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Article

The Crowding-out Effect of Local Government Financing Platform Debt on Enterprise Investments: A Debt Regulation Perspective

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Abstract

This research investigates the impact of China's recent debt regulation on the crowding-out effect of local government financing platform (LGFP) debt on enterprise investment. We find that the crowding-out effect of LGFP debt on enterprise investment has significantly weakened since the implementation of debt regulation. The policy effect is more significant for enterprises with greater financing constraints and higher sensitivity to market-based debt pricing than those with lower financing constraints and pricing sensitivity. In addition, debt regulation has produced more satisfactory results in regions with faster marketization and more developed financial systems. The primary mechanism underlying the effect of debt regulation policies is debt replacement and the market-based reform of LGFPs. In particular, replacing debt with instruments that have more explicit financing purposes, along with transforming LGFPs into industrial investment companies that rely less on direct fiscal support, helps ease the crowding-out effect. Overall, our findings offer valuable insights for improving government debt systems in emerging and transitional economies, thereby fostering economic vitality and enhancing fiscal stability.

Keywords: local government financing platforms; debt management regulation; local government debt; enterprise investments; crowding-out effect
JEL: C33, D22, G38, H74

1. Introduction

The impact of the government debt on the private sector is a classic topic (Demirci et al., 2019). In the current era where the uncertainty of global economy intensifies and fiscal stimulus policies are implemented across the globe, this issue has received renewed attention. As the evolvement of China's local government debt and the impact of recent reform policies have become a focal point, this study focuses on the latest policy changes and systematically explores the impact of the Chinese government's debt regulation policies since 2015 on the crowding-out effect of local government financing platform debt on enterprise investment.

The debt-raising activities of the government mainly affect the private sector through channels such as the cost of capital (Elmendorf and Mankiw, 1999), asset allocation (Friedman, 1978), and liquidity premiums (Krishnamurthy and Vissing-Jorgensen, 2012). The crowding-out theory posits that if the deficit in public savings induced by the public debt cannot be fully compensated by an increase in private savings, overall savings will decrease and interest rates will increase over time (Gerrard, 1996). In addition, public investments can squeeze out the private sector in the input and output markets or the financial markets, leading to the crowding out of private investment and ultimately to a decline in capital and output. In terms of empirical results, various studies of the crowding-out effect of government debt on the private sector have been documented in the United States (Akkoyun et al., 2023), Canada (Cebula, 1978), Europe (Becker and Ivashina, 2018), and the Organisation for Economic Co-operation and Development (OECD) countries (Bairam and Ward, 1993; Cho and Rhee, 2013).

Government debt in China can be divided into central government debt and local government debt, among which local government debt has more complex origins and structures and is also a focus of academic and social attention. Before the reform of local government debt management, local government financing platforms (hereinafter referred to as local government financing platform (LGFPs) or platform companies) were the primary means of expanding local government debt. LGFPs are enterprises owned by local governments and set up to raise funds for infrastructure construction (Clarke and Lu, 2017). The initial establishment of LGFPs was due to the Chinese government's investment and financing system, and their expansion was closely related to policies addressing the global financial crisis (Qiu et al., 2022). The debt incurred by LGFPs is mainly referred to as local government hidden debt, which is repaid directly or indirectly through local finances outside the budget or guaranteed by local fiscal authorities (Mao and Xu, 2021). The main perspective in previous studies has been that the hidden debt intensifies debt repayment pressures and potential financial risks to local governments (Wang et al., 2016; Zhou, 2021), crowds out financial resources available to en-

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terprises (Liu et al., 2020), and impedes economic growth. Some studies that focus on the micro-level mechanism of the impact of hidden debt on the private sector have provided initial evidence that LGFP debt has a crowding-out effect on enterprise investment (Huang et al., 2020; Yu and Kang, 2020).

In recent years, the Chinese government has paid considerable attention to the problems of local government hidden debt. In September 2014, the State Council's Opinions on Strengthening the Management of Local Government Debt (No.43 Document, https://www.gov.cn/zhengce/content/2014-10/02/content_9111.htm) proposed to "divest the government financing functions of financing platform companies". The No. 43 Document, together with the New Budget Law effective from 2015, established a new framework for government debt management, and a series of reform policies were implemented to regulate debt-raising activities of local governments. The debt regulation policy has been emphasized since then. The Ministry of Finance's "2022 Report on the Implementation of China's Fiscal Policy" (Sourced from Chinese Government Websites: https://www.gov.cn/xinwen/2023-03/21/content_5747677.htm) identifies the policy of "resolutely curbing the increase of hidden debt and prudently and orderly resolving the stock of hidden debt" as one of the key contents of "preventing and resolving major risks". In July 2024, the Resolution of the Central Committee of the Communist Party of China on Further Deepening Reform Comprehensively to Advance Chinese Modernization stated that "systems for managing government debt will be improved. We will establish a system to monitor and regulate all local government debt, as well as long-term mechanisms to prevent and defuse hidden debt risks. We will move faster to reform and transform local government financing platforms"[1] ([1]Sourced from China daily. https://www.chinadaily.com.cn/a/202407/22/WS669db327a31095c51c50f2f8.html). Once again, the importance of the hidden debt issue has been elevated to a new strategic level.

As LGFP debt characteristics are closely related to policies implemented by the Chinese government, this study focuses on the impact of debt regulation on the crowding-out effect of LGFP debt on enterprise investment. Employing data from Chinese listed companies and LGFPs, we construct a panel dataset covering the period 2010–2020 to empirically examine whether the reform of the local government debt management system and the implementation of the New Budget Law since 2015 have reduced the crowding-out effect. We further investigate whether specific policies, namely the debt replacement and the market-oriented transformation policies, mitigate the crowding-out effect and their underlying mechanisms.

Our analysis aims to contribute to the existing research in multiple ways. The first contribution is our research perspective. This article focuses on the impact of debt management reform, providing valuable insights for understanding China's latest local government debt management system. In recent years, with increasing attention from various sectors to issues surrounding local government debt in China, research on local government debt has gradually expanded. Recent studies can be divided into two categories. The first explores the causes and influencing factors of the local government debt (Chen et al., 2020; Geng and Qian, 2024). The second examines the macro and micro impacts of local government debt (Huang et al., 2020; Li and Qin, 2024; Nie et al., 2024; Wen et al., 2024; Yu and Kang, 2020; Zhang et al., 2022). In this category, Huang's article is the core literature on the crowding-out effect of government hidden debt on corporate investment, but that study does not focus on the impact of debt governance. Although some studies have focused on debt governance (Tang et al., 2024; Wang et al., 2025; Xiong et al., 2024), relatively little literature focuses on investment crowding-out effects. Our study systematically examines how debt regulation affects the relationship between hidden debt and corporate investment, thereby supplementing the literature on the effectiveness of local debt governance and contributing Chinese policy experience to international research on crowding-out effects.

Our second contribution is the theoretical analysis framework. Our researchon the crowding-out effect of local government debt has delved into the unique nature of hidden debt. Unlike traditional government debt, the primary borrowers of hidden debt are not government departments, which implies different risk profiles and economic consequences. An aggregated perspective on local government debt may obscure the mechanisms underlying different types of debt. Based on the characteristics and risks of hidden debt, we integrate the theories of soft budget constraints, information asymmetry, and resource misallocation into a unified framework to analyze how debt regulation can mitigate the crowding-out effect. Thus, our study enriches the analytical framework of local government debt management and corporate investment mechanisms. Our research framework is also of reference value to other economies facing soft budget constraints and transitional issues.

Finally, previous research rarely examines the policy implementation paths for debt regulation and especially lacks research on mechanisms of specific reform policies, such as debt replacement and local government financing platform transformation policies. We analyze the mechanisms by which the reformation policies mitigate the crowding-out effects by two specific policies: the issuance of local government bonds to replace existing hidden debts and the market-oriented transformation of platform companies. We empirically evaluate the impact of "debt replacement effects" and "market-oriented transformation effects" on mitigating the crowding-out effects and thereby enrich the research on the effective mechanisms. Our research also provides insights for further advancing the implementation

path of local government debt reforms and offers empirical evidence for improving financial support policies and stimulating the vitality of emerging market economies. Our research findings on the effective path of debt governance can be extended to other transitional economies, providing useful references for policymakers to strengthen public debt management and enhance fiscal policy sustainability.

2. Policy Background

In the past 30 years, many developing countries have implemented fiscal decentralization and shifted the responsibility for providing public goods from the central government to local governments (Bao et al., 2024; Bardhan and Mookherjee, 2006). The 1994 tax-sharing reform in China transferred a portion of tax revenues to the central government, thereby enhancing the central government's ability to regulate financial resources. However, with the increase in local government spending, the asymmetry between central and local expenditure responsibilities and income allocation has become increasingly prominent (Fan and Lv, 2012; Liu et al., 2024).

After the outbreak of the 2008 global financial crisis, to stimulate domestic demand and avoid an economic hard landing, the Chinese State Council issued the "Four Trillion" fiscal plan in November 2008. An important part of the implementation of this plan was for local governments to undertake investments in infrastructure, real estate, and other related fields to stimulate economic development (Chen et al., 2020). It was in this context that the Ministry of Finance and China Banking Regulation Commission opened a new financing channel for local governments by encouraging the establishment of LGFPs to fund infrastructure investments (Chen et al., 2020).

The expansion of LGFP debt since 2008 in China has been significant (Zhang, 2023). According to the Wind database, more than 3500 LGFPs are included in the monitoring statistics, of which more than 56% (1968) were established between 2000 and 2010. The number of platform companies established after 2015 gradually decreased, totaling only 341. The platform company hierarchy includes county, prefecture, and provincial levels. Among the rapidly growing platform companies that have been operating since 2000, approximately 50% are county-level platforms.

At the same time, the average proportion of LGFP debt to local Gross Domestic Product (GDP) increased from 9.45% to 17.96%. In terms of debt structure, the proportion of district- and county-level LGFP debt to total debt balance in 2015 was 24%, representing an increase of 9.4 percentage points from 2010. Platform companies at lower levels have relatively weak debt repayment ability. This trend indicates that the scale and potential risks of hidden debts were increasing.

Because of the increasing prominence of LGFP debt issues, the Chinese government implemented a series of top-to-bottom debt management systems from late 2014 to 2017 (Bao et al., 2024). Among these, the New Budget Law, approved by the Standing Committee of the National People's Congress, and the No. 43 Document served as guiding documents for local government debt reform. A summary of the relevant policies is presented in the Table 1.

The means of local government financing and the functions of LGFPs have been gradually changing since then. The issuance of the No. 43 Document promoted the implementation of a series of hidden debt governance measures, including strengthening daily monitoring, curbing increments, resolving existing stock, and promoting the transformation of platform companies. Among them, issuing local government bonds to replace platform companies' debt was an important way to resolve the hidden debt problem. Previously, according to the Budget Law of the People's Republic of China, implemented in 1995, local governments were not the main issuers of bonds. The implementation of the New Budget Law in 2015 opened a path for market-oriented issuance of local government bonds, providing a mechanism for local governments to raise funds legally to solve development problems.

According to Fig. 1 drawn from 3300 city-year data, the balance of local government bonds increased since 2015, from 4.04 trillion RMB yuan in 2015 to 25.42 trillion RMB yuan in 2020, with an average annual growth rate of 106%. At the same time, LGFP bonds increased from 5.1 trillion RMB yuan in 2015 to 10.9 trillion RMB yuan in 2020, representing an average annual growth rate of 22%. The growth rate of local government bond balance significantly exceeded that of LGFP bonds, indicating that local governments' financing methods have changed since the implementation of debt management reforms. The new financing demand is mainly met through the issuance of general bonds and special bonds by local governments. Through regulation of the debt issuance mechanism, the proportion of hidden debt was gradually reduced, indicating a tendency to replace hidden debt with explicit debt.

On the other hand, the functions of LGFPs have also changed gradually. Since the introduction of debt regulation, the central government has required LGFPs to divest their government financing functions, clarify the boundary between enterprises and government, and promote the gradual transformation of LGFPs into market-oriented entities, such as infrastructure operation companies, asset holding platforms, and industrial investment companies, to fundamentally curb the expansion of local government hidden debt. Fig. 2 depicts the revenue proportion of government-based businesses for LGFPs from 2015 to 2020, which includes the statistics of 1760 city-year observations. It shows that since 2015, the proportion of revenue from government-based businesses has decreased for most regions, indicating a significant transformation trend. The above analysis indicates that, since the introduction of debt

Table 1. Summary of debt regulation policies.

Issuance date	Policy name	Key point
Aug, 2014	The New Budget Law	Previously, according to the Budget Law implemented since 1995, local governments could not be the main issuers of bonds. The new budget law effective from 2015 establishes a legal framework of direct financing for local governments, aiming at allowing the local government to issue government bonds within a certain limit.
Sep, 2014	Opinions of State Council on Strengthening the Administration of Local Government Debts (the No. 43 Document)	A standardized local government direct financing mechanism and corresponding supervision system have been established. The government financing function of LGFPs has been stripped off and LGFPs are not allowed to add new government debt.
Dec, 2015	Opinions on Implementing Management of Local Government Debt Quota	A top-down debt quota management system has been regulated: The total local government debt limit should be determined by the State Council and submitted to the National People's Congress for approval. The Ministry of Finance distributes the debt quota to each province. Then, the provincial finance department allocates the quota to the prefecture level cities.
Nov, 2016	Management Measures for Local Government Special Debt and General Debt Budgets	This document has formulated specific practices for the management of two types of local government debts.

Note: LGFP, Local Government Financing Platform.

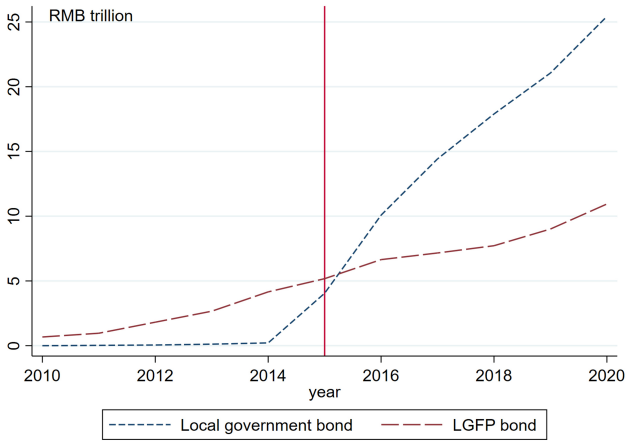


Fig. 1. The balance of local government bonds and LGFP bonds. LGFP, local government financing platform.

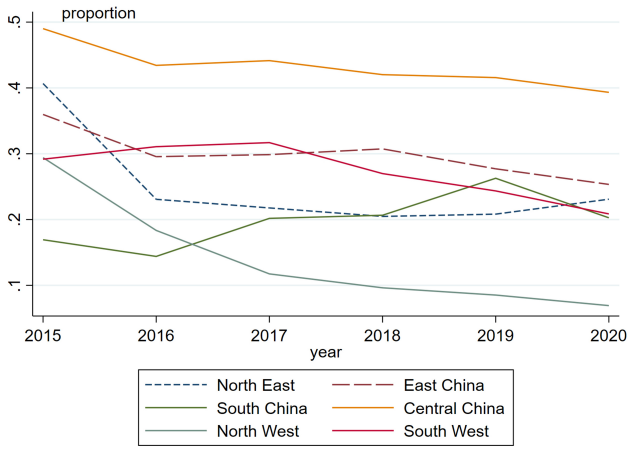


Fig. 2. The revenue proportion of LGFP's government-based business.

regulation, measures to strip platform companies of their government financing functions have also achieved notable results.

In the following sections, we examine the impact of local government debt reform policies on corporate investment through both theoretical and empirical analysis.

3. Theoretical Basis and Hypotheses

3.1 Impact of the Debt Regulation on the Crowding-out Effects

Based on the characteristics of repayment obligations and the risk-return profile of LGFP debt, we established a theoretical framework on how the impact of debt regulation affects the crowding-out effects from the perspectives of soft budget constraints, information asymmetry, and resource allocation.

(1) Strengthening soft budget constraints. From the original design, LGFPs should be market-oriented independent legal entities. However, in practice, because of the close relationship between LGFPs and local governments in terms of asset injection, fund transactions, and income sources (Jin et al., 2023), there is an implicit endorsement relationship between LGFP debt and local government credit. The result of this implicit guarantee is that although platform companies independently bear legal responsibility, a moral hazard in LGFP debt expansion may arise (Huang, 2014), stemming from the "expectation of assistance" by government departments. This expectation has also been recognized by financial institutions and investors, and the "urban investment faith" is one of its manifestations. Therefore, under the constraints of a soft budget, local governments support the borrowing entities of hidden

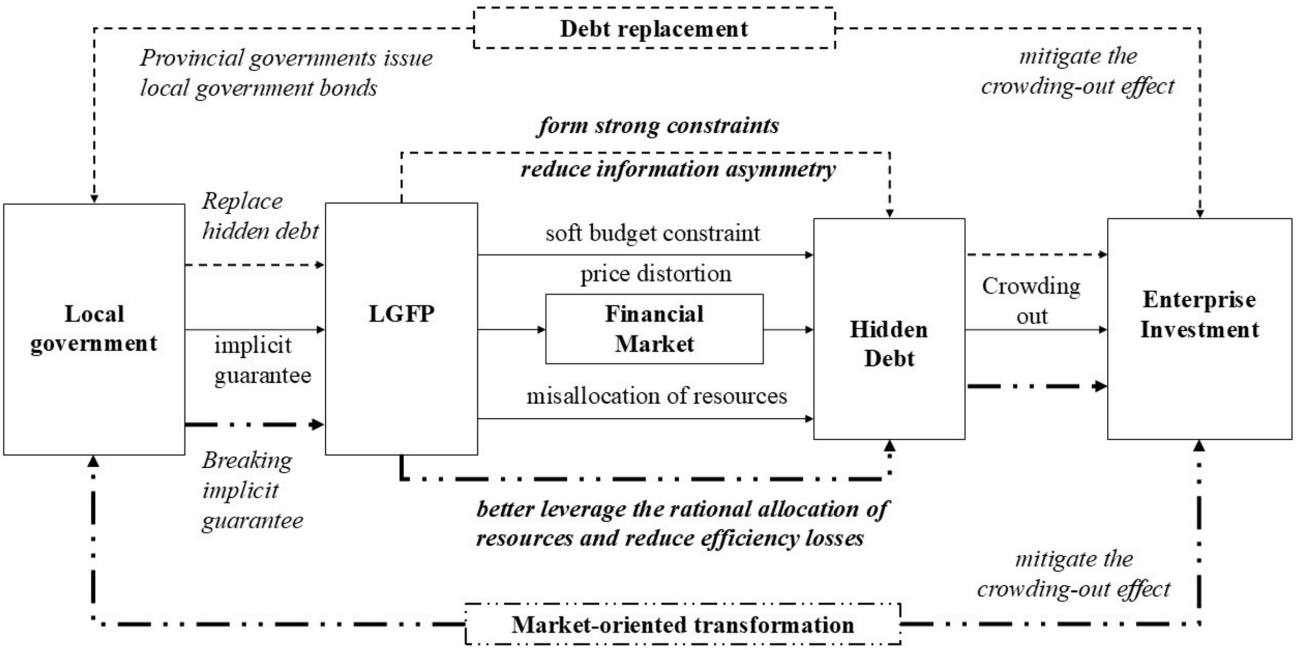


Fig. 3. The theoretical framework for the impact of debt regulation on the crowding out effect of the hidden debt.

debts in different forms, leading to the excessive expansion of hidden debts (Lin et al., 2022). Since debt regulation reform, the government financing function of LGFPs has been divested; therefore, local governments no longer bear the repayment responsibility for LGFP's borrowing behavior. As a result, the implicit guarantees have been broken, and the soft budget constraints have improved.

(2) Relieving information asymmetry. Incomplete information can lead to market failure and may result in a "lemon effect" due to adverse selection. The risk of hidden debt is closely related to the fiscal policies and financial situation of the local government. However, because the local government does not act as the debt issuer and is not subject to information disclosure, investors may have limited information to assess the risk of LGFP debt. In addition, there is no contractual form for local governments to endorse LGFP debt, and there are significant differences in the bailout obligations of LGFP debt by the local governments. The uncertainty surrounding this rescue responsibility makes it difficult for financial markets to reasonably price it. The failure of financial market pricing mechanisms may result in expected yields of bonds that do not fully reflect default risk, leading to price distortions and "adverse selection", further intensifying the crowding-out effects of the hidden debt on corporate investments. Since 2015, the implementation of the new budget law has promoted a market-oriented mechanism for local government debt issuance, which helps improve adverse selection caused by information asymmetry and price distortion and alleviate the crowding-out effect of hidden debt on enterprises.

(3) Improving resource misallocation. Unlike government debt that is directly financed by the government, LGFPs are corporate entities with homogeneous financing channels like physical enterprises. In the case of limited local financial resources, there may be financing competition between local government financing platforms and enterprises (Liu et al., 2023). The implicit guarantees provide platform companies with higher priority in the customer sequence of financial institutions, which means that the expansion of LGFP may squeeze out bank credit available to enterprises (Yarba and Güner, 2020; Zhang et al., 2022), resulting in financial resources not being effectively allocated to high-return investment projects. After the debt management system reform in 2015, the borrowing behavior of local governments has been strictly regulated, the debt scale has not been allowed to exceed the limit, and the use of the debt funds is strictly monitored. These policies are conducive to improving the efficiency of financial resource allocation and alleviating crowding-out effects.

Therefore, we propose the following hypotheses.

Hypothesis 1: The debt regulation since 2015 has weakened the crowding-out effect of LGFP debt on enterprise investments.

3.2 Mechanism of Debt Regulation for Crowding-out Effects

If Hypothesis 1 is supported, then we must further test the effective mechanism of debt regulatory policies. Based on the specific measures and implementation paths of debt management reform, we propose two possible mechanisms: the debt replacement effect and the market-oriented transformation effect. The debt replacement effect primarily mitigates crowding-out effects by strengthening soft budget constraints and relieving information asymmetry. The

market-oriented transformation effect primarily mitigates the crowding-out effect by improving resource misallocation.

(1) Debt replacement effect. The "debt replacement" refers to the policy mechanism that regulates the issuance of local government debt and optimizes the structure of government debt, thereby reducing the proportion of hidden debt in the local government debt structure and alleviating crowding-out effects. In particular, the New Budget Law that became effective in 2015 has changed how local governments raise funds in the markets. After the reform, provincial governments can issue local government bonds within the regional debt quota approved by the State Council without having to borrow indirectly through LGFPs. The direct issuance of bonds by local governments has resolved the mismatch between financing legal entities and actual fund users that existed in previous financing practices. This policy may help clarify local government credit systems and form strong constraints on local governments' borrowing based on their solvency and financial sustainability. Therefore, soft budget constraints are strengthened, and the crowding-out effect is alleviated.

Meanwhile, the issuance of local government bonds requires compliance with rating and information disclosure procedures. Timely disclosure of local government bond issuance arrangements, regional financial and debt situations, bond information, and credit rating reports can help improve the transparency of local government financial information (Mo and Zhang, 2023), reduce information asymmetry, promote reasonable pricing of local government debt, and objectively reflect regional credit levels and project risk premiums (Zhan and Zheng, 2015). In addition, after the debt reform, debt at various levels of LGFPs was collected by provincial governments for overall planning, and local finance departments coordinated bond issuance, fiscal revenue and expenditure, and treasury management. Overall, debt planning helps local governments raise funds reasonably based on their funding needs, reduce information asymmetry between different administrative levels, and improve the efficiency of fund utilization.

Therefore, we propose the following:

Hypothesis 2: Standardizing the local government financing mechanisms and adjusting debt structure through debt replacement can alleviate the crowding-out effect by strengthening soft budget constraints and relieving information asymmetry.

(2) Market-oriented transformation effect. Another key measure of debt regulation is to divest the government financing function of LGFPs and promote their transformation into market-oriented business entities. By transforming LGFP positioning, the risk of outstanding hidden debt can be gradually controlled and resolved. Following the debt regulation, the central government required a clear division of responsibilities between enterprises and local governments, and clarified that financial institutions could not require local governments to provide guarantees for the financing of LGFPs. As a result, LGFPs lacking operational capabilities are likely to be gradually phased out. This means that the credit rating and operating performance of the financing entity itself play greater roles in resource allocation, possibly reducing the mismatch of financial resources in the market. Therefore, we propose the following hypothesis:

Hypothesis 3: Divesting the government financing functions of LGFPs and promoting market-oriented transformation can alleviate the crowding-out effect by improving resource misallocation.

In summary, we believe that debt regulation can alleviate investment crowding-out effects through two pathways: debt replacement and the market-oriented transformation of LGFPs, as shown in the theoretical framework in Fig. 3. In the figure, the solid line represents the mechanism of the crowding-out effect, the dash line with two dots represents the path of the market-oriented transformation effect, while the uniform dotted line represents the path of the debt replacement effect.

4. Data and Methodology

4.1 Data and Sample Selection

We constructed a sample comprising panel data from 2010 to 2020. The level of hidden debt was assessed using the liability of LGFP companies[2] ([2]The research sample of this paper encompasses financial data from 3077 local government financing platforms with public debt issuance records, accounting for 88% of the total number of local government financing platforms included in national monitoring. This sample provides an appropriate measure of the scale of local government hidden debt. Our statistical method is a relatively comprehensive measurement approach within the scope of currently available data.) with publicly issued bond records summed at the city level. The financials of China's A-share listed companies, excluding the financial sector, were used to represent enterprise investment. We matched the data at the firm-city-year level according to prefecture-level cities and years. We also used economic and other characteristic data for prefecture-level cities in the regression analysis. The data were primarily obtained from the Wind database.

Following the approach used in previous studies (Yu and Kang, 2020), enterprise-level data were subjected to the following procedures: (1) samples with missing key financial information were excluded, and (2) to control for the impact of outliers on the regression analysis, we applied winsorisation at the 1st and 99th percentiles for continuous variables. Ultimately, a total of 37,826 firm-year observations were obtained, and city and province data were matched for each observation. The software used for data cleaning and statistical analysis is Stata 18.0 (StataCorp LLC, College Station, Texas, USA).

4.2 Research Design

Following the methodology outlined by Yu and Kang (2020), who developed a research model to test the causal relationship between local government debt and enterprise investment, we added the exogenous shock of debt regulation to our tests and applied Eqn. 1 to identify the impact of LGFP debt on enterprise investment and the treatment effect of debt regulation.

$$\begin{aligned} \text{Invest}_{i,t} &= \beta_0 + \beta_1 \times \text{Debt}_{c,t} + \beta_2 \\ &\times \text{Reform}_{c,t} + \beta_3 \times \text{Reform}_{c,t} \times \text{Debt}_{c,t} + \sum \text{j}\eta_j \\ &\times \text{X}_{j,i,t} + \sum \text{k}\gamma_k \times \text{Z}_{k,c,t} + \theta_t + \lambda_i + \varepsilon_{i,t} \end{aligned} \tag{1}$$

In Eqn. 1, $Invest_{i,t}$ denotes enterprise investment, and $Debt_{c,t}$ is the total debt of LGFPs summed at the city level and normalized by the city GDP. $Reform_{c,t}$ is a dummy variable that takes a value of 1 beginning in 2015 and 0 otherwise. The cross-product term of *Reform* and *Debt* measures the moderating effect of debt regulation, which is the core explanatory variable in this paper. X and Z are firm-level and regional-level control variables, respectively. λ and θ denote industry-fixed effects and time-fixed effects, respectively. ε is the error term.

To further investigate the channels through which the debt regulation policy operates, we applied the following causal chain model to analyze its mechanism in influencing the crowding-out effect on firm investment.

In the first step, we investigate whether debt regulation had a significant impact on the restructuring of the local government debt management system by testing the causal relationship between the dummy variable $Reform_{c,t}$ and the proxies depicting the outcome of the specific debt regulation policies, namely, the debt replacement effect ($Replace_{c,t}$) and the market-oriented reformation effect ($Mkt_{c,t}$). These two effects correspond to Hypotheses 2 and 3, as shown in Eqns. 2,3, respectively.

$$\begin{aligned} \text{Replace}_{c,t} &= \beta_0 + \beta_1 \times \text{Reform}_{c,t} + \beta_2 \\ &\times \text{Controls} + \theta_t + \lambda_i + \varepsilon_{c,t} \end{aligned} \tag{2}$$

$$\begin{aligned} \text{Mkt}_{c,t} &= \beta_0 + \beta_1 \times \text{Reform}_{c,t} + \beta_2 \\ &\times \text{Controls} + \theta_t + \lambda_i + \varepsilon_{c,t} \end{aligned} \tag{3}$$

Next, we test whether the debt replacement effect and the market-oriented reformation effect alleviate the crowding-out effect of the hidden debt on firm investments, as shown in Eqns. 4,5, respectively. The coefficient of the cross-product term is expected to be positive, which means the moderation effect is opposite to that of the main effect.

$$\begin{aligned} \text{Invest}_{i,t} &= \alpha + \beta_1 \times \text{Debt}_{c,t} + \beta_2 \\ &\times \text{Replace}_{c,t} + \beta_3 \times \text{Debt}_{c,t} \times \text{Replace}_{c,t} + \sum \text{j}\eta_j \\ &\times \text{X}_{j,i,t} + \sum \text{k}\gamma_k \times \text{Z}_{k,c,t} + \theta_t + \lambda_i + \varepsilon_{i,t} \end{aligned} \tag{4}$$

$$\begin{aligned} \text{Invest}_{i,t} &= \alpha + \beta_1 \times \text{Debt}_{c,t} + \beta_2 \times \text{Mkt}_{c,t} \\ &+ \beta_3 \times \text{Mkt}_{c,t} \times \text{Debt}_{c,t} + \sum \text{j}\eta_j \times \text{X}_{j,i,t} \\ &+ \sum \text{k}\gamma_k \times \text{Z}_{k,c,t} + \theta_t + \lambda_i + \varepsilon_{i,t} \end{aligned} \tag{5}$$

The definition and measurement of the main variables are presented in Table 2, and descriptive statistics are presented in Table 3.

5. Empirical Results

5.1 Baseline Results

The baseline regression examines the relationship between hidden debt, debt management reform, and enterprise investment using Eqn. 1. Firm-level cluster-robust standard errors were applied to address heteroskedasticity concerns. The results presented in columns (1) and (2) of Table 4 reveal that the coefficient of *Debt* is negative at the 1% significance level, suggesting that LGFP debt has a significant crowding-out effect on enterprise investments. The coefficient of the cross-product term *Debt* × *Reform* is significantly positive at the 1% level, indicating that the crowding-out effect has been weakened after debt regulation, as presented in Table 4, columns (3). We have adopted a stepwise approach to add control variables, incorporating firm-level and city-level control variables into the formula, and further adding provincial-level and macro-level control variables in to the regression analysis. The macro-level control variables include the macroeconomic growth indicator of the national GDP growth rate (*Ggdp*) and the monetary policy proxy of the Interbank Offered Rate (*Ibor*). The results are reported in columns (4) and (5) of Table 4, respectively. The results indicate that the benchmark regression results remain robust after controlling for firm, regional, and macro-level factors. To enhance the robustness of the results, we replaced prefecture-level hidden debt data with provincial-level data. The proxy variable is the balance of LGFP bonds at the provincial level divided the by the provincial GDP. The regression results using the provincial-level data are presented in column (6), Table 4. The sign and significance of the regression coefficients are the same as those at the prefecture level, further verifying that enterprises' investments are inversely correlated with hidden debt and that the mitigation of crowding-out effects by debt management regulation is significant. These findings support Hypothesis 1.

Table 2. Variable definition and description.

Variables	Measurement	Formula
Dependent variable		
Enterprise investment (*Invest*)	Ratio of net cash outflow from investing activities to total assets (in percentage points). Denote *i* as the enterprise and *t* as the year.	$\text{Invest}_{i,t} = \frac{\text{CFI}_{i,t}}{\text{Asset}_{i,t}} \cdot 100$
Independent variable		
Hidden debt ratio (*Debt*)	Referring to Huang et al. (2020), *Debt* is calculated by the formula on the right where *LGFPD* is calculated by summing up the payables and financial liabilities[3] ([3]According to Huang et al. (2020), LGFP debt includes bank loans, bonds, accounts payables and notes payables.) of LGFPs. Provincial-level data have also been tested, and the proxy variable is replaced by the balance of LGFP bonds. Denote *v* as the LGFP, *c* as the city and *t* as the year.	$\text{Debt}_{c,t} = \frac{\sum_{v=1}^{m} \text{LGFPD}_{c,v,t}}{\text{GDP}_{c,t}}$
Mechanism variables		
Debt replacement ratio (*Replace*)	The ratio of the local government bonds (*LGB*) to the sum of the local government bonds and LGFP bonds (*LGFPB*). Denote *p* as the province and *t* as the year.	$\text{Replace}_{p,t} = \frac{\text{LGB}_{p,t}}{\text{LGB}_{p,t}+\text{LGFPB}_{p,t}}$
Market-oriented reformation rate (*Mkt*)	The ratio of revenue from market-based ([4]Referring to Yan et al. (2020), the market-based revenue is the total revenue excluding those revenues closely related to the public expenditure and the raw data were derived from the top five revenue components disclosed by LGFP companies.) (*LGFPMR*) to the total revenue (*LGFPR*) of LGFP companies.	$\text{Mkt}_{c,t} = \frac{\sum_{v=1}^{m} \text{LGFPMR}_{c,v,t}}{\sum_{v=1}^{m} \text{LGFPR}_{c,v,t}}$
Instrumental variable		
Tax-sharing reform (*Taxref*)	The decrease in the degree of fiscal decentralization between the average of 1994–1997 and that of 1990–1993. The degree of fiscal decentralization is measured by the ratio of the general public budget revenue of each province to the general public budget revenue of the central government.	
Health expenditure (*Pvph*)	Per capita medical and health expenditure (in RMB 100; approximately USD 15.24, based on the 2010–2020 average exchange rate of RMB 6.5629 per USD)	
Control variables		
Sales (*Sales*)	Enterprise sales (in RMB 100 million; approximately USD 15.24 million, based on the 2010–2020 average exchange rate of RMB 6.5629 per USD)	
Logarithm of assets (*Lnasset*)	Logarithm of enterprise assets	
Liquid assets (*Liquid*)	Percentage of current assets to total assets of enterprises	
Net Profit Margin (*Npm*)	Percentage of enterprise net profit margin	
GDP per capita (*Ctpercgdp*)	Logarithm of per capita GDP	
GDP growth rate (*Pvggdp*)	Percentage of GDP growth rate	
Population growth rate (*Gcapita*)	Percentage of population growth rate	
Fiscal self-sufficiency (*Pvfn*)	Ratio of general public budget revenue divided by budget expenditure	

Note: GDP, Gross Domestic Product; CFI, net cash outflow from investing activities; Asset, the total assets of the enterprise; LGFPD, local government financing platform debt; LGFPMR, local government financing platform market-based revenue; LGFPR, local government financing platform revenue; *Pvph*, Per capita medical and health expenditure.

5.2 Robustness Tests

In this section, we conduct a series of endogeneity tests and robustness tests to verify the baseline regression results, including instrumental variable (IV) regression, dynamic effects tests, placebo tests, converting the regression model into a Staggered Difference-in-Differences (staggered-DID) model, and other robustness tests. Overall, our test results demonstrate the validity of the baseline regression.

5.2.1 Test of Endogeneity Issues

First, to address concerns regarding endogeneity, we conducted a one-period lag test of the benchmark model and constructed a regression Eqn. 6. Due to the generation of

Table 3. Descriptive statistics.

Variables	N	Mean	Min	M (P25, P75)	Max
Firm-level					
Sales (*Sales*)	37,826	51.61	0.00	10.08 (3.29, 30.83)	1300.00
Logarithm of assets (*Lnasset*)	37,826	12.49	9.20	12.39 (11.47, 13.38)	17.83
Liquid assets (*Liquid*)	37,826	52.89	0.00	57.72 (36.94, 73.90)	97.00
Net Profit Margin (*Npm*)	37,826	7.52	–89.38	7.10 (1.52, 14.23)	49.50
Enterprise investment (*Invest*)	37,826	5.84	–17.35	3.95 (0.03, 9.60)	38.01
Prefecture-level cities					
Hidden debt ratio (*Debt*)	3300	0.16	0.00	0.07 (0.02, 0.19)	2.97
Reform effect (*Reform* × *Debt*)	3300	0.12	0.00	0.01 (0.00, 0.11)	1.60
Market-oriented reformation rate[5] ([5]Due to data availability, the time period of this indicator is from 2012–2020.) (*Mkt*)	1760	0.64	0.02	0.68 (0.48, 0.84)	0.99
GDP per capita (*Ctpercgdp*)	3300	10.87	10.01	10.86 (10.47, 11.25)	12.15
Provincial-level					
GDP growth rate (*Pvggdp*)	341	8.41	–8.24	8.49 (4.19, 11.70)	23.58
Population growth rate (*Gcapita*)	341	0.43	–5.67	0.40 (0.00, 0.85)	3.02
Fiscal self-sufficiency rate (*Pvfn*)	341	47.97	20.49	44.75 (34.37, 59.01)	92.64
Debt replacement ratio (*Replace*)	341	0.38	0.00	0.43 (0.00, 0.71)	0.97

Table 4. Baseline results.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Invest	*Invest*	*Invest*	*Invest*	*Invest*	*Invest*
Debt	–0.56***	–0.55***	–1.50***	–1.64***	–1.42***	–11.86***
	(–3.39)	(–3.20)	(–4.70)	(–4.79)	(–4.05)	(–3.02)
Debt × *Reform*			1.13***	1.29***	1.26***	10.77***
			(3.14)	(3.48)	(3.39)	(2.81)
Ctpercgdp					0.31*	–0.72**
					(1.74)	(–2.06)
Pvggdp					0.04***	0.03**
					(2.86)	(2.58)
Pvfn					0.02***	0.04***
					(3.92)	(4.88)
Gcapita					0.06	0.05
					(1.20)	(0.97)
Ibor					0.21	0.07
					(1.02)	(0.32)
Ggdp					–0.19***	–0.24***
					(–3.98)	(–5.04)
Controls		Yes		Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	37,826	37,826	37,826	37,826	37,826	37,826
Adj.R^2	0.04	0.07	0.04	0.07	0.07	0.09

Note: Data are obtained from the Wind database. N denotes the number of observations. The sample size is 37,826 firm-year observations. Z-statistics adjusted with robust standard errors are in parentheses and superscripts ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. *Ctpercgdp*, GDP per capita; *Ibor*, Interbank Offered Rate; *Ggdp*, the national GDP growth rate; FE, Fixed Effect.

lag variables, the number of research samples for lag effects is 33,456 observations. We also accounted for the impact of unobservable individual factors by controlling for firm fixed effects (v_i).

Table 5. Endogenous test results.

Variable	Lagged variable	2SLS (*Taxref* as IV)		2SLS (*Pvph* as IV)	
	(1)	(2)	(3)	(4)	(5)
	$Invest_{t+1}$	*Debt*	*Invest*	*Debt*	*Invest*
Debt	–1.60** (–2.31)				
Debt × *Reform*	0.86* (1.78)				
IV (Taxref)		0.90*** (21.56)			
IV (Pvph)				0.01*** (8.32)	
Instrumented-Debt			–4.56*** (–3.95)		–9.63*** (–3.96)
Instrumented-Debt × *Reform*			2.80** (2.34)		11.11*** (4.33)
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
N	33,456	37,826	37,826	37,826	37,826
Kleibergen-Paap rk LM statistic		1706.43 (p value = 0.00)		235.26 (p value = 0.00)	
Kleibergen-Paap rk Wald F statistic		504.60		127.42	

Note: Data are obtained from the Wind database. N denotes the number of observations. Sample size is 33,456 for lagged variable test and 37,826 for other tests. Z-statistics adjusted with robust standard errors are in parentheses and superscripts ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. FE denotes Fixed Effect. 2SLS, Two-Stage Least Squares; IV, instrumental variable; rk LM, rank Lagrange Multiplier.

$$\begin{aligned} \mathrm{Invest}_{i,t+1} &= \beta_0 + \beta_1 \times \mathrm{Debt}_{ct} + \beta_2 \\ &\times \mathrm{Reform}_t + \beta_3 \times \mathrm{Reform}_t \times \mathrm{Debt}_{c,t} + \sum \mathrm{j}\eta_j \\ &\times \mathrm{X}_{j,i,t} + \sum \mathrm{k}\gamma_k \times \mathrm{Z}_{k,c,t} + \theta_t + \mathrm{v}_i + \varepsilon_{i,t} \end{aligned} \quad (6)$$

As presented in column (1) of Table 5, the coefficient of the main effect Debt is –1.60, significant at the 5% level, and the coefficient of the interaction term Debt × Reform is 0.86, significantly positive at the 10% level. These results align with those of the baseline regression, indicating that the baseline regression results are still valid after accounting for endogeneity, lagged effects, and other unobservable firm-level effects.

Second, we have employed an instrumental variable approach to further rule out the potential endogeneity problem. We have used the changes in fiscal decentralization before and after the 1994 tax-sharing reform (*Taxref*) as an instrumental variable (IV) for LGFP debt. The second and third columns of Table 5 present the two-stage IV regression results (*Taxref* as IV). The instrumental variables meet the relevant conditions, that is, the degree of fiscal decentralization is related to the hidden debt of the local governments. The provinces with a significant decrease in fiscal decentralization after the tax-sharing system have a greater financial pressure, which is highly correlated with the expansion of hidden debt. This IV also satisfies the exogeneity condition, that is, the tax-sharing reform that occurred in 1994 was an external variable unrelated to the individual company investments at the time level. The specific calculation method for instrumental variables is the decrease in the degree of fiscal decentralization between the average of 1994–1997 and that of 1990–1993. The degree of fiscal decentralization is measured by the ratio of the general public budget revenue of each province to the general public budget revenue of the central government. The Kleibergen-Paap rk Wald F statistic for the first-stage regression is 504.60, far above the Stock-Yogo 10% critical value of 7.03, and the Kleibergen-Paap rank Lagrange Multiplier (rk LM) statistic rejects the underidentification null ($p < 0.001$), confirming that the instruments are strong and relevant. The results show that after the possible endogeneity issue has been considered, the regression coefficient of the hidden debt on enterprise investment remains negative and the coefficient of the moderating effect (*Debt* × *Reform*) remains positive, indicating that the debt regulation can significantly decrease the level of crowding-out effect on enterprise investments, which is fully consistent with our benchmark results. To further enhance robustness, based on previous research (Chen, 2024), we have also used the annual per-capita healthcare and medical expenditure at the provincial-level (in hundred RMB, per-capita healthcare represented by *Pvph*) as an instrumental variable of LGFP debt. Similarly, this instrumental variable satisfies the correlation condition that *Pvph* is correlated to the public finance expenditure, and further related to local government debt. The IV also meets the exogeneity condition that expenditure at the regional level is an external variable that is not correlated with individual firms' investments. Columns (4) and (5) of Table 5 present the two-stage IV regression results estimated through *Pvph*. For this alternative instrument set, the Kleibergen-Paap rk Wald F statistic still exceeds the 10% maximal IV size critical value. The second-stage estimates are also consistent with baseline results. These findings indicate that the instrumental variable regression results are robust.

5.2.2 Dynamic Effect Test

To further strengthen the robustness of the baseline result, we conducted dynamic effect tests. Fig. 4 provides the coefficient estimates of the cross-product terms, and the sample size is 37,826 firm-year observations. The vertical lines represent the 90% confidence intervals. The results show that before the reform, none of the coefficient estimates of the cross-product term were significant at the 10% significance level; in and after the year of the reform, the coefficient estimates of the cross-product term are significantly positive at the 10% significance level. The results of the dynamic effect test indicate that the debt management reform that began in 2015 significantly impacted the crowding-out effect.

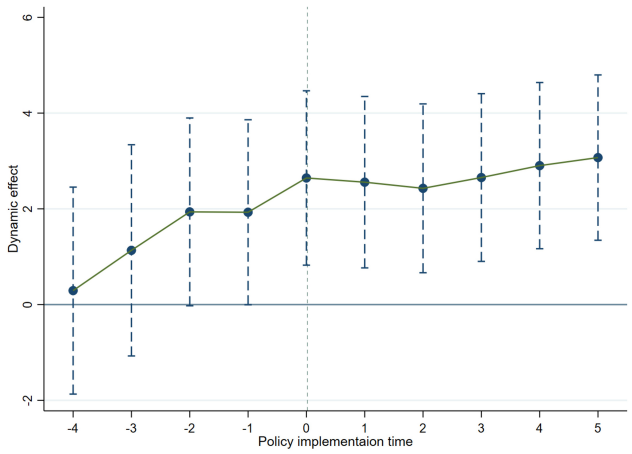


Fig. 4. Dynamic effects test.

5.2.3 Placebo Test

To rule out other macro-policy and random factors, we also conducted a placebo test. The process is as follows: first, cross-product terms of the policy effect were randomly assigned to each city; second, the estimated coefficients were obtained through the regression of the Generalized Difference-in-Differences model (Generalized DID model). The kernel density plots of the estimated coefficients of the interaction terms were generated after the experiment was repeated 1000 times. The plots are shown in Fig. 5 and the sample size is 37,826 firm-year observations. The results of the placebo test show that the estimated coefficients of the cross-product terms of the policy effects after the random treatment cluster around 0. Such results indicate that the benchmark regression is robust.

5.2.4 Other Robustness Test

(1) Changing the regression model. We also adopted other model settings and parameter selection methods to conduct robustness tests on the benchmark regression. First, we changed the time variable for policy implementation. Although the reform policy was introduced in 2015,

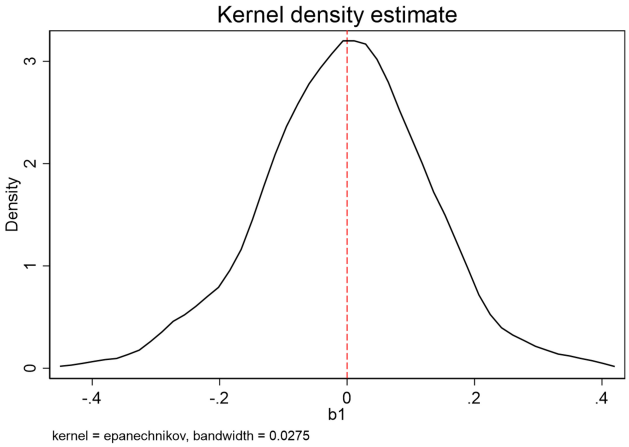


Fig. 5. Distribution of coefficient estimates after random treatment. The figure presents the kernel density distribution of placebo estimated coefficients. b1 refers to the estimated coefficient. The red dashed line indicates the center.

there may be differences in the implementation time among cities. Following Liang and Wang (2021), we changed the implementation time of the reform, measured by the time when local government debt balances were announced by each prefecture-level city. The year of implementation and the subsequent years are assigned a value of 1; otherwise, years are assigned a value of 0, and the model was changed to a staggered DID. Specifically, the year in which the Wind database first disclosed the balance of the local government debt of each city was taken as the first year of reform implementation. By determining the implementation time of policies in various prefecture-level cities, we replaced the original single time-point model with an interleaved-point model for estimation. The results are shown in Table 6, Panel A, column (1). The regression results are consistent with the baseline regression results.

We changed the measurement method of policy effects, using the average hidden debt ratio of cities in the three years before policy implementation to measure the impact intensity of reform policies (Wang et al., 2023). Cities with hidden debt ratios above the average before policy implementation served as the experimental group, and cities with debt ratios below the average served as the control group for regression. In this case, the interaction term (DID) directly reflects the policy effect. The results are shown in the second column of Table 6, Panel A. The regression results still indicate that the alleviation of the crowding-out effect by the reform is significant.

We examined the robustness of multi-time DID estimators based on the Callaway and Sant'Anna estimator for staggered Difference-in-Differences (CSDID) method proposed by Callaway and Sant'Anna (2021). The estimation results are reported in Table 6, Panel B. The results show that various types of treatment effects (*Simple ATT*, *C_average,* and *G_average*) are significant. Notably,

Table 6. Robustness test results.

Panel A	(1)	(2)	(3)	(4)
	Staggered policy time	Staggered DID	Changing policy time	Sub-sample test
Variable	*Invest*	*Invest*	*Invest*	*Invest*
Debt	–1.46*** (–3.81)		–2.44*** (–3.53)	–1.64*** (–4.85)
Debt × *Reform*	0.98** (2.57)			1.47*** (3.91)
DID		0.30** (2.19)		
Debt × *Reform_2011*			0.77 (1.12)	
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	37,826	37,826	17,204	32,241
Panel B: Estimation by Callaway and Sant'Anna (2021) method				
Simple ATT	0.64*** (2.82)			
Pre_avg	–0.09 (–0.45)			
Post_avg	0.81*** (3.30)			
C_average	0.67*** (3.05)			
G_average	0.52** (2.35)			

Note: Data are obtained from the Wind database. N denotes the number of observations. Sample size is 32,241 for sub-sample test. Sample size is 17,204 for changing policy time test. Sample size is 37,826 for other tests. Z-statistics adjusted with robust standard errors are in parentheses and superscripts ***, ** denote significance at 1%, 5% levels, respectively. FE denotes Fixed Effect. DID, the interaction term which reflects the policy effect; ATT, Average Treatment Effect on the Treated; C_average, Calendar-time-specific average; G_average, Group-specific average.

the post-treatment effect (*Post_avg*) is significant, while the pre-treatment effect (*Pre_avg*) is not significant, further demonstrating the robustness of DID estimation.

(2) Excluding other random factors. To further exclude the influence of other factors on the reliability of policy effectiveness, we randomly assumed that the policy shocks occurred in 2011 and used data before the real policy implementation (17,204 observations) for testing. The results show that the interaction term (*Debt* × *Reform_2011*) is not significant, as shown in column (3) of Table 6, Panel A. This indicates that it is not other random factors that alleviate the crowding-out effect of hidden debt on corporate investment.

(3) Excluding the sample of net investment recovery. As corporate investment is a continuous process, there are some samples with net investment recovery during our testing period. We excluded these samples for sub-sample testing, and the results are presented in the fourth column of Table 6, Panel A. The results show that even after excluding samples with net investment recovery, our benchmark regression results remain robust.

5.3 Heterogeneity Analysis

The effect of local government debt regulation on enterprise investment may vary depending on differences across firms and regions. In this section, we delve deeper into the heterogeneity of the baseline findings by considering enterprises' characteristics and their regional environment.

5.3.1 Enterprise Heterogeneity

In this section, the heterogeneity of the impact of LGFP debt regulation on the crowding-out effect is examined according to enterprises' characteristics in terms of industry distribution, financing constraints, and property rights structure. The enterprise heterogeneity analysis results are presented in Table 7.

First, we have tested the discrepancy across different industries. To simplify the process, we have divided the enterprises into manufacturing and non-manufacturing groups according to the industry codes and conducted sub-sample tests. The results of the industry heterogeneity test presented in columns (1) and (2) in Table 7 show that, for the manufacturing group, the policy effect is significant, whereas that for the non-manufacturing group is not. The difference may stem from the capital structures of manufacturing industries and non-manufacturing industries. Specifically, manufacturing enterprises generally require bank credit to support their investments; therefore, their investment decisions are more closely related to the conditions of the debt market. Non-manufacturing industries, such as the information technology and technology service industries, which usually operate with much fewer fixed assets, have a higher proportion of equity financing funds in their investment sources. After the reform of the local government debt management system, the implicit guarantee mechanism has been broken, leading to a more significant impact on the debt market. However, the impact on equity financing that

Table 7. Results of enterprise heterogeneity analysis.

Variable	Industry		Financing constraint		Property rights	
	Manufacturing	Non-manufacturing	High	Low	SOE	Non-SOE
	(1)	(2)	(3)	(4)	(5)	(6)
	Invest	*Invest*	*Invest*	*Invest*	*Invest*	*Invest*
Debt	–1.64***	–1.12*	–1.92***	–0.57	–1.20**	–1.31***
	(–3.92)	(–1.74)	(–2.57)	(–0.61)	(–2.43)	(–2.88)
Debt × *Reform*	1.75***	0.19	1.25**	1.01	0.35	1.53***
	(3.82)	(0.29)	(2.17)	(1.40)	(0.65)	(3.05)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	24,315	13,511	18,925	18,901	11,868	25,958
Chow test	3.76		10.32		17.99	
	p-value: 0.00		*p*-value: 0.00		*p*-value: 0.00	

Note: Data are obtained from the Wind database. N denotes the number of observations. Sample size is 37,826 in total for each test. Z-statistics adjusted with robust standard errors are in parentheses and superscripts ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. FE denotes Fixed Effect. SOE, state-owned enterprise; non-SOE, non-state-owned enterprise.

does not rely on the credit guarantee system is relatively small. Therefore, this has led to differences in the significance of the policy effects between the manufacturing and non-manufacturing groups.

We have also tested the differences in financing constraints by constructing the financing constraint index (*SA*) following the method introduced by Hadlock and Pierce (2010). The *SA* is calculated using Eqn. 7, where *LnAsset* is the logarithm of the enterprise assets and *Age* is the age of the enterprise. The larger the *SA*, the more financial constraints the enterprise faces.

$$\mathrm{SA} = -0.737 \times \mathrm{LnAsset} + 0.043 \times (\mathrm{LnAsset})^2 - 0.04 \times \mathrm{Age} \tag{7}$$

We have conducted subgroup regression based on median of the financing constraint index (*SA*), and the results are reported in columns (3) and (4) of Table 7. The regression results show that for the group with high financing constraints, both the crowding-out effect of LGFP debt on corporate investment and the policy effect of debt regulation are significant. However, for the group with low financing constraints, the regression coefficient is not significant. The main reason is that enterprises facing higher financing constraints rely more on financial institutions and external investors for financial support for investment, and are therefore more significantly affected by the distortion of financial market prices caused by the excessive expansion of local government financing platform debt. After the implementation of debt regulation policies, as information asymmetry in the debt market has been alleviated, market price distortions have been resolved, and the policy effects are more pronounced among these enterprises that rely on external financing. This indicates that debt management reform has played an effective role in alleviating these enterprises' financing constraints, further supporting **Hypothesis 1**.

Lastly, previous studies have demonstrated that the crowding-out effect of local government debt varies among enterprises with different property rights structures (Huang et al., 2020). Following this line of thought, we find it essential to further examine whether debt management reforms have different effects on enterprises with different property rights structures. The last two columns of Table 7 report the test results of different ownership structures, revealing the discrepancy that the policy effect for non-state-owned enterprises (non-SOEs) is significant, whereas that for state-owned enterprises (SOEs) is not.

This heterogeneity may stem from the fact that debt regulation has disrupted the implicit guarantee system, weakened the preferential position of SOEs and platform companies in the credit market, and thus created a more equitable competitive environment for non-SOEs. The results of this heterogeneity analysis indicate that reform policies can correct market distortions and have a profound impact on stimulating the vitality of the private economy. We performed Chow tests for each subsample, and the results indicate that the differences between groups are statistically significant.

5.3.2 Regional Heterogeneity

Differences in economic foundations, local policies, and business environments among various regions in China may lead to regional differences in the effectiveness of debt management reforms. In this section, we examine regional heterogeneity, which mainly includes economic development, financial resources, and the degree of marketization

Table 8. Results of regional heterogeneity analysis.

Variable	Economic development		Financial resources		Marketability	
	(1)	(2)	(3)	(4)	(5)	(6)
	Above average	Below average	Above average	Below average	Above median	Below median
	Invest	*Invest*	*Invest*	*Invest*	*Invest*	*Invest*
Debt	–2.49***	–1.03**	–2.14***	–0.92**	–2.01***	–0.82*
	(–4.31)	(–1.99)	(–3.32)	(–2.04)	(–2.90)	(–1.74)
Debt × *Reform*	1.64***	0.87	1.91***	0.95*	2.05***	0.85*
	(2.92)	(1.46)	(2.92)	(1.93)	(2.97)	(1.69)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	24,275	13,551	28,044	9782	20,646	17,180
Chow test	3.11		4.55		7.10	
	p-value: 0.00		*p*-value: 0.00		*p*-value: 0.00	

Note: Data are obtained from the Wind database. N denotes the number of observations. Sample size is 37,826 in total for each test. Z-statistics adjusted with robust standard errors are in parentheses and superscripts ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. FE denotes Fixed Effect.

to track cross-sectional differences. The results are presented in Table 8.

Firstly, we have tested the heterogeneity of urban economic development. We have used urban GDP as a proxy variable and grouped the samples by cities for regression using the median GDP. The results are presented in columns (1) and (2) of Table 8. The results show that for regions with stronger economic strength, the coefficient of *Debt* × *Reform* is significantly positive. For regions with weaker economic development levels, the coefficient of the interaction term is not significant. This result indicates that for regions with higher economic development, the policy effect of debt governance is more significant.

We have further explored the heterogeneity of regional financial resources and financing environments. Using the average interest rate spread of LGFP bonds issued in the primary market, the sample is divided into two groups by province. Provinces with an average bond issuance coupon rate lower than the national average are classified as having stronger regional financial resources and a better-than-average financing environment. The regression results of the groups are reported in columns (3) and (4) of Table 8. In both groups, the interaction coefficients between the hidden debt and the debt management reform are significantly positive. We conducted a Chow test[6] ([6]Chow test (Chow, 1960) is a commonly used method for testing the significance of differences between groups. A *p*-value less than the significance level indicates that the Chow test is passed, meaning the null hypothesis that there is no significant difference between groups is rejected.) on the two groups, the result indicated significant differences in the regression outcomes between the two groups, suggesting heterogeneity between sub-groups. For regions with richer financial resources and stronger financing environments, the interaction coefficient is more significant, and the absolute value is greater. This may indicate that in regions with richer financial resources, reform policies have a greater impact on alleviating information asymmetry in financial markets, thereby leading to more significant implementation effects of debt regulation.

We have also examined the heterogeneity of regional marketability on the effectiveness of local government hidden debt governance. The degree of marketability has been measured using the marketization process score, where higher scores indicate higher marketization at provincial level. The data are obtained from the China Marketization Index and WIND database, and sub-group regression analysis are performed based on the median marketization process score. The results are reported in columns (5) and (6) of Table 8. In both groups, the interaction coefficients between the hidden debt and the debt management reform are significantly positive. The Chow test results indicate significant differences in the regression outcomes between the two groups. In terms of regression coefficients and significance, the regression coefficients of the interaction terms are more significant and have a larger absolute value in regions with faster marketization processes. This may suggest that in regions with higher levels of marketization, debt management reforms have a more pronounced effect on breaking implicit guarantees, leading to more significant reform outcomes.

5.4 Mechanism Analysis

5.4.1 Analysis of the Debt Replacement Effect and the Market-Based Transformation Effects

The results from the benchmark regression, robustness testing, and heterogeneity analysis support the basic hypothesis that debt management reform has reduced the crowding-out effect of local government hidden debt expansion on corporate investment, confirming Hypothesis 1. Based on this and the theoretical analysis in the pre-

vious section, further research was conducted to examine the impact of the "debt replacement path" and the "market-oriented transformation path" on the crowding-out effect of local government hidden debt on corporate investment as part of governance measures for local government hidden debt.

We first examine the debt replacement mechanism of the debt regulatory policies. The debt replacement ratio (*Replace*) was used as a proxy variable to measure the percentage of local government bond issuance used to replace local government hidden debt. Such a replacement makes hidden debt explicit and optimizes the overall debt structure. Column (1) in Table 9, Panel A reports the results for the relationship between the debt regulation policy and the debt replacement effect. The results show that the debt management reform policy significantly optimized the structure of local government debt, and the explicit debt included in local fiscal supervision has gradually replaced the hidden debt that was not included under budget supervision.

We then test whether the debt replacement effect alleviated the crowding-out effect. The results reported in column (2) show that the coefficient of the interaction term between the debt replacement ratio and the hidden debt ratio (*Debt* × *Replace*) is significantly positive, suggesting that local government debt replacement alleviates the crowding-out effect of hidden debt on enterprise investment. This finding demonstrates that, following the reform of local government debt management, restructuring debt management system through regulated borrowing mechanisms and strengthening hard debt constraints has had a significant effect in easing the crowding-out effect of hidden debt on enterprise investment, thus verifying Hypothesis 2.

We also examine the market-oriented transformation mechanism, with results presented in columns (3) and (4) of Table 9, Panel A. We used the proportion of market-oriented business conducted by platform companies (*Mkt*) as a proxy variable for market-oriented transformation by platform companies. We excluded platform companies where the main business income could not be disaggregated, yielding a total of 22,827 observations in this part of the study.

The test results show that the debt regulation policy has significantly increased the proportion of market-oriented business conducted by platform companies, indicating that the market-oriented reform channel is valid. The test results for the market-oriented reform mechanism and investment crowding-out effect show that the interaction term between the proportion of market-oriented business conducted by platform companies and the hidden debt ratio (*Debt* × *Mkt*) is significantly positive at the 10% level. The sign of the regression coefficient of the interaction term is opposite to that of the main effect of the hidden debt ratio (*Debt*). The result indicates that the increase in the proportion of market-oriented business conducted by platform companies can mitigate the crowding-out effect of hidden debt on enterprise investment. This suggests that since the debt management reform, divesting the government financing function from platform companies, promoting the market-oriented transformation of platform companies, and allocating resources rationally based on risk and return, the crowding-out effect of hidden debt on enterprise investment has been significantly alleviated. The above result supports Hypothesis 3.

We also conducted the mechanism tests using a DID method to strengthen our conclusion, and the regression model is presented as follows:

$$\begin{aligned} \text{Invest}_{\text{i,t}} &= \alpha + \beta_1 \times DID_{c,t} + \beta_2 \\ &\times \text{Replace}_{c,t} + \beta_3 \times \text{Replace}_{c,t} \times DID_{c,t} + \sum \text{j}\eta_{\text{j}} \\ &\times \text{X}_{\text{j,i,t}} + \sum \text{k}\gamma_{\text{k}} \times \text{Z}_{\text{k,c,t}} + \theta_t + \lambda_{\text{i}} + \varepsilon_{\text{i,t}} \end{aligned} \tag{8}$$

$$\begin{aligned} \text{Invest}_{\text{i,t}} &= \alpha + \beta_1 \times DID_{c,t} + \beta_2 \times \text{Mkt}_{\text{c,t}} \\ &+ \beta_3 \times \text{Mkt}_{\text{c,t}} \times DID_{c,t} + \sum \text{j}\eta_{\text{j}} \times \text{X}_{\text{j,i,t}} \\ &+ \sum \text{k}\gamma_{\text{k}} \times \text{Z}_{\text{k,c,t}} + \theta_t + \lambda_{\text{i}} + \varepsilon_{\text{i,t}} \end{aligned} \tag{9}$$

where the measurement of DID is the same as that of the robustness test in Section 5.2.4. The mechanism test results from the DID method using Eqns. 8,9 are presented in Table 9, Panel B. The main effect (*DID*) and the interaction term (*DID* × *Replace* and *DID* × *Mkt*) are significantly positive, indicating a positive moderating effect, which is in line with our previous findings.

5.4.2 Further Research on the Mechanism Analysis

To further investigate the different debt replacement methods, we classified local government bonds into special and general categories according to their financing purposes and recalculated the replacement rate for each category. The observed discrepancies in the regression results for the two subgroups reveal how differences in debt structure used to replace hidden debt influence the extent to which investment crowding-out effects are mitigated. The results, presented in Panel A of Table 10, show that both types of debt replacement can significantly mitigate the crowding-out effect, with the impact of special bonds more pronounced as measured by parameter estimates. To further compare the differences in the debt replacement effects of the two types of bond, we conducted a sub-group test. We categorized cities where the amount of issued special bonds was less than that of general bonds into one group (the General group) and the remaining cities into another group (the Special group). We then tested the differences in the debt replacement effects between the two groups. The results are reported in columns (5) and (6) of panel A in Table 10. The regression coefficient for the cross-product term *Debt* × *Replace* is significantly positive at the 1% level for the Special

Table 9. Results of mechanism analysis.

Panel A: causal chain method				
Variable	Debt replacement		Market-based reformation	
	(1)	(2)	(3)	(4)
	Replace	*Invest*	*Mkt*	*Invest*
Reform[7] ([7]To avoid multi-collinearity, the reform time is measured using the staggered time point method.)	0.07***		0.02***	
	(38.08)		(5.56)	
Debt		–1.56***		–3.37*
		(–4.25)		(–1.78)
Debt × *Replace*		1.57***		
		(2.89)		
Debt × *Mkt*				4.25**
				(2.03)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	37,826	37,826	22,827	22,827

Panel B: DID method		
Variable	(1) Debt replacement	(2) Market–based reformation
	Invest	*Invest*
DID	0.35* (1.86)	0.37* (1.84)
DID × *Replace*	0.96* (1.80)	
DID × *Mkt*		1.46* (1.71)
Replace	–0.79 (–1.04)	
Mkt		–0.22 (–0.64)
Controls	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
N	37,826	22,827

Note: Data are obtained from the Wind database. N denotes the number of observations. Sample size is 37,826 for debt replacement test and 22,827 for Market-based reformation test. Z-statistics adjusted with robust standard errors are in parentheses and superscripts ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. FE denotes Fixed Effect.

group and not significant for the General group. The Chow test results also indicate that the differences between groups are statistically significant. The sub-group test results further confirm that using special bonds to replace hidden debt is more effective in mitigating the crowding-out effect. This is mainly explained by the purpose of special bonds, which is more explicit. In contrast, general bonds have a wide range of uses and a relatively vague evaluation mechanism for economic benefit. Therefore, debt replacement through special bonds is more effective in promoting prudence in local government expenditure and improving the soft budget constraints. This finding supports Hypothesis 2.

We defined two types of LGFP reform to further explore the market-based transformation mechanism. The research method was to classify the regional transformation path as infrastructure operations or industrial investment according to the relative number of each type of LGFP at the city level. Cities in which the proportion of LGFPs classified as capital goods sector firms is higher than the average are classified as infrastructure operation paths, whereas others are classified as industrial investment paths. We performed a mechanism analysis for each subgroup, and the results are presented in Panel B of Table 10. We found that in regions in which LGFPs have adopted the industrial investment reformation path, the effect of market-based transformation is significant, whereas in regions that have adopted the infrastructure operation path, the transformation effect is not significant. The possible explanation is that the business nature of infrastructure operations is still closely related to local fiscal expenditures. Therefore, the market-based transformation effect is relatively weak. In contrast, in cities that adopted the "industrial investment transforma-

Table 10. Further research on the mechanism analysis.

Panel A: Debt replacement						
Variable	General bonds		Specialized bonds		Special group	General group
	(1)	(2)	(3)	(4)	(5)	(6)
	General_replace	*Invest*	*Special_replace*	*Invest*	*Invest*	*Invest*
Reform	0.07***		0.09***			
	(21.53)		(28.38)			
Debt		–0.95***		–0.87***	–1.73***	–1.34*
		(–2.78)		(–2.90)	(–3.59)	(–1.68)
Debt × *General_replace*		3.97**				
		(2.27)				
Debt × *Special_replace*				4.89***		
				(3.06)		
Debt × *Replace*					2.94***	1.81
					(3.25)	(1.64)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	37,826	37,826	37,826	37,826	20,744	17,082
Chow test	2.32					
	p-value: 0.00					

Panel B: Market-based reformation				
Variable	Industrial investment		Infrastructure operation	
	(1)	(2)	(3)	(4)
	Mkt	*Invest*	*Mkt*	*Invest*
Reform	0.04***		–0.01	
	(8.13)		(–1.07)	
Debt		–3.46*		2.99
		(–1.88)		(0.60)
Debt × *Mkt*		4.57**		–0.30
		(2.25)		(–0.05)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	14,876	14,876	7951	7951
Chow test	1.81			
	p-value: 0.00			

Note: Data are obtained from the Wind database. N denotes the number of observations. Sample size is 37,826 in total for debt replacement test and 22,827 in total for Market-based reformation test. T-statistics adjusted with robust standard errors are in parentheses and superscripts ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. FE denotes Fixed Effect.

tion path", LGFPs' operational performance and financial situation play a greater role in resource allocation, effectively improving resource misallocation and alleviating the crowding-out effect on real enterprises. Thus, the policy effect of hidden debt governance is more significant. The Chow test results also indicate that the differences between groups are statistically significant. These results further support Hypothesis 3.

6. Conclusions

This study has systematically investigated the crowding-out effect of local government hidden debt on Chinese enterprises' investment by constructing a panel dataset combining the financials of LGFPs and Chinese listed companies from 2010 to 2020. Unlike previous studies, our research has focused on the impact of hidden debt regulation and local government debt management reforms beginning in 2015 on the crowding-out effect. The empirical analysis was conducted using a generalised DID approach. We also assessed the mechanisms through which debt regulation policies affect enterprise investment using a moderating effect model, a perspective not previously developed in the literature.

The findings show that the crowding-out effect of LGFP debt on enterprise investment has significantly weak-

ened after debt regulation. These results hold after a series of robustness tests and after accounting for potential endogeneity issues.

Subgroup regression results capturing enterprise heterogeneity show that, for manufacturing enterprises, non-SOEs, and enterprises facing greater financing constraints, the regulatory effect of debt management reform is more pronounced. Heterogeneity arises from the varying degrees of impact that different enterprises experience from the information asymmetry and resource misallocation caused by government financing platform debt on the financial market. For enterprises more severely impacted by the excessive expansion of hidden debt, the regulatory effect of reform policies is stronger. This suggests that the identification of the debt regulation effect in this study is well targeted. In addition, regional heterogeneity analysis shows that in regions with faster marketisation and more developed financial resources, debt regulation produces better policy effects, implying that the effectiveness of debt management policies is conditioned by regional environments.

Mechanism analyses indicate two effective paths through which debt management reforms operate: debt replacement and the market-oriented transformation of local government financing platforms. Further analysis of the debt replacement path shows that, compared with general bonds, issuing special bonds more effectively optimises local government debt structures, promotes prudence in local government expenditure, improves the soft budget constraints, and achieves the intended policy effect of replacement. Analysis of the market-oriented transformation path indicates that adopting an industrial investment transformation path more effectively enhances the independent operational capability of platform companies, effectively improves resource misallocation, and achieves the desired policy effect of market-oriented transformation. These findings provide new evidence on governance approaches that mitigate the crowding-out effect of hidden debt on enterprise investment in China.

The issue of local government debt reform has wide-ranging and far-reaching economic impacts. Although the governance of hidden debt has achieved some results, local government debt management still requires long-term systematic reforms, and the dynamic alignment of debt scale with economic development remains a long-term challenge. Our research offers several practical implications for policymakers seeking to enhance the effectiveness of government debt management. First, the structure of local government debt should be optimized and the share of hidden debt reduced to limit the distortive effects of government financing behavior on financial markets. Local governments should strengthen comprehensive statistical monitoring of hidden debt, strictly control its increase, gradually reduce its proportion in the debt structure, and achieve reasonable debt optimization.

Second, improving management mechanisms for local government bond issuance can enhance the efficiency of investment and financing. Governments should strengthen the rationality of the purpose and scale of local government bond financing. For special bonds, emphasis should be placed on assessing the profitability and feasibility of funded projects. For projects unable to generate sufficient returns to cover principal and interest, financing needs should be carefully evaluated. For general bonds, the review process should better incorporate reasonable assessments of financing scale and debt repayment ability. In terms of fund utilization, it is necessary to strengthen fund supervision, improve regular information disclosure, conduct audits and post-evaluations to assess the benefits generated through the use of debt funds, and improve fund utilization efficiency.

Third, accelerating the classification transformation of platform companies helps resolve hidden debt risks. Local governments should develop differentiated transformation plans based on local resource endowments and platform companies' qualifications. Platform companies with low capabilities and limited independent operating capacity should be liquidated, while those with homogenous business models in the region should be restructured and reorganised to leverage synergies and improve asset management capabilities. Platform companies should be encouraged to transform into local industrial investment and asset operation companies to drive the development of the local real economy. In addition, they should adopt modern corporate governance structures and market-oriented operating mechanisms, deepen institutional and mechanism reforms, optimize incentive mechanisms for management and core teams, and stimulate endogenous growth momentum within the enterprise.

Fourth, improving fiscal and financial policies supports a more efficient allocation of resources. Regulatory agencies should consider optimizing performance management and risk assessment mechanisms for financial institutions to guide them to optimize customer selection criteria and conduct reasonable evaluations of their customers' financing needs and solvency in credit management mechanisms. The primary criteria for evaluating a company's credit qualifications should be based on financial conditions and operational performance rather than ownership status. This approach can help prevent excessive credit concentration in local SOEs, meet the financing needs of high-quality enterprises, guide rational allocation of regional financial resources, support financial services for the real economy, and ultimately promote high-quality regional development.

Finally, our research enriches the literature on public debt management and fiscal policy in the international context, with implications for other economies. From a theoretical perspective, our research corresponds to the theory of soft budget constraints, initially proposed in transitional economies. Our findings indicate that strengthening gov-

ernment budget constraints can alleviate excessive government debt expansion, providing new evidence for the application of soft budget constraint theory. In practical policy terms, the findings also have international relevance. In the post-pandemic era, public debt has risen globally, and debt risk issues have received increasing attention. Against the backdrop of global economic challenges, managing public debt in a growth-friendly manner while ensuring sustainable fiscal and financial stability is a concern for all economies. This study shows that improving government financing efficiency and enhancing transparency in debt expenditure can mitigate the crowding-out effect of government debt on private sector investment, providing a valuable policy reference for emerging markets and transition economies. The findings indicate that effective government debt management can enhance economic vitality and fiscal sustainability.

Due to data availability, a limitation of this research is the sample size of enterprises. Given the data quality and our research objectives, we selected the most suitable sample set under existing conditions. Another limitation is that the impact of crowding out on other aspects of enterprise activities and the interaction between policies could be further explored. Future research may address these issues.

Availability of Data and Materials

All data reported in this paper will be shared by the corresponding author upon reasonable request.

Author Contributions

YXZ: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing-Original draft preparation, Visualization. YDZ: Resources, Writing-Reviewing and Editing, Project administration, Supervision. Both authors contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

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Conflicts of Interest

The authors declare no conflicts of interest.

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