# Beyond the Real Estate Sector: Local Debt, Banking Risk, and Government Venture Capital

A thesis submitted by

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# Abstract

This paper examines the effects of China's central government policy that curtails credit access to the real estate sector. I focus on three key aspects: local government debt ratios, regional banks' risk (measured by negotiable certificate of deposit (NCD) spread yields), and government venture fund investment activities. These effects primarily operate through the land revenue channel. Cities with high policy exposure show a 12.5% average increase in debt ratios relative to those with low exposure. The average yield spread in the high exposure group rose by 19.5% compared to the lower exposure group, statistically significant at the 10% level. Highly exposed cities also exhibit substantially higher venture fund activity, with investment amounts doubling relative to less exposed cities.

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# 1 Introduction

Public debt has become a major concern across advanced and emerging economies since the financial crisis. Between 2008 and 2023, China's local government debt balance increased from 5 trillion yuan to 40.74 trillion yuan. Research has examined government debt's impacts on private investment(Liang et al., 2017; Huang et al., 2020), firm innovation(Fan et al., 2022; Croce et al., 2019), economic growth(Asteriou et al., 2021; Reinhart et al., 2012; Eberhardt and Presbitero, 2015), and transmission(Altavilla et al., 2017). The determinants of rising government debt has been an important topic among economists, which is explained through tax-smoothing(Barro, 1979), safe asset provision(Azzimonti and Yared, 2019), and dynamic efficiency theories(Blanchard, 1985). Also, Alesina and Passalacqua (2016) emphasizes that fiscal policy and politics are inextricably linked. In China, banks are predominantly state-owned, especially regional banks. Local governments thus have incentives to compel banks to hold government debt to avoid default, a phenomenon termed as financial repression by Chari et al. (2020). This paper empirically studies how real estate sector credit shocks affect local government debt ratios - a form of financial repression - and their spillover effects on regional banks through the land finance channel. The land finance channel represents local governments' dependence on land transfer revenue in China. Through this channel, local governments sell land use rights to developers to generate fiscal income, which they then use to fund infrastructure investments. This mechanism creates a direct link between real estate market conditions and local governments' financial capacity. I also examine how local governments respond when the land finance channel becomes constrained. I find that they seek alternative growth engineer through government venture funds - a novel link that has not been previously established in the literature.

The real estate sector in China plays a crucial role in shaping its hybrid economy (Xiong, 2023), seen in figure 1. In China, the real estate industry is closely tied to local governments' land sales behavior, and understanding this relationship is key to comprehending the country's economic development over the past 40 years. The term 'land finance' captures this relationship, but it cannot be fully understood without examining the dynamic between the central and local governments. While China is politically centralized, economic decisions are decentralized, giving local governments significant autonomy. Local government officials can be promoted to higher ranks based on strong local economic performance, encouraging them to drive economic growth and fostering competition among local governments. This dynamic also allows the central government to retain control over local entities, a phenomenon referred to by some as the "mayor economy" (Jin, 2023). One of the most crucial interactions between the central and local governments can be traced back to the 1994 tax-sharing reform. Under this policy, local governments lost significant tax revenue

rights but retained the ability to claim non-tax revenues, such as income from the sale of land-use rights. At the same time, they were assigned responsibilities like infrastructure spending and providing public goods. This reform significantly shaped local government behavior. Another critical event was the 4 trillion yuan stimulus package in November 2008, following the global financial crisis of 2007/2008. Only a small part of the 4 trillion yuan stimulus package came from the central government, which led local governments to break the rule that they cannot borrow from financial institutions in order to support the stimulus. As a result, local governments borrowed from banks in 2009, and after 2012, they turned to financing through local government financing vehicles (LGFVs), which fueled the growth of shadow banking in China (Chen et al., 2020). For local governments, land serves as the primary collateral for financing, linking their debt financing activities to future land sales profits (Gyourko et al., 2022). Real estate-related debt accounts for about 25% of banks' assets in China, with approximately half of it connected to local governments (Xiong, 2023). This raises concerns about the potential for a banking crisis if the real estate sector collapses. Xiong (2023) argues that the risks faced by the Chinese real estate sector differ from those faced by the U.S. market in the mid-2000s, and a banking crisis is unlikely due to the central government's commitment to financial stability. But one event may indicate the guarantee may not be perfect, especially for regional commercial banks: in 2019, when Baoshang Bank, a distressed city-level commercial bank, failed. Creditors whose claims were under 50 million RMB were fully compensated, whereas those with larger claims faced partial losses. This marked the first instance where Chinese regulators allowed significant investors in a commercial bank to experience financial losses, signaling a potential shift in the implicit guarantee system. The unique structure of city commercial banks, controlled by local governments and operating within their jurisdictions, provides a lens to examine how local government debt ratios spillover into bank risk.

Empirical evidence quantifying the relationship between the real estate sector and local government debt ratios is limited, primarily due to complex endogeneity issues. Two main challenges exist: First, reverse causality may occur where high local government debt ratios lead to reduced economic growth, which in turn creates downward pressure on land sale revenue. Second, omitted variable bias arises when unobserved factors simultaneously affect both land revenue and local government debt levels. An important omitted variable is the informal network between local officials and real estate developers. Such connections could simultaneously encourage land sales and facilitate government borrowing through local banks, yet these networks are inherently unobservable in empirical analysis.

One study by (Cheng et al., 2022) quantifies the relationship between land sales revenue and local government debt by exploiting the 2014 land restriction policy as an exogenous shock. This policy prohibited

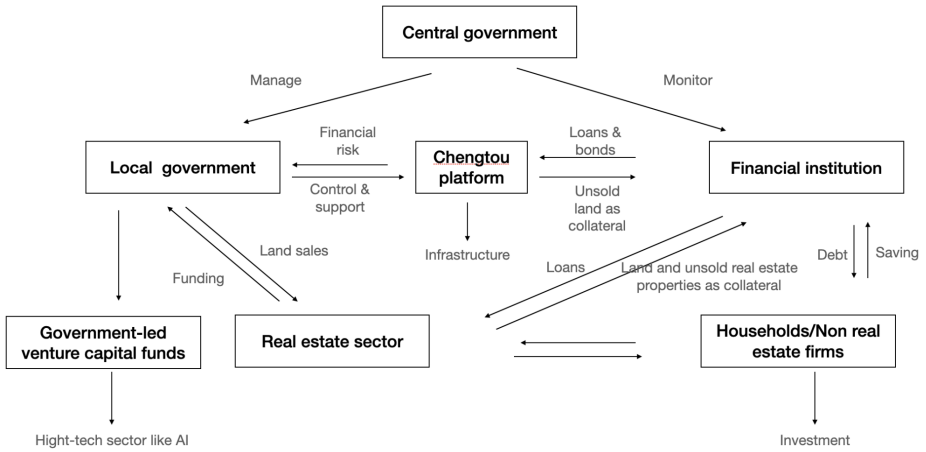


Figure 1: China's hybrid economy

metropolitan cities with populations exceeding five million from increasing their construction land supply. The authors argue that the population-based policy criteria provide exogenous variation suitable for causal inference. Using a Propensity Score Matching-Difference in Differences (PSM-DID) approach, they demonstrate a substitution effect between land sales revenue and local government debt.

This study makes several contributions to the literature. First, it examines how credit shocks to the real estate sector influence local government debt ratios through the land finance channel. Second, it demonstrates that this default-risk borrowing carries significant costs. Specifically, local government debt creates spillover effects on regional banks through their governance connections, as measured by the spread yields of Negotiable Certificates of Deposit (NCDs) issued by city commercial banks in the Chinese interbank market. Third, this study pioneers the investigation of the relationship between land finance and government venture fund activities. When cities heavily dependent on land finance face constraints in this revenue channel, local governments seek alternative methods to stimulate economic growth, as evidenced by changes in their venture capital investment portfolios.

My identification strategy relies on two sources of variation. First, I exploit variation in local governments' dependence on the real estate sector, particularly through the land financing channel, and variation arising from both the geographical segmentation of China's credit market (Huang et al., 2020) and also the inter-city competition for political promotions (Li and Zhou, 2005). The first source provides cross-sectional variation, while the second source offers time variation through real estate sector credit shocks. As the

policy was implemented simultaneously across regions, my identification leverages the interaction between these two sources of variation in a basic differences-in-differences framework. I compare outcomes between prefecture-level cities with higher reliance on land financing (thus more exposed to the real estate sector) to those with lower reliance. This study examines three key outcome variables. The first is debt ratio as a measure of financial repression. The second is government venture fund activities, which represent local governments' efforts to diversify beyond land financing and real estate dependence for economic growth. The third is the spread yields of Negotiable Certificates of Deposit (NCDs) issued by city commercial banks in the Chinese interbank market, which capture the spillover risk from local government debt to regional banks. The basic estimating equation follows a difference-in-differences (DID) framework. This approach allows me to control for both city and time fixed effects, thereby accounting for all time-invariant differences across cities and temporal changes such as macroeconomic fluctuations. The key identification assumption is that there are no concurrent shocks correlated with cities' reliance on land financing. To address this concern, I include interactions between city characteristics and time indicator variables, allowing the effects to vary over time.

I find that cities that rely more heavily on land finance experience increases in both local government debt and government venture fund activities. These results remain robust when excluding tier-1 cities (Beijing, Shanghai, Chongqing, and Tianjin). The exclusion of tier-1 cities serves as a robustness check, ensuring my findings are not driven by these cities' unique administrative status and exceptionally developed financial markets. Regarding the financial cost of regional banks, I find that, at the monthly level, the yield spread of their negotiable certificates of deposit increases in cities with greater dependence on land-based financing channels.

## 2 Background

"Three Red Lines Policy," introduced in August 2020 and officially implemented in early 2021 by the Chinese government, offers a quasi-natural experiment to observe how credit tightening in the real estate sector impacts banks and local government debt risks,and the risk exposure of regional commercial banks. Developers seeking to refinance are evaluated against three thresholds: liabilities must not exceed 70% of assets (excluding advance proceeds from projects sold on contract), net debt must not exceed equity, and cash must be at least equal to short-term borrowings. The policy classifies real estate enterprises into four tiers—red, orange, yellow, and green—based on the extent of their breach of the "Three Red Lines." Companies in the red tier, having breached all three thresholds, are prohibited from taking on new interest-bearing loans. The

policy aims to mitigate financial risks associated with the debt expansion of real estate companies and shift the economy toward higher-tech intensified.

The Chinese real estate sector is deeply integrated into both the economy and financial system. This integration operates through several critical channels. As the dominant component of household asset portfolios, real estate serves as the primary investment vehicle in China's developing financial markets. Local governments heavily depend on land sales for revenue and leverage future land sales through LGFPs for debt financing. Firms, especially well-capitalized ones, extensively use real estate assets as collateral and have increasingly invested in land since 2007. The banking sector faces significant exposure to real estate risks through its lending to households, developers, local governments, and firms, with these loans either explicitly or implicitly backed by real estate assets(Liu and Xiong, 2018).

Local governments are pivoting toward government venture funds when real estate no longer functions as a growth engine. These governments invest in companies with the expectation that these firms will establish subsidiary factories or register their businesses within the local jurisdiction, ultimately aiming to increase employment rates and tax revenues, which directly benefits local officials' political careers.

Venture capital plays a crucial role in financing and driving technological advancements and innovation globally(Akcigit et al., 2022). In its effort to fast-track China's rise as a global technology leader, the Chinese government has utilized government venture capital funds to channel capital into key strategic industries. By the first quarter of 2020, Chinese authorities had established 1,741 guidance funds with a combined registered target of 11 trillion RMB (1.55 trillion USD)(Luong et al., 2021).

My paper is organized as follows: In section 3, I describe the setting and empirical predictions. Section 4 presents the data and empirical strategy. Section 5 discusses the results.

# 3 Setting and Empirical Predictions

## 3.1 Origins of the credit shock

The story begins in 2020 when Evergrande's attempt to go public through a backdoor listing failed, leading to the first signs of a potential break in Evergrande's cash flow. Evergrande Group was once China's largest real estate developer by sales. On August 20, 2020, the Ministry of Housing and Urban-Rural Development and

the People's Bank of China held a meeting in Beijing with key real estate companies, including Evergrande, where they discussed plans to implement the "three red lines" starting on January 1, 2021, to curb high-debt expansion. In November 2020, Evergrande experienced its first overdue commercial paper.

## 3.2 Empirical Predictions

Due to its central role in China's economy, particularly in the development of local cities, limiting the real estate sector's access to credit supply could have significant consequences.

***Predictions 1.*** The competitive dynamics among local officials, along with the booming real estate sector, helped shape China's economic miracle. Once real estate companies are unable to secure loans from financial institutions, they lack the funds and thus the demand for land use rights. Consequently, local governments' land sale revenues are expected to decline.

***Predictions 2.*** Furthermore, when the key engine of growth is halted, local governments, burdened by high levels of debt, are left without land revenue to support their obligations. In China, banks are state-owned, and local banks are heavily influenced and controlled by local governments. Under these circumstances, local governments are expected to borrow more from banks and other financial institutions to cover their debt interest payments.

***Predictions 3.*** For local governments, another approach to boosting the economy or achieving growth targets is through what is commonly known as a government venture fund, a type of venture capital fund. Local governments have been establishing these funds for several years with the goal of investing in industries that can stimulate local economic growth. First, the local government sets up a fund and either invests in privately-owned venture capital managed by venture capitalists or directly invests in industries and companies. Second, the companies receiving these funds are expected to set up subsidiary factories or register their businesses in the city, thereby creating job opportunities and generating tax revenue. Whether this objective is fully realized or not, with the real estate sector's declining prospects and decreasing land revenue, local governments are expected to establish more government venture funds, particularly targeting high-tech companies, to align with the central government's goal of transitioning the economy towards high-tech industries.

***Predictions 4.*** Regional banks' financing costs, particularly for city commercial banks, are expected to rise in cities highly dependent on land finance. Two mechanisms drive this relationship. First is the risk

exposure effect: when cities heavily rely on land finance, their local government debt becomes more sensitive to real estate market conditions. Any decline in land revenues increases the perceived risk of associated regional banks, leading to higher financing costs in the interbank market. Second is the governance linkage effect: given the close connections between local governments and city commercial banks, deteriorating local fiscal conditions directly impact these banks' borrowing costs. These two channels suggest that cities more dependent on land finance will see their regional banks face higher financing costs, as measured by the spread yields of Negotiable Certificates of Deposit (NCDs).

# 4 Data and Empirical Strategy

## 4.1 Data

My goal is to use prefecture-level variation in local governments' reliance on land finance to obtain causal estimates of the impact of the credit shock to the real estate sector. First, I discuss how to measure exposure to the land sales revenue and the outcome data. I then describe the identification strategy used in this paper.

I first use the ratio of income from the Grant and Assignment of State-Owned Land Use Rights to the revenue of the local general public budget at the end of 2019, before the implementation of the policy, to avoid potential influence caused by Covid-19. This ratio measures the local government's exposure to the real estate credit shock.

$$Exp_c = \frac{Landsale_{2019}}{Generalbudgeincome_{2019}} \tag{1}$$

$Exp_c$ is a measure of the extent to which each city was exposed to the crisis at the end of 2019. Cities are categorized into either low treatment group or high treatment group based on this ratio, with the median serving as the cutoff value.

The data comes from Wind Information Co. (WIND). Since WIND only covers local government debt information for this specific period, the dataset starts in 2017. The unit of observation in the paper is at the prefecture level.

My primary outcome variables come from Wind Information Co. (WIND), a leading company in financial software services in China. For government venture capital funds, I manually collected government venture fund data from announcements on government websites and used Python web scraping to track sub-funds and portfolio companies, ultimately collecting data on 22,607 portfolio companies. See Table 1

and Table 2 for more detailed information.

## 4.2 Empirical Strategy

My identification strategy relies on two sources of variation. First, I exploit variation in local governments' dependence on the real estate sector, particularly through the land financing channel as shown in Figure 1, and variation arising from both the geographical segmentation of China's credit market (Huang et al., 2020) and also the inter-city competition for political promotions (Li and Zhou, 2005). The first source provides cross-sectional variation, while the second source offers time variation through real estate sector credit shocks. As the policy was implemented simultaneously across regions, my identification leverages the interaction between these two sources of variation in a basic differences-in-differences framework. I compare outcomes between prefecture-level cities with higher reliance on land financing (thus more exposed to the real estate sector) to those with lower reliance. The key outcomes examined in this paper are the debt ratio; the yield spread of negotiable certificates of deposit issued by regional banks, which serves as a proxy for their financial cost; and government venture fund activities, which reflect local governments' efforts to replace land-based financing and real estate dependence with alternative sources of economic growth.

The basic estimating equation follows a difference-in-differences (DID) framework. This approach allows me to control for both city and time fixed effects, thereby accounting for all time-invariant differences across cities and temporal changes such as macroeconomic fluctuations. The key identification assumption is that there are no concurrent shocks correlated with cities' reliance on land financing. To address this concern, I include interactions between city characteristics and time indicator variables, allowing the effects to vary over time.

The basic estimating equation follows a difference-in-differences (DiD) framework.

$$y_{ct} = \alpha + \delta_t + \delta_c + \beta \times \text{Treat}_c \times post_t + \sum_{\tau=2017, \tau \neq 2019}^{\tau=2023} (X'_{2019} \times T_t^{\tau})\delta_\tau + \varepsilon_{ct} \tag{2}$$

Where $y_{ct}$ represents the outcome variables for city $c$ in year $t$; $\delta_t$ and $\delta_c$ are year and city fixed effects, respectively. I categorize cities into high treatment and low treatment groups based on their reliance on land revenue, measured as the ratio of land revenue to the Comprehensive Fiscal Capacity of Local Governments (which includes all potential revenue sources available to local governments). The median value is used as the cutoff for this categorization. The coefficient of interest is $\beta$. The vector $X'_i$ includes control variables such as the local government's fiscal self-sufficiency rate, GDP growth rate, and GDP per capita. The fiscal self-

sufficiency rate, defined as the ratio of general public budget revenue to general public budget expenditure, reflects the extent to which the local government depends on central government transfer payments. A higher fiscal self-sufficiency rate indicates a greater reliance on the central government to support local economic development. All control variables are measured before the policy implementation and are interacted with year dummy variables to avoid issues related to bad controls.

### 4.3 Pretrend Analysis

To test my identification strategy, event study is conducted from the equation

$$y_{ct} = \alpha + \delta_t + \delta_c + \sum_{\tau=2017, \tau \neq 2019}^{\tau=2023} \beta_\tau \times \text{Treat}_c \times \mathbb{I}[t = \tau] + \sum_{\tau=2017, \tau \neq 2019}^{\tau=2023} (X'_{2019} \times T_t^\tau)\delta_\tau + \varepsilon_{ct} \tag{3}$$

Where Treat$c$ denotes cities in which the ratio of $Expc$ is greater than the median, as defined by equation (1). The data sample spans from 2017 to 2023. The policy was announced in August 2020 and implemented at the beginning of 2021. The year 2019 serves as the baseline period.

We should observe no statistically significant difference between the high treatment and low treatment groups before the policy implementation if the credit shock is truly exogenous. Figures 3 to 9 present the results of the event study and the accompanying sensitivity analysis following the approach of (Rambachan and Roth, 2023).

## 5 Result

### 5.1 Results Analysis

As shown in Figure 1, real estate plays an important role in China's economy because local governments rely heavily on land sales revenue to support the local economy by investing in infrastructure. I first demonstrate that total land sale revenue for local governments experienced a sharp decline due to the real estate credit shock, relating to prediction 1. Table 3 shows, based on the estimates from equation (2) with the log of land sale revenue as the outcome variable, that the land sale revenue of cities in the high treatment group decreased by 10% compared to the low treatment group, as presented in column (4) of Table 3. This result is statistically significant at the 5% level.

Table 4 shows that, based on the estimates from equation (2) with the debt ratio as the outcome vari-

able, the debt ratio of local cities in the high treatment group increases after the policy is implemented, relating to prediction 2. Column (4) of Table 4 presents that the debt ratio of cities in the high treatment group increased by 12.5% compared to the low treatment group (statistically significant at the 1% level) on average, which represents a substantial impact from an economic perspective. This effect reflects the fact that local governments maintain control over financial institutions at the local level. When a credit shock to the real estate sector occurs, the long-standing land finance channel—a key growth engine for local governments to stimulate the economy—begins to weaken. The resulting lack of revenue to repay the interest on their existing debt and to refinance their investments incentivizes local governments to borrow from financial institutions, especially those under their direct or partial control.

Figure 3 shows there is no differential pre-trend, and after the policy implementation, cities that rely more heavily on real estate through land finance increased their debt ratio, which is consistent with my identification assumption.

In Table 5, the outcome variable is the number of portfolio companies invested in by government venture funds at the prefecture level. The reason for including this variable is that local government officials have an incentive to boost the local economy. One characteristic of government venture funds is that local governments use them as a tool to attract industries to settle in their city or to set up sub-factories, through which they hope to transform the local economy, boost economic growth, increase employment, and generate tax revenue.

Table 5 shows an increasing trend in government venture fund investments in cities that are highly exposed to the real estate credit shock, relating to prediction 3. Column (4) of Table 5 indicates that local governments in highly exposed cities invest 100% more (statistically significant at the 5% level) compared to cities less exposed to the policy on average.

Figure 4 shows the results of the event study for the outcome variable, the number of portfolio companies. It can be observed that the high treatment group exhibits an upward trend, suggesting that the parallel trend assumption is likely to hold. There is a concern that the absence of differences in pre-trends doesn't mean that post-trends meet the assumption of parallel trends. To further strengthen the analysis, I conduct a sensitivity analysis following the method of (Rambachan and Roth, 2023), as shown in Figure 5. Sensitivity analysis is a way to test how much the parallel trends assumption can be violated before my conclusions no longer hold, by using the concept called breakdown value, which is the threshold at which

particular hypotheses of interest can no longer be rejected. The breakdown value is nearly 0.4, indicating that if the differential trend for the post-treatment period is 0.4 times greater than that of the pre-treatment period, I cannot reject the null hypothesis of no treatment effect.

There are limitations in the government venture capital data. Not all local governments have established government venture funds. A total of 180 cities have set up such funds, with 61 in the high treatment group and 119 in the low treatment group.

Table 6 differs from Table 5 in that it focuses specifically on the number of portfolio companies related to the IT sector. Since government venture funds are used by the Chinese government to boost high-tech and AI industries, this is an important distinction. Column (4) of Table 6 shows that local governments in highly exposed cities invest 110% more (statistically significant at the 5% level) compared to cities less exposed to the policy on average.

Table 7 presents the results of the yield spread for negotiable certificates of deposit issued by regional banks, relating to Prediction 4. Column (4) uses monthly-level data, showing that the yield spread in the high treatment group increased by 19.5% compared to the low treatment group, which is statistically significant at the 10% level on average. This represents a substantial economic impact.

Figure 8 shows the results of the event study for the outcome variable, yield spread on Negotiable Certificates of Deposit. It can be observed that in the post-event period, there is an increase in the yield spread, although this increase is not significant.

## 5.2 Mechanisms

To show this effect is through land finance channel, I use another measure of exposure to the policy. That is, I redefine the high treatment group using the ratio of real estate investment to GDP, with with the 2019 median as the cutoff value. As shown in Tables 8 and 9 in the appendix, no significant impact is found, indicating that reliance on land revenue is key to understanding local government behavior. I also conduct an event study using this new definition of treatment, as shown in Figures 10 and 11 in the appendix.

### 5.3 Robustness

I conduct several tests to verify the robustness of my findings. First, excluding direct-administered municipalities from the regression model does not alter the main results, as shown in Tables 4, 5, 6, and 7. These municipalities often have unique political and economic characteristics that might influence their financial behavior, so their exclusion confirms that my results are not driven by these outliers.

Second, a placebo test setting the policy shock at the end of 2018 confirms the robustness of my findings, as reported in Tables 10 and 11. This test helps rule out the possibility that my observed effects are due to pre-existing trends or coincidental changes unrelated to the actual policy.

Regarding housing prices as a potential confounding factor, the nationwide declining trend is captured by year fixed effects in all specifications. This approach controls for any macroeconomic factors affecting all cities similarly during the study period. Additionally, I exclude large cities from the sample, where housing prices demonstrate greater stability compared to smaller markets. This exclusion further strengthens the identification strategy by reducing the influence of potentially heterogeneous housing market dynamics across different city tiers.

## 6 Conclusion

Using "The Three Red Policy" as a quasi-experimental setting, I examine how real estate credit shocks affect local government behavior through the land finance channel. This channel represents local governments' high dependence on land sales revenue for infrastructure investment and GDP growth. The disruption of this channel leads to significant consequences. As real estate developers are the major participants in the land market, declining land sales revenue severely impacts local governments' funding sources, resulting in increased government debt burden. Given local governments' control over city commercial banks, this effect becomes more pronounced when the land finance channel weakens. I showed that a risk nexus exists between local governments and regional banks. When regulating the possibilities of local government default, policy makers should consider the risk to regional banks, which is a channel that can influence the real economy. Furthermore, I document that cities with higher reliance on land finance are more likely to explore alternative growth engines, particularly through establishing government venture funds, an area that has received limited attention in existing literature.

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# 7 Appendix I

Table 1: Variable Definitions

| VARIABLES | Definition |
|---|---|
| consumption | Consumption per capita at the city level in log form. |
| fisuff | Fiscal self-sufficiency rate of local government, measured by the ratio of public budget revenue to the public budget expenditure at the end of 2019. |
| gdpper | GDP per capita in log form at the end of 2019. |
| debtratio | The amount of local government debt—both general and special bonds—divided by their total fiscal resources, including tax revenue, transfers, and other government income sources. |
| landrevenue | The total revenue from land sales at the city level in log form . |
| company_count | The number of company that government venture fund invest at the city level . |
| techcompany_count | The number of high-tech company that government venture fund invest at the city level . |

Table 2: Summary Statistics

| VARIABLES | mean | p50 | SD | min | max | obs |
|---|---|---|---|---|---|---|
| **Panel A** | | | | | | |
| Debt Ratio | 296.60 | 246.50 | 202.80 | 44.25 | 853.99 | 2,435 |
| **Panel B** | | | | | | |
| Yield Spread of NCD | 0.41 | 0.35 | 0.34 | -0.31 | 1.97 | 975.00 |
| **Panel C** | | | | | | |
| the Number of Portfolio Companies | 33.05 | 6.00 | 85.65 | 1.00 | 722.00 | 684 |
| the Number of Portfolio Tech Companies | 20.28 | 2.00 | 57.84 | 0.00 | 465.00 | 684 |
| **Panel D** | | | | | | |
| Fiscal Self-sufficiency Rate | 37.50 | 31.53 | 25.84 | 1.29 | 275.25 | 2,478 |
| GDP per capita | 10.77 | 10.68 | 0.52 | 9.46 | 12.12 | 2,478 |

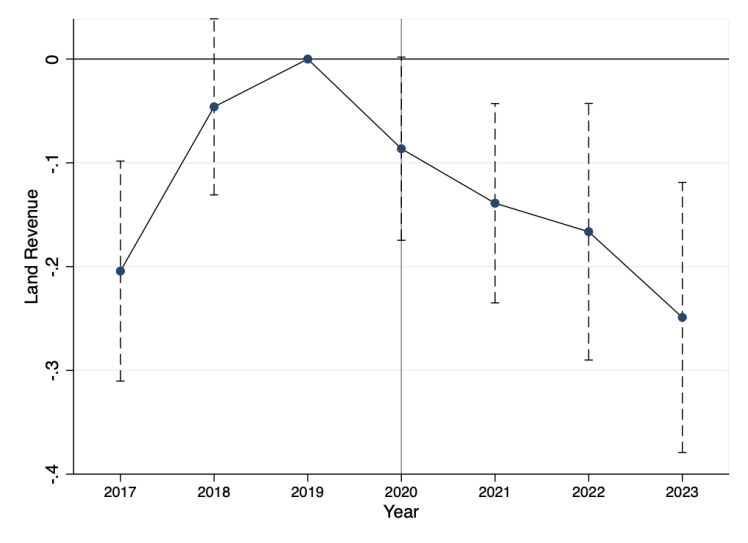


Figure 2: Land Revenue Is Decreasing

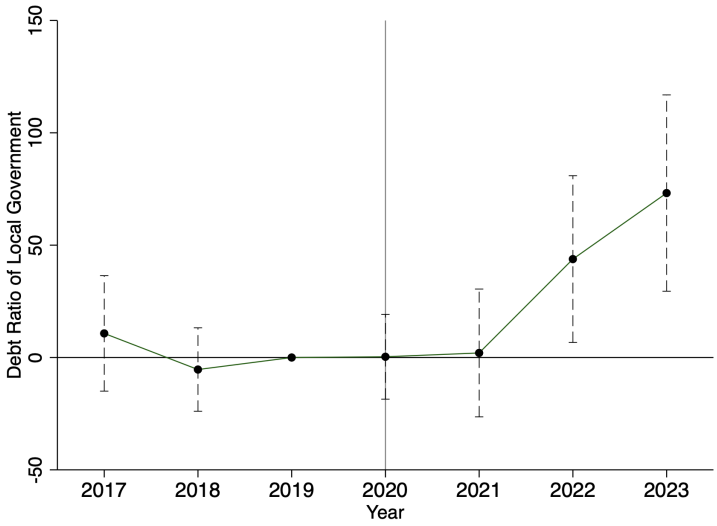


Figure 3: Event Study for Debt Ratio of Local Government

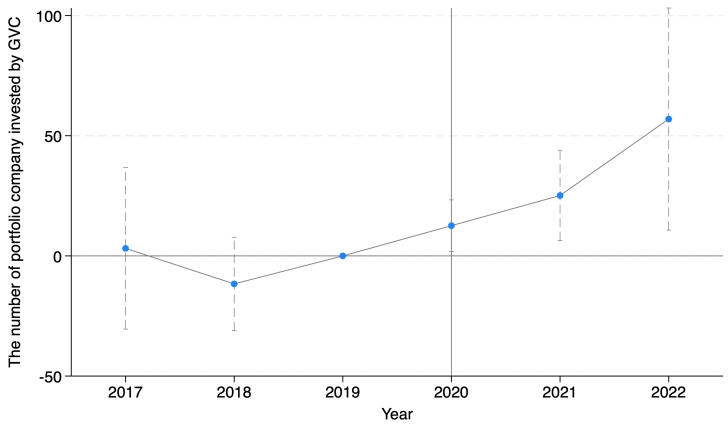


Figure 4: Event Study for the Number of Portfolio Companies Invested by GVC

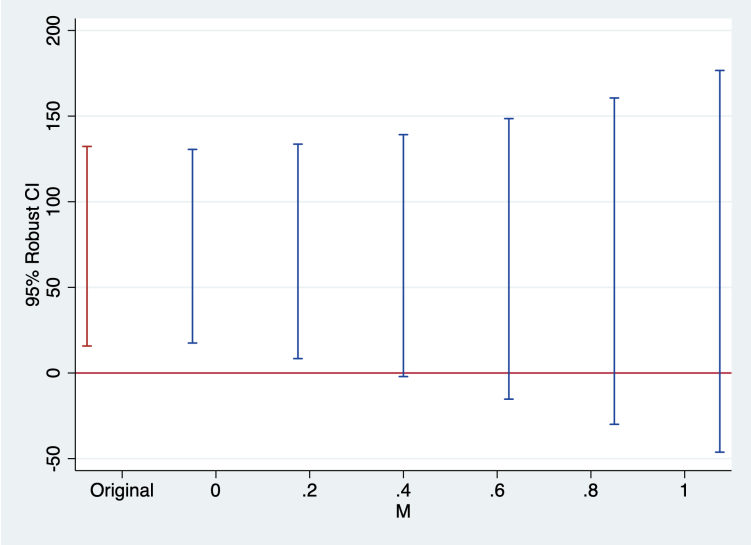


Figure 5: Sensitivity Analysis for Invested Portfolio Company

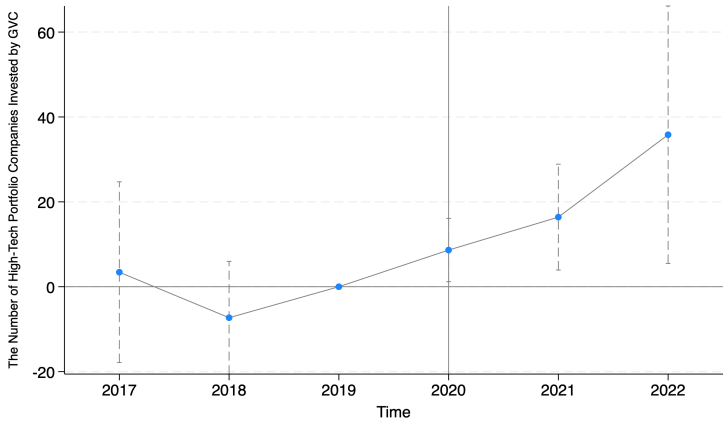


Figure 6: Event Study for the Number of Portfolio Tech Companies Invested by GVC

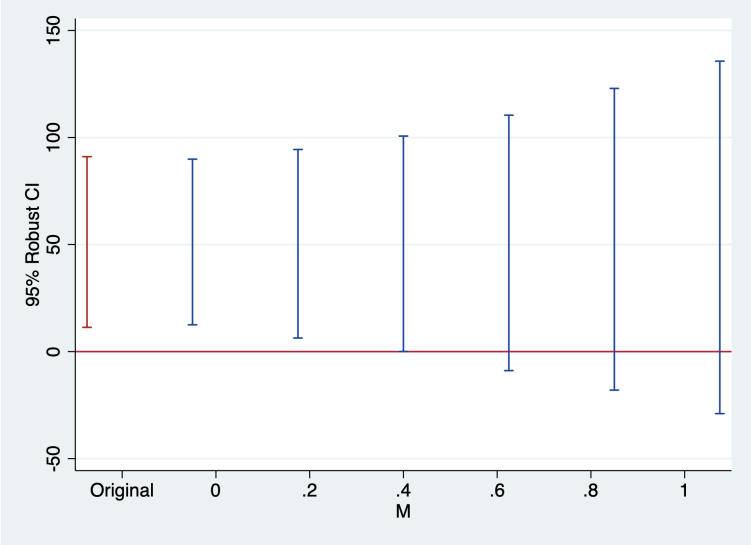


Figure 7: Sensitivity Analysis for Invested Portfolio Hightech Company

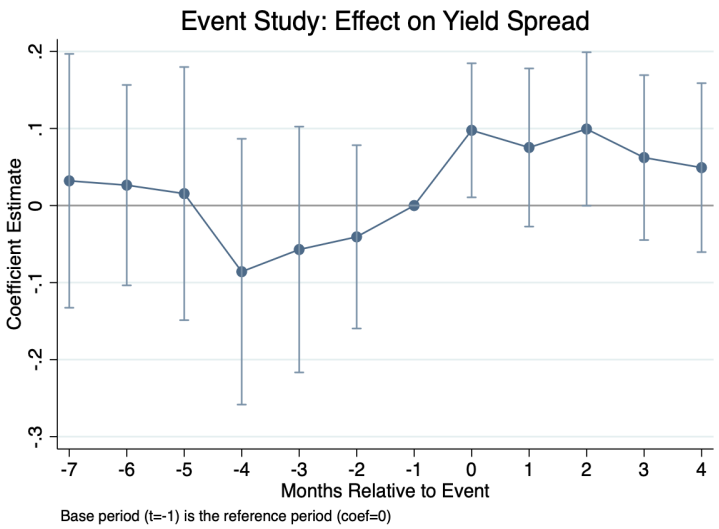


Figure 8: Event Study for the Yield Spread of NCDs

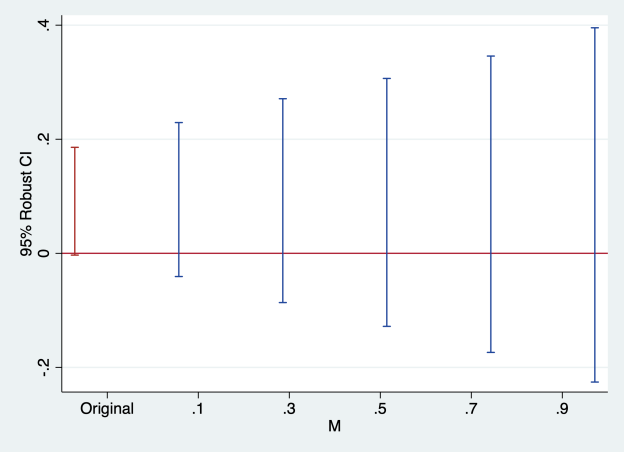


Figure 9: Sensitivity Analysis for Negotiable Certificate of Deposit

Table 3: Land Revenue Outcome

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Land Total Revenue | Land Total Revenue | Land Total Revenue | Land Total Revenue |
| High Treatment city × post 2020 | -0.10** | -0.10** | -0.10** | -0.10** |
| | (0.05) | (0.05) | (0.05) | (0.05) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP per capita | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 2,037 | 2,009 | 2,037 | 2,009 |
| R-squared | 0.944 | 0.940 | 0.945 | 0.941 |

*Note:* Land total revenue is taken in log form. I include Beijing, Shanghai, Tianjin, and Chongqing in columns (1) and (3), and exclude them in columns (2) and (4). Debt ratio is winsorized at the 97.5th percentile. Standard errors are clustered at the city level. All columns include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate, GDP per capita, and GDP growth rate.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: Debt Ratio Outcome

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Debt Ratio | Debt Ratio | Debt Ratio | Debt Ratio |
| High Treatment city × post 2020 | 28.66** | 29.83** | 35.05** | 36.97*** |
| | (13.26) | (13.35) | (13.78) | (13.92) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP per capita | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 2,218 | 2,190 | 2,213 | 2,185 |
| R-squared | 0.753 | 0.751 | 0.757 | 0.756 |

*Note:* I include Beijing, Shanghai, Tianjin, and Chongqing in columns (1) and (3), and exclude them in columns (2) and (4). Debt ratio is winsorized at the 97.5th percentile. Standard errors are clustered at the city level. All columns include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate, GDP per capita, and GDP growth rate. The control group includes cities with below-median exposure to land revenue in 2019 (low exposure group). Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Portfolio Company Outcome

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Portfolio Company | Portfolio Company | Portfolio Company | Portfolio Company |
| High Treatment city × post 2020 | 38.20** | 27.96* | 43.78*** | 35.99** |
| | (15.18) | (14.25) | (15.36) | (14.90) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 566 | 543 | 470 | 447 |
| R-squared | 0.771 | 0.759 | 0.817 | 0.803 |

*Note:* I include Beijing, Shanghai, Tianjin, and Chongqing in columns (1) and (3), and exclude them in columns (2) and (4). Standard errors are clustered at the city level. All columns include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate and GDP growth rate. The sample is restricted to 180 cities that established government venture capital funds, with 61 in the high treatment group and 119 in the low treatment group. The low treatment group includes cities with below-median exposure to land revenue in 2019 (low exposure group).
Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: Number of Portfolio IT Companies Outcome

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Portfolio IT | Portfolio IT | Portfolio IT | Portfolio IT |
| High Treatment city × post 2020 | 25.22** | 17.97* | 28.22*** | 22.50** |
| | (10.33) | (9.28) | (10.40) | (9.56) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 566 | 543 | 470 | 447 |
| R-squared | 0.767 | 0.757 | 0.811 | 0.801 |

*Note:* I include Beijing, Shanghai, Tianjin, and Chongqing in columns (1) and (3), and exclude them in columns (2) and (4). Standard errors are clustered at the city level. All columns include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate and GDP growth rate. Since not all cities have government venture capital funds, this regression is limited to 180 cities: 61 in the high treatment group and 119 in the low treatment group. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7: Yield Spread of Negotiable Certificate of Deposit

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Yield Spread | Yield Spread | Yield Spread | Yield Spread |
| High Treatment city × post 2020 August | 0.02 | 0.03 | 0.03 | 0.08* |
| | (0.05) | (0.05) | (0.05) | (0.05) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| Bank assets | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 37,656 | 36,988 | 36,988 | 962 |
| R-squared | 0.661 | 0.660 | 0.690 | 0.646 |

*Note:* Column (1) includes Beijing, Shanghai, Tianjin, and Chongqing, which are excluded in columns (2)–(4). All regressions include city and year fixed effects, and standard errors are clustered at the city level. Column (3) additionally includes fiscal self-sufficiency rate and bank assets as controls. Columns (1)–(3) use daily-level data, while column (4) uses monthly-level maximum planned issuance amounts. The control group includes cities with below-median land revenue exposure in 2019 (low exposure group).

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

# 8 Appendix II

Table 8: Debt Ratio Outcome (Alternative Treatment Definition)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Debt Ratio | Debt Ratio | Debt Ratio | Debt Ratio |
| High Treatment city × post 2020 | 15.36 | 15.00 | 16.68 | 15.64 |
| | (13.20) | (13.29) | (13.45) | (13.51) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP per capita | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 2,435 | 2,407 | 2,426 | 2,398 |
| R-squared | 0.741 | 0.739 | 0.745 | 0.743 |

*Note:* The treatment variable in this table is redefined using the ratio of real estate investment to GDP in 2019. Beijing, Shanghai, Tianjin, and Chongqing are included in columns (1) and (3), and excluded in columns (2) and (4). Debt ratio is winsorized at the 97.5th percentile. Standard errors are clustered at the city level. All regressions include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate, GDP per capita, and GDP growth rate. The control group includes cities with below-median exposure to land revenue in 2019 (low exposure group).
Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 9: Number of Portfolio Companies Outcome (Alternative Treatment Definition)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Portfolio Company | Portfolio Company | Portfolio Company | Portfolio Company |
| High Treatment city × post 2020 | -39.86*** | -32.68*** | -15.34 | -13.04 |
| | (10.83) | (9.88) | (10.20) | (8.84) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 636 | 613 | 527 | 504 |
| R-squared | 0.771 | 0.760 | 0.810 | 0.797 |

*Note:* The treatment is redefined using the ratio of real estate investment to GDP in 2019. Beijing, Shanghai, Tianjin, and Chongqing are included in columns (1) and (3), and excluded in columns (2) and (4). Standard errors are clustered at the city level. All regressions include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate and GDP growth rate. The control group includes cities with below-median exposure to land revenue in 2019 (low exposure group).

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

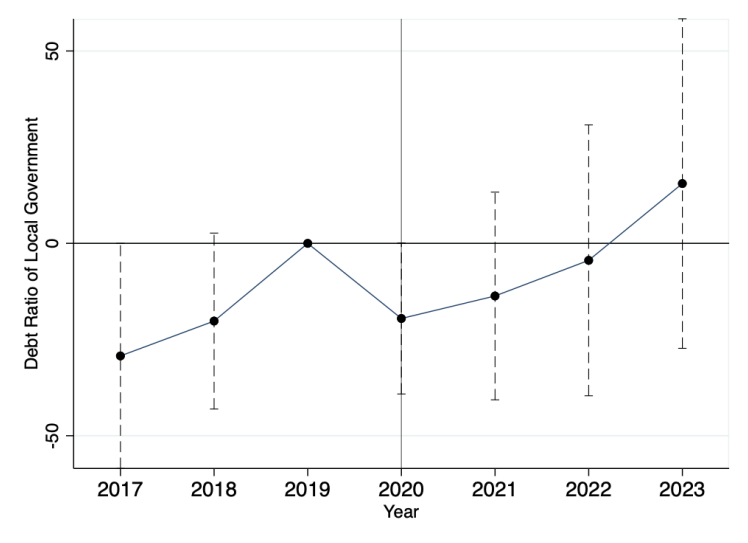


Figure 10: Event Study With Different Treatment Definition for Debtratio of Local Government

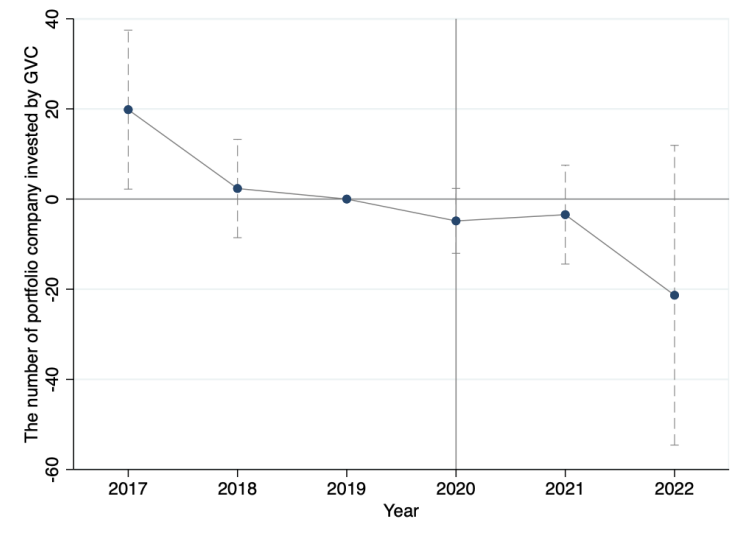


Figure 11: Event Study With Different Treatment Definition for Invested Portfolio Company

Table 10: Debt Ratio Outcome (Placebo Test: 2018 Treatment Year)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Debt Ratio | Debt Ratio | Debt Ratio | Debt Ratio |
| High Treatment city × post 2018 | -1.11 | -0.70 | 2.97 | 3.44 |
| | (10.74) | (10.92) | (10.37) | (10.54) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP per capita | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 1,282 | 1,266 | 1,271 | 1,255 |
| R-squared | 0.833 | 0.831 | 0.830 | 0.829 |

*Note:* This is a placebo test using 2018 as the fake treatment year. Beijing, Shanghai, Tianjin, and Chongqing are included in columns (1) and (3), and excluded in columns (2) and (4). Debt ratio is winsorized at the 97.5th percentile. Standard errors are clustered at the city level. All regressions include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate, GDP per capita, and GDP growth rate.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 11: Number of Portfolio Companies Outcome (Placebo Test: 2018 Treatment Year)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | Portfolio Company | Portfolio Company | Portfolio Company | Portfolio Company |
| High Treatment city × post 2018 | 1.81 | 4.63 | 4.23 | 7.43 |
| | (8.46) | (8.70) | (10.46) | (10.79) |
| Fiscal self-sufficiency rate | N | N | Y | Y |
| GDP growth rate | N | N | Y | Y |
| Year fixed effect | Y | Y | Y | Y |
| City fixed effect | Y | Y | Y | Y |
| Observations | 395 | 379 | 322 | 306 |
| R-squared | 0.916 | 0.900 | 0.921 | 0.906 |

*Note:* This is a placebo test using 2018 as the fake treatment year. Beijing, Shanghai, Tianjin, and Chongqing are included in columns (1) and (3), and excluded in columns (2) and (4). Standard errors are clustered at the city level. All regressions include year and city fixed effects. Columns (3) and (4) include the control variables of fiscal self-sufficiency rate and GDP growth rate.

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.