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Facilitating or inhibiting? Financing platform debt and corporate green transformation

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Article

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Abstract

Local government debt and corporate green transformation are key issues in China's high-quality economic development. As the core carrier of local government's implicit debt, the role of financing platforms issuing urban investment bonds (UIBs) on corporate green innovation is a key entry point in resolving debt risks and promoting green transformation. This paper constructs an analytical framework from two channels: ability (financial support, lowering the corporate tax burden, and reducing pass-through expenditures) and willingness (willingness to green transformation, and the degree of sustainable development). The two form a trade-off mechanism; the ability channel will promote corporate green innovation, and the willingness channel will inhibit corporate green innovation. This paper analyzes A-share listed firms from 2017–2023. We find that the UIBs significantly promote green innovation, confirming the dominance of ability effects. The positive impact strengthens with higher sci-tech expenditure, industrial upgrading, and environmental regulation. The promotion effect of green UIBs on green innovation is significantly more potent than that of non-green UIBs, and UIBs inhibit strategic green innovation and promote substantive green innovation. This paper helps to realise the synergistic promotion of the prevention and control of hidden debt risks of local governments and the green transformation of enterprises, and provides policy references for the high-quality development of the economy.

1. Introduction

The current downward pressure on the economy and the increase in the debt burden have led to the growing prominence of the problem of local government debt. Integrating development and security and preventing and resolving risks in key areas such as local government debt is significant for China's social stability and the realization of Chinese-style modernization. Local government debt, as one of the three prominent risks, should be steadily resolved. The prevention and resolution of hidden local government debt risks should be regarded as an important guarantee, an intrinsic requirement, and a key task for economic and social development (Feng et al., 2025). The 2015 Budget Law formally authorized local governments to issue debt. Despite this formalization, UIBs—classified as implicit debt through local financing platforms have maintained a persistent growth trajectory (Wang et al., 2023). Understanding the mechanisms and economic effects of such platform debt remains essential for effective local government risk management (Wen et al., 2024). Existing scholarship has primarily examined how aggregate local government debt influences regional environmental performance (Wang & Nie, 2025). While structural adjustment and economic transformation represent crucial dimensions of high-quality development, the specific impact of financing platform debt on green transition outcomes warrants further investigation.

Green transformation is a crucial approach to achieving environmental sustainability and ecological balance. Against a growing global consensus on green development, green transformation at the enterprise level has become a key means of responding to this international paradigm. The green transformation of enterprises has gradually become the microfoundation for the green transformation of the national economy (Sun & Min, 2024). Companies must make a green shift to reduce environmental pollution caused by carbon emissions (Qamruzzaman, 2025). Green innovation is an important means of realizing green transformation. Green innovation is an important initiative for enterprises to reduce carbon emissions, reduce environmentally damaging behaviors, and establish inter-enterprise competitive advantages (Huang et al., 2025). However, green innovation requires a large amount of resources, and it takes a long time to realize its benefits. At the current stage, it is necessary to realize the unity of ability and willingness to stimulate the internal energy of enterprise green innovation. Enterprises should consolidate a series of material foundations, such as technology and capital, and create a favorable business environment to stimulate enterprises to engage in green innovation and enhance their willingness to do so (Luo & Wang, 2025).

The issuance of UIBs represents a significant channel through which financing platforms exert structural effects on corporate green innovation. This study addresses a pivotal question emerging from the intersection of debt risk and green development agendas how do UIBs ultimately affect corporate green innovation? UIBs influence corporate green innovation through two competing mechanisms. While ability channels foster innovation through fiscal support and cost reduction, willingness channels may suppress it via distorted incentives. Empirical evidence from Chinese A-share listed companies (2017–2023) shows UIBs generally promote green innovation, with ability effects outweighing willingness constraints. This positive impact strengthens with higher technological expenditure, industrial upgrading, and environmental regulations. The effect proves particularly strong in state-owned enterprises, financially constrained firms, and companies with established green capabilities. Notably, UIBs simultaneously promote substantive innovation while constraining strategic green innovation, revealing the complex dual nature of their impact. These findings illuminate how the same financial instrument can both enable and constrain sustainable transformation through different transmission channels.

Compared with the existing literature, the marginal contributions of this paper are mainly the following three points: First, it broadens the examination of financing platforms' structural effects by integrating UIBs with corporate green innovation within a unified framework. While existing literature predominantly addresses credit risk pricing and macroeconomic impacts, this analysis bridges the microeconomic consequences of implicit local debt with corporate environmental innovation, addressing a critical research gap (Feng et al., 2022). Second, the research advances mechanism analysis by systematically examining the dual channels of corporate capability and willingness. Moving beyond conventional linear approaches that emphasize only promotion effects (Geng & Qian, 2024), this investigation reveals the competing pathways through which UIBs influence green innovation, offering a more nuanced understanding of their dual-edged nature. Third, from a policy coordination perspective, the study demonstrates how multiple regulatory variables—technological expenditure, industrial upgrading, and environmental regulation—synergistically enhance green innovation outcomes. This approach transcends the single-dimensional focus prevalent in existing research, providing empirical evidence for optimizing policy combinations to amplify positive effects (Liu & Zhao, 2025).

The rest of the paper is structured as follows. Section 2 introduces the background, providing a literature review and theoretical analysis. Section 3 presents the empirical research design. Section 4 presents the empirical benchmark regression results. Section 5 is the mechanism test. Section 6 is further analysis. Section 7 is the conclusion and policy recommendations.

2. Institutional background, literature review, theoretical analysis

2.1. Institutional background

China's local government debt structure encompasses both explicit and implicit obligations, with UIBs representing a predominant form of implicit debt through local government financing vehicles (Wang et al., 2025). The regulatory landscape was substantially reshaped by the 2015 Budget Law, which enhanced fiscal transparency while simultaneously alleviating corporate financing constraints and fostering conditions conducive to green innovation. UIBs primarily finance infrastructure projects directed toward socioeconomic development objectives, with notable regional concentration in eastern coastal provinces. The repayment mechanism inherently relies on local fiscal capacity and policy support, creating an implicit guarantee expectation that has facilitated remarkable expansion. Ministry of Finance data indicates outstanding UIBs grew eightfold between 2011 and 2020, reaching 3.9 trillion yuan, while aggregate local government debt reached 51.2 trillion yuan by May 2025, reflecting the persistent growth trajectory of these instruments (Ye et al., 2022; Li et al., 2024).

2.2. literature review

Existing research on UIBs primarily examines two dimensions. The first concerns their economic consequences, particularly their role in bridging fiscal gaps and supporting infrastructure development (Li & Yan, 2022). UIBs represent unique instruments backed by local governments and secured through land use rights. Studies have documented their function in credit expansion and social credit enhancement (Fan, 2022; Ren et al., 2024; Cao et al., 2024). The second research stream addresses credit risk dynamics. Platform restructuring has substantially reduced bond-specific risks while generally constraining corporate risk-taking (Wan et al., 2024; Bao et al., 2024). While existing literature has established mature analytical frameworks for economic and risk transmission effects, the relationship between UIBs and regional green innovation activities remains underexplored despite growing policy emphasis on green transformation (Zhou et al., 2023). This gap presents a promising direction for expanding research on the economic consequences of these instruments.

Existing research has identified three primary drivers of corporate green innovation. Government and policy interventions address the "double externality" problem inherent in green innovation, where technological spillovers create positive externalities while pollution generates negative ones (Li et al., 2017). Financial and technological enablers constitute the second category, with fintech development and digital industry integration policies providing crucial support for substantive green innovation (Chen and Zhang, 2025). Digital technologies further facilitate green innovation by improving environmental information disclosure and financial resource access (Zhang et al., 2025). Resource availability and external pressures form the third determinant, where financing capacity through internal and external channels, political capital, and stakeholder demands collectively shape corporate engagement in green innovation (Xiang et al., 2022). Existing work has primarily considered local government debt through aggregate perspectives, noting its role in entrepreneurial development and infrastructure investment (Xiong et al., 2024), while UIBs specifically function as complementary instruments for urban development and public service optimization (Chen et al., 2022; Li and Qi, 2025).

From the perspective of structural adjustment and green transformation, this paper explores the factors that influence UIBs issuance on corporate green innovation, and it also complements and improves the related green innovation literature. This paper reveals the importance of UIBs issued by financing platforms on corporate green innovation. It provides a literature reference on promoting green innovation from the perspective of traditional debt instruments. In addition, this paper enriches the literature on the economic consequences of UIBs. The research in this paper fills the gap between UIBs issued by financing platforms and green economic development from a micro perspective. Specifically, the reform of the new budget law mitigated previous arguments about the crowding-out effect of financing platform debt on corporate green innovation. When UIBs issued by financing platforms is used for productive expenditures and balance economic growth and sustainable development.

2.3. Theoretical Analysis

The UIBs issued by local governments and local financing platforms play an important role in making up for the gap in fiscal funds, stabilising economic growth, and promoting infrastructure construction. The promulgation of the new Budget Law provides a more transparent financing method. Local governments can use this to enhance the government's financial strength, ease the financial pressure to solve the problem of financial scarcity, and then reduce the risk (Li & Yan, 2022).

2.3.1. The role of UIBs on enterprise green innovation channels and mechanisms

(1) Capacity channel

Local financing platforms issuing UIBs can promote green innovation through the enterprise capacity mechanism. The capability level can focus on three perspectives: financial support, enterprise tax burden, and enterprise burden shifting.

In terms of financial support, the issuance of UIBs helps alleviate fiscal constraints at the local level while enhancing governments' capacity to provide targeted support for green innovation initiatives. As these bond funds are directed toward infrastructure and public service projects, local governments demonstrate increased fiscal effort level. This heightened fiscal engagement not only improves the allocation efficiency of public resources but also expands the scale of subsidies and institutional support available for corporate green technology research and development. Such financial backing directly addresses critical resource gaps that enterprises encounter during ecological transitions, particularly in essential areas like high-skilled talent acquisition and green patent development. Firms can consequently strengthen their inherent capabilities for pursuing sustainable innovation pathways. (Yu et al., 2024; Dang et al., 2025).

In terms of enterprise tax burden, the UIBs can indirectly reduce the tax burden on enterprises, thereby freeing up additional resources for green innovation activities. As local governments experience improved fiscal conditions, they gain greater policy space to implement structural tax reductions or introduce tax incentives specifically targeting green technologies. This reduction in tax liabilities directly enhances corporate cash flow and retained earnings, which in turn

stimulates motivation for expanding long-term research and development investments. The tax effect stemming from fiscal improvements not only strengthens enterprises' capacity to reinvest in green technology sectors but also diminishes the cost attractiveness of continuing to rely on traditional pollution-intensive production methods. (Zhao et al., 2022).

In terms of enterprise burden shifting, improving local public services supported by UIBs reduces the pass-through expenditures. This is specifically manifested in the fact that it can significantly reduce unproductive rent-seeking expenditures such as corporate hospitality and travel expenses (Hammes & Mandell, 2019), and indirectly inject resource momentum for green innovation. Local governments can reduce the proportion of enterprise social security contributions through the subsidy of UIBs funds, which can directly reduce the pressure of labour costs and help enterprises recruit or retain green innovation talents. Furthermore, by implementing social security subsidies and similar forms of support, the government effectively shoulders part of the labor-related costs for enterprises. This fiscal intervention not only alleviates pressure on companies in recruiting and retaining green talent but also indirectly strengthens their organizational capacity to sustain investments in green innovation (Wei et al., 2023).

(2) Willingness channel

The expansion of UIBs intensifies the competition among local governments for land to attract capital. It inhibits the willingness of enterprises to engage in green innovation by changing the allocation of land resources. On the one hand, the issuance of UIBs by financing platforms uses land grant revenues as a source of guarantee and debt repayment (Cheng et al., 2022). Low-quality land attraction tends to attract high-pollution, high-energy-consumption and low-value-added low-end manufacturing enterprises, and has limited attraction to low-pollution, high-value-added, green and innovative enterprises (Xie et al., 2024). On the other hand, local governments rely on UIBs funds to increase infrastructure subsidies, hindering the upgrading of the green industrial structure and the diffusion of green technology. This low-quality land resource allocation pattern directly reflects the inhibition of enterprises' willingness to participate in green innovation. Low-quality land allocation reduces enterprises' ESG score and sustainable development level (Ji & Nie, 2024), which makes enterprises tend to avoid long-term green innovation investment and opt for short-term crude production, and inhibits the degree of green transformation of enterprises.

After implementing the new Budget Law in 2015, local governments' authority to issue bonds independently has been liberalised. As the core financing tool of local financing platforms, UIBs have been studied for their economic consequences, mainly focusing on the growth effect and credit risk (Wen & Ma, 2019). However, there is a gap in research on how they affect corporate green innovation. Existing theories and empirical evidence show that UIBs can act on corporate green innovation through two opposing transmission paths, which form a competitive relationship, and this paper needs to clarify which path is dominant through empirical tests. The specific transmission pathway is shown in Fig. 1. Based on this, this paper proposes the following competing hypotheses:

H1a. The expansion of UIBs promotes the green innovation capability of enterprises by enhancing financial support, reducing the tax burden and shifting the burden to enterprises.

H1b. The expansion of UIBs inhibits the willingness of enterprises to innovate in a green way by changing the way of green transformation.

2.3.2. Analysis of the moderating effect of UIBs issuance on corporate green innovation

(1) Science and technology expenditure

Government support is crucial to the continuous development of green innovation. While targeting scientific and technological progress, the "science and technology" can also play the role of policy guidance, effectively driving the green innovation behaviour of micro subjects (Abbas et al., 2023). On the one hand, fiscal science and technology expenditures are an important source of funds for enterprises to obtain subsidies, which help enterprises to carry out green R&D and green innovation investment. After the issuance of UIBs by local financing platforms, the source of fiscal funds has become more extensive, and the injection of fiscal funds ensures that enterprises have sufficient R&D funds to enhance their green innovation capabilities. As a result, the fiscal expenditure on science and technology enhances the financing needs of enterprises, while improving their ability to obtain entrepreneurial investment and the overall level of green innovation (Beladi et al., 2021).

(2) Industrial structure upgrading

The core of industrial structure upgrading is to transform from traditional industries to green industries with low pollution and high technology, and this process will reconstruct the logic of local economic development and enterprise behavioural decisions (Guan et al., 2024). On the one hand, industrial structure upgrading means that the proportion of green industries in the regional economy increases, and local governments will guide UIBs funds to tilt towards green industries, when the UIBs funds match more closely with the demand of enterprises for green innovation, and can directly support the research and development of enterprises' green technologies and the renewal of equipments. On the other hand, the "agglomeration effect" brought about by upgrading the industrial structure will strengthen the green innovation synergy among enterprises, reduce the cost of innovation, and amplify the capital effect of UIBs issuance through the industrial network.

(3) Environmental Regulation

Environmental regulation alters the motivation of enterprises to engage in green innovation through the construction of constraints and incentives, which in turn affects the conversion efficiency of UIBs capital flow into the field of green innovation. According to the "Porter effect" and the theory of environmental regulation, reasonable environmental regulation can not only compel enterprises to reduce pollution through compliance constraints, but also encourage enterprises to undertake green innovation through incentive policies. As the intensity of environmental regulation increases, firms will take the initiative to utilize UIBs for green innovation (Wang et al., 2024). In addition, market-oriented environmental regulation can also prompt UIBs to support enterprises in

participating in emissions trading, enabling enterprises to reduce emissions and sell excess quotas through green innovation, which further strengthens the support effect of UIBs on green innovation. Based on this, this paper puts forward the following hypotheses:

H2a. Science and technology expenditure positively regulates the relationship between UIBs and enterprises' green innovation. The larger the scale of science and technology expenditure and the stronger the green orientation, the more significant is the promotion effect of UIBs on enterprises' green innovation.

H2b. Industrial structure upgrading positively regulates the relationship between UIBs issuance and corporate green innovation. The higher the level of industrial structure upgrading, the more significant the promotion effect of UIBs on corporate green innovation.

H2c. Environmental regulation positively regulates the relationship between UIBs and corporate green innovation. The higher the intensity of environmental regulation, the more significant the promotion effect of UIBs on corporate green innovation.

3. Methodology

3.1. Model construction

We employ the following Bidirectional Fixed Effects Model to estimate the impact of UIBs on corporate green innovation:

$$ln_green_patent_{i,t} = \alpha + \beta_1 cb_{j,t} + \gamma\, Controls_{i,j,t} + \mu_i + \lambda_t + \epsilon_{i,t}$$

1

Where subscripts i、j、t denote enterprise, city, and year. the explanatory variable $ln_green_patent_{i,t}$ denotes the logarithmic value of the total number of green patents granted by enterprise i in year t. $cb_{j,t}$ represents the UIBs variable. $Controls_{i,j,t}$ is the control variable at the enterprise level and city level. μ_i is the individual fixed effect; λ_t is the time fixed effect; and $\epsilon_{i,t}$ is the random disturbance term. The benchmark regression in this paper clusters at the city level.

3.2. Variable selection

3.2.1. Explanatory variable

Corporate green innovation capacity (ln_green_patent). According to Kong et al. (2024), data on green invention patents and green utility model patents for listed companies were obtained from the China Research Data Service Platform (CNRDS). According to the China Patent Law, the total number of green invention patents granted represents green innovation, classified based on technological innovativeness and complexity. Since the total number of patents granted for green inventions contains zero values, this study adds 1 to the raw data before normalization and then calculates the logarithm, which is recorded as ln_green_patent.

3.2.2. Core explanatory variable

Urban investment bonds issuance size (cb). This paper draws on (Tolliver et al.,2020) to use the logarithmic value of the financing platform's UIBs issuance. However, in the specific calculation, taking into account that some prefecture-level cities did not issue UIBs in some years, there is a value of 0. Therefore, the treatment of adding 1 and taking the logarithm is used.

3.2.3. Control variables

The control variables in this paper are categorized into the following levels: enterprise-level control variables, which include the company's financial indicators and corporate governance indicators, divided into two parts. Financial indicators include firm size $(Size)$, defined as the natural logarithm of the firm's total asset size; firm profitability (ROA), measured by the firm's return on total assets; firm growth (Growth), measured by the growth rate of the firm's operating revenues; firm leverage (Lev), measured by the ratio of the firm's total liabilities to its total assets; and firm cash flow $(CashFlow)$. Defined as the ratio of net operating cash flow to total assets of the enterprise; Fixed assets of the enterprise $(Fixed)$ Corporate governance indicators include corporate maturity $(FirmAge)$, measured by the logarithm of (the current year - the year of the enterprise's founding + 1). equity concentration ($Top1$), expressed as the proportion of shares held by the first largest shareholder. the size of the board of directors (Board), expressed as the logarithm of the number of board of directors. the proportion of independent directors Top1, expressed as the proportion of the total assets of the enterprise; and the proportion of the total assets of the enterprise. $(Indep)$, independent directors divided by the total number of directors; and executive compensation $(TMTPay1)$, expressed as the relative compensation of the top three executives.

3.3. Sample Selection and Data Source

This paper takes the A-share manufacturing listed companies from 2016 to 2023 as the sample. The data are processed as follows: excluding financially distressed firms, addressing missing observations, winsorizing continuous variables at the 1st and 99th percentiles, and removing financial companies. We obtain 30,601 firm-year observations. Enterprise green innovation data is obtained from the China Research Data Service Platform $(CNRDS)$and the total number of green invention patents and the total number of utility model green patents invented by enterprises are obtained, respectively. Data related to UIBs are obtained from the Wind database of UIBs, which manually summarizes the usage details and issuance scale of 17,834 county- and district-level UIBs across 230 prefectural-level cities from 2017 to 2023, and aggregates the scale by prefectural-level city. The city-level data are obtained from the China Urban

Statistical Yearbook, and the enterprise-level control variables are obtained from the Wind database and the Cathay Pacific $(CSMAR)$database. Table 1 presents descriptive statistics for all primary variables.

Table 1
Summary statistics.

$VarName$	Obs	$Mean$	SD	Min	$Median$	Max
ln_green_patent	30601	0.342	0.747	0.000	0.000	6.698
cb	30601	2.750	2.439	-0.010	3.073	7.149
$Size$	30601	22.271	1.303	19.982	22.070	26.250
$ROA1$	30601	0.034	0.066	-0.250	0.037	0.187
$Growth$	30601	0.305	0.729	-0.681	0.120	4.264
Lev	30601	0.407	0.202	0.059	0.397	0.884
$CashFlow$	30601	0.048	0.067	-0.146	0.048	0.230
$Fixed$	30601	0.191	0.148	0.002	0.160	0.642
$FirmAge$	30601	3.021	0.296	2.197	3.045	3.611
$Board$	30601	2.095	0.194	1.609	2.197	2.565
$Indep$	30601	0.379	0.053	0.333	0.364	0.571
$Top1$	30601	0.329	0.145	0.088	0.305	0.726
$TMTPay1$	30601	14.781	0.651	13.394	14.734	16.636

4. Empirical analyses

4.1. Basic result

Table 3 presents the results of the baseline regression test examining the impact of UIBs on firms' green innovation, which is analyzed in this paper using a fixed-effects regression model. In column (1), no control variables are added, and in columns (2) and (3), corporate financial level and corporate governance level characteristic variables are added in turn. The results in column (1) show that the regression coefficient of the core explanatory variable (cb) is positive and passes the significance test at the 1% level, indicating that UIBs issuance by financing platforms generally promotes green innovation of enterprises. The regression coefficients of UIBs of financing platforms in columns (2) and (3) are 0.007 and 0.008, and the estimated coefficients have not changed significantly after adding the firm-level control variables. They are still significant at the 1% level. The above regression results indicate that UIB issued by financing platforms can have a considerable positive contribution to corporate green innovation, and Hypothesis 1 is verified.

Table 3
Baseline regression results

	(1)	(2)	(3)
	ln_green_patent	*ln_green_patent*	*ln_green_patent*
cb	0.009***	0.007***	0.008***
	(3.46)	(3.01)	(3.03)
Size		0.150***	0.151***
		(9.63)	(9.70)
*ROA*1		-0.097*	-0.112*
		(-1.65)	(-1.87)
Growth		-0.008	-0.008
		(-1.62)	(-1.64)
Lev		-0.102**	-0.100**
		(-2.40)	(-2.34)
CashFlow		0.005	0.009
		(0.11)	(0.19)
Fixed		0.134**	0.139**
		(2.11)	(2.21)
FirmAge			-0.128
			(-0.98)
Board			0.007
			(0.16)
Indep			0.069
			(0.53)
*Top*1			0.180*
			(1.86)
*TMTPay*1			0.000
			(0.02)
_cons	0.222***	-3.039***	-2.812***
	(26.26)	(-8.94)	(-5.53)
FirmFE	YES	YES	YES
YearFE	YES	YES	YES
N	30601	30601	30601

*Note: ***, **, and * indicate significance at the 1%,5% and 10% levels; the values in parentheses are t statistics.*

	(1)	(2)	(3)
	ln_green_patent	ln_green_patent	ln_green_patent
R^2	0.0592	0.0699	0.0703
*Note: ***, **, and * indicate significance at the 1%,5% and 10% levels; the values in parentheses are t statistics.*			

4.2. Robustness Tests

4.2.1. Instrumental Variable Approach

This study employs an instrumental variable (IV) approach to address potential endogeneity concerns between UIBs issuance by local government financing vehicles and corporate green innovation Wan et al., 2025). First, a constant weight is calculated as the time-invariant mean ratio of the city's interest-bearing debt balance to the total interest-bearing debt balance of its host province. This constant weight is then multiplied by the contemporaneous interest-bearing debt balance of the host province to generate an interaction term. This weighted value serves as the instrumental variable for the city's annual interest-bearing debt balance. This design satisfies the relevance condition through its direct relationship with UIBs, while its construction from provincial aggregates and constant weights supports exogeneity. Empirical tests confirm the exclusion restriction holds, indicating the instrument affects green innovation solely through UIBs exposure.

Equations (2) and (3) present the first-stage and second-stage regression models, respectively. In Eq. (2),. $iv_debt_balance$ denotes the weighted value of the interest-bearing debt balance. The term θ_j represents prefecture-level city fixed effects, an $v_{j,t}$ is the error term. All other variables maintain the same definitions as in Eq. (1). For the second-stage regression in Eq. (3), the key explanatory variable is the fitted value of the UIBs, denoted as $\widehat{cb}$, which is obtained from the first-stage regression. Equations (2) and (3) are shown below.

$$cb_{j,t} = \eta + \delta\, iv_debt_balance_{j,t} + \gamma\, Controls_{j,t} + \theta_j + \mu_i + \lambda_t + v_{j,t}$$

2

$$ln_green_patent_{i,t} = \alpha + \beta_1 \widehat{cb_{j,t}} + \gamma\, Controls_{i,j,t} + \mu_i + \lambda_t + \epsilon_{i,j,t}$$

3

The instrumental variable regression results are presented in Table 3. The first-stage F-statistic of 869.64 confidently rejects the hypothesis of a weak instrument. In the second stage, the estimated coefficient for the instrumented cb is 0.064 and is statistically significant at the 1% level. This positive and significant result suggests that an increase in UIBs issuance is associated with an enhancement in corporate green innovation, even after accounting for potential endogeneity. The model includes a full set of control variables and accounts for both firm and year fixed effects.

Table 3
Two-stage least squares regression results

	(1) Stage I	(2) Stage II
$Variable$	cb	ln_green_patent
cb		0.064***
		(3.36)
$iv_debt_balance$	0.001***	
	(14.32)	
$Controls$	YES	YES
$FirmFE$	YES	YES
$YearFE$	YES	YES
$Kleibergen$ $PaaprkWaldFstatistic$	869.64	-
N	24606	24606
R^2	0.6185	0.0706
*Note: *** indicates significance at the 1% level; the values in parentheses are t statistics.*		

4.2.2. Alternative Clustering of Standard Errors

To mitigate potential bias from omitted variables, we alter the clustering level of standard errors as a robustness check. Following Guo et al. (2025), Column (1) of Table 4 presents results where standard errors are clustered at the city level in the baseline regression. This approach helps account for correlations within cities, such as those arising from geographical location. The estimated coefficient for UIBs remains statistically significant at the 5 percent level, confirming the robustness of our primary finding.

4.2.3. Alternative Measure of the Dependent Variable

In Table 4, Column (2) adopts an alternative metric for corporate green innovation following Zhou and Feng (2025), measuring the share of green invention patents in total patent grants. This structural approach better captures firms' underlying commitment to green technology development. The results maintain a positive and statistically significant relationship with UIBs scale, confirming the fundamental finding persists under this refined measurement.

4.2.4. Altering the Time Window

In Column (3), we modify the sample period by excluding the years 2019 to 2022 to isolate potential confounding effects of the COVID-19 pandemic, which may have substantially impacted corporate green innovation activities. The test results show that the significance and positive sign of the core explanatory variable do not change markedly. This suggests that our baseline Model (1) is well-specified and that the regression results are robust, as supported by Zheng et al. (2025). The coefficient for UIBs scale remains significantly positive, indicating that the promoting effect of bond issuance on corporate green innovation is consistent across different time periods.

4.2.5. One-Period Lag of the Key Variable

Considering potential endogeneity and the possible time lag for UIBs to affect corporate green innovation, we follow Zhang et al. (2025) and lag the UIBs variable by one period. The regression results demonstrate that the impact of UIBs issuance on firm green innovation remains significantly positive after this adjustment. This finding is largely consistent with the baseline regression results, further attesting to their reliability.

4.2.6. Incorporating Additional Control Variables

To isolate the net effect of UIBs issuance on green innovation, we introduce additional city-level control variables. Following Liu et al. (2025), Column (5) of Table 4 includes four such variables: per capita GDP, the share of secondary industry, the share of tertiary industry, and population density. After incorporating these additional controls, the core finding remains unchanged. The coefficient for UIBs in Column (5) is still positive and statistically significant at the 1 percent level. This provides further evidence that the promoting effect of UIBs on corporate green innovation is robust.

Table 4
Robustness test results.

	(1)	(2)	(3)	(4)	(5)
$Variable$	*Clustering to City Level*	$Variable$ $Substitution$	$Adjustment$ $Window$	$Variablelag$ $oneperiod$	$Increase$ $ControlVariables$
cb	0.007**	0.001*	0.007**		0.008***
	(2.16)	(1.70)	(2.48)		(3.02)
cb_lag1				0.007**	
				(2.45)	
$pergdp$					-0.066**
					(-2.10)
industry2					0.003
					(0.74)
$industry3$					0.006
					(1.62)
$density$					-0.043
					(-1.42)
$Controls$	YES	YES	YES	YES	YES
$FirmFE$	YES	YES	YES	YES	YES
$YearFE$	YES	YES	YES	YES	YES
N	30601	30603	17854	25047	30603
R^2	0.0709	0.0037	0.0913	0.0689	0.0710
*Note: ***, **, and * indicate significance at the 1%,5% and 10% levels; the values in parentheses are t statistics.*					

5. Mechanism analysis

Based on the theoretical analysis presented above, it is evident that corporate capability and corporate willingness serve as critical mechanisms through which UIBs issued by financing platforms influence corporate green innovation. This study will empirically test these two distinct mechanistic pathways. Following the approach of Wan et al. (2024), we construct a mechanism test model (4). This model, drawing on methods from recent causal inference literature, regresses the proposed mechanism variables (M) directly on the core explanatory variable (cb). We further examine the transmission channels by analyzing how UIBs issuance affects corporate green innovation through the dual lenses of capability and willingness.

$$M_{i,t} = \alpha + \beta_1 cb_{j,t} + \gamma Controls_{i,j,t} + \mu_i + \lambda_t + \epsilon_{i,t}$$

4

Capacity level

5.1. Fiscal Support Perspective

UIBs strengthen corporate green innovation capacity through fiscal support mechanisms spanning fiscal effort, profitability, and marketization. By enhancing fiscal and market conditions, governments channel bonds to green sectors while boosting corporate earnings and innovation efficiency. This study tests their mediating roles between UIBs and green innovation.

5.1.1. Fiscal Effort

Based on the preceding theoretical analysis, this paper empirically tests the fiscal effort mechanism. Drawing on existing literature (Mertens, 2003), we calculate regional fiscal effort as the difference between actual fiscal revenue and expected fiscal revenue ($finance_effort$). The expected fiscal revenue is estimated using the following model:

$$\frac{General\ Public\ Budget\ Revenue_{it}}{GDP_{it}} = \theta_1 + \theta_2 \ln(GDP_{it}\ per\ capita) + \theta_3 \frac{Industry1\ Output_{it}}{GDP_{it}} + \theta_4 \frac{Industry2\ Output_{it}}{GDP_{it}} + \theta_5 \frac{Total\ Im}{}$$

our specification accounts for the additional city-level control variables introduced in the robustness tests. According to the results in Table 6, the regression result of cb passes the significance test, and the coefficient is positive, indicating that the UIBs enhances the level of financial efforts and thus promotes green innovation of enterprises.

Table 6
finance effort mechanism test

$Variable$	$finance_effort$
cb	0.006***
	(14.85)
$Controls$	YES
$CityFE$	YES
$YearFE$	YES
$_cons$	-1.511***
	(-26.77)
N	2011
R^2	0.7014

*Note: *** indicate significance at the 1% level; the values in parentheses are t statistics.*

5.1.2. Profitability

While receiving financial support through UIBs, a firm's inherent profitability remains a critical factor that influences the ultimate effect on its green innovation by enhancing the conversion efficiency of innovation investments. Following the approach of Yang et al. (2025), this study uses earnings before interest and taxes (EBIT) from financial statements, transformed into logarithmic form, to measure corporate profitability. The results reported in Column (1) of Table 7 show an estimated coefficient for cb of 0.038, which is statistically significant at the 10 percent level. This suggests that the issuance of UIBs enhances corporate profitability, thereby further promoting corporate green innovation.

5.1.3. Marketization Level

In regions with a higher degree of marketization, consumers demonstrate a stronger willingness to pay for green products, and market regulation is more effective at preventing greenwashing. Consequently, firms in these regions exhibit a greater propensity to channel UIBs funds into sustained green innovation efforts. Drawing on Fan et al. (2020), we employ the Fan Gang Marketization Index, specifically utilizing the overall "Marketization Index for Each Region" to measure the marketization level. The results in Column (2) of Table 7 indicate that the estimated coefficient for cb is positive and statistically significant at the 1 percent level. This implies that UIBs issuance contributes to enhancing corporate green innovation capability by fostering a higher degree of marketization.

5.2. Corporate Tax Burden

The corporate tax burden represents a significant channel through which UIBs influence green innovation capability. When these bonds alleviate fiscal pressures, governments gain flexibility to implement tax relief policies that directly enhance firms' disposable capital for green initiatives. Simultaneously, bond-funded infrastructure improvements indirectly reduce operational costs, creating combined fiscal space for environmental innovation. Following Pan et al. (2024), we measure tax burden as net taxes paid relative to total assets. The significantly negative coefficient in Table 7, Column (3) demonstrates that UIBs effectively reduce corporate tax burdens, thereby facilitating green innovation and advancing sustainable development objectives.

5.3 Corporate Burden Shifting

5.3.1. Non-Productive Expenditure

A reduction in non-productive expenditure optimizes capital allocation efficiency. Financial support from UIBs issued by financing platforms enables local governments to undertake infrastructure projects, promoting a reallocation of funds. This shifts resources previously dedicated to redundant administrative expenses towards initiatives such as building green R&D teams and upgrading low-carbon processes, thereby enhancing capital utilization efficiency and injecting resource momentum into green innovation. Based on Yang and He (2025), non-productive expenditure is measured directly using corporate entertainment and travel expenses, adjusted for relativity. The results in Column (4) of Table 7 show a significantly negative coefficient at the 1 percent level following UIBs issuance, indicating suppression of corporate non-productive expenditure. This suggests the mitigation of fiscal fund shortages, thereby encouraging firms to channel more resources into productive construction rather than rent-seeking costs.

5.3.2. Social Security Burden

Following the issuance of UIBs, expanded fiscal revenue sources allow local governments to provide talent subsidies. This helps stabilize corporate cash flow fluctuations, reduces the risk of layoffs within green innovation teams due to cost pressures, secures the human capital support and project continuity essential for green innovation, and ultimately enhances green innovation capability. Following Li et al. (2024), the social security burden is measured by the sum of corporate social security contributions and employee compensation payable, scaled by operating revenue. The results in Column (5) of Table 7 indicate a significantly negative coefficient at the 5 percent level after the issuance of UIBs, suggesting an alleviation of the social security burden. The results for the mechanism variables across these three perspectives confirm hypothesis H1a.

Table 7
Capacity direction mechanism analysis

	(1)	(2)	(3)	(4)	(5)
	$FinancialSupport$		$Corporateburden$	$Corporatepass-throughexpenditure$	
$Variable$	$lnebit$	$market$	$taxburden$	*Unproductive expenditures*	*Social security burden*
cb	0.038*	0.144***	-0.032***	-0.015**	-0.032**
	(1.73)	(8.83)	(-3.20)	(-2.06)	(-2.49)
$Controls$	YES	YES	YES	YES	YES
$FirmFE$	YES	NO	YES	YES	YES
$CityFE$	NO	YES	NO	NO	NO
$YearFE$	YES	YES	YES	YES	YES
$_cons$	-38.393***	-6.054***	-2.755	20.398***	-2.762
	(-7.08)	(-2.69)	(-1.30)	(11.36)	(-1.02)
N	30603	1942	30601	26898	30603
R^2	0.5620	0.7707	0.0764	0.1692	0.0764

*Note: ***, **, and * indicate significance at the 1%,5% and 10% levels; the values in parentheses are t statistics.*

Willingness Level

5.4. Corporate Willingness to Transform

The theoretical analysis posits that the land-financing model, driven by the issuance of UIBs from financing platforms, intensifies competition among local governments for land-based investment. By lowering entry barriers, this model attracts extensive, resource-heavy firms and significantly suppresses corporate willingness to undergo green transformation. This weakened willingness manifests as a relaxation in sustainability-oriented performance and a decay in motivation for green development. This study analyzes this mechanism along two dimensions: first, by measuring long-term transformation motivation through sustainability performance metrics, and second, by quantifying the actual decline in corporate green development intensity. Together, these reveal the pathway through which UIBs issuance inhibits corporate willingness for green transformation by altering land resource allocation.

5.4.1. Sustainability Performance

Existing research often measures sustainability performance through financial performance and environmental-social-responsibility performance. Following the triple bottom line principle of corporate performance, an indicator system is constructed across three dimensions: economic, environmental, and social performance. Furthermore, acknowledging the distinct internal and external characteristics of performance across these dimensions, both internal and external data are utilized to comprehensively measure sustainability performance. Referring to the method of Huang et al. (2025), Return on Assets (ROA) is used to gauge economic performance, and the environmental dimension score (ENV) from the Hua Zheng ESG rating system is employed to measure environmental performance. For social performance (SOC), the social dimension score from the Hua Zheng ESG rating is commonly adopted as a proxy indicator in related research. The results in Column (1) of Table 8 show a statistically significant negative coefficient at the 5 percent level. This indicates that UIBs issuance negatively affects the degree of corporate sustainability from the willingness perspective, thereby impacting the level of corporate green innovation.

5.4.2. Green Development Intensity

We selected environmental performance data from six different ESG rating sources to measure green development intensity. These sources maintain relative consistency in assessment criteria, reference indicators, and coverage. Since different rating agencies employ different scoring scales, we adopted a method from existing literature (Qian et al., 2025) to facilitate comparison and quantify rating divergence. First, ESG ratings were converted into percentile rankings. Subsequently, a min-max normalization method was applied to standardize the ESG scores to a range between 0 and 1. The standard deviation of these standardized scores was then calculated to quantify ESG rating divergence. As shown in Column (2) of Table 8, the regression coefficient for the explanatory variable is negative and statistically significant at the 1 percent level. This suggests that after the issuance of UIBs, the accelerated land competition inherent in the land-financing model suppresses the intensity of corporate green development, further impairing corporate green innovation capability.

The results for these two mechanism variables confirm hypothesis H1b. This provides further support for the view that UIBs issuance, by fueling investment competition and promoting development reliant on land, operates contrary to corporate willingness and ultimately suppresses corporate green innovation.

Table 8
Willingness direction mechanism analysis

	(1)	(2)
$Variable$	*Sustainable Development Index*	*Green Development Degree*
cb	-0.001**	-0.097***
	(-2.07)	(-3.27)
$_cons$	0.160	47.825***
	(1.25)	(11.10)
$Controls$	YES	YES
$FirmFE$	YES	YES
$YearFE$	YES	YES
N	29725	29727
R^2	0.2604	0.0894
*Note: *** and ** indicate significance at the 1%,5% levels; the values in parentheses are t statistics.*		

6. Further Analysis

6.1. Heterogeneity Analysis of the Impact of UIBs on Corporate Green Innovation

6.1.1. Fiscal Pressure

This study examines fiscal pressure using the gap between general public budget expenditure and revenue relative to revenue (Bao et al., 2024). Table 9 reveals UIBs significantly enhance corporate green innovation in high fiscal pressure regions, while showing limited effects in low-pressure areas. The regional disparity stems from differential resource allocation patterns. In fiscally constrained regions, these bonds become essential tools that local governments deliberately channel toward green innovation, strengthening corporate capabilities through improved profitability and marketization. Conversely, areas with comfortable fiscal conditions rely more on conventional subsidies, resulting in weaker targeted effects. This demonstrates how UIBs generate greater marginal benefits for green innovation where fiscal constraints compel more strategic fund allocation.

6.1.2. Property Rights Nature

Ownership structure significantly influences how firms respond to UIBs in green innovation. State-owned enterprises benefit from institutional advantages that align with the policy objectives of these bonds. Their inherent government connections facilitate targeted fund allocation through controlled financing platforms, while policy mandates like carbon reduction targets create strong incentives for green innovation investment. The availability of implicit government guarantees further reduces perceived risks in long-term environmental projects (Yu et al., 2022). In contrast, non-SOEs face different constraints, prioritizing profitability and bearing full responsibility for potential innovation failures, which directs their investment preferences toward shorter-term ventures. Empirical results confirm this divergence. Table 9 shows a statistically significant positive coefficient of 0.014 for SOEs, while non-SOEs demonstrate no significant relationship. This pattern underscores how SOEs' institutional positioning enables them to more effectively utilize UIBs through capability channels, leveraging advantages in fund access, cost management, and risk mitigation to achieve stronger green innovation outcomes.

6.1.3. Green Development Intensity Heterogeneity

The heterogeneity analysis further examines how corporate green development levels shape the effectiveness of UIBs. Following Zhang et al. (2025), we employ an ESG-based green development intensity measure. Table 9 shows firms with high green development intensity exhibit a statistically significant positive coefficient at the 10% level in Column (5), while low-intensity firms in Column (6) demonstrate no significant relationship. This divergence suggests that advanced environmental management capabilities and existing green technology reserves enable high-intensity firms to more effectively absorb and convert bond funds into innovation outputs. Conversely, firms with weaker environmental foundations often lack complementary capacities, resulting in inefficient resource allocation that may even divert funds to non-green purposes, thereby diminishing green innovation outcomes.

6.1.4. Asset Structure Heterogeneity

Fixed asset intensity significantly influences how firms channel UIBs into green innovation. Following Kadzima et al. (2025), we bifurcate the sample by the median fixed asset ratio. Table 9 reveals firms with higher fixed asset ratios demonstrate a statistically significant coefficient at the 5% level in Column (7), whereas low-ratio firms show no significant effect in Column (8). This divergence suggests capital-intensive firms utilize these bonds more effectively for physical upgrades like environmental equipment and low-carbon retrofits, while asset-light firms' innovation—oriented toward intangible R&D—benefits less from such financing, with effectiveness further weakened without tangible asset anchoring.

6.1.5. Bond Attribute Heterogeneity

Green UIBs, whose fund usage is constrained to green projects, can directly address corporate needs for equipment upgrades and technology transformation in green innovation, leading to a more targeted promoting effect (Wang et al., 2022). Based on the research of Okafor et al. (2024), the regression results in Columns (1) and (2) of Table 10 show that both green and non-green UIBs significantly promote corporate green innovation. However, the promoting effect of green UIBs is significantly stronger, with its economic significance outweighing mere statistical significance. The effective fund conversion rate per unit of green UIBs for corporate green innovation is higher, evidenced by an estimated coefficient of 0.086, which is significantly greater than the 0.007 coefficient for non-green bonds. Non-green UIBs are primarily directed towards traditional infrastructure and livelihood projects, with only a portion of funds indirectly spilling over into green innovation areas, diluting their promoting effect. After controlling for year and firm fixed effects along with other variables, the promoting effect of green UIBs on corporate green innovation is approximately 12 times that of non-green bonds. This difference confirms that the green attribute of UIBs is a key factor in enhancing their efficacy for corporate green innovation, providing an empirical basis for optimizing the issuance structure of UIBs and strengthening targeted support through green funds.

Table 9

$Heterogeneity Analysis$

	Financial Pressure Level		$Corporate Attributes$		$Green Development Level$		$Fixed Assets Proportion$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Variable$	Low Level	High Level	$SOEs$	$Non-SOEs$	$HighLevel$	$LowLevel$	$HighRatio$	$LowRatio$
cb	0.007	0.010***	0.014***	0.004	0.007*	0.004	0.009**	0.003
	(1.55)	(2.91)	(2.79)	(1.27)	(1.67)	(1.42)	(2.09)	(0.84)
$Controls$	YES	YES	YES	YES	YES	YES	YES	YES
$FirmFE$	YES	YES	YES	YES	YES	YES	YES	YES
$YearFE$	YES	YES	YES	YES	YES	YES	YES	YES
N	15233	15370	8727	21115	15653	14046	14876	14823
R^2	0.0635	0.0573	0.1154	0.0557	0.0767	0.0432	0.0732	0.0617

*Note: ***, **, and * indicate significance at the 1%,5% and 10% levels; the values in parentheses are t statistics.*

Table 10
Heterogeneity analysis of whether the debt is green

	(1)	(2)
	$GreenUrban InvestmentBond$	Non-$GreenUrban InvestmentBond$
cb	0.086**	0.007***
	(2.21)	(2.88)
$Controls$	YES	YES
$FirmFE$	YES	YES
$YearFE$	YES	YES
N	3362	26337
R^2	0.0401	0.0682

*Note: *** and ** indicate significance at the 1%,5% levels; the values in parentheses are t statistics.*

6.2. Moderating Effects

Theoretical analysis and research hypotheses suggest that government science and technology expenditure, industrial structure upgrading, and government environmental regulation can enhance the promoting effect of UIBs on corporate green innovation capability, exerting positive moderating effects from these three aspects. This study tests these moderating effects based on Model (5), which extends Model (1) by incorporating a moderator variable, $Moderator_{i,t}$, and its interaction term with the core explanatory variable, $cb_{j,t}$. A statistically significant positive coefficient β_3 would indicate that the moderator variable positively moderates the relationship between UIBs issuance and corporate green innovation.

$$ln_green_patent_{i,t} = \alpha + \beta_1 cb_{j,t} + \beta_2 Moderator_{i,t} + \beta_3 cb_{j,t} * Moderator_{i,t} + \gamma Controls_{i,j,t} + \mu_i + \lambda_t + \epsilon_{i,t}$$

5

6.2.1 Science and Technology Expenditure

Industrial structure upgrading can theoretically moderate the impact of UIBs on corporate green innovation by altering the alignment between corporate green innovation demand and the allocation of UIBs. Following Bai and Zheng (2024), this study calculates government science and technology expenditure using data from city statistical yearbooks. The per capita general public budget expenditure on science and technology, transformed into logarithmic form, serves as the proxy variable for fiscal science and technology expenditure. The regression results in Column (1) of Table 12 show that the estimated coefficient for the interaction term between the explanatory variable (cb) and science and technology expenditure ($cb * scienceexpenditure$) is positive and statistically significant at the 1 percent level. This confirms that science and technology expenditure exerts a positive moderating effect on the relationship between UIBs and corporate green innovation.

6.2.2. Industrial Structure Upgrading

Local governments in China play a pivotal role in implementing industrial structure upgrading. As local governments promote industrial structure optimization, green technology innovation, and industrial green transformation, relevant policy support for industrial structure optimization may differentially affect the green innovation of firms of varying sizes and types. Drawing on related research by Dang et al. (2025), industrial structure upgrading is measured by the annual increase in the value-added of the tertiary industry as a proportion of GDP. The regression results in Column (2) of Table 12 indicate that the estimated coefficient for the interaction term between the explanatory variable (cb) and industrial structure $(cb * industry)$ is positive and statistically significant at the 1 percent level. This suggests that industrial structure upgrading positively moderates the relationship between UIBs and corporate green innovation, fostering synergistic development between the two.

6.2.3. Environmental Regulation

Environmental regulation serves as a crucial mechanism for green transformation, balancing ecological protection with technological advancement. Following Chen et al. (2018), we analyze government work reports from 267 prefecture-level cities (2017–2023) through text segmentation and keyword frequency counting, building on Liu et al.'s (2023) framework of environmental dimensions in Table 11.The significantly positive coefficient (1% level) for the $Cb * ER$ interaction term in Table 12 Column (3) demonstrates how environmental regulation strengthens the bond-innovation relationship, revealing the synergistic effect when policy instruments align with financial mechanisms.

Table 11

$Totalwordfrequencyforenvironmentalregulation$

Variables	Indicators	Keywords
ER	$environmentalprotection$	Environmental protection, environment, environmental quality, environmental protection inspectors, pollution prevention, pollution control, greening, green, green development, low carbon, emission reduction, ecology
	$depletionofresources$	water consumption, energy consumption, resources, saving, intensive, energy, new energy, clean energy, coal to electricity, coal to gas, centralized heating, reuse, recycling, renewable
	$environmentalsynergymanagement$	Sustainable, collaborative development, synergistic governance, intersectoral cooperation, coordinated sewage control ,public participation, joint control, joint management, integrated watershed management, regional cooperation, complementary strengths, win-win cooperation, common advancement, protection collaboration, transfer, joint regions
	$other$	Ecological barriers, Water resource preservation, Soil and water preservation, Eco-friendly development, Blue sky and white clouds, Blue water, Clean terrain, Green space, River governor, Lake governor system, Tree planting, Afforestation, Preserve greenery

Table 12
Moderating Effects

	(1)	(2)	(3
$Variable$	ln_green_patent	ln_green_patent	ln_green_patent
cb	0.004	-0.024**	-0.013**
	(1.53)	(-2.48)	(-2.14)
$scienceexpenditure$	0.011		
	(1.60)		
$cb * scienceexpenditure$	0.001***		
	(3.10)		
$Industry$		0.012	
		(1.39)	
$cb * Industry$		0.001***	
		(3.28)	
ER			-0.007**
			(-2.00)
$Cb * ER$			0.003***
			(3.44)
$Controls$	YES	YES	YES
$FirmFE$	YES	YES	YES
$YearFE$	YES	YES	YES
N	30603	30603	30603
R^2	0.0612	0.0608	0.0605
*Note: *** and ** indicate significance at the 1%,5% levels; the values in parentheses are t statistics.*			

6.3. Green Innovation Strategies

The empirical results of Table 13 reveals a notable divergence in how UIBs affect different forms of green innovation. Column (1) demonstrates a statistically significant negative relationship with strategic green innovation, confirming the suppressing effect through the willingness channel (Li et al., 2025). Conversely, Column (2) shows the positive relationship with substantive innovation observed in baseline regressions, highlighting the parallel operation of the capability mechanism. This clear distinction between innovation types provides compelling evidence of the competing transmission channels, substantially enriching our understanding of the complex relationship.

Table 13
Corporate Green Innovation Strategy

	(1)	(2)
	Strategic Green Innovation	*Substantive Green Innovation*
cb	-0.004**	0.008***
	(-2.24)	(3.03)
$Controls$	YES	YES
$FirmFE$	YES	YES
$YearFE$	YES	YES
N	30603	30603
R^2	0.0170	0.0703
*Note: *** and ** indicate significance at the 1%,5% levels; the values in parentheses are t statistics.*		

7. Conclusion and Policy Implications

Corporate green innovation constitutes a series of market-oriented decisions and practices undertaken primarily under the constraints and incentives of market mechanisms, aiming to achieve synergy between self-interest and green value. UIBs issued by financing platforms represent a significant financial instrument, and their impact effect and internal mechanism on corporate green innovation capability have increasingly become a focus of academic attention. This study examines how UIBs shape corporate green innovation using A-share listed firms from 2017–2023. Results indicate these bonds enhance green innovation capability while suppressing innovation willingness, with findings robust to various checks. The positive effect operates primarily through the capability channel, whereas the willingness channel exerts a constraining influence. Heterogeneity analysis reveals stronger effects among state-owned enterprises, firms in high fiscal pressure regions, those with advanced green development foundations, higher fixed asset ratios, and where bonds carry green certification. Further evidence shows technological expenditure, industrial upgrading and environmental regulation positively moderate this relationship, while strategic green innovation outcomes corroborate the willingness channel's inhibitory role.

Based on the above conclusions, this paper proposes four policy recommendations. First, optimize the issuance structure of UIBs and strengthen the targeting of funds. Expand the scale of green UIBs. Given that the promoting effect of green UIBs on corporate green innovation is significantly higher than that of non-green bonds, local financing platforms should be guided to prioritize issuing green UIBs, explicitly directing funds towards green innovation areas such as environmental protection equipment upgrades and low-carbon process retrofits.

Second, enhancing corporate capabilities requires coordinated fiscal and tax measures. Local governments should align UIBs with tax incentives such as value-added tax rebates and green R&D deductions. Bond funds can simultaneously ease human resource costs through social security contribution reductions and streamline administrative overhead by improving public services. Furthermore, developing green product pricing mechanisms and environmental rights markets through these funds enables firms to monetize innovation outcomes via market premiums and carbon quota trading, thus strengthening endogenous innovation incentives.

Third, regulate land resource allocation to mitigate the suppression of corporate willingness. Curb competition among local governments based on land-for-investment. Establish an assessment mechanism that links land conveyance to green innovation performance. Restrict local government "race to the bottom" practices, such as attracting energy-intensive firms through low-priced industrial land transfers. Guide UIBs funds away from "land development" and towards "green industry construction."

Fourth, policy coordination should amplify positive effects. Elevate technological spending within bond allocations to support green R&D platforms and university-industry partnerships. Direct funds toward tertiary sectors while strengthening green supply chain infrastructure to boost innovation synergy through industrial clustering. Simultaneously, refine environmental regulations with clearer emission standards and expand market mechanisms like pollution credit trading, creating complementary constraint & incentive systems.

Declarations

Ethical statements

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Informed consent

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Author Contribution

All authors have made substantial intellectual contributions to this work. W was primarily responsible for the conceptualization of the research framework and the development of the theoretical hypotheses. He designed the methodology, performed the formal analysis, and curated the datasets related to urban investment bonds and city-level macroeconomic indicators. H conducted the robustness checks, including the instrumental variable approach and alternative model specifications, and wrote the original draft of the manuscript.W contributed to the investigation and validation processes, with a specific focus on the data pertaining to corporate green innovation and firm-level financial metrics. H developed the software scripts for data processing and econometric analysis, and was responsible for the visualization of the results, including the creation of figures and tables. W played a key role in the review and editing of the manuscript, providing critical revisions for intellectual content, and managed the project administration and funding acquisition.Both authors discussed the results, reviewed the final manuscript, and approved the submitted version.

Data Availability

The data generated and analyzed during this study are not publicly available due to the sensitive nature of information related to China's implicit debt. A de-identified dataset can be provided upon reasonable request by contacting the corresponding author via hezeyu0112@163.com. We are committed to cooperating with responsible data-sharing inquiries while ensuring confidentiality and compliance.

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Figures

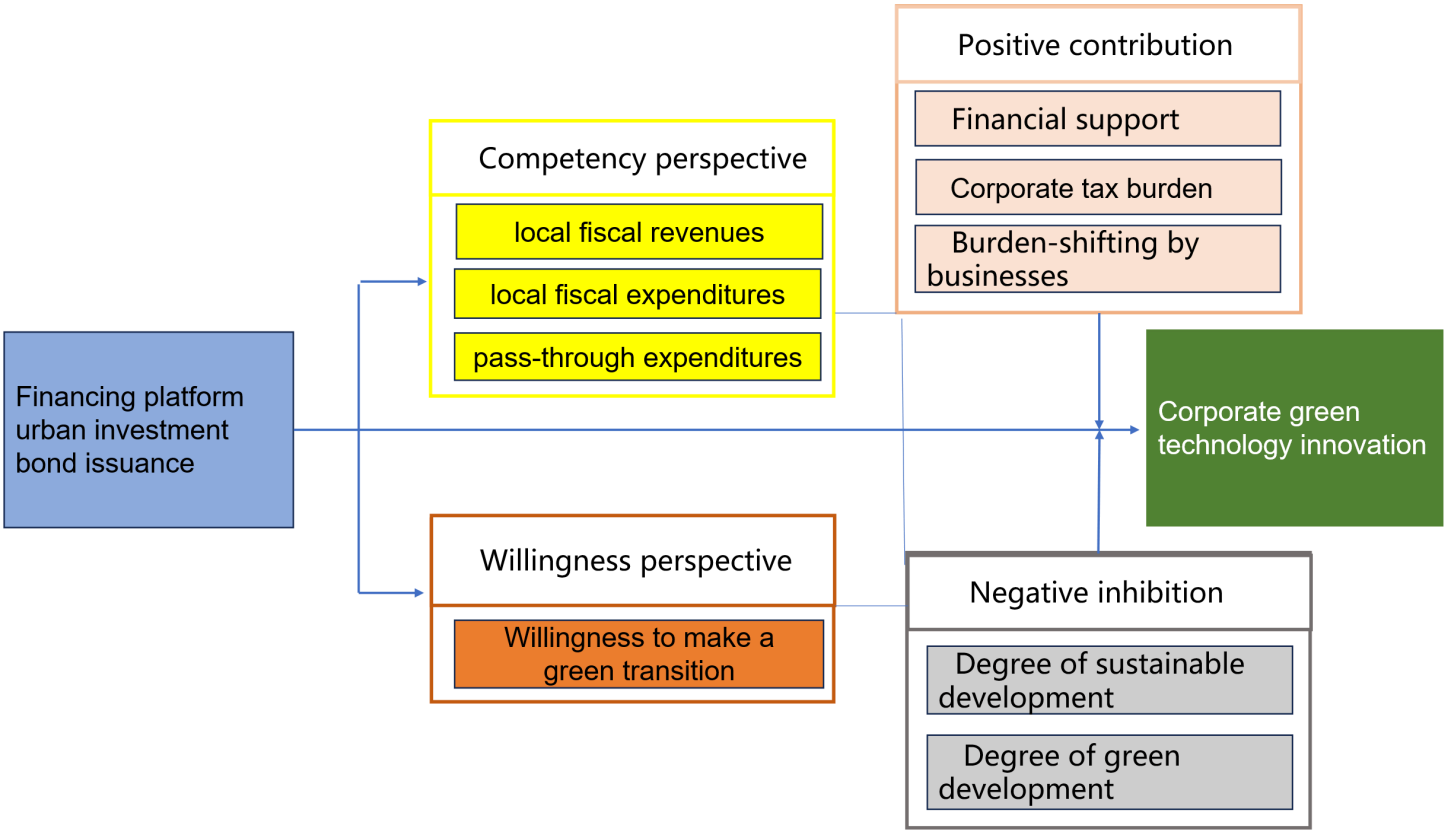


Figure 1

Pathways for UIBs to corporate green innovation