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Original Paper

Debt Governance Spillovers: How Local Government Financing affects Enterprise Green Transformation

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Abstract

This study conducts quasi-natural experiment based on local government debt governance launched in China in 2015. Employing a progressive difference-in-differences (DID) approach, this study matches data from Chinese-listed enterprises from 2010 to 2019 to evaluate the effect of the local government debt governance on enterprise green transformation. Findings indicate that debt governance significantly promotes the green transformation of enterprises. This conclusion remains robust after multiple robustness tests. Mechanism analysis reveals that debt governance enables the green transformation of enterprises by alleviating overcapacity. Heterogeneity analysis shows that debt governance significantly promotes the green transformation of enterprises in cities with advanced industrial structures, environmental priorities, non-resource-based economies, and among non-state-owned and technology-intensive enterprises. This study offers valuable insights for countries managing public debt while promoting green transformation among enterprises.

Keywords

Local government debt governance, Enterprise green transformation, Overcapacity

JEL CLASSIFICATION: H63; Q56; L52; E62; O13

1. Introduction

Green development is an important topic of global concern, and The Chinese government is actively committed to green transformation. Therefore, promoting the green transformation of enterprises has become the focus of China's modern governance. What is the green transformation of enterprises? Based on efficiency theory and institutional theory, Zhang et al. (2024) and Yang and Yi (2023) all believe that the green transformation of enterprises is mainly manifested in carbon emission reduction management and green innovation. The green transformation of enterprises is influenced by micro and

macro factors (Taghizadeh & Zhao, 2025; Lu et al., 2025), and government behavior is an important aspect that affects the green transformation of enterprises (Akhtaruzzaman et al., 2025; Liu & Li, 2025). Therefore, the relationship between local government behavior and green transition has become an issue worthy of concern.

Local government debt governance is an important component of China's fiscal reform. This institutional innovation has demonstrated significant efficacy in enhancing the allocative efficiency of debt capital while simultaneously fostering a conducive policy ecosystem for facilitating the green transition. This study examines how local government debt governance affects the green transformation of enterprises in China. Understanding this relationship is important because reducing the adverse impact of government actions on business entities and promoting green development of enterprises are the key issues that many economies.

Two streams of literatures align with this topic. First, past research has identified factors affecting green transformation, such as environmental regulations, fintech, digitalization, fiscal incentives, and corporate social responsibility. Tang et al. (2023) and Yu et al. (2021) find that environmental regulations encourage enterprise green R&D while accelerating green transformation. Tian et al. (2023) note that fintech can strengthen enterprise green innovation. Berikhanovna et al. (2023) and Ali et al. (2024) emphasize that green financial policies, e.g., concessional loans and low-interest services, can encourage green innovation. Furthermore, Hunjra et al. (2024) note that big data pilot zones can stimulate low-carbon innovation. Chishti et al. (2024; 2025) find that AI and green ICT foster energy transformation. Gramkow and Anger-Kraavi (2018) suggest that fiscal incentives can reduce enterprise financing constraints, thereby supporting green transformation. Moreover, Achi et al. (2022) find that green innovation is driven by CSR disclosure through external oversight and market incentives. Additionally, some scholars have focused on leadership characteristics. For example, Tawiah et al. (2024) observe that returnee executives facilitate green innovation by sharing cross-border green knowledge. Nonetheless, to our knowledge, no prior studies have examined how the local government debt governance influences the green transformation of enterprises. As such, the present study examines whether local government debt governance encourages enterprise green transformation while identifying its underlying mechanisms.

Second, past research prioritizes the microeconomic effects of China’s local government debt governance. Chinese scholars indicate that local government debt governance relieves enterprise financing constraints. For instance, Deng et al. (2023) report higher post-reform enterprise leverage ratios, signaling improvements in financing conditions. Liu et al. (2022) find that debt governance significantly improves the maturity mismatch between enterprise investment and financing, thereby enhancing capital efficiency. Wang and Liang (2023) suggest that debt governance reduces debt default risk for private infrastructure firms, thereby stabilizing the private economy. Moreover, debt governance has positively influenced various aspects of enterprise development. Huang et al. (2023) find that debt governance redirected enterprise investments from financial to real assets, stimulating the

real economy. Li et al. (2023) and Hu et al. (2022) also find that debt governance, advanced enterprise digitalization, and human capital upgrading improve competitiveness and innovation. Zhang and Kuang (2021) demonstrate that debt governance enhance enterprise technological innovation and supports sustainable growth. These studies elucidate how company growth is impacted by the local government debt governance. However, the relationships between enterprise green transformation and local government debt governance remain underexplored. This study from the perspective of overcapacity, focusing on how the local government debt governance influences the green transformation of enterprises. This study identifies that debt governance enables the green transformation of enterprises by alleviating overcapacity. In fact, the growth of local government debt leads to excessive subsidies, resulting in overcapacity, thereby hindering green transformation. Local debt governance reduces regional overcapacity and is conducive to the green transformation of enterprises by standardizing government borrowing behavior and reducing unreasonable subsidies.

This study employs a progressive difference-in-differences (DID) model to examine the effects of the 2015 local government debt governance reform on the green transformation of enterprises, treating it as a quasi-natural experiment. Employing this quasi-experiment, the study poses the following research questions: Did debt governance significantly promote enterprise green transformation? If so, what are the specific mechanisms at play? Does debt governance have varying effects on green transformation across enterprise types? Compared to past research, the present study's marginal contributions are as follows. First, past research has not identified local government debt governance as a main driver of green transformation among enterprises. Through empirical analysis, the present study establishes the relationship between the two, expanding the literature on enterprise green transformation and the microeconomic impact of the local government debt governance in China. Second, past research typically attributes the effect of the local government debt governance on enterprises to mitigating financing constraints but overlooking the role of overcapacity alleviation. However, the mechanism analysis of this study reveals that alleviating overcapacity is a key pathway through which the local government debt governance encourages enterprise green transformation. Third, the findings of this study serve as a valuable resource for governments in China and other countries in formulating enterprise green transformation and debt management policies.

The remainder of this study is organized as follows. Section Two presents the context regarding the local government debt governance. Section Three provides the research hypotheses and theoretical analysis. Section Four details the study design. Section Five presents the results and interpretations of the main findings. Section Six discusses the transmission method. Section Seven provides additional analysis, and Section Eight offers the conclusions, limitations and recommendations for future research.

2. Background Context of Local Government Debt Governance

The Chinese central government introduced the local government debt governance in 2015 to enforce stricter controls. debt governance efforts have aimed to regulate borrowing practices and curb

unsustainable debt accumulation through four approaches. First, municipal bond markets should be formalized by eliminating opaque financing vehicles and authorizing provincial bond issuance. Second, strict borrowing caps should be imposed, and debt financing for operational expenditures should be prohibited. Third, subnational debt should be integrated into comprehensive budgeting systems to enable end-to-end borrowing, utilization, and repayment oversight. Finally, risk assessment and transparency mechanisms, including debt risk evaluation systems and mandatory disclosure requirements, should be introduced to enhance governmental financial accountability.

This debt governance mode regulates local government debt issuance methods, procedures, and utilization, thereby mitigating excessive government subsidies and overcapacity. Standardized and transparent fiscal practices by local governments facilitate efficient resource allocation in regions and create a policy environment conducive to corporate green transformation. As such, the gradual implementation of China's local government debt governance offers a natural quasi-experiment for evaluating its impact.

3. Theoretical Analysis and Research Hypothesis

A significant factor contributing to overcapacity is the rise in local government debt. Specifically, increased municipal debt makes it easier for the government to provide subsidies, leading to blind investment and low-level repetitive construction. This will seriously damage the ecological environment of the industry and hinder the green and sustainable development of enterprises. For example, in some regions, local governments give excessive financial subsidies to attract investment from steel companies. In such cases, steel companies tend to blindly expand capacity and have no incentive to make green transition. Earlier studies support this perspective. For instance, Blonigen and Wilson (2010) find that government subsidies can affect overcapacity significantly. Thus, overcapacity hinder the green transformation of enterprises through two channels: urban- and enterprise-level mechanisms. Overcapacity at the urban level distorts credit allocation, as governments prioritize bailouts for struggling firms, which constrains financing for high-quality enterprises (Wang and Zhao, 2019; Huang et al., 2019). The crowding-out effect reduces funding for green innovation, limiting enterprise transformation and hindering the development of green technologies.

At the enterprise level, overcapacity has two adverse effects. First, it suppresses enterprise green innovation. For instance, Wu et al. (2019) show that overcapacity reduces enterprise profits, lowering investments in high-risk, slow-return R&D and weakening innovation incentives. Additionally, overcapacity impedes environmental protection, as it has been identified as an obstacle to renewable energy adoption and energy transition (Del Río et al., 2016; Andersen et al., 2023). Overcapacity-prone enterprises exhibit poor environmental responsibility (Mashwani et al., 2024), while their carbon emission efficiency lags behind healthy enterprises (Wu et al., 2023; Shao et al., 2022). Moreover, enterprises demonstrate considerably lower green total factor productivity than viable enterprises (Sun and Yin, 2023). These findings indicate that overcapacity limits both environmental protection and the

green transformation of enterprises.

China's local government debt governance was launched in 2015, strictly regulating debt issuers, limits, usage, and approval procedures. The debt governance approaches curb the subsidization of overcapacity enterprises, accelerate the exit of outdated capacity. Meanwhile, debt governance also reduces government market intervention, improves resource allocation, and further boosts capacity utilization for viable firms. Research indicates that a reduction in overcapacity can support the green transformation of enterprises. Song et al. (2019) and Guo et al. (2022) find that significantly mitigating overcapacity lowers pollutant emissions. Yang and Wang (2022) suggest that alleviating overcapacity boosts green total factor productivity by strengthening resource allocation efficiency and technological innovation. Lai and Wang (2024) confirm the positive impact of overcapacity alleviation on renewable energy development efficiency. The findings suggest that overcapacity alleviation is essential for green and sustainable development.

Based on the above, this study proposes Hypotheses 1 and 2 accordingly.

Hypothesis 1: Local government debt governance encourages enterprise green transformation.

Hypothesis 2: Local government debt governance encourages enterprise green transformation by alleviating overcapacity.

The impact effect of local government debt governance on the green transformation of enterprises are heterogeneous at the regional level. First of all, Urban characteristics shape how the local government debt governance impacts enterprise green transformation. For example, the effect varies across cities with different industrial structures. Cities with more developed industrial structures typically possess superior technologies and management practices, which enable them to attract policy and financial support under debt governance and thereby accelerate green transformation. In contrast, enterprises in cities with less developed industrial structures may face technological and financial constraints that hinder green transformation. Thus, this debt governance model could potentially significantly impact the promotion of enterprise green transformation in cities with developed industrial systems.

Second, the impact of debt governance on green transformation varies by whether enterprises are in cities that prioritize environmental protection. In such cities, governments provide more substantial incentives and support, facilitating policy backing and funding encouraging enterprises to actively pursue green transformation. In contrast, enterprises frequently encounter incomplete policy enforcement and resource misallocation in cities with non-environmental priorities, constraining the motivation for effective green transformation. Therefore, debt governance will likely have greater impacts on enterprise green transformation in cities that prioritize environmental protection.

Furthermore, the impact of debt governance on enterprise green transformation varies across resource-dependent and non-resource-dependent cities. Specifically, resource-dependent cities typically display homogeneous, rigid industrial structures. Thus, slowed development in other sectors and limited innovation in these cities constrain green transformation. Enterprises of resource-dependent cities struggle to reduce their resource reliance in the short term, even with the local government debt

governance, generating weaker green transformation results. Comparatively, non-resource-dependent cities with varied, balanced industrial structures can apply debt governance more easily, alleviating overcapacity while accelerating green transformation. Therefore, in non-resource-dependent cities, debt governance will likely exert a more substantial impact on green transformation.

Based on the above, this study proposes Hypothesis 3 accordingly.

Hypothesis 3: The promotion of enterprise green transformation will be more significantly impacted by the local government debt governance for enterprises in cities with more developed industrial structures, environmental priority, and non-resource dependence.

The effectiveness of the local debt governance in promoting green transformation is shaped by enterprise heterogeneity. First, the local government debt governance's effect on green transformation differs across enterprise ownership structures. Non-state-owned enterprises, characterized by market orientation and operational flexibility, are generally more responsive to green transformation initiatives. In contrast, constrained by government guidance and stakeholder pressures, state-owned enterprises (SOEs) display slower decision-making and weaker transformation incentives. Therefore, the local government debt governance will potentially have a greater impact on the green transformation of non-SOEs.

Second, the impact of the local government debt governance varies depending on the degree of enterprise resource dependency. Specifically, technology-intensive enterprises prioritize R&D and green innovation, supported by stronger capabilities in technological renewal, enhancing their transformative capacity.

Thus, debt governance will likely drive green transformation in technology-intensive enterprises more than capital- or labor-intensive enterprises. Based on the above, this study proposes Hypothesis 4 as follows.

Hypothesis 4: Local government debt governance will have a more significant effect in promoting green transformation for non-state-owned, capital-intensive enterprises.

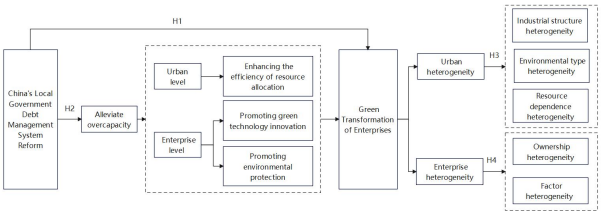

Figure 1. Mechanism Diagram and Heterogeneity Analysis Diagram

4. Research Design

4.1 Identification Strategy and Model Setting

This study employs a progressive DID model to examine the effects of China's local government debt governance. The OLS and canonical DID models are the primary foundations of the current research. Compared to OLS, DID models mitigate endogeneity concerns, leading to more accurate estimates of

the causal policy effects. Moreover, while a canonical DID model is suitable for one-time nationwide policies, it cannot capture the varying effects of different treatments. The progressive DID model overcomes this limitation, making it more suitable for evaluating phased and regional policies. As the local government debt governance has been gradually implemented in China, this study employs the progressive DID model to assess its impact on enterprises' green transformation.

The benchmark model is calculated as follows:

$$Green_{i,c,t} = \alpha_0 + \alpha_1 DID + \lambda X_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \quad (1)$$

Where *i*, *c*, and *t* indicate the enterprise, city, and year, respectively. Following Lu et al. (2022), *Green* represents enterprise green transformation, is measured as the natural logarithm of green patent counts plus one. The *DID* variable is the policy shock variable, indicating whether the local government debt governance was implemented in the city where the enterprise is located. μ_i corresponds to industry fixed effects and ν_t represents year fixed effects. $\varepsilon_{i,t}$ is the error term. *X* represents a series of control variables at the enterprise and city levels.

To improve the accuracy of model identification, this study controls for other key factors that may influence enterprise green transformation, including (1) enterprise size (*Size*), measured as the natural log of the enterprise's total assets; (2) enterprise age (*Age*), measured as the natural log of the year the enterprise was founded; (3) leverage ratio (*Lev*), measured as the ratio of the enterprise's total liabilities to total assets; (4) growth capability (*TobinQ*). Tobin's Q is a main indicator of an enterprise's growth capability—the stronger the growth capability, the more likely the enterprise is to pursue green transformation; (5) financing constraints (*SA*), measured using the SA index; (6) regional economic level (*Pgdp*), measured as the natural log of the per capita GDP of the region; (7) regional financial development level (*Finance*), determined by the ratio of the region's GDP to the year-end balance of financial institution loans; (8) the local fiscal level (*Government*), determined by the ratio of the local fiscal general budgetary expenditure (in ten thousand RMB) to the region's GDP.

4.2 Sample Selection

Given that local government debt governance was implemented in 2015, this study selects Chinese-listed companies from 2010 to 2019 as the research sample.

4.3 Data Sources

This study employs the following methodology to determine when each city implemented local government debt governance. First, we use the Wind database's prefecture-level local government bond issuance data as a reference and cross-verify debt-related information with official sources. Sources include local government annual fiscal reports, debt issuance explanations, and official disclosure portals. We identify the specific time each city's first public disclosure of local government debt balances through manual verification to indicate the actual debt governance implementation in that area. Additional data was derived from the Wind and CSMAR databases.

Consistent with existing research on variable treatment, the raw data was processed through the following steps: (1) we exclude special treatment enterprises (ST, *ST, and PT); (2) we exclude enterprises from the financial, real estate, education, and public service sectors; (3) we use imputation methods to address missing data regarding enterprise-level control variables. The main variables' descriptive statistics are presented in Table 1. The local government debt governance policy shock variable shows a sample mean of 0.514. Thus, 51.4% of the sample enterprises belong in the treatment group, while 48.6% belong in the control group.

Table 1. Descriptive statistics.

Variable	N	Mean	SD	Min	Max
Green	17586	0.399	0.861	0.000	6.913
DID	17586	0.514	0.500	0.000	1.000
Size	17586	22.215	1.396	13.763	28.636
Age	17586	17.726	5.795	0.000	61.000
TobinQ	17586	2.293	15.724	0.684	1752.705
SA	17564	-3.755	0.269	-5.237	-1.455
Lev	17586	3.551	4.439	0.032	132.956
Pgdp	17586	11.339	0.568	9.104	13.056
Finance	17586	1.539	0.695	0.118	7.450
Government	17586	0.166	0.104	0.044	2.349

5. Empirical Results

5.1 Benchmark Regression

Using (1), this study evaluates the effects of China's local government debt governance on the green transformation of enterprises. The benchmark regression results are shown in Table 2. Columns (1) to (3) of Table 2 show the results controlling for industry and year fixed effects. Column (1) presents the regression results without control variables; the debt governance dummy variable (DID) regression coefficient is significantly positive at the statistical significance level of 1%. This finding indicates that the local government debt governance implementation significantly promotes the green transformation of enterprises. Column (2) shows the results with the enterprise-level controls added to address omitted variable bias. The local government debt governance dummy variable (DID) regression coefficient remains significantly positive. This finding further confirms that the local government debt governance stimulates enterprise green transformation. Column (3) encompasses city-level control variables. The local government debt governance regression coefficient remains significantly positive. The findings suggest that the local government debt governance supports enterprise green transformation.

Table 2. Results of Benchmark Regression

	(1)	(2)	(3)
VARIABLES	Green	Green	Green
DID	0.1143***	0.0818**	0.0741**
	(0.0364)	(0.0340)	(0.0328)
Size		0.1838***	0.1866***
		(0.0176)	(0.0176)
Age		0.0050	0.0035
		(0.0048)	(0.0048)
TobinQ		0.0008***	0.0010***
		(0.0002)	(0.0002)
SA		0.5013***	0.4566***
		(0.1379)	(0.1370)
Lev		-0.0059***	-0.0057***
		(0.0016)	(0.0016)
Pgdp			0.1250***
			(0.0270)
Finance			-0.0215
			(0.0178)
Government			-0.0066
			(0.0883)
Constant	0.3398***	-1.9136***	-3.4983***
	(0.0214)	(0.4097)	(0.5169)
Observations	17,586	17,564	17,564
Year FE	YES	YES	YES
Industry FE	YES	YES	YES
Adjusted R^2	0.0527	0.157	0.162
F	9.878	24.91	19.01

Note. Standard errors are clustered at the enterprise level. *p < 0.10, **p < 0.05, ***p < 0.01.

5.2 Parallel Trend Test

The DID method for causal identification requires a parallel trends assumption to hold. This study conducted a parallel trends test to test this assumption and present the results in Figure 2. Figure 2 shows that the regression coefficients are not significant during the pre-reform period (pre_1 to pre_4). This finding suggests that the parallel trends assumption is met. Moreover, the post-reform coefficients (post_1–post_4) become significant, indicating that the debt governance's green transformation impact

emerges post-policy. The findings confirm that the DID approach satisfies the parallel trends assumption when estimating the impact of debt government.

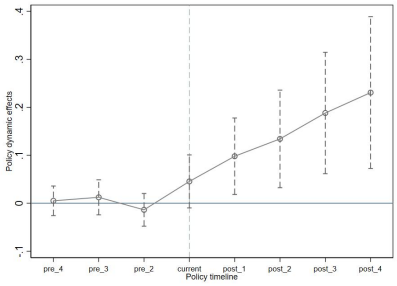

Figure 2. Parallel Trend Test

5.3 Placebo Test

We conducted a placebo test to assess the robustness of the benchmark regression results. A pseudo policy timeline was created by randomly assigning local government debt governance timing to different cities. We used (1) to perform counterfactual estimations and repeated the process 500 times. Figure 3 shows the kernel density plot of the estimated coefficients.

In contrast to the significantly positive coefficient (0.0741) in the benchmark regression, the coefficients calculated for the pseudo policy show no significant deviation from zero. This discrepancy suggests that the benchmark regression results are unlikely to be biased by omitted variables, providing robust support for the conclusion that the local government debt governance stimulates the green transformation of enterprises.

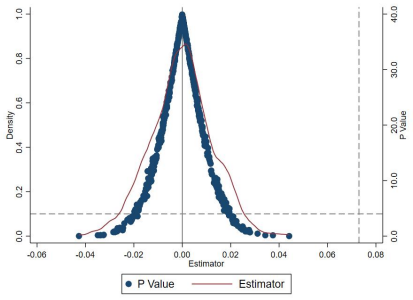

Figure 3. Placebo Test

5.4 Robustness Check

This study conducted a series of robustness tests to confirm whether the relationship between the local government debt governance and enterprise green transformation remains robust.

First, we modify the dependent variable measurement. Following Ding and Cheng (2024), we develop a comprehensive green development index system for enterprises, comprising economic profits, social value, and environmental benefits. We use the entropy method to calculate the green development composite index, which measures the level of enterprise green development. The composite index serves as an alternative measure of enterprise green transformation. The regression results are reported in Column (1) of Table 3. Aligning with the benchmark, the DID variable's regression coefficient is

0.0043, which is significant at the statistical significance level of 5%. This result confirms that the positive effect of the local government debt governance on enterprise green transformation remains robust.

Second, we exclude directly administered municipalities (DAMs) samples. Specifically, we consider that DAMs vastly differ from other cities. For instance, DAMs typically possess more developed economic systems and industrial structures, along with stronger policy implementation capacities and higher levels of administrative efficiency, which contribute to notable market disparities.

Thus, to improve the generalizability and reliability of the research results and accurately assess the impact of the local government debt governance on enterprise green transformation, we exclude enterprises in DAMs from the sample. Column (2) of Table 3 shows that after removing the samples with special cities, the DID regression coefficient is 0.0741 and significant at the statistical significance level of 5%. This finding implies that the local government debt governance has a widespread and generalizable effect on enterprise green transformation.

Third, we adjust the clustering level. Specifically, the disturbance variance and covariance structure differ depending on the clustering level. Higher clustering levels relax assumptions and provide more robust standard error estimation. Since the policy shock variable is defined at the city level, we further adjust clustering to the city level for robustness testing, as shown in Column (3) of Table 3. After this adjustment, the DID regression coefficient is 0.0741 and significant at the statistical significance level of 10%, indicating that the previous conclusions are robust.

Fourth, this study adds additional control variables. Amid green transformation, an enterprise's governance capability and structure play a crucial role in resource allocation, technological innovation, and environmental investment decisions. Effective governance can foster environmentally friendly policies and practices, encouraging green transformation. Thus, we add three enterprise governance control variables in the benchmark regression to account for omitted variable bias: (1) *Board*, measured as the number of board members; (2) *Top1*, measured as the proportion of shares held by the largest shareholder; (3) *Dual*, indicating a dummy variable that is equal to 1 if the roles of chair and CEO are held by the same individual and 0 otherwise. Furthermore, a city's macroeconomic environment influences enterprises' green transformation decisions. Thus, we add three city-level control variables: (1) *Industrialization*, taken as the number of large industrial enterprises; (2) *Infrastructure*, taken as the total collection of public libraries; (3) *Traffic*, taken as highway freight volume. Column (4) of Table 3 shows that the DID regression coefficient is 0.0594 and significant at the statistical significance level of 10%. This finding indicates that the local government debt governance continues to significantly influence enterprise green transformation, even after controlling for enterprise governance and city-level variables. This result further supports the robustness of the main findings.

Table 3. Robustness Check

	(1) Replace the dependent variable	(2) Exclude samples from municipalities	(3) Cluster to cities	(4) Add control variables
VARIABLES	Green	Green	Green	Green
DID	0.0043**	0.0741**	0.0741*	0.0538*
	(0.0020)	(0.0328)	(0.0403)	(0.0320)
Size	0.0025***	0.1867***	0.1867***	0.1915***
	(0.0006)	(0.0176)	(0.0141)	(0.0182)
Age	0.0005**	0.0035	0.0035	0.0022
	(0.0002)	(0.0048)	(0.0059)	(0.0048)
TobinQ	-0.0000	0.0010***	0.0010***	0.0009***
	(0.0000)	(0.0002)	(0.0002)	(0.0002)
SA	0.0209***	0.4566***	0.4566***	0.4520***
	(0.0064)	(0.1370)	(0.0905)	(0.1355)
Lev	-0.0000	-0.0057***	-0.0057***	-0.0062***
	(0.0001)	(0.0016)	(0.0017)	(0.0017)
Pgdp	-0.0004	0.1249***	0.1249**	0.0496
	(0.0013)	(0.0270)	(0.0482)	(0.0382)
Finance	-0.0027***	-0.0215	-0.0215	-0.0027
	(0.0009)	(0.0178)	(0.0200)	(0.0181)
Government	-0.0061	-0.0066	-0.0066	0.0419
	(0.0051)	(0.0883)	(0.1282)	(0.0860)
Board				0.0708
				(0.0809)
Top1				-0.0718**
				(0.0343)
Dual				0.0577*
				(0.0302)
Ennumber				0.0581**
				(0.0240)
Infrastructure				-0.0093
				(0.0203)
Traffic2				0.0217
				(0.0236)
Constant	0.0534**	-3.4977***	-3.4977***	-3.2703***

	(0.0268)	(0.5168)	(0.7441)	(0.6082)
Observations	17,169	17,565	17,565	17,565
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Adjusted R^2	0.0471	0.162	0.162	0.168
F	4.486	19.07	43.18	12.50

Note. Standard errors are clustered at the enterprise level. *p < 0.10, **p < 0.05, ***p < 0.01.

6. Mechanism Analysis

The benchmark regression analysis indicates that the local government debt governance significantly promotes enterprise green transformation. Based on the earlier theoretical analysis, we hypothesize that the local debt governance encourages enterprise green transformation by alleviating overcapacity. We measure overcapacity at the enterprise and city levels while conducting empirical testing. Enterprise-level overcapacity reflects individual enterprises' production capacity and resource utilization efficiency. Meanwhile, city-level overcapacity encompasses a wider industrial structure and regional economic issues. These two dimensions are interrelated and jointly shape local government policy decisions and enterprise green transformation. By measuring overcapacity at both levels, this study offers a more comprehensive understanding of how the local government debt governance influences the green transformation of enterprises.

First, following Aretz and Pope (2018), we apply a stochastic frontier model to estimate enterprise-level overcapacity by calculating the gap between actual and optimal capacity. We then aggregate these values at the city level, dividing the total overcapacity by the number of enterprises in each city. Finally, we take the logarithm of this ratio to construct the measure of city-level overcapacity. Table 4 presents the regression results. Column (1) of Table 4 shows the enterprise-level results. The DID coefficient is –0.0722 and significant at the statistical significance level of 5%. This result suggests that the local government debt governance effectively reduces enterprise overcapacity. Column (2) of Table 4 presents the city-level regression results. The DID coefficient is –0.1490 and significant at the statistical significance level of 5%. This result suggests that the local government debt governance significantly mitigates enterprise- and city-level overcapacity, supporting Hypothesis 2.

Table 4. Mechanism Analysis

	(1)	(2)
VARIABLES	Enterprise level Overcapacity	City level Overcapacity
DID	-0.0722**	-0.1490**
	(0.0364)	(0.0594)
Pgdp	-0.1199***	-0.8499***

	(0.0334)	(0.0287)
Finance	-0.0047	-0.4891***
	(0.0250)	(0.0225)
Government	-0.3189*	0.5646***
	(0.1882)	(0.1193)
Size	0.5737***	
	(0.0147)	
Age	-0.0046	
	(0.0038)	
TobinQ	0.0030***	
	(0.0004)	
SA	0.0511	
	(0.0900)	
Lev	-0.0096***	
	(0.0032)	
Constant	-3.7286***	9.4452***
	(0.7167)	(0.3142)
Observations	16,008	1,834
Year FE	YES	YES
Industry FE	YES	YES
Adjusted R^2	0.493	0.536
F	237.7	530.8

Note. Standard errors are clustered at the enterprise level. *p < 0.10, **p < 0.05, ***p < 0.01.

7. Additional Analysis

7.1 Urban-level Heterogeneity Analysis

Heterogeneity in Urban Industrial Structure

Differences in industrial structures across cities lead to varying degrees of overcapacity, which may influence the effectiveness of the local government debt governance in addressing the issue. Accordingly, we examine how the effects of debt governance implementation vary across cities with different industrial structures, measured by the share of the tertiary sector in GDP; a higher ratio indicates a more developed industrial structure.

Columns (1) and (2) of Table 5 report the regression results. For cities with developed industrial structures, the coefficient of DID is 0.1340, which is significant at 1%. However, the DID coefficient is not significant for cities with less developed industrial structures. The results confirm that debt governance significantly drives enterprise green transformation in cities with advanced industrial structures, with no significant effect in less advanced cities.

Heterogeneity in Environmental Priority Cities

Environmental priority cities are commonly characterized by heavier pollution and environmental pressure. This prompts governments in these cities to adopt green transformation policies more aggressively and offer stronger policy support for enterprise greening. Therefore, this study hypothesizes that due to environmental pressure, governance focus, and resource allocation, environmental priority cities may receive a more significant positive impact of the local government debt governance on green transformation. According to the document "Notice of the State Council on the Eleventh Five-Year Plan for National Environmental Protection" issued by the State Council of China in 2007, this study divides cities into groups that prioritize the environment and those that do not.

The regression results are presented in Table 5, Columns (3) and (4). Regarding cities with environmental priority, the DID coefficient is 0.1056 and significant at the 1% level; the coefficient for cities with non-environmental priority is not significant.

Heterogeneity in Urban Resource Dependency

There are a number of resource-dependent cities in China, relying heavily on natural resources and facing severe pollution. Compare to non-resource-dependent cities, the industries of resource-dependent cities are typically with high pollution and energy consumption. Higher ecological damage and pollution levels in resource-dependent cities may hinder green transformation. This study infers that the local government debt regulation will have varying impacts on enterprise green transformation across resource-dependent and non-resource-dependent cities. Thus, according to the document "Notice of the State Council on the National Sustainable Development Plan for Resource-based Cities (2013–2020)" issued by the State Council of China in 2013, this study divides cities into groups that resource-dependent and those that do not.

Columns (5) and (6) of Table 5 present the regression results. Specifically, the local government debt governance significantly promotes enterprise green transformation in non-resource-dependent cities but has no significant impact on resource-dependent cities. A potential reason may be that over-reliance on resources stifles the development of other industries and innovation, further obstructing green transformation. In contrast, non-resource-dependent cities feature more balanced industrial development and a diversified economic structure. This balance mitigates environmental contamination concerns and reduces the costs and resistance associated with green initiatives.

The above findings verify Hypothesis 3.

Table 5. Urban-level Heterogeneity Analysis

	(1) Advanced industrial	(2) Low-level industrial	(3) Environmental priority	(4) Non-environmental priority	(5) Non-resource dependent	(6) Resource dependent

	structure	structure				
VARIABLES	Green1	Green1	Green1	Green1	Green1	Green1
DID	0.1340***	-0.0090	0.1056***	-0.0907	0.0968***	-0.1194
	(0.0489)	(0.0410)	(0.0338)	(0.0952)	(0.0349)	(0.0824)
Pgdp	0.2269***	0.0119	0.1293***	-0.0594	0.1354***	-0.1545
	(0.0370)	(0.0438)	(0.0362)	(0.0839)	(0.0308)	(0.0983)
Finance	-0.0413**	0.0187	-0.0257	-0.0387	-0.0353*	-0.0183
	(0.0207)	(0.0330)	(0.0195)	(0.0559)	(0.0198)	(0.0443)
Government	-0.0817	-0.0272	0.0387	-1.1655**	0.0054	-1.2026*
	(0.0801)	(0.4346)	(0.0969)	(0.5639)	(0.0908)	(0.6157)
Size	0.1638***	0.2136***	0.1854***	0.2196***	0.1823***	0.2475***
	(0.0217)	(0.0236)	(0.0188)	(0.0422)	(0.0190)	(0.0408)
Age	0.0036	0.0040	0.0005	0.0253*	0.0040	-0.0140
	(0.0074)	(0.0053)	(0.0050)	(0.0140)	(0.0049)	(0.0161)
TobinQ	0.0009	0.0010***	0.0009***	0.0070	0.0009***	0.0157
	(0.0030)	(0.0002)	(0.0002)	(0.0076)	(0.0002)	(0.0178)
SA	0.5195**	0.4233***	0.4274***	0.6828**	0.4692***	0.1774
	(0.2017)	(0.1300)	(0.1464)	(0.3024)	(0.1413)	(0.3328)
Lev	-0.0084***	-0.0029	-0.0072***	-0.0010	-0.0070***	0.0067
	(0.0027)	(0.0018)	(0.0019)	(0.0025)	(0.0018)	(0.0052)
Constant	-3.9204***	-2.9742***	-3.5951***	-1.4522	-3.4727***	-2.3539
	(0.8365)	(0.7226)	(0.6125)	(1.3781)	(0.5609)	(1.5527)
Observations	8,765	8,800	15,153	2,412	15,739	1,826
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.182	0.147	0.170	0.145	0.164	0.199
F	14.24	11.47	17.89	3.633	16.70	5.516
P-value for the test of inter-group differences	0.028					

Note. Standard errors are clustered at the enterprise level. *p < 0.10, **p < 0.05, ***p < 0.01.

7.2 Enterprise-level Heterogeneity Analysis

Ownership Heterogeneity

Due to differences in access to and use of local debt funds, state-owned enterprises (SOEs) may have easier access to financing but also face greater overcapacity, which impedes their green transformation. This study analyzes the differences between SOEs and non-SOEs to determine if ownership structure impacts the effect of debt governance on the green transformation of enterprises.

The regression results are presented in Columns (1) and (2) of Table 6. The DID coefficient for non-SOEs is 0.0754 and significant at 10%. The coefficient for SOEs is not statistically significant. These findings indicate that debt governance does not significantly impact SOEs, while it does for non-SOEs. A potential reason is that the decision-making of SOEs must comply with government mandates, with limited autonomy in independent decision-making, which may hinder the resolution of overcapacity. However, non-SOEs rely more on market mechanisms, facilitating flexibility and responsiveness to market signals. This leads these enterprises to make agile adjustments to market demand and achieving more effective overcapacity reduction.

Factor Dependency Heterogeneity

Different factor dependencies of enterprises vary significantly in terms of overcapacity. Capital-intensive enterprises, such as those in the steel and automotive industries, often require larger fixed-asset investments and R&D spending, making them more likely to face overcapacity. We classify enterprises into technology-intensive and non-technology-intensive to investigate how the local debt governance impacts enterprise green transformation with varying factor dependencies.

Columns (3) and (4) of Table 6 present the regression results. For technology-intensive enterprises, the DID coefficient is 0.1308 and significant at 5%, while that for non-technology-intensive enterprises is not significant.

The above findings support Hypothesis 4.

Table 6. Enterprise-level Heterogeneity Analysis

	(1)	(2)	(3)	(4)
	Non-state-owned	State-owned	Technology-intensive	Non-technology-intensive
VARIABLES	Green1	Green1	Green1	Green1
DID	0.0754*	0.0531	0.1308**	0.0204
	(0.0417)	(0.0575)	(0.0571)	(0.0368)
Pgdp	0.1680***	0.0330	0.1544***	0.0386
	(0.0331)	(0.0464)	(0.0500)	(0.0271)
Finance	0.0196	-0.0688**	-0.0257	-0.0280*
	(0.0199)	(0.0291)	(0.0379)	(0.0168)

Government	0.0028	-0.0054	-0.1504	0.0315
	(0.1373)	(0.1235)	(0.2482)	(0.0745)
Size	0.1683***	0.2026***	0.3057***	0.1370***
	(0.0280)	(0.0245)	(0.0374)	(0.0167)
Age	-0.0049	0.0115	0.0014	0.0095
	(0.0048)	(0.0086)	(0.0067)	(0.0058)
TobinQ	0.0010***	0.0028	0.0049	0.0005**
	(0.0002)	(0.0088)	(0.0033)	(0.0002)
SA	0.3213**	0.5397**	0.6720***	0.4855***
	(0.1356)	(0.2140)	(0.1988)	(0.1805)
Lev	-0.0062***	0.0015	-0.0119***	-0.0009
	(0.0017)	(0.0051)	(0.0028)	(0.0014)
Constant	-3.9589***	-2.6721***	-5.3536***	-1.5564***
	(0.6267)	(0.9918)	(0.8702)	(0.5636)
Observations	9,735	7,702	7,432	10,133
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Adjusted R^2	0.130	0.222	0.176	0.175
F	9.978	10.41	14.16	10.32

Note. Standard errors are clustered at the enterprise level. *p < 0.10, **p < 0.05, ***p < 0.01.

8. Conclusion, Policy Implications, and Limitations

8.1 Conclusion

This study focuses on the local government debt governance policy that China implemented in 2015, examining its mechanisms and effects on enterprise green transformation. The main conclusions are as follows:

First, enterprise green transformation is significantly affected by the local government debt governance. Robustness testing supports this conclusion, including parallel trend tests, placebo tests, explanatory variable replacement, special sample exclusion, clustering stratum adjustment, control variables, and the exclusion of other policies. Second, the mechanism analysis shows that debt governance reduces overcapacity at the city and enterprise levels, promoting green transformation. Finally, heterogeneity analysis reveals that debt governance has a more substantial positive impact on green transformation in non-state-owned and technology-intensive enterprises and cities with more developed industrial structures, environmental priorities, or non-reliance on resource-based industries.

8.2 Policy Implications

First, governments should establish mechanisms to phase out overcapacity enterprises and reform local debt management systems. Local governments should phase out bailout schemes for overcapacity

enterprises and establish an exit mechanism for inefficient capacity. Furthermore, local governments should enhance transparency in fiscal management, and strengthen debt-related legislation.

Second, governments should implement a dynamic capacity management system to redirect resources toward green transformation. This helps anticipate and identify overcapacity risks, adjust production limits swiftly, and guide efficient industrial planning. Legislators can also redirect overcapacity enterprises toward low-energy, low-emission industries. Governments should also encourage businesses to reduce unproductive capacity through bankruptcy or debt restructuring to allocate resources for green industries.

Third, China's central government should establish a cross-regional green transition oversight system. Implementing an "environmental technology upgrade debt extension" connection strategy would ensure that debt reduction keeps pace with green transitioning.

8.3 Limitations

Although this study provides valuable insights, its limitations are as follows. First, it relies on data from listed enterprises, excluding unlisted firms. This omission may affect the accuracy of the results. Second, while overcapacity reduction is identified as a key mechanism, other pathways may also play a role. Despite these constraints, the findings offer valuable policy implications. Future research should broaden the sample to include unlisted enterprises and incorporate case analyses. Additionally, examining alternative mechanisms would yield a more comprehensive understanding of the effects of debt governance.

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References

Achi, A., Adeola, O., & Achi, F. C. (2022). CSR and green process innovation as antecedents of micro, small, and medium enterprise performance: moderating role of perceived environ mental volatility. *Journal of Business Research*, *139*, 771-781. https://doi.org/10.1016/j.jbusr es.2021.10.016

Akhtaruzzaman, M., Banerjee, A. K., & Boubaker, S. (2025). Government intervention and gree n innovation in renewable energy. *Energy Economics*, *145*, 108185. https://doi.org/10.1016/j. eneco.2025.108185

Ali, A., Li, J., Zhang, J. et al. (2024). Exploring the impact of green finance and technological

innovation on green economic growth: Evidence from emerging market economies. *Sustai nable Development*, *32*(6), 6392-6407. https://doi.org/10.1002/sd.3031

Andersen, O. W., & Pedersen, R. H. (2023). The paradox of overcapacity in African energy se ctors. *Energy for Sustainable Development*, 72, 83-87. https://doi.org/10.1016/j.esd.2022.11.0 11

Aretz, K., & Pope, P. F. (2018). Real options models of the firm, capacity overhang, and the cross section of stock returns. *The Journal of Finance*, *73*(3), 1363-1415. https://doi.org/10. 1111/jofi.12617

Berikhanovna, C. M., Bauirzhanovna, B. A., Kudaibergenovna, N. G., Gulbagda, B., & Serikov na, Y. G. (2023). The influence of green credit policy on green innovation and transformat ion and upgradation as a function of corporate diversification: The Case of Kazakhstan. *Ec onomies*, *11*(8), 210. https://doi.org/10.3390/economies11080210

Blonigen, B. A., & Wilson, W. W. (2010). Foreign subsidization and excess capacity. *Journal o f International Economics*, *80*(2), 200-211. https://doi.org/10.1016/j.jinteco.2009.10.001

Chishti, M. Z., Salam, M., Xaisongkham, S. et al. (2025). Influence of green ICT and socioec onomic factors on sustainable development: Evidence from Chinese provinces. *Research in International Business and Finance*, *73*, 102624. https://doi.org/10.1016/j.ribaf.2024.102624

Chishti, M. Z., Xia, X., & Dogan, E. (2024). Understanding the effects of artificial intelligence on energy transition: The moderating role of Paris Agreement. *Energy Economics*, *131*, 1 07388. https://doi.org/10.1016/j.eneco.2024.107388

Del Río, P., & Janeiro, L. (2016). Overcapacity as a barrier to renewable energy deployment: t he Spanish case. *Journal of Energy*, *1*(1), 8510527. https://doi.org/10.1155/2016/8510527

Deng, X., Cao, C., & Li, Y. F. (2023). Local debt management system reform and corporate l everage ratio. *Finance and Trade Research*, *34*(10), 62-72. https://link.cnki.net/doi/10.19337/ j.cnki.34-1093/f.2023.10.006

Ding, H. Y., & Cheng, Q. W. (2024). Digital innovation, entrepreneurship, and green developm ent of manufacturing enterprises. *Science Research Management*, *45*(01), 84-97. https://link. cnki.net/doi/10.19571/j.cnki.1000-2995.2024.01.009

Gramkow, C., & Anger-Kraavi, A. (2018). Could fiscal policies induce green innovation in dev eloping countries? The case of Brazilian manufacturing sectors. *Climate Policy*, *18*(2), 246- 257. https://doi.org/10.3390/su11236783

Hu, Y., Zhang, H. M., & Ma, W. J. (2022). Reform in local government debt governance and human capital upgrading. *Economic Management*, *44*(08), 152-169. https://link.cnki.net/doi/1 0.19616/j.cnki.bmj.2022.08.009

Huang, H., Duan, K., & Cai, C. (2023). Reform of the management system of local governme nt debt and the development of real economy. *Journal of Quantitative & Technical Econo mics*, *40*(02), 48-68. https://link.cnki.net/doi/10.13653/j.cnki.jqte.2023.02.008

Huang, J., Chen, X. Y., & Ding, Z. (2019). Excess capacity, crowding-out effect of credit reso urce and the economic consequences. *Accounting Research*, *2019*(2), 65-70. https://link.cnki. net/doi/10.3969/j.issn.1003-2886.2019.02.011

Hunjra, A. I., Zhao, S., Goodell, J. W., & Liu, X. (2024). Digital economy policy and corpora te low-carbon innovation: Evidence from a quasi-natural experiment in China. *Finance Res earch Letters*, *60*, 104910. https://doi.org/10.1016/j.frl.2023.104910

Lai, A., & Wang, Q. (2024). How coal de-capacity policy affects renewable energy developmen t efficiency? Evidence from China. *Energy*, *286*, 129515. https://doi.org/10.1016/j.energy.202 3.129515

Li, Y. F., Cao, C., & Chu, E. M. (2023). Reform of the local debt management system and di gital transformation of enterprises. *Economic Perspectives* (in Chinese), (04), 79-94.

Liu, G. C., Cheng, F. Y., Yao, S. J., & Zhang, J. (2022). Local government debt governance and corporate investment-financing maturity mismatch alleviation. *Journal of Management World*, *38*(11), 71-89. https://link.cnki.net/doi/10.19744/j.cnki.11-1235/f.2022.0165

Liu, S., & Li, Y. (2025). Does Government's Attention to Green Development Promote Enterpri se Green Transition? Evidence from China. *Emerging Markets Finance and Trade*, *21*. http s://doi.org/10.1080/1540496X.2025.2486685

Lu, H., Pan, Y., Fan, R., & Guan, W. (2025). Green credit policy and heavily polluting enterpr ises' green transition. *International Review of Financial Analysis*, *103*, 104162. https://doi.or g/10.1016/j.irfa.2025.104162

Lu, Y., Gao, Y., Zhang, Y., & Wang, J. (2022). Can the green finance policy force the green t ransformation of high-polluting enterprises? A quasi-natural experiment based on "Green Cr edit Guidelines". *Energy Economics*, *114*, 106265. https://doi.org/10.1016/j.eneco.2022.10626 5

Mashwani, A. I., Mushtaq, R., Gull, A. A., & Rind, A. A. (2024). The walking dead: are zom bie firms environmentally and socially responsible? A global perspective. *Journal of Enviro nmental Management*, *355*, 120499. https://doi.org/10.1016/j.jenvman.2024.120499

Shao, S., Yin, J. Y., Fan, M. T., & Yang, L. L. (2022). Zombie firms and low-carbon transfor mation development: A perspective on carbon emission performance. *The Journal of quanti tative and technical economics*, *39*(10), 89-108. https://link.cnki.net/doi/10.13653/j.cnki.jqte.2 0220920.004

Song, J., Wang, B., Fang, K., & Yang, W. (2019). Unraveling economic and environmental im plications of cutting overcapacity of industries: A city-level empirical simulation with input -output approach. *Journal of cleaner production*, *222*, 722-732. https://doi.org/10.1016/j.jclep ro.2019.03.138

Sun, B. W., & Yin, J. (2023). Harming others without benefiting itself: negative effects of zom bie enterprises on green total factor productivity. *China Population Resources and Environ*

ment (in Chinese), *33*(2), 38-50.

Taghizadeh-Hesary, F., & Zhao, X. (2025). Does Executive Green Cognition Drive Corporate G reen Development? *The Singapore Economic Review*, 1-22. https://doi.org/10.1142/S0217590 825490049

Tang, L., Jiang, H. F., Zheng, J. et al. (2023). How the ecological rule of law leads the green development transformation: Impact of new environmental protection law on corporate gre en technology innovation. *China Soft Science (in Chinese)*, *2023*(08), 43-53.

Tawiah, V., Gyapong, E., & Usman, M. (2024). Returnee directors and green innovation. *Journ al of Business Research*, *174*, 114369. https://doi.org/10.1016/j.jbusres.2023.114369

Tian, H., Siddik, A. B., Pertheban, T. R., & Rahman, M. N. (2023). Does fintech innovation a nd green transformational leadership improve green innovation and corporate environmental performance? A hybrid SEM–ANN approach. *Journal of Innovation & Knowledge*, *8*(3), 1 00396. https://doi.org/10.1016/j.jik.2023.100396

Wang, L. G., & Zhao, W. Y. (2019). The impact of capacity utilization on credit allocation eff iciency: based on supply-side structural reform of finance. *Reform*, *2019*(12), 133-145. http s://link.cnki.net/doi/10.3969/j.issn.1003-2886.2019.02.011

Wang, Q. Q., & Liang, R. B. (2023). Reform in the management system of local government debt and default of private enterprises in infrastructure construction. *The Journal of Quanti tative & Technical Economics*, *40*(03), 91-110. https://link.cnki.net/doi/10.13653/j.cnki.jqte.20 23.03.001

Wu, Q., Chang, S., Bai, C., & Wei, W. (2023). How do zombie enterprises hinder climate cha nge action plans in China? *Energy Economics*, *124*, 106854. https://doi.org/10.1016/j.eneco. 2023.106854

Wu, Y., He, Z. C., Zheng, J. J. et al., 2019. The conduction mechanism and effect of industry upgrading upon capacity utilization with the view of technological innovation. *Scientific Decision Making*, *2019*(02), 47-71. https://link.cnki.net/doi/10.3773/j.issn.1006-4885.2019.02.0 47

Yang, W. J., & Wang, Q. (2022). Can resolving overcapacity improve green total factor produc tivity? A Quasi-natural experiment based on China's industrial de-capacity. *On Economic P roblems*, *07*, 1-12. https://link.cnki.net/doi/10.16011/j.cnki.jjwt.2022.07.007

Yang, Y., Yi, C., 2023. Path selection for enterprises' green transition: Green innovation and gr een mergers and acquisitions. *Journal of Cleaner Production*, *412*, 137397. https://doi.org/1 0.1016/j.jclepro.2023.137397

Yu, L.C., Zhang, W. G., Bi, Q. (2021). Can the reform of environmental protection fee-to-tax promote the green transformation of high-polluting enterprises?-evidence from quasi-natural experiments implemented in accordance with the environmental protection tax law. *China Population, Resources and Environment*, *31*(5), 109-118. https://link.cnki.net/doi/10.12062/cpr

e.20200703

Zhang, J. S., & Kuang, H. Y. (2021). Does local debt governance promote enterprise innovatio n: Empirical evidence from listed companies. *International Financial Research*, *06*, 86-96. https://doi.org/10.16475/j.cnki.1006-1029.2021.06.009

Zhang, S., Dong, R., Jiang, J., Yang, S., Cifuentes-Faura, J., Peng, S., & Feng, Y. (2024). Wh ether the green credit policy effectively promote green transition of enterprises in China? Empirical analysis and mechanism verification. *Environmental Research*, *244*, 117910. https: //doi.org/10.1016/j.envres.2023.117910