio is high, it indicates a lack of market confidence in the company's stock, that is, investors' uncertainty about the company's future development. Changes in the stock market value circulation ratio represent changes in the market's confidence in the company's stock. A decrease in the ratio indicates an increase in market confidence in the company's future development and stock stability; an increase in the ratio indicates a decrease in market confidence in the company and a willingness to sell the company's stock. When market confidence in a company increases, it attracts more investor attention, and the company can raise more funds through stock financing, increasing the proportion of equity financing in the company's financing structure. Through the stock market value circulation ratio, companies can take advantage of the market's optimistic sentiment to obtain lower financing costs. However, because equity financing usually does not have a clear repayment deadline, if the market value circulation ratio continues to rise and market confidence declines, companies may increase short-term loans due to a large funding gap, which may also lead to term mismatch in the company's financing structure. Therefore, the stock market value circulation ratio can change the company's financing cost through market sentiment, affect the company's financing capacity, and also affect the term mismatch in the company's financing structure due to the special nature of stock terms. However, the impact of the stock market value circulation ratio on a company's investment behavior may have a reverse effect. The reason is that the stock market value circulation ratio reflects the liquidity of the company's own stock, that is, its popularity. With limited investment, if the financing capacity of other companies improves, the company's own investment capacity will decrease. Therefore, while the financing capacity of companies with a higher stock market value circulation

ratio may increase, their investment capacity is likely to decrease, reflecting the financing capacity of other companies.

The validation steps employed in this study are as follows:

Step 1: Verify the impact of green bond issuance on corporate investment and financing and term mismatch using the basic regression equation for both with and without control variables.

Step 2: Verify the impact of green bond issuance on the individual stock circulation ratio, using the same equation as in the first step, but replacing the dependent variable with the individual stock market value circulation ratio. If both regression results are significant, it confirms that the individual stock market value circulation ratio is a mechanism variable affecting corporate investment and financing and term mismatch due to green bond issuance.

The regression results of Step 1 are shown in Table 2 and are not repeated here. Table 10 presents the relationship between the individual stock market value circulation ratio and corporate investment, corporate financing, and term mismatch.

From columns (1) and (2) of the table, it can be seen that, with and without all control variables, the coefficient of the individual stock market value circulation ratio on corporate investment is significantly negative at the 1% level. This indicates that after the issuance of green bonds, the individual stock market value circulation ratio decreases by 16.2%, suggesting an increase in market confidence in the company, thereby enhancing its investment decision-making ability and increasing investment capacity.

Columns (3) and (4) of the table represent the impact of the individual stock market value circulation ratio on corporate financing. Without control variables, the coefficient of the individual stock market value circulation ratio on corporate financing is significantly negative at the 5% level, indicating a 10.7% decrease in the individual stock market value circulation ratio after the issuance of green bonds, which represents an increase in market confidence in the company, attracting more investor attention and thereby enhancing corporate financing capacity. After including all control variables, the coefficient of the individual stock market value circulation ratio on corporate financing is significantly negative at the 1% level, indicating a more significant decrease in the individual stock market value circulation ratio after controlling for all variables. The impact of green bond issuance on the individual stock market value circulation ratio remains highly significant.

Columns (5) and (6) of the table show the results of testing the relationship between the individual stock market value circulation ratio and corporate investment and financing term mismatch. Without control variables, the coefficient is significantly negative at the 5% level, indicating a 10.7% decrease in the individual stock market value circulation ratio after green bond issuance, leading to increased market confidence and a reduction in the degree of corporate investment and financing term mismatch. After including all control variables, both coefficients remain significantly negative at the 1% level, indicating that control variables do not affect the test results, and the individual stock market value circulation ratio reduces the degree of corporate investment and financing term mismatch. These results demonstrate that the individual stock market value circulation ratio plays a highly significant mechanism effect between green bond issuance and the enhancement of corporate value.

Table 10. Mechanism Study of Green Bond Issuance on Corporate Investment, Financing, and Term Mismatch Based on Market Sentiment Channel

	Corporate Investment		Corporate Financing		Maturity Mismatch	
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Individual stock market capitalization liquidity ratio	Individual stock market capitalization liquidity ratio	Individual stock market capitalization liquidity ratio	Individual stock market capitalization liquidity ratio	Individual stock market capitalization liquidity ratio	Individual stock market capitalization liquidity ratio
Core Explanatory Variables						
$Green_i \times Post_t$	-0.162***	-0.155***	-0.107**	-0.156***	-0.107**	-0.155***
	(0.052)	(0.050)	(0.041)	(0.050)	(0.041)	(0.050)
Control Variables	NO	YES	NO	YES	NO	YES
Constant	0.883***	1.027***	0.879***	1.025***	0.879***	1.027***
	(0.004)	(0.066)	(0.005)	(0.063)	(0.005)	(0.066)
Observations	2,434	2,394	2,710	2,466	2,710	2,394
R ²	0.555	0.572	0.574	0.572	0.574	0.572
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Enterprise Fixed Effects	YES	YES	YES	YES	YES	YES

5. Conclusions and Implications

This study conducts regression analysis based on panel data of A-share listed companies and green bond issuance data from 2012 to 2022, aiming to analyze the impact of green bond issuance on corporate investment, financing, and term mismatch. The regression results are obtained by establishing corresponding models and testing their robustness, demonstrating the robustness of the regression results. Finally, the mechanism analysis of the conclusions is conducted to explore the formation mechanism of the conclusions and validate the findings of the study.

The research results of this study can be summarized into three parts:

Firstly, the issuance of green bonds promotes the increase in corporate investment levels. Green bonds, due to their unique characteristics, not only possess bond features but also emotional characteristics. Fundamentally, green bonds aim to improve the environment and address environmental issues, meeting public demand. These sentiments contribute to the benign development of investments, thereby promoting corporate investment levels.

Secondly, the issuance of green bonds promotes the increase in corporate financing levels. Comparative analysis between companies within the industry that have not issued green bonds and those that have, demonstrates the validity and robustness of this conclusion.

Thirdly, the issuance of green bonds effectively alleviates the degree of term mismatch in corporate investment and financing. The conclusion drawn from the analysis indicates that after issuing green bonds, the term mismatch situation of enterprises significantly improves. Green bonds provide many enterprises, especially small and medium-sized enterprises, with alternative financing channels. Moreover, due to policy incentives, the economic pressure on enterprises is reduced. Enterprises no longer rely on short-term loans for long-term investments, naturally alleviating the degree of financing mismatch.

In fact, the impact of green bond issuance on corporate development is multifaceted. However, this study has limitations in that it did not comprehensively study the characteristics of enterprises, only focusing on a few important indicators for regression analysis, which may lead to the omission

of important parameters. Additionally, most of the companies that issued green bonds experienced rapid growth after 2020, but the majority did not appear in the A-share market, thus not included in the study sample, which may also introduce bias to the research. Therefore, future studies should strive for further improvement.

Through this study, several insights can be drawn regarding green bond issuance:

1. The implementation of green finance policies has played a certain role in promoting the country's economic development and is exerting a significant impact on improving the national economic structure. The study findings indicate that green bond issuance significantly enhances corporate investment and financing levels, which are essential for business development. Additionally, the research results demonstrate that issuing green bonds can significantly reduce the degree of term mismatch in corporate investment and financing. Term mismatch, a result of financial constraints, poses significant challenges and threats to a company's financial structure. The preferential policies for green bond issuance alleviate this phenomenon, allowing companies to bear lower debts to obtain more investments, thereby reducing financial risks and facilitating corporate development. Therefore, further promotion and improvement of green bond issuance are needed.

2. In order to promote economic development, many preferential policies have been introduced by the government to stimulate economic growth. However, this study shows that the promotion of green bond issuance does not depend on these incentives. Even after removing the observation values affected by policy incentives, the regression results remain significant, indicating the robustness of the promotion effect of green bond issuance on corporate development. Therefore, promoting both green bond issuance and other incentive policies is not contradictory and can be done simultaneously. The focus of future research may be on how to coordinate their relationship to better promote economic development.

3. From the sample data used in this study, it is observed that currently, state-owned enterprises dominate the issuance of green bonds. Data shows that over 50% of green bond issuers are state-owned, while private enterprises account for less than 3%. Mobilizing the participation of non-state-owned enterprises is a policy issue that needs to be addressed. Studying the problems encountered in the issuance of green bonds by non-state-owned enterprises and finding solutions to these problems is a major challenge for green bond issuance.

4. Mechanism studies reveal that financing constraints are an important factor affecting corporate investment, financing, and term mismatch, posing a major challenge for many enterprises. The reason for financing constraints lies in the problems in the corporate financing structure. Therefore, easing financing constraints can start with improving and adjusting the corporate investment and financing structure, promoting the development of diversified investment portfolios, and expanding corporate financing channels. For example, green bonds provide a low-cost financing channel for enterprises. However, despite nearly a decade of policy development, the policies for green bond issuance are still imperfect. Therefore, it is necessary to improve green bond issuance policies as soon as possible to truly support enterprise development.

5. This study also indicates that market sentiment in economic markets is an important factor affecting corporate development. Factors influencing market sentiment include government policy inclinations, stock market fluctuations, corporate disclosure of information, and the international market environment. Exploring how to better utilize market sentiment to achieve corporate development is an important research question. While many scholars have made progress in various fields, efforts are still needed to explore how to utilize these achievements effectively.

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