

A Study on the Green Innovation Effects of Local Government Debt Governance

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| Received: 13.08.2026 | Accepted: 24.10.2026 | Published: 29.10.2026

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Abstract

Original Research Article

The paper empirically examines the impact of local government debt governance on corporate green innovation and its underlying mechanisms by using data on cities and A-shares listed on the Shanghai and Shenzhen stock exchanges from 2009 to 2024. The research shows that local government debt governance can enhance significantly corporate green innovation. The mechanisms tests indicate that local government debt governance promotes corporate green innovation by increasing the credit funds availability and the short-term financial assets allocation. Heterogeneity analysis reveals that the positive effect of local government debt governance on green innovation is more pronounced in state-owned enterprises, firms whose directors, supervisors, and senior management have a financial background, and firms without internal control deficiencies.

Keywords: Local government debt governance, corporate green innovation, credit funds availability, financial asset allocation.

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1 INTRODUCTION

Firm, as key micro-level actors, plays a vital role in deepening the innovation-driven development strategy and achieving higher-quality economic growth. In particular, corporate green innovation is an indispensable path toward promoting high-quality economic development, building a modern economic system, and achieving high-level ecological development. Although green innovation is regarded as an effective measure for firms to achieve a “win-win” outcome in terms of economic efficiency and environmental protection, green innovation activities generally involve long cycles, substantial investment, and high risks.

In recent years, scholars have conducted extensive research to explain the mechanisms for corporate green innovation. The resource-based view posits that firms should increase investment in intangible assets to enhance a firm’s sustainable competitive advantage. The ecological innovation theory posits that firms should integrate environmental issues into their corporate strategies through innovations in products and processes to gain a competitive advantage. Porter hypothesis suggests that strict environmental regulations will drive green innovation and improve environmental performance. However, corporate green innovation is a

systemic endeavor. Although these theoretical hypotheses explain the occurrence of corporate green innovation from the perspectives of resources, ecology, and environmental regulations, they overlook the fact that local government debt governance may also influence corporate green innovation. Local government debt governance, as a means of constraining government behavior, not only helps mitigate the credit crowding-out effect of the government, but also influences the efficiency of resource allocation in the real economy.

Previous studies have shown that an increase in local government debt will lead to difficulties and higher costs in corporate financing by intensifying competition for capital between the government and enterprises, thereby inhibit corporate innovation. Conversely, the better the governance of local government debt, the lower the credit crowding-out effect on enterprises, which may increase corporate innovation output. In other words, local government debt governance may contribute to enhancing corporate green innovation. Based on the above analysis, this paper hypothesizes that local government debt governance may influence corporate green innovation. However, few studies have examined the relationship between local government debt governance and corporate green innovation, and the underlying mechanisms have yet to be elucidated.

This paper makes two main contributions. First, the paper enhances the economic effects of local government debt governance. Previous research has shown that the expansion of local government debt may suppress firms' willingness to innovate by credit crowding out. However, This study of the paper finds that local government debt governance helps enhance corporate green innovation. Second, this paper identifies the credit funds availability as the mechanism in local government debt governance on corporate green innovation. Given that funding is a key factor for corporate green innovation, this paper further examines the impact of local government debt governance on the credit funds availability. The findings reveal that local government debt governance helps improve the credit funds availability for firms. Finally, the paper finds that the relationship between local government debt governance and financial asset allocation is a double-edged sword, featuring both a "reservoir effect" and a "crowding-out effect."

2 Literature Review, Theoretical Analysis, and Research Hypotheses

2.1 Literature Review

(1) Research on corporate green innovation. The micro-level factors, such as corporate governance (Amore and Bennesen, 2016), green organizational identity (Chang and Chen, 2013), green innovation strategy (Song and Yu, 2018), influence the level of green innovation in firms. At the macro level, factors such as artificial intelligence (Song et.al, 2025), digital development (Li et.al, 2023), and environmental policy (Zhang et.al, 2022) also affect corporate green innovation. Meanwhile, the economic consequences of corporate green innovation have attracted widespread interest among scholars. Firms that can provide green products and services in an environmentally friendly manner are better positioned to gain a competitive advantage (Weng et.al, 2015).

(2) Research on local government debt governance. Existing research indicates that local government debt governance has significant implications for carbon emissions (Zheng et.al, 2025), economic development (Wang et.al, 2026), employment (Xiao et.al, 2026), and corporate ESG performance (Cai et.al, 2025). Local government debt governance helps reduce financing constraints for firms and alleviate financing costs (Cai et.al, 2025). When local government debt is low, increasing government debt helps promote economic growth and high-quality economic development. However, when local government debt is high, increasing government debt will inhibit economic growth (Cui et.al, 2025). As local government debt continues to grow, the expansion of government debt will amplify financial risks in neighboring regions, leading to systemic financial risks.

The above literature indicates that, although existing studies have achieved certain results in the area

of "local government debt governance and corporate green innovation", there are still some research gaps that warrant further investigation. First, existing research has not yet examined the relationship between local government debt governance and firm characteristics such as corporate green innovation, access to financing, and financial asset allocation. Second, Existing research has not yet examined the impact path of local government debt governance on corporate green innovation from the perspectives of financing availability and financial asset allocation.

2.2 Theoretical Analysis and Research Hypotheses

2.2.1 Channels for Credit Funds Availability

China launched a 4 trillion fiscal stimulus package in 2008 in order to address the global financial crisis and stimulate economic growth. In response to the central government's call, local governments have engaged in debt financing through local financing platforms and shadow banking, leading to an unexpected surge in local government debt. The continued rise in local government debt not only poses the risk of systemic financial instability, but also further exacerbates credit frictions, and reduces bank lending to enterprises. After 2014, China implemented the "Opinions on Strengthening the Management of Local Government Debt" plan, which prohibited local governments obtaining funds through financing platform companies (Cai et.al, 2025). The implementation of this plan alleviated, to some extent, the crowding-out effect of local government borrowing on corporate credit (Zheng et.al, 2025). In view of this, the paper posits that local government debt governance can reduce the crowding-out of corporate credit resources by local governments, thereby promoting corporate green innovation. Based on this, this paper proposes the following hypotheses.

H1 Local government debt governance can promote corporate green innovation by improving credit funds availability

2.2.2 Channels for Financial Asset Allocation

In recent years, China has repeatedly emphasized the need to focus economic development efforts on the real economy, and avoid the phenomenon of firms "shifting away from the real economy toward the financial sector". In theory, local government debt governance can promote corporate green innovation through the "reservoir effect". When local governments increase their debt levels, they will crowd out corporate credit, thereby inhibiting corporate green innovation.

With the implementation of the local government debt management system reforms, the credit crowding-out effect will be alleviated (Cai et.al, 2025). This will prompt firms to increase their allocation to trading financial assets to generate short-term returns, thereby fostering green innovation initiatives. Conversely, if firms, motivated by arbitrage opportunities to earn returns on long-term financial

assets, allocate most of their funds to long-term financial assets such as derivatives and real estate and so on, this will crowd out funding for green innovation, leading to insufficient green innovation efforts. Based on this, this paper proposes the following hypotheses.

H2 Local government debt governance can promote corporate green innovation through the Reservoir Effect
H3 Local government debt governance can inhibit corporate green innovation through the Crowding-Out Effect

3 Data Sources and Research Design

3.1 Data Sources

This paper uses city and companies listed on the Shanghai and Shenzhen A-share markets from 2009 to 2024 as the research sample. The sample was then

processed as follows. (1) Exclude ST-classified listed companies. (2) Exclude samples from relatively specialized industries, such as the financial sector. (3) Exclude samples with missing values for key variables. Meanwhile, all continuous variables were trimmed at the top and bottom 1% levels in order to avoid the potential impact of outliers on the empirical results. After these adjustments, a final sample of 42,400 annual observations was obtained. The data samples primarily sourced from the CSMAR and CNRDS databases.

3.2 Research Design

To examine whether local government debt governance affects corporate green innovation and its underlying mechanisms, the following econometric model was developed.

$$Green_{it} = \beta_0 + \beta_1 \times LGDG_{it} + \beta \times Controls_{it} + firm_i + year_t + \mu_{it} \quad (1)$$

$$CFA_{it} = \beta_0 + \beta_1 \times LGDG_{it} + \beta \times Controls_{it} + firm_i + year_t + \mu_{it} \quad (2)$$

$$FFA_{it} = \beta_0 + \beta_1 \times LGDG_{it} + \beta \times Controls_{it} + firm_i + year_t + \mu_{it} \quad (3)$$

Where, “Green” refers to corporate green innovation, measured by the number of green inventions for which a firm filed independent applications during the year. Following the approach taken in previous literature, this study uses the green patent codes listed in the “International Patent Classification Green List” established by the World Intellectual Property Organization. Based on searches of data from the China National Intellectual Property Administration and cross-referencing with the CNRDS database, the number of green patent applications for firm is identified.

LGDG serves as a proxy variable for local government debt governance, measured by the Treat $\times$ Post interaction term. If a city is one of the 10 pilot cities and provinces—Shanghai, Beijing, Zhejiang, Guangdong, Jiangsu, Shandong, Jiangxi, Ningxia, Qingdao, and Shenzhen—participating in the reform of the local government debt system under the “self-issued, self-repaid” bond program, Treat is set to 1, otherwise, it is 0. Post uses Document No. 43 of the 2014 “New Budget Law” as the policy shock point. If the year is before 2014, the Post value is 0, otherwise, it is 1.

“Controls” refers to a set of control variables. Following the approach in previous literature, the following variables were controlled. SIZE, firm size, is measured by the natural logarithm of assets. LEV, debt repayment capacity, is measured by the debt-to-equity ratio. CASH, cash flow capacity, is measured by net cash flow from operating activities divided by total assets. BAL, degree of equity oversight, is measured by the sum of the 2-5th shareholdings divided by the largest shareholder. DEN, labor intensity, is measured by the number of employees divided by total assets. TAN,

proportion of tangible assets, is measured by tangible assets divided by total assets. DUAL, dual roles, is Determined whether the Chairman and the General Manager are the same person. if they are one, the value is 1, otherwise, it is 0. BOA, board size, is measured by the sum of board number. IDR, proportion of independent directors, is measured by the number of independent directors divided by total board members. AGE, management average age, is measured by the natural logarithm of the average age of the board of directors, supervisors, and senior management. In addition, firm and year fixed effects were controlled.

CFA refers to the credit funds availability, measured by the proportion of bank loans. The greater the amount of bank loans a firm can obtain, the higher its financing availability. FAA refers to financial asset allocation, measured by the ratio of financial assets divided by total assets. Financial assets include trading financial assets, held-to-maturity investments, derivative financial assets, loans and advances, available-for-sale financial assets, and investment in real estate.

4. ANALYSIS OF EMPIRICAL RESULTS

4.1 Descriptive Statistical Analysis

Table 1 presents the descriptive statistics for the main variables in this study. The results show that the mean value for corporate green innovation (Green) is 0.8161, with a minimum of 0 and a maximum of 23, indicating a certain degree of variation among firms. The mean for local government debt governance (LGDG) was 0.4805, indicating that the sample covered nearly 50% of the cities involved in debt governance. Regarding the control variables, the means for SIZE, LEV, and CASH were consistent with the actual characteristics of

listed companies, and did not exhibit any significant anomalies.

Table 1: The descriptive statistical analysis results

	N	Mean	SD	Min	P25	P50	P75	Max
Green	42400	0.8161	3.0327	0.0000	0.0000	0.0000	0.0000	23.000
LGDG	42400	0.4805	0.4996	0.0000	0.0000	0.0000	1.0000	1.0000
SIZE	42400	22.186	1.3034	19.739	21.253	21.984	22.922	26.245
LEV	42400	0.4205	0.2137	0.0502	0.2480	0.4091	0.5765	0.9511
CASH	42400	0.0461	0.0691	-0.1651	0.0077	0.0459	0.0865	0.2396
BAL	42400	0.7360	0.5981	0.0293	0.2646	0.5782	1.0530	2.7199
DEN	42400	1.3236	1.1099	0.0636	0.5804	1.0476	1.7119	6.5243
TAN	42400	0.9315	0.0832	0.5402	0.9194	0.9592	0.9805	1.0000
DUAL	42400	0.2987	0.4577	0.0000	0.0000	0.0000	1.0000	1.0000
BOA	42400	8.4542	1.6421	5.0000	7.0000	9.0000	9.0000	14.000
IDR	42400	0.9230	0.0882	0.3333	0.3333	0.3636	0.4286	0.5714
AGE	42400	3.8967	0.0676	3.5743	3.8533	3.9005	3.9435	4.1366
CFA	29409	0.1231	0.1471	0.0000	0.0051	0.0707	0.1838	0.6548
FAA	42400	0.0491	0.0947	0.0000	0.0001	0.0088	0.0521	0.4672

4.2 Baseline Regression Results

Table 2 presents the results of the baseline regression in this paper. The first column shows the results without control variables. The second column shows the results with control variables but without controlling for annual fixed effects. The third column shows the results with control variables and control for both firm-specific and annual effects. As shown in the

first column of Table 2, the regression coefficient for LGDG is 0.1972 at the 1% significance level. Meanwhile, the results in the third column reveals that the regression coefficient for LGDG remains significantly positive at the 1% level, indicating that local government debt governance can significantly enhance corporate green innovation.

Table 2: The baseline regression results

	Green	Green	Green
	(1)	(2)	(3)
LGDG	0.1972*** (4.4779)	0.2962*** (8.8890)	0.1822*** (4.1273)
Controls	NO	YES	YES
cons	0.7213*** (31.487)	-7.0364*** (-7.0790)	-3.5645*** (-3.1126)
Observations	42400	42400	42400
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	NO	YES
F Statistics	20.05***	50.88***	9.84***
Adj.R2	0.6454	0.6447	0.6461

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The numbers in parentheses are t-values.

4.3 Robustness Tests

To ensure the reliability of the empirical findings in this paper, the following robustness tests were conducted. First, the dependent variable was replaced with the number of independently filed green utility model applications in the same year as a proxy for corporate green innovation. The results are presented in Table 3 (1). Second, the robust standard errors were adjusted by clustering them into individual robust standard errors. The results are presented in Table 3 (2). Third, to exclude the impact of the COVID-19 pandemic,

the data from 2020 onward were removed, and the results are shown in Table 3 (3). Fourth, to eliminate the influence of the municipalities directly under the central government, the samples from Beijing, Shanghai, Tianjin, and Chongqing were removed. The results are shown in Table 3 (4). As can be seen from the results in Table 3, the coefficient for local government debt governance remains significantly positive at the 5% level, indicating that the conclusions of this study are robust.

Table 3: The robustness tests results

	(1)	(2)	(3)	(4)
LGDG	0.2753*** (2.9996)	0.1822** (2.0156)	0.1104** (2.4481)	0.1305*** (2.7663)
Controls	YES	YES	YES	YES
cons	-12.574*** (-5.2829)	-3.5645 (-1.4919)	-3.6342** (-2.4685)	-1.8601 (-0.8283)
Observations	42400	42400	23522	28112
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
F Statistics	5.51***	3.30***	3.28***	3.17***
Adj.R2	0.4829	0.6461	0.6625	0.6227

5 Analysis of the Influence Mechanism

5.1 Credit Fund Accessibility Tests

Previous literature suggests that local government debt governance helps mitigate the credit crowding-out effect, thereby facilitating greater access to credit funds for firms. Therefore, the paper examines the impact of local government debt governance on credit funds availability. Meanwhile, this study further categorizes bank loans into long-term loans (LCFA) and short-term loans (SCFA). This is done to examine through which loan type—long-term or short-term—local government debt governance promotes corporate

green innovation. Table 4 presents the regression results on the impact of local government debt governance on credit funds availability. As shown in the first column of Table 4, the coefficient for LGDG is significantly positive at the 1% level, indicating that local government debt governance helps improve credit funds availability. Looking further the results at the second and third columns, the paper shows that local government debt governance can promote more corporate green innovation by increasing both short-term and long-term credit funds.

Table 4: The credit fund accessibility test results

	CFA (1)	SCFA (2)	LCFA (3)
LGDG	0.0049** (1.9679)	0.5575*** (5.5209)	0.8876*** (6.9544)
Controls	YES	YES	YES
cons	-0.2874*** (-3.9948)	-35.431*** (-12.971)	-54.290*** (-14.896)
Observations	29140	35817	29140
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
F Statistics	128.11***	468.20***	434.84***
Adj.R2	0.6135	0.5637	0.6736

5.2 Financial Asset Allocation test results

The better a firm's financial asset allocation, the more effectively it can utilize various resources, thereby promoting green innovation. To this end, the paper examines whether local government debt governance can optimize financial asset allocation, thereby promote corporate green innovation. Table 5 presents the results regarding the impact of local government debt governance on firms' financial asset allocation. The first column shows the impact of local government debt governance on firms' total financial asset allocation (FAA, measured as the ratio of financial assets held to total assets). The second column presents the results regarding the impact of local government debt governance on firms' short-term financial asset allocation (SFAA, measured as the ratio of trading financial assets to total assets). The third column presents the results regarding the impact of local government debt

governance on firms' long-term financial asset allocation (LFAA, measured as the ratio of financial assets excluding trading financial assets to total assets). As shown in Table 5, in the short term, local government debt governance can encourage firms to increase their allocation to short-term financial assets, which helps boost their short-term investment returns and promotes green innovation. However, in the long term, local government debt governance will lead firms to shift resources from the real economy to the financial sector, reducing funding for the real economy, and resulting in a decline in green innovation. It is evident that the affect of local government debt management on corporate green innovation by financial asset allocation is a double-edged sword. In the short term, it provides funding for corporate green innovation, but in the long term, it will crowd out funding.

Table 5: The financial asset allocation test results

	FAA	SFAA	LFFA
	(1)	(2)	(3)
LGDG	0.0132*** (9.5763)	0.0062*** (6.0108)	0.0073*** (7.4122)
Controls	YES	YES	YES
cons	-0.1116*** (-3.1019)	-0.0784*** (-2.8897)	-0.0351 (-1.3687)
Observations	42400	42400	42400
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
F Statistics	59.93***	34.94***	39.14***
Adj.R2	0.5802	0.5983	0.5886

6 Extensive Analysis

6.1 Heterogeneity Analysis in ownership structures

Firms with different ownership structures have distinct business objectives and sources of funding. Theoretically, compared to private enterprises, state-owned enterprises (SOEs) have a government background and enjoy greater advantages in terms of information exchange and trust with bank financial institutions. Therefore, when local government debt governance improves and the crowding-out effect of credit is alleviated, SOEs are better positioned to secure capital injections from banks, thereby improving

corporate green innovation. Table 6 reports the effects of local government debt governance on corporate green innovation across different ownership structures. The results show that the coefficients for local government debt governance are 0.3554 for state-owned enterprises and 0.0913 for private enterprises. The former is significant at the 1% level, while the latter is not significant at the 10% level, indicating that the promotional effect of local government debt governance on green innovation is more pronounced in state-owned enterprises.

Table 6: The different ownership structures results

	State-owned enterprises	Private enterprises
	(1)	(2)
LGDG	0.3554*** (4.7909)	0.0913 (1.5866)
Controls	YES	YES
cons	3.3082 (1.3567)	-8.8286*** (-6.7403)
Observations	15090	27261
Firm fixed effects	YES	YES
Year fixed effects	YES	YES
F Statistics	4.86***	14.27***
Adj.R2	0.6828	0.6270

6.2 Heterogeneity Analysis in financial background

Financial background represents one's professional experience. More importantly, it reflects sensitivity to market dynamics. Executives with financial background have a deeper understanding of how capital markets operate and what investors need. As a result, they are more likely to view green innovation as a long-term reputation strategy rather than merely a compliance obligation under national market regulations. Table 7 reports the effects of local government debt governance on corporate green innovation under different financial backgrounds. Specifically, if any one of the chairperson, directors, or supervisors has a financial background, the

firm is classified as having a financial background, otherwise, it is classified as having no financial background. The results show that the coefficients for local government debt governance are 0.2608 and 0.1075 for firms with and without a financial background, respectively. The former is significant at the 1% level, while the latter is not significant at the 10% level, indicating that the promotional effect of local government debt governance on green innovation is more pronounced in firms where the member of the board of directors, supervisors, and senior management has a financial background.

Table 7: The different financial background results

	Financial background-Yes	Financial background-No
	(1)	(2)
LGDG	0.2608*** (4.7261)	0.1075 (1.5866)
Controls	YES	YES
cons	-5.2708*** (-3.5606)	0.2588 (0.1117)
Observations	26700	13751
Firm fixed effects	YES	YES
Year fixed effects	YES	YES
F Statistics	7.46***	4.27***
Adj.R2	0.6849	0.5744

6.3 Heterogeneity Analysis in Internal Control level

Internal controls serve as a crucial tool for corporate governance. Strong internal controls can curb managerial short-sighted behavior and over-investment in innovation resulting from agency problems. Meanwhile, sound internal controls can also facilitate a firm's access to external financing, thereby providing financial support for green R&D. Thus, the level of internal controls may also influence the relationship between local government debt governance and corporate green innovation. Table 8 reports the effects of local government debt governance and corporate green

innovation under different internal control levels. The presence or absence of internal control deficiencies is derived from the CSMAR database. The results show that the coefficients for local government debt governance are 0.1599 and 0.1911 for firms with and without internal control deficiencies, respectively. The former is not significant at the 10% level, while the latter is significant at the 1% level. These findings indicate that the positive effect of local government debt governance on green innovation is primarily observed in firms without internal control deficiencies.

Table 8: The different internal control level results

	Internal control-bad	Internal control-good
	(1)	(2)
LGDG	0.1599 (0.4010)	0.1911*** (3.5439)
Controls	YES	YES
cons	-20.315** (-2.0506)	-4.8239*** (-3.6018)
Observations	309	30057
Firm fixed effects	YES	YES
Year fixed effects	YES	YES
F Statistics	2.52***	9.53***
Adj.R2	0.3445	0.6160

7 CONCLUSIONS AND IMPLICATIONS

The central government has successively issued numerous implementations plans for local government debt governance in order to better support corporate financing and innovation. This paper examines the relationship between local government debt governance and corporate green innovation, using a sample of A-share listed companies on the Shanghai and Shenzhen stock exchanges and urban debt reforms from 2009 to 2024. The research findings indicate that local government debt governance helps enhance corporate green innovation. Local government debt governance influences corporate green innovation through credit funds availability and financial asset allocation. The effect of local government debt governance on green innovation varies across different ownership structures, financial backgrounds, and internal control scenarios.

Based on the findings of this paper, the following policy implications are proposed. On the one hand, the government should strengthen quota management and budgetary constraints, strictly control new debt issuance and resolve existing debt, promote market-based financing, regulate urban investment platforms, eliminate implicit government guarantees, establish a comprehensive debt monitoring and risk early-warning mechanism, and implement lifelong accountability. On the other hand, the government should guide financial institutions to streamline their approval processes. Financial institutions can use big data and AI to assist with approvals, implement differentiated authorization, reduce the time required to process low-risk transactions, and improve approval efficiency. Finally, firms should proactively share information with external stakeholders to alleviate

information asymmetry. For example, firms can ensure that the financial statements disclosed to banks are accurate and transparent by standardizing financial accounting practices, thereby securing bank loans. Meanwhile, firms must actively impel their digital transformation, replacing traditional reports with traceable real-time data to reduce search costs for external investors and banks.

Funding

This research was supported by the ①Jiangxi Department of Education Science and Technology Project (General Program) “Local Government Debt Governance, Corporate Financial Behavior, and Corporate Green Innovation” (GJJ2400408), and ②Jiangxi Management Science Program “A Study on Improving the Institutional Mechanisms for a Virtuous Cycle Among Science and Technology, Industry, and Finance in Jiangxi Province—Science and Technology Insurance” (20262BAA100024)

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