THE CROWDING OUT EFFECT OF LOCAL GOVERNMENT DEBT ON FIRM INNOVATION: THE MODERATING ROLE OF PRIVATE BANKING

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The Crowding Out Effect of Local Government Debt on Firm Innovation: The Moderating Role of Private Banking

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ABSTRACT

I investigate the impact of local government debt (LGD) on firm innovation in China, where private firms contribute to 70% of the country's technological innovations, bank loans are the primary source of financing for the real sectors, and the aggregate LGD shoots up from around 9.6% in 2008 to 15.8% in 2009 and to 20.6% of GDP in 2013. I posit that the upsurges in LGD crowd out firm innovation because LGD reduces the lending capacity of state-owned banks to private firms, and private banking moderates the negative effect of LGD. Consistently, I find a strong negative relationship between LGD and firm innovation using data covering 260 cities and 111,244 unique non-listed manufacturing firms from 2006 to 2013. My analysis shows that private firms' financial constraint is one plausible channel through which the crowding out effect occurs. Furthermore, I find that the crowding out effect is less severe in cities where private banking plays a more significant role in the local credit market. My findings imply that LGD crowds out innovation of private firms in China and hampers capital market efficiency, and that private banking plays a positive role in mitigating the LGD's crowding out effect and fosters innovation in China.

Keywords: Local government debt; Innovation; Financial constraint; Government ownership of banks; Private banking

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1. Introduction

Governments often employ stabilization fiscal policies in response to financial crises. Although expansionary fiscal spending may promote economic recovery in the short run, a surge in government debt resulting from deficit spending policies raises concerns about their effects on long-term economic growth prospects. Given the crucial role of innovation in establishing a firm's long-term competitive advantage (Porter, 1992) and driving a country's economic growth (Romer, 1986), I empirically investigate whether changes in government debt affect firm innovation and how private banks moderate the effect of government debt in the background of China. The adverse effects of government debt on economic growth are well-grounded in economic theory, and in political theory, government ownership of banks may displace the financing of private firms and reduce subsequent per capita income and productivity growth (Kornai, 1979; Shleifer and Vishny, 1994; La Porta, Lopez-de-Silanes, and Shleifer, 2002). China's unique politico-economic structure provides an interesting setting to test these theories empirically.

In response to the global financial crisis in 2009, China launched a four trillion-yuan stimulus program, with the majority of the program's funds allocated towards municipal construction, communication and transportation, and land overhaul and preservation. Three-quarters of the four trillion-yuan stimulus spending was financed by local government debt (LGD), and according to the estimation by Bai, Hsieh, and Song (2016), about 90% of LGD were financed via bank loans in 2009. The increase in LGD resulting from the 2009 stimulus plan was substantial, rising from an aggregate of 1.25 trillion yuan in 2006 to 12.41 trillion yuan in 2013, corresponding to 20.62% of GDP the same year. Since local governments are not allowed to run deficits directly, municipalities finance the stimulus program by instructing their local government financing vehicles (LGFVs) to issue bonds and take bank loans. Through an analysis of bonds and loans generated by these LGFVs, my study finds that LGD impedes firm innovation by tightening bank credit available for local firms. Furthermore, I show that such a crowding out effect primarily affects private firm innovation while leaving state-owned firms unscathed from the financial constraint brought about by rising LGD. In China, the private sector dominates the state and listed sectors in terms of both the output size and the growth trend (Allen, Qian, and Qian, 2005), contributing more than 50% of tax revenue and over 60% of GDP in China. Moreover, private

firms are also essential drivers of innovation. According to the report[1] by China National Intellectual Property Administration (CNIPA), private firms have contributed to 70% of the country's technological innovations over the 40 years since the implementation of the reform and opening-up policy. In addition, the latest data from the All-China Federation of Industry and Commerce indicates that the total R & D expenses of the top 1,000 private enterprises have reached 1.08 trillion-yuan, accounting for 38.58% of the total R & D expenditure in the country and 50.16% of the R & D expenditure of all enterprises in China. Given the substantial role of private firms in driving innovation and fostering economic growth, financial resource misallocation between the private sector and state-owned sector could severely impede long-term economic growth in China.

My study highlights two unique politico-economic features of China that contribute to the local crowding out effect of government debt on private firm innovation. Firstly, the government control over the banking industry. China's financial system is dominated by the banking industry, which includes three policy banks, six big state-owned commercial banks, and a significant number of small banks. Big state-owned banks dominate the banking industry, holding about 60% of total banking assets, and allocate the majority of credits to the state-owned sector. Such ownership structure in the banking industry allows extensive government control over the choice of projects being financed, thus promoting the government's goals. When the government initiated the 2009 stimulus plan, state-owned banks responded actively by lending to politically desirable projects. Secondly, the geographical segmentation of the credit market. Since the credit market in China is geographically segmented because of operation costs, regulatory burdens, and information asymmetry, the increase in local debt financing does not trigger nationwide capital inflows. Meanwhile, state-owned banks' dominating power in the interbank market restricts fund reallocation, and the interest rate ceiling regulation limits the increase in bank deposits. As a result, LGD is mainly shouldered by local banks, and when the local government borrows more, there is less credit available for local firms. However, not all firms are affected equally. Given the government control over the banking industry, state-owned firms with political connections gain favorable access to bank credits, while private firms are rationed more substantially.

After showing that LGD is negatively associated with private firm innovation, I employ three approaches to identify the causal relationship by showing that financial constraint is one plausible

[1] http://cnipa-ipdrc.org.cn/UpLoad/2022-04/2022429164701.pdf

underlying economic channel of the crowding out effect. I first test whether LGD affects firm leverage and financing cost. If the increase in LGD reduces available local credit resources, firms should be forced to leverage less and endure higher financing costs. Consistent with this view, I find that firms decreased leverage and paid higher financing costs in response to government debt issuance. Furthermore, this effect is more substantial for private firms than state-owned firms, indicating that private firms face higher financial constraints and unit costs of debt financing induced by expanding LGD. Next, I exploit the heterogenous external financial needs across industries to explore whether the adverse impact of LGD on innovation is demonstrated by amplifying the financial constraints of firms. I show that private firms in industries more financially dependent on external resources are more affected by municipal debt, whereas state-owned firms are unaffected. My last approach is to investigate how firm-level financial constraint mediates the effect of LGD on innovation, and I use internal cash flow to proxy the extent of financial constraints following Cong et al. (2019). I find that financially constrained firms are more vulnerable to the increase in LGD since the crowding out effect is more pronounced in firms with lower cash flow. Again, these crowding out effects only manifest in private firms. Through these approaches, I find consistent results implying that financial constraint is one plausible channel through which LGD crowds out innovation and that credit rationing is more binding for private firms.

The completion of the four trillion spending plan in China heavily relies on state control over the banking and corporate sector. While the municipalities implement efficient control over big state-owned banks, they have weaker discursive power in the operation of small private banks. Although state domination is still one of the most salient features of the banking industry in China, deregulation in the banking industry has created a more favorable market environment for private banks to thrive, resulting in a more market-oriented and competitive banking industry. Therefore, I argue that private banking moderates the crowding out effect of LGD on private firm innovation for three key reasons. First of all, state-owned banks typically function as vehicles to fulfill political targets, providing financing to projects that have high social returns, but possibly entail high risk and low profitability, or to favored groups such as the government and state-owned firms (Clarke, Cull, and Shirley, 2005). Private banks, on the other hand, are generally well-informed and profit-oriented, lending prudentially to protect profit-maximizing strategies or costs minimization rules (Shleifer and Vishny, 1994). With the higher presence of private banks, the

municipalities should exercise less control in the local credit market. Moreover, due to lower performance incentives and "soft" budget constraints, state-owned banks face less competition than private ones (Shleifer and Vishny, 1997; Sheshinski and Lopez-Calva, 2003). However, to survive on profitability, private banks give loans more out of economic motivations. They have the advantage of flexibility, allowing them to adopt differentiated competitive strategies to survive and find the market niche. Competing for deposit and skirting regulation via shadow banking and financing efficient private firms are both essential strategies. In addition, with the advantages of "soft information" and "relationship lending", small banks can better support the debt financing of small and medium firms (Berger and Udell, 2002; Petersen and Rajan, 2002; Hakenes et al., 2015). Therefore, when more private banks exist in the local credit market, private firms could gain greater access to bank credit. Thus, in light of the above, when the local government implements the four trillion-yuan stimulus plan, private firms in cities with a higher proposition of private banks are less likely to be affected by financial constraints resulting from LGD expansion.

I exploit the heterogeneous role played by private banks in the local credit market across cities to examine the moderating role of private banking in the local crowding out effect. Although my setting is less likely to be subjected to the endogeneity problem because ownership of banks in China is exogenously determined by the regulatory authorities, I address this concern using the propensity score matching algorithm, through which I match cities with different levels of private banks accounting for essential characteristics that affect firm innovation. Based on matched samples, I find that the crowding out effect on private firm innovation is more severe in cities more dominated by central state-owned banks and less pronounced in cities with more active private banks. I further investigate the moderating role of private banking on private firm innovation by depicting the trend of private firm innovation by ownership structure in the local banking sector in matched cities. I show a parallel trend of private firm innovation in matched cities before the surge in LGD resulted from the 2009 stimulus spending program, and I find evidence consistent with my position that active private banks reduce the crowding out effect of LGD and facilitate private firm innovation. Next, I explore the channel through which the moderating role of private banks manifests. In particular, I find that private banks support private firm innovation by alleviating the financial constraint brought by LGD expansion. My findings have important policy implications for the ongoing reforms of the banking sector in China, highlighting the need for a more diverse

and competitive banking system that accommodates the financing needs of private firms and fosters innovation.

To further address the crowding out effect of LGD and the moderating role played by private banks, I examine the association among LGD, capital misallocation, and the banking industry. If government debt crowds out innovation by reallocating capital away from the more efficient private sector to the less efficient public sector (Allen, Qian, and Qian, 2005; Song, Storesletten, and Zilibotti, 2011), such resource misallocation will cause substantial damage on economic growth (Song and Wu, 2015). Therefore, I analyze the effect of LGD on firm output and marginal capital productivity and find a negative correlation between LGD and private firms' output and a positive correlation between LGD and private firms' marginal capital productivity. These results indicate that LGD indeed crowds out private firm innovation and results in less efficient recourse allocation. Moreover, I demonstrate that central state-owned banks exacerbate the misallocation associated with LGD, while private firms play a crucial role in improving capital allocation efficiency. My findings underscore the benefit of private banking and are consistent with prior studies that higher degrees of public ownership of banks are associated with lower growth of per capita productivity, and slower economic growth (La Porta, Lopez-de-Silanes, and Shleifer, 2002).

This paper is related to three strands of literature. First, this paper is related to the literature on the impact of government debt on firm financing and economic growth. Using the cross-section of US stock returns, Croce et al. (2019) show that the increase in government debt predicts higher risk premiums for innovation-intensive firms, leading to higher cost of capital and subsequent declines in productivity and economic growth. While Graham, Leary, and Roberts (2014) investigate government crowding out of corporate debt in the US, Demirci, Huang, and Sialm (2019) show a negative relationship between government debt and corporate leverage in an international setting. Finance is not the only channel through which elevated government debt levels affect economic growth. Prior literature documents that LGD crowds out private investment, deteriorates the fiscal balance, and induces future distortionary taxation and higher inflation (Aizenman, Kletzer, and Pinto, 2007; Calderón and Fuentes, 2013; Huang, Pagano, and Panizza, 2020), affecting long-run economic growth. This study contributes to this literature by revealing the crowding out effect of LGD on private firm innovation and economic growth.

Second, my results contribute to the literature on government ownership of banks. Shirley and Walsh (2000) summarize that political intervention, corporate governance problems, and problems associated with the competition are the three main reasons why public banks perform less well than private banks. La Porta, Lopez-de-Silanes, and Shleifer (2002) find evidence that higher government ownership of banks in 1970 is negatively correlated with the growth of per capita income and productivity, supporting the "political" theories on the effects of government ownership of firms. Andrianova et al. (2008)'s findings are in line with the "development" view of government ownership of banks. However, they hold the policy implication denoting that "governments should build institutions that foster the development of private banking." Clarke, Cull, and Shirley (2005) survey about papers exploring the privatization of banks in developing countries and conclude that bank privatization usually improves bank efficiency. Yuan, Zhou, and Zou (2022) show how a large publicly listed state-owned bank responds to the government's counter- cyclical financing initiative while trying to meet the expectations of bank regulators and public investors. My paper points out a new channel through which government ownership of banks can influence long-term economic growth and emphasizes the essential role of private banking, which broadly aligns with the "political" view of government ownership of banks.

Third, this paper also speaks to the literature on institutions and innovation. Kong (2020) finds that government spending negatively affects innovation output and suggests that resource diversion is an underlying mechanism. Howell (2017) investigates the effect of government R & D subsidies on innovation and finds that the provision of early-stage R&D subsidies considerably increases the likelihood of firms receiving subsequent venture capital, thus promotes firm innovation and boosts revenue. Bian et al. (2017) compare the role of government-owned and private banks in financing innovation and find that government participation in credit allocation crowds out private banking and hampers corporate innovation. Atanassov and Liu (2020) document that sizeable corporate income tax cuts boost corporate innovation. See He and Tian (2018, 2020) for surveys about institutions and innovation. This paper may shed light on institutions and innovation by exploring the crowding out effect of LGD on innovation in the background of China's unique politico-economic structure. See Allen, Qian, and Gu (2017), Hachem (2018), and Song and Xiong, (2018) for surveys about the financial market and institutions in China. Despite being a counterexample to the law-finance-growth nexus (La Porta et al., 1998, 1999, 2002), China has experienced tremendous economic growth in the past 30 years

and is now the second-largest economy globally. Understanding the ongoing reforms in China's institutions provides important policy implications.

My study is related to four contemporaneous papers. Ru (2008) shows that government credit to state-owned firms crowds out private firms in the same industry but crowds in private firms in downstream industries. Lu, Yin, and Wang (2021) explore impact of local government debt on publicly-listed firms' R&D activities. Moreover, while Huang, Pagano, and Panizza (2020) find that local government crowds out firm fixed investment, Fan et al. (2022) rely on political turnover to identify the effect of LGD on firm innovation. My study differs from the three papers in that I provide evidence showing the role played by the banking industry under China's unique politico-economic structure in examining the effects of LGD. I find that government ownership of banks provides a plausible explanation for the crowding out effect of LGD on private firm innovation and show essential benefits of the development of private banking. I also demonstrate that private banks could address capital misallocation resulting from the expansion of LGD, leading to better capital allocation and fostering innovation and economic growth.

The paper is organized as follows. Section 2 describes the institutional background. Section 3 describes the data. Section 4 presents the results. Finally, Section 5 concludes the paper.

2. Institutional Background

In this section, I briefly describe the background of local government debt under China's unique politico-economic structure, and its connections to China's banking industry and credit market. And I introduce the role of private sector in economic growth in China.

2.1 Local Government Financing in China

Institutional reforms have shaped the history of local government financing in China (e.g., Bai, Hsieh, and Song, 2016; Chen, He, and Liu, 2020). Before 1994, local governments in China had sufficient autonomy in managing local taxes. However, the Chinese government's 1994 Budget Law curtailed local governments' control over local taxes and inhibited local governments from running deficits and borrowing from banks or issuing bonds directly. To address their financing needs, local governments have resorted to establish local government financing vehicles (LGFVs) and engage in off-balance-sheet borrowing through LGFVs. Local governments provide implicit guarantees to these LGFVs. Typically, municipalities instruct these LGFVs to take bank loans or

issue bonds and transfer assets, usually land, to LGFVs to use as collaterals. However, prior to 2009, these LGFVs were subject to limited financing activities under strict prohibition and monitoring by the central government.

In the depth of the 2008 global financial crisis, the Chinese economy experienced a severe downturn, with GDP growth falling from 9.5% in 2008 Q3 to 6.4% in 2009 Q1. To counteract the economic impact of the crisis, the Chinese government launched a four trillion-yuan stimulus program at the end of 2008, which was intended to be spent by 2010. The stimulus program primarily focused on public infrastructure, with 25% of spending financed by the central government and the remaining amount financed by the local governments. In order to facilitate the implementation of the stimulus program, the central government, together with The China Banking and Insurance Regulation Committee (CBIRC) and the Ministry of Finance, enacted a series of policies that relaxed the financial constraints faced by these local governments. Specifically, these policies included the relaxation of the China's Budget Law in 1994, which encouraged local governments to borrow from banks through their LGFVs. Additionally, in March 2009, the CBIRC issued Document No. 92, which encouraged local governments to utilize various methods, including increasing local fiscal subsidies and establishing LGFVs, to attract financial institutions to support the stimulus plan. Finally, in October 2009, the Ministry of Finance announced Document No. 631, which permitted local governments to finance the stimulus plan with all available sources of funds. These policy changes effectively encouraged local government financing and facilitated the implementation of the four trillion-yuan stimulus program.

With the financing encouragement instruction from Beijing, local government debt skyrocketed in the process of carrying out the unprecedented stimulus program. Bank loans financed the bulk of the debt. As Bai, Hsieh, and Song (2016) estimate, around 90% of the stimulus program undertaken by local governments was funded by bank loans in 2009. Although the aggressive financing policy was reverted back to normal in 2010, and the 2009 stimulus loans were largely transferred to municipal corporate bonds (Chen, He, and Liu, 2020), local governments still assume implicit liability and bear the pressure of debt rollover.

2.2 Banking Industry in China

China's financial system is heavily bank-based, with bank loans constituting an average of 70% of the increase in the social financing scale from 2006 to 2021 (see Figure 1). The banking industry

in China is comprised of over 4,000 banks, which include three wholly state-owned policy banks, six large-scale state-owned commercial banks (SOCBs), 12 joint-stock commercial banks (JSCBs), 41 locally incorporated foreign banks, 128 city commercial banks (CCBs), 1596 rural commercial banks (RCBs), and over 2000 other rural bank institutions (see Figure 1). The three policy banks are non-profit financial institutions specializing in policy-based financing activities. SCOBs, JSCBs, CCBs, and RCBs provide enterprise financing, while other rural banks, such as credit cooperatives, primarily specialize in household and small business finance. However, despite a significant number of banks, state-owned banks dominate the banking industry in China, holding nearly 60% of total banking assets.

The "political" view of government ownership of banks asserts that political intervention is a critical feature in the operation of state-owned banks. Given the state control over the banking sector in China, anecdotal evidence indicates that local branches of large banks are greatly affected by pressure to lend to local governments and local state-owned firms (Deng et al., 2005; Dobson and Kashyap, 2006). Moreover, with influence on bank branches and a curial role in bank managers' career development, the local communist party could have more say in banks' lending decisions (Yeung, 2009; Ho et al., 2017). As a result of the politico-economic structure in the banking system, substantial proportions of credit from the state-owned banks tilt to the local government and state-owned firms, while private firms are discriminated in the credit market (Poncet, Walter, and Hylke, 2010). When Beijing initiated the four trillion-yuan stimulus plan and instructed the local government to fulfill the spending targets, those state-owned banks responded actively by substantially increasing their credit supply to the local government and their LGFVs. As Deng et al. (2005) denote, "Beijing ordered state-owned banks to lend and they lent."

The specific structure of the Chinese banking industry has evolved over time. Despite prominent state-dominating, the banking industry has become more market-oriented and competitive after certain deregulations. Starting from 2005, the government gradually allows private capital to enter the banking industry and relaxes branch entry restrictions (Chong, Lu, and Ongena, 2013; Gao et al., 2019). With these favorable reformations and deregulations in the banking industry, small and private banks have become more viable and active in the banking competition. Surviving on profits, small and private banks adopt differentiated strategies, lending efficiently and prudently to quality firms. To compete with big banks and find the market niche, small and private banks rely on their advantages in "soft information" and "relationship lending" and thus improve credit access for

small and medium firms. Although the six large-scale state-owned commercial banks have already been publicly listed after ownership reformations, the central government remains their largest shareholder and retains control over them. On the other hand, ownership of small banks is distributed among local governments, communities, Chinese citizens, and foreign investors (or companies), manifesting the influence of private capital in China's banking industry. Thus, while the local governments implement control over state-owned banks, small and private banks are less susceptible to government control. Meanwhile, Chinese local governments choose to default on banks with weaker political power (Gao, Ru, and Tang, 2021), and default risks associated with public affiliated debt may reduce private banks' willingness to lend to the local government. As a consequence, local governments in cities with a higher proposition of small and private firms have less control over the local credit market.

2.3 Geographical Segmentation of China's Credit Market

Chinese credit market exhibits a distinct feature of geographical segmentation attributed to three factors. First, regulation and administration barriers. While banks are required to report out-of-city loans to the local branches of the People' s Bank of China, the regulatory duty is not clearly specified in the law. Thus, banks are practically refrained from lending to cross-city firms. Furthermore, information asymmetry and monitoring costs between banks and customers located in different cities add barriers to cross-city lending (e.g., Berger and Udell, 2002; Degryse and Ongena, 2005). As a result, localized operation strategies are prevalent in China's banking sector.

Second, limited fund reallocation in the credit market. The 75% cap on loan-to-deposit ratios set by the People's Bank of China, combined with the large state-owned banks' dominating role in the repo market, limit fund reallocation in the banking industry (Hachem and Song, 2021). Such limitation is particularly binding for small banks as large state-owned banks can take advantage of branch advantage and political connection in the fund competition. Consequently, the interbank market rarely fills the financing gap when local governments take on significant credits. Meanwhile, the People's Bank of China and CBIRC set a monthly lending cap for each bank, so when banks lend more to the municipalities, they have less lending capacity for the local private sector.

Lastly, shadow banking transactions resulting from interest ceilings and liquidity regulation are confined to local regions. Liquidity regulation can trigger unintended credit booms in the presence

of interbank market power (Hachem and Song, 2021). The four trillion-yuan stimulus package in 2009, combined with the liquidity regulation in China's banking industry, fostered the rapid development of massive shadow banking in China (Chen, He, and Liu, 2020; Hachem and Song, 2021). However, the costs of off-balance-sheet funding are sufficiently higher, and Acharya et al. (2021) provide evidence that shadow banking transactions remain geographically divided.

Taken together, regulation, administration costs, and state dominance in the banking sector contribute to the unique segmentation in China's credit market. Anecdotal evidence (e.g., Gao, Ru, and Yang, 2019) shows that nearly 90% of bank loans in China are within-city loans, suggesting substantial cross-city barriers in the lending business. The geographical segmentation of China's credit market exacerbates the local crowding-out effect of government debt.

2.4 The Essential Role of Private Firms in Innovation and Economic Growth in China

Allen, Qian, and Qian (2005) show that the private sector in China has been the driving force behind the country's economic growth, outperforming the state and listed sector by a significant margin. The private sector dominates the state and listed sectors in terms of output size and growth trend, contributing to more than 50% of tax revenue and over 60% of GDP in China, as the National Bureau of Statistics reports. Private firms have reached a new milestone, contributing 68% of China's total industrial output in 2020, as per the latest data from the Chinese Yearbook (2021). Private firms are also leading the charge regarding innovation in China. According to the National Intellectual Property Administration (CNIPA), private firms constitute 90% of the high-tech enterprises in China and contribute to 70% of the country's technological innovations achievements over the past 40 years of reform and opening up. Additionally, the top 1,000 private enterprises have spent a total of 1.08 trillion yuan on R&D, accounting for 38.58% of the country's total R&D expenditure and 50.16% of all enterprises' R&D expenditure in China, according to statistics from the All-China Federation of Industry and Commerce.

Despite being the most dynamic sector in innovation and economic growth, private firms gain limited financing support from the formal financial sector, namely banks and markets (Allen, Qian, and Gu, 2017). The dominating banking system in China's financial market primarily funds the government and state-owned firms, and China's bond market is mostly occupied by government bonds and corporate bonds issued by large state-owned firms. Private firms also have limited access to the stock market in China, as pointed out by Allen et al. (2017), due to deficiencies in

IPO listing and delisting procedures. Given the essential role of private firms in innovation and economic growth in China, a formal financial market that inefficiently accommodates private sector financing needs could lead to severe resource misallocation in the capital market, posing detrimental effects on the long-term growth of the entire economy.

3. Data and Summary Statistics

3.1 Data

My dataset comprises five distinct components: (i) non-listed manufacturing firm characteristics, (ii) local government debt, (iii) patent application information, (iv) city-level characteristics, and (v) bank branch information. I draw upon six sources to assemble this dataset. The primary source is the Annual Survey of Industrial Firms (ASIF), conducted by the National Bureau of Statistics (NBS) of China. The ASIF database spans 1998 to 2013 and covers state-owned and non-state-owned manufacturing firms with annual sales above five million yuan until 2009 and above 20 million yuan after that. It includes manufacturing firms' financial report information, making it a widely used resource for academic research (e.g., Huang, Pagano, and Panizza, 2020; Fan et al., 2022; among others). However, for 2010, the ASIF data lacks significant balance sheet variables. To address this data loss, I supplement the ASIF data with a second data source, the National Tax Statistics Database (NTSD), which is jointly conducted by the State Administration of Taxation and the Ministry of Finance of China and covers detailed financial statements for both manufacturing and non-manufacturing firms during the period 2007 to 2013. By exploiting the overlap between ASIF and NTSD, I can supplement missing data for a large number of firms. Nonetheless, the resulting sample size for the 2010-2011 is smaller than that of other years.

The third component of my dataset comprises patent application information obtained from the China National Intellectual Property Administration (CNIPA). This information includes a patent's name, application year, and patent type, which can be classified into Invent Patents (IPs), Utility Model Patents (UMPs), and Design Patents (DPs). The fourth component is prefecture-city-level local government debt data referring to Huang, Pagano, and Panizza (2020). This dataset is constructed using the financial statements of local government financing vehicles (LGFVs) from the Wind database and covers the period from 2006 to 2013. The fifth component of my dataset comprises prefecture-city-level characteristics obtained from the China City Statistical Yearbook. Finally, bank branch information is retrieved from the China Banking and Insurance Regulation

Committee (CBIRC), which includes a bank branch's name, establishment date, exit date, and operating location. By merging these diverse data sources, I obtain a dataset comprising 846,555 firm-year observations, covering 260 cities and 111,244 unique manufacturing firms from 2006 to 2013.

3.2 Variable Construction

In this Section, I define all the dependent variables, independent variables, and control variables. Table 2 provides the summary of detailed definitions of the variables used in my tests.

3.2.1 Measuring Innovation

I adopt two sets of variables to measure the innovation of manufacturing firms. I first use a manufacturing firm's total number of patent applications in a year to capture the firm innovation productivity. Specifically, using the information extracted from the CNIPA, I divide these patents into IPs, UMPs, and DPs. As the distribution of the firm patent data is right skewed, I take the natural logarithm of patent application counts, IPs application counts, UMPs application counts, and DPs application counts. I add one to the actual number of patent counts to avoid losing observations when calculating the natural logarithm. I label these variables as $Patents$, $Yinv$, Yum, $Ydes$, respectively. My second set measure of firm innovation is based on firms R & D investment. I adopt two variables to measure firm R & D investment. One is calculated as the natural logarithm of one plus a firm's R & D investment in a year and labeled it as $log\ (1 + R\ \&\ D)$; the other one is defined as the ratio of R & D investment to firm revenue ($R\ \&\ D\_Ratio_{i,t}$). I multiply 100 to the latter measure, so the variable represents percentage changes. Since ASIF provides manufacturing firms' R & D expenditure only from 2006 to 2007, I complement the R & D information by exploiting the overlap between ASIF and NTSD. Despite this effort, approximately half of the firm-year observations in my sample still lack R & D information.

3.2.2 Measuring Local Government Debt

As documented in Section 2, Chinese local governments are prohibited from directly borrowing from banks and issuing bonds. Instead, municipalities engage in off-balance-sheet borrowing via their LGFVs. Although LGFVs are not obligated to disclose their financial statements, they are required to reveal financial liability information for the current year and at least three previous years in their bond offering prospectus. Under such intuitional background, Huang, Pagano, and

Panizza (2020) develop a measure of the quantity of local government debt by exploiting the balance sheets information obtained in LGFVs' bond offering. LGFVs' liabilities encompass short-term borrowing, notes payable, non-current liabilities due within one-year, other current liabilities, short-term bonds payable, long-term borrowing, and bonds payable. The city-level total local government debt is the sum of these short-term and long-term liabilities for all LGFVs in a given city. Using this information, I construct the measure of local government debt as the log value of the ratio of city-level total local government debt to city-level GDP and denote it as LGD.

3.2.3 Measuring Banking Industry by Ownership

Referring to Allen, Qian, and Qian (2005)'s methodology in dividing the state sector and private sector in the Chinese economy, I examine two sectors of the banking sector: (1) the *Central State Sector*, which includes all banks with ultimate control by the central government; (2) the *Private Sector*, which comprises small banks with various types of private and local government ownership[2]. To proxy the role of state-owned banks and private banks, I use market share by ownership in the banking industry. Given the significant market share of the six big state-owned commercial banks (hereafter big banks) in the *Central State Sector*, I also use the market share of big banks to proxy the role of state banks. Meanwhile, since RCBs own the most significant branch share among small banks, I also use the market share of RCBs to proxy the role of private banks.

I measure market share by ownership based on banking competition measures. As documented in prior literature, banking competition can be measured in terms of loans, deposits, or branches owned by banks in the local credit market (e.g., Petersen and Rajan, 1995; Bikker and Haaf, 2002; Degryse, Laeven, and Ongena, 2009). Since city-level bank-specific loans and deposits data is not available in China, I define banking competition variables following Degryse and Ongena (2007) and Chong, Lu, and Ongena (2013) with bank branch data obtained from (CBIRC). I first measure the intensity of city-level banking competition by the Herfindahl–Hirschman Index (HHI) defined in equation (1). Then, I assume that all bank branches are homogeneous in their efficiency and measure the city-level market share of central state-owned banks, big banks, small banks, and RCBs using equations (2)-(5), respectively. I utilize these market share variables to measure the local credit market dominance by bank ownership.

[2] I exclude other rural banks, such as credit cooperatives, from the analyze, since such banks mostly specialize in household and small business finance and barely provide enterprise financing.

The Herfindahl–Hirschman Index (HHI)

$$HHI = \sum_{k=1}^{K_i}(\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 \quad (1)$$

Market share of central state-owned banks

$$HHI\_Cstate = \sum_{c=1}^{C_i}(\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI \quad (2)$$

Market share of big banks

$$HHI\_Big = \sum_{b=1}^{B_i}(\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI \quad (3)$$

Market share of small banks

$$HHI\_Small = \sum_{s=1}^{S_i}(\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI \quad (4)$$

Market share of RCBs

$$HHI\_RuralC = \sum_{r=1}^{R_i}(\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI \quad (5)$$

where *C*, *B*, *S*, and *R* are the number of banks for four types of banks, central state-owned banks, big banks, small banks, and RCBs, respectively in a city. I use HHI as the denominator to keep a consistent scaling between the HHI and the market shares. Thus, the market share measures the proportion of HHI contributed by central state-owned banks, big banks, small banks, and RCBs, proxying for their role in the local credit market.

3.2.4 Measuring Other Firm Characteristics and City Characteristics

Apart from firm innovation, I construct measure of other firm characteristics as follows. I measure firm leverage as the ratio of total debt to total assets ($Leverage$), total firm debt as the log value of total debt (log_debt), interest payment as the log value of total interest payment [3] ($log\_interestExp$) and the log value of the ratio of total interest payment to total debt ($interestRate$), and financial expenses as the log value of the ratio of financing cost to total debt ($log\_financialExp$). Following the prior literature, I include a vector of firm-level control variables, including the log value of firm total assets ($assets$), the log value of firm age (log_age),

[3] The ASIF dataset reports the net interest payment as the interest revenue received from debtors minus the interest cost paid to creditors. It's worth noting that certain firms in the ASIF dataset may report a negative interest rate, indicating that they are net creditors rather than debtors.

the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$), which are correlated with firm innovation.

Following the existing literature, I also control for a vector of city-level characteristics which could affect firm innovation. I mainly control for macroeconomic factors, including the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$).

3.3 Summary Statistics

I report summary statistics of all variables discussed above in Table 2. To alleviate the concern of estimation bias driven by outliers, I drop observations for firms with negative assets and winsorize all variables at the 1st and 99th percentiles.

Statistics in Panel A of Table 2 show a remarkable surge in government debt. The mean of LGD increased almost tenfold from 2006 to 2013, with the ratio to GDP increasing from 5.6% in 2006 to 20.6 % in 2013. Panel B suggests that central state-owned banks dominate the banking industry in China, occupying over 70% of the market despite small banks' mildly rising market share. I compare the statistics of state-owned and private firms in Panel E of Table 2. Although state-owned firms have slightly higher R & D than private firms, they create substantially fewer patents than private firms, implying that state-owned firms are less efficient than private firms in innovation. While state firms have higher leverage and total debts and thus are more leveraged than private firms, private firms pay higher costs in debt financing. These stylized facts suggest that state firms have preferable access to credit financing, while private firms face debt financing constraints and pay higher financing costs.

4. Empirical Evidence

I aim to provide a comprehensive analysis of the relationship between LGD and firm innovation and how private banks moderate the effect of government debt in the context of the Chinese financial market. I start by showing the negative association between LGD and firm innovation. Then, I employ three approaches to identify the causal relationship by establishing financial constraint as the underlying economic channel of the crowding out effect. Next, I seek to link the crowding out effect of LGD on firm innovation to the banking industry in China, demonstrating the outcomes of one of the most salient features of the financial market in China under its unique

politico-economic structure. I show that state control over the banking industry is a crucial factor contributing to the crowding out effect of LGD. Moreover, I demonstrate the role of private banks in moderating the crowding out effect of LGD on innovation by reducing private firm financing constraints. Finally, I find that LGD would lead to capital misallocation and show that the development of private banks facilitates more efficient resource allocation in the capital market.

4.1 The Crowding-out Effect of LGD on Firm Innovation

I begin the empirical analysis by showing the correlation between prefecture city LGD on firm innovation. To exploit variation of LGD cross cities and control for firm heterogeneity, I conduct firm-level OLS regression analysis as follows.

$$Y_{i,c,t} = \beta LGD_{c,t} + X_{i,c,t}\Gamma + C_{c,t}I + \alpha_c + \tau_t + \sigma_i + \varepsilon_{i,c,t} \quad (6)$$

where $Y_{i,c,t}$ represents the dependent variable in firm *i*, city *c*, and year *t*. $Y_{i,c,t}$ includes the log value of firm R & D spending ($log\ (1 + R\ \&\ D)$), the ratio of R & D spending to revenue ($R\ \&\ D\_Ratio_{i,t}$ **)**, and the log value of one plus the total number of patent application ($Patents$), and the log value of one plus the total number of patent application in different categories including Invent Patents ($Yinv$,), Utility Model Patents (Yum), and Design Patents ($Ydes$). $LGD_{c,t}$ is the critical variable of interest, which is the log value of the ratio of local government debt to GDP. $X_{i,c,t}$ is a vector of firm-level controls, including the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). $C_{c,t}$ is a vector of city-level controls, including the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). α_c, τ_t and σ_i are city, year, and firm fixed effects, respectively. I include firm fixed effect to rule out firm-specific time invariant heterogeneity, city fixed effect to rule out city-specific time invariant features that may affect the relation between LGD and firm innovation and to account for the possibility that firms change locations, and year fixed effect to account for time-specific shocks. I cluster the standard error at the firm level. I am mainly interested in the coefficients β, which capture firm innovation behavior in response to heterogeneous cross-city LGD shocks. The results for OLS estimation are reported in Panel A Table 3. Cohn, Liu, and Wardlaw (2022) argues that when there are many zeros in data, taking log after adding one may produce biased estimates and even incorrect sign and recommends the use of Poisson estimation. To ensure the robustness of my findings, I follow Correia, Guimarães, and

Zylkin (2020) and conduct Poisson pseudo-likelihood regression with the total number of patent application ($N\_Patents$), and the total number of patent application in different categories including Invent Patents (N_Yinv,), Utility Model Patents (N_Yum), and Design Patents (N_Ydes) as the independent variables. The results are presented in Panel B Table 3.

Column (1) and column (2) in Panel A Table 3 report the effect of LGD on the log value of firm R & D investment and the ratio of R & D spending to revenue, respectively. The correlation between LGD and firm R & D is negative and statistically significant at the 1% level, suggesting that 1% increase in debt-to-GDP ratio is linked to a 0.045 percentage-point decrease in firm R & D and a 0.005 percentage point decrease in the ratio of R & D spending to revenue. In column (3), I replace the dependent variable with the log value of the total number of firm patents. Column (4) to column (6) presents the effect of LGD on three kinds of patents separately. The coefficient estimates on LGD in column (3) to column (5) all indicate a negative and significant correlation between LGD and firm innovation at the 1% level, revealing that LGD is consistently associated with a reduction in firm innovation. The magnitudes of the coefficient estimates show that a 1% increase in debt-to-GDP ratio is correlated with a 0.013 percentage-point decrease in all patents, a 0.004 percentage-point decrease in Invent Patents (IPs), a 0.010 percentage-point decrease in Utility Model Patents (UMPs), and a 0.0006 percentage-point decrease in Design Patents (DPs), respectively. Meanwhile, the estimation of Poisson pseudo-likelihood regression with multiple fixed effects reported in Panel B Table 3 shows that there is a robust negative correlation between LGD and firm innovation.

In Table 4, I estimate equation (6) separately for state-owned firms and private firms, providing additional insights into the relationship between LGD and firm innovation. The dependent variable in column (1) and column (2) is the log value of firm R & D, and the dependent variable in column (3) and column (4) is the ratio of R & D spending to revenue. The results indicate that LGD is only significantly negatively associated with private firm R&D spending as the coefficient estimates on LGD for state-owned firms are barely significant. Column (5) to column (12) focus on the number firm patents, and the results show that while the coefficient estimates on LGD for private firms are negative and significant at the 1% level, the coefficient estimates on LGD for state-owned firms are not statistically significant. I conduct bootstrap and permutation tests for difference in coefficients estimated on LGD between state-owned firms and private firms and find significant differences. These implications are clear: LGD tends to have more pronounced and consistent

adverse effects on the innovation of private firms than on state-owned firms, which have political connections and enjoy preferable access to bank credits.

In summary, my results show that LGD appears to be negatively associated with firm R & D investment and innovation output, and this crowding out effect of LGD on firm innovation mainly focuses on private firms.

4.2 The Crowding Out Effect and Financial Constraints

The prior results are consistent with the argument that in the geographically segmented credit market, firms face financing constraints when the local governments take on more debt and thus lead banks to tighten credit supply to private firms. However, these simple correlations may be subject to endogeneity issues such as reverse causality and common shocks. Reverse causality issues may arise when private firms experience negative shocks in innovation output, and the local governments respond by borrowing more to reverse the situation. Similarly, common issues such as infrastructure construction and industrial technological upgrading may affect private firm innovation and LGD, leading to biased estimations. To address the endogeneity concerns, I investigate whether financial constraints is the channel through which LGD affects innovation. If increasing LGD crowds out firm innovation by tightening firms' access to credits under China's unique political-economic structure, LGD would also lead to lower corporate leverage and higher financial cost. Moreover, the ex-ante level of financial constraint faced by firms may impact the extent of the crowding out effect. In other words, financially constrained firms, which are more reliant on external financial resources or have a lower level of cash flow, would be more severely affected by the crowding out of increasing LGD.

4.2.1 Debt Financing and Financial Cost

In order to investigate whether the observed negative relationship between LGD and firm innovation is attributable to financial constraint, I first replace the dependent variable in equation (6) with firm leverage ($Leverage$) and the log value of firm debt (log_debt), and estimate this equation separately for the whole sample, the state-owned firms, and private firms.

Table 5 reports the effect of LGD on firm leverage and firm debt, providing two further pieces of evidence supporting the view that the negative effect of LGD on firm innovation is driven by financial constraints. First, the results in columns (1) and (4) indicate that LGD is also negatively

related to firm leverage and firm debt. The coefficient estimates on LGD suggest that a 1% increase in the ratio of LGD to GDP is associated with a 0.003 percentage-point decrease in firm leverage and a 0.017 percentage-point decrease in firm debt. Second, while column (3) and column (6) show that such a negative correlation exists for the leverage and debt in the private firm sample, column (2) and column (5) document that it is absent in the state-owned firm sample. Bootstrap and permutation tests for differences in coefficients estimated on LGD for state-owned firms and private firms are significantly different. These findings imply that LGD reduces debt financing resources available for private firms, thus hindering their investment in innovation and innovation output.

After showing that LGD reduces private firms' access to credit resources, I explore how LGD influences firms' financial cost by replacing the dependent variable in equation (6) with variables that proxy for financial cost, including the log value of total interest payment ($log\_interestExp$), the log value of the ratio of total interest payment to total debt ($interestRate$), and the log value of the ratio of financing cost to total debt ($log\_financialExp$). I present the estimation in Table 6. Consistent with the conjecture that financial constraint is one plausible mechanism through which LGD crowds out private firm innovation, I find that LGD significantly increases private firms' financial cost, while state-owned firms are not affected. As LGD reduces private firms' ability to secure debt financing and raises the cost of debt, its impact on the overall interest payment is negligible. These findings also imply the outcome of shadow banking in China. The conflicts between limited credit quotas from big banks and the strong demand for capital triggered the development of shadow banking. Despite providing support to the private sector, such off-balance-sheet lending imposes higher cost.

Overall, the results reported in Table 5 and Table 6 indicate that LGD not only reduces the total amount of debt resources obtained by private firms, but also leads to an increase in the unit cost of private firm debt financing. These findings support the argument that increasing LGD undermines private firm innovation by reducing private firms' access to financial resources in the local credit market.

4.2.2 External Financial Dependence

In line with the institutional background of China's unique political-economic structure, private firms are more likely to experience credit tightening from banks when the local government issues

more LGD. In contrast, state-owned firms with political connections are not affected. To further examine the underlying mechanism of the crowding-out effect, I investigate whether the negative correlation between LGD and innovation is more severe for firms in industries that require more external financial resources. To test this hypothesis, I follow Amore, Schneider, and Žaldokas (2013) to construct an index of external financial dependence. I take the average across the industry of the combined net change in equity and debt normalized by the book value of assets. I then sort industries by high and low financial dependence based on the industry mean financial dependence. Based on whether their external financial need was above or below the industry mean, I divide the sample into two groups: firms with high external financial dependence and firms with low external financial dependence. To disentangle the unique politico-economic structure in China, I further divide each of the two samples into the state-owned firm and the private firm samples. I estimate equation (6) on the six subsamples with the log value of firm R & D spending ($log\ (1 + R\ \&\ D)$) and the log value of one plus the total number of patent application ($Patents$) as the dependent variables and report the result in Table 7.

Column (1) and column (7) in Table 7 present the effect of LGD on Firm R &D and patents estimated on firms with high external financial dependence, while column (2) and column (8) present the results estimated on firms with low external financial dependence. The coefficients on LGD are significantly negative, implying the crowding out effect on firm R & D investment and patent applications. Meanwhile, the magnitude of coefficients estimated on LGD indicates that the crowding out effect on innovation is significantly more severe for firms in industries with high external financing needs. Furthermore, I explore heterogeneity by estimating separate regressions for the innovation of private and state-owned manufacturing firms (columns (3), (5), (9), and (11), and columns (4), (6), (10), and (12), respectively). The empirical analysis reveals that the crowding out effect on innovation is primarily attributed to the detrimental impact of LGD on private firms, as the effect is statistically significant only for private firms and not for state-owned enterprises. This finding aligns with the notion that private firms are more financially constrained than state-owned firms, and therefore, more vulnerable to the adverse effects of LGD on credit resources and financial costs, even though private firms with low external financial dependence suffer less from the increase in LGD. Overall, the results of this analysis provide evidence to support the argument that LGD in China undermines private firm innovation by reducing their access to credit market financial resources, particularly for firms in industries with high external financing needs.

Moreover, the findings further show that financial constraint is one of the underlying mechanisms explaining the crowding out effect of LGD on private firms.

4.2.3 Cash Flow

Following my analysis of industry-level heterogeneity in financial constraints, I employ a different empirical strategy to test the hypothesis that financial constraint is a plausible economic channel through which LGD crowds out firm innovation. In particular, I measure firm-level financial constraints with firms' net operating cash flow. If the data is consistent with the idea that an increase in LGD leads to banks' tightening credit supply, the negative correlation between LGD and innovation should be less severe for firms with more cash flow. In other words, firms that are less financially constrained ex-ante are affected less by the surging LGD. Following prior literature (Kaplan and Zingales, 1997; Lewellen and Lewellen, 2016), I use firms' net operating cash flow to measure the extent of the firm financial constraint. It is calculated as profits minus taxes plus depreciation scaled by beginning-of year total fixed assets. Based on this proxy for financial constraint, I divide the entire sample into two groups: firms with high cash flow and firms with low cash flow. The division is based on the industrial median value. To account for the unique politico-economic structure in China, I further divide the two samples into four subsamples based on whether these firms are state-owned firms or private firms. I estimate equation (6) on the six subsamples with the log value of firm R & D spending ($log\ (1 + R\ \&\ D)$) and the log value of one plus the total number of patent application ($Patents$) as the dependent variables and report the result in Table 8.

Column (1) and column (7) in Table 8 present the effect of LGD on Firm R &D and patents estimated on firms with high cash flow, while column (2) and column (8) present the results estimated on firms with low cash flow. Consistent with the findings in Table 7, the innovation of firms with high cash flow is significantly less affected by the local government debt. Next, I study private and state-owned manufacturing firms separately and present the estimations in columns (3), (5), (9), and (11), and columns (4), (6), (10), and (12), respectively. Still, the effect of local LGD on firm innovation is only significant for private firms, although private firms with high cash flow are affected less by LGD.

The results in Table 7 and Table 8 are consistent with my conjecture that financial constraint is one essential mechanism that explains the crowding out effect of local government debt on firm

innovation, as firms more dependent on external financial resources and firms with a lower level of cash flow tend to be more financially constrained and thus are more affected. Meanwhile, significant different findings between state-owned firms and private firms provide a glance into the credit discrimination phenomenon under China's unique politico-economic structure. LGD is more likely to crowd credit resources available for financially constrained private firms.

4.3 The Crowding Out Effect and The Banking Industry

As introduced in the institutional background in Section 2, local governments' massive increase in debt largely relies on state control over big state-owned banks, which dominate the banking industry. While big state-owned banks are efficiently controlled by the governments, private banks are not. Therefore, the level of state control over the banking sector is affected by the degree of local banking competition contributed by private banking. Anecdotal evidence shows that the increase in banking competition may reduce lending corruption and enhance credit availability (Barth et al., 2009; Chava et al., 2013). Additionally, small banks have advantages in providing credits to small and medium firms because of their shorter decision hierarchy and comparative advantage in relationship lending (Berger and Udell (2002), Petersen and Rajan (2002), Hakenes et al. (2015)). In China, the development of small private banks has played a critical role in changing the competitive landscape of the banking industry. Therefore, private firms located in cities where private banks hold more market share, and thus exhibit higher banking competition, may face less credit constraint. If LGD implements a causal effect on firm innovation with credit rationing and financial constraint as the economic mechanism, the crowding out effect on private firm innovation should be more substantial in cities more dominated by state-owned banks. On the other hand, if private banks moderate the crowding out effect of LGD by enabling more credit access to private firms, private firms located in cities where private banks hold more market share should be less affected by LGD expansion.

4.3.1 The Moderating Role of Private Banking with Propensity Score Matching

To examine whether private banking moderates the crowding out effect of LGD and whether government control over the banking industry contributes to the crowding out effect of LGD, I exploit the heterogeneity of the banking industry in terms of ownership across prefecture cities in China and estimate the effect of LGD on firm innovation. Specifically, I estimate the impact of LGD on firm innovation considering the ownership structure of the banking industry in each city.

However, one empirical challenge in exploring the role played by state-owned and private banks is the endogeneity problem. Namely, cities, where private banks occupy higher market shares may be different from cities in which state-owned banks gain more competitive power. For example, prefectures with more private banks may also be home to more innovative firms. Hence, the role of the banking industry could be driven by the differences in these cities' rather than the ownership structure in the local credit market. Although my setting is less likely to be subjected to the endogeneity problem because the regulatory authorities exogenously determine ownership of banks in China, I address this concern with the propensity score matching algorithm.

To implement propensity score matching in my estimation, I first define four variables, namely $HHI\_CstateH$, HHI_BigH, HHI_SmallH, and $HHI\_RuralCH$ based on the market share of central state-owned banks (HHI_Cstate), the market share of big banks (HHI_Big), the market share of small banks (HHI_Small), and the market share of RCBs (HHI_RuralC). $HHI\_CstateH$ equals 1 if the market share of central state-owned banks (HHI_Cstate) of a city is above the cross-city median and equals 0 otherwise. HHI_BigH, HHI_SmallH, and $HHI\_RuralCH$ are all defined in similar manner. Then, I estimate four probit models in which the dependent variables are $HHI\_CstateH$, HHI_BigH, HHI_SmallH, and $HHI\_RuralCH$, respectively. The independent variables in the probit models are LGD and other city-level variables including log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). I draw on city-level information in 2005, which is one year before the start of my sample period, to estimate the probit models. I use the propensity score calculated from the probit regression to perform the nearest-neighbor propensity score matching without replacement. Using this matching methodology, I obtain four sets of cities; each set includes two groups of cities that possess matching characteristics, divided by high or low market share of central state-owned banks, big banks, small banks, and RCBS, respectively. I estimate equation (6) for firms located in cities with heterogenous banking ownership structures to investigate the role of state-owned and private banks in the crowding out effect of LGD. To account for the unique politico-economic structure in China, I estimate the effect of LGD separately for state-owned firms and private firms. The results are presented in Table 9.

Table 9 Panel A presents the effect of LGD on firms' R & D investment, subsampled by central-state-owned banks' market share (HHI_Cstate), big banks' market share (HHI_Big), and firms' ownership in terms of state-owned or private. Comparing column (1) to column (2) and column (7) to column (8) in Table 9 Panel A respectively, I find that firms located in cities with high central state-owned banks' market share (or high big banks' market share) are more significantly affected by LGD than firms located in cities with low central state-owned banks' market share (or lower big banks' market share). Comparing the coefficient estimated for state-owned firms (columns (3), (5), (9), and (11)) and private firms (column (4), (6), (10), and (12)) in Table 9 Panel A, I continue to observe that the crowding out effect is primarily focused on private firms while state-owned firms, which enjoy preferential treatment from state-owned banks, are not significantly affected. In Table 9 Panel C, I replace the dependent variable with firm patents and estimate equation (6) on the identical subsamples used in Table 9 Panel A. I observe consistent results in Table 9 Panel C as in Panel A. Overall, these findings show that LGD crowds out private firm innovation more severely in cities with high central state-owned banks' market share (or high big banks' market share), suggesting that state control over the banking sector contributes to the crowding out effect of surging LGD on private innovation.

Table 9 Panel B and Panel D demonstrate the moderating role of private banking in the crowding out effect of LGD. Table 9 Panel B reports the effect of LGD on firms' R & D spending, subsampled by small banks' market share (HHI_Small), RCBs' market share (HHI_RuralC), and firms' ownership in terms of state-owned or private. Columns (1) to column (2) and column (7) to column (8) in Table 9 demonstrate that firms located in cities with high small banks' market share (or RCBs' market share) are less seriously affected by LGD than firms located in cities with low small banks' market share (or RCBs' market share). Comparing the coefficient estimated for state-owned firms and private firms in Table 9 Panel B, I continue to find that the crowding out effect is focused on private firms even though their innovation suffers less from LGD in cities where private banks play a more significant role. In Table 9 Panel D, I replace the dependent variable with firm patents and estimate equation (6) on the same subsamples in Table 9 Panel B. I find consistent results in Table 9 Panel D as in Panel B. These findings indicate that private banking moderates the local crowding out effect of LGD on private firm innovation as firms located in cities where private banks occupy higher market shares are less affected by LGD.

Overall, the results in Table 9 demonstrate that while private banking mitigates the crowding out effect of LGD, state-owned banks could contribute to this phenomenon, indicating that the local crowding out effect is affected by the level of state control over the banking sector. While state-owned banks lend preferably to the local government and state-owned firms, private banks play dynamic roles in the local credit market and foster a more competitive and efficient banking industry, moderating the crowding out effect of LGD. Although private firms are less susceptible to the effect of LGD in cities where private banking plays a more substantial role, private firms face more significant credit resource constraints in the time of LGD expansion than state-owned firms.

4.3.2 The Moderating Role of Private Banking on Private Firm Innovation

After showing how the level of state control over the banking sector affects the local crowding out effect of LGD, I further investigate the moderating role of private banking on private firm innovation. I start by depicting the trend of private firm innovation by ownership structure in the local banking sector in matched cities. My findings, depicted in Figure 2, reveal substantial differences in private firm innovation after the implementation of the four trillion stimulus plan in response to the 2008 financial crisis. Panel (1) to panel (4) in Figure 2 show the average of private firm patent application counts in matched cities with a high or a low market share of central state-owned banks' market share, big banks' market share, small banks' market share, and RCBs' market share, respectively. *High Central State-owned Bank* indicates a group of cities with above the industry median market share of central state-owned banks (HHI_Cstate) and have a matched city with HHI_Cstate below the industry median, and *Low Central State-owned Bank* indicates a matched group of cities. *High (low) Big banks, High (low) Small banks,* and *High (low) RCBs* are defined in similar methods. In Figure 2, I observe that the two lines representing private firm patents in each of these panels are trending closely in parallel in the 3 years leading to the 2008 financial crisis, despite the fact that firms located in cities with more small private banks are hit less by the 2008 shock. However, after the 2009 stimulus plan, which resulted in surging LGD, the two lines start to diverge, indicating that private firms in cities with a higher level of private banking are less affected by the massive increase in LGD and experienced a more significant increase in innovation output compared to firms in cities more dominated by state-owned banks.

I next examine the moderating role of private banking in a regression framework illustrated by the following equations modified based on equation (6):

$$Y_{i,c,t} = \beta LGD_{c,t} + \rho LGD_{c,t} * HHI\_SmallH + X_{i,c,t}\Gamma + C_{c,t}I + \alpha_c + \tau_t + \sigma_i + \varepsilon_{i,c,t} \quad (7)$$

$$Y_{i,c,t} = \beta LGD_{c,t} + \rho LGD_{c,t} * HHI\_RuralCH + X_{i,c,t}\Gamma + C_{c,t}I + \alpha_c + \tau_t + \sigma_i + \varepsilon_{i,c,t} \quad (8)$$

where HHI_SmallH equals 1 for cities with small banks' market share (HHI_Small) above the industry median and have a matched city with HHI_Small below the industry median and equals 0 for the matched cities. $HHI\_RuralCH$ is defined in similar methods.

I estimate equation (7) and equation (8) on private firms and present the results in Table 10. Column (1) and column (2) focus on firm innovation measured as the log value of one plus the total number of patent application ($Patents$). I show that the coefficient estimated on LGD is negative and statistically significant at the 1% level, and the coefficients estimated on $LGD_{c,t} * HHI\_SmallH$ and $LGD_{c,t} * HHI\_RuralCH$ are both positive and statistically significant at the 1% level. These findings are in line with my expectation that while LGD crowds out private firm innovation, the presence of more private banks in the local credit market mitigates such crowding out effect. To further investigate the channel through which private banking mitigates the effect of LGD, I replace the dependent variable with firm leverage ($Leverage$) in column (2) and column (5) and I continue to find negative coefficients on LGD and positive coefficients on $LGD_{c,t} * HHI\_SmallH$ and $LGD_{c,t} * HHI\_RuralCH$, implying that private banking mitigates the crowding out effect of LGD on private firm debt financing by providing credits to private firms and relieving their financial constraint brought about by the expansion of LGD. Column (3) and column (6) replace the dependent variable with the log value of firm debt (log_debt) and I find consistent results.

There are two possible reasons why private banks mitigate the crowding-out effect of LGD. Firstly, private banks may increase lending to local private firms specifically for funding research and development (R&D) initiatives. Secondly, private banks may allocate more loans to support the general operations of local private firms, thus freeing up additional funds for R&D investments. In either scenario, private banks play a crucial role in alleviating the financial constraints imposed by the rising levels of LGD. In sum, my empirical evidence presented in Tables 10 and Figure 2 are consistent with my conjecture that private banks play a vital role in moderating the adverse

effects of LGD on private firm innovation by enabling more credits to private firms, as private firms located in cities where private banks occupy higher market shares are less financially constrained and are subject to less crowding out by LGD. My results highlight the crucial role of private banking in fostering private firm innovation and mitigating the negative effects of LGD on the local economy by facilitating greater access to credit for private firms. Nevertheless, under China's unique politico-economic structure, private firms are still being credit rationed despite obtaining credit support from small private banks.

4.3.3 Additional Evidence on The Crowding Out Effect and The Moderating Role of Private Banking

Following my analysis in demonstrating the role of the banking industry in the relationship between LGD and innovation, I investigate the association between LGD and resource misallocation, providing further evidence showing the effect of LGD on real economy and the moderating role of private banking. Private firms are not only the critical driver of innovation but are also more efficient than state-owned firms, playing a vital role in economic growth in China. According to the data from the Chinese Yearbook (2021), private sector firms contributed to 68% of China's total industrial output in 2020, reaching a new high point. However, the expansion of LGD could shift credit access away from the more productive private sector to the state sector, resulting in adverse impacts on industrial output and capital productivity, and ultimately detrimental effects on economic growth. I conduct two additional tests to investigate whether LGD leads to capital misallocation in such circumstances.

I first estimate the effect of LGD on industrial output, defined as the log value of industrial value added ($Vaindst$) based on Hsieh and Song (2015), and present the results in Table 11. My findings in Table 11 suggest a significantly negative correlation between LGD and industrial output for all firms (columns (1)). However, this negative relation is only observed for private firms (column (3)), whereas state-owned firms remain unaffected (column (2)). These results imply that LGD undermines private firms' growth, while state-owned firms are not affected because of their political connections and preferential access to bank credit. Meanwhile, the effect is more substantial for firms with high external financial dependence (column (4)) than firms with low external financial dependence (column (5)). Therefore, my findings in Table 11 indicate that LGD

not only crowds out innovation but also leads to a decline in their production by reducing the financial resources available for private firms.

To further examine whether LGD is associated with capital misallocation, I replace the dependent variable with capital productivity deviation ($CP\_Deviation$), defined as the percentage deviation of capital productivity from the industry mean, and estimate equation (6) separately for private firms and state firms. The results of this analysis are presented in Table 12. Suppose that more LGD leads to tighter financial constraints on private firms, marginal capital productivity should be positively related to LGD as private firms are generally more efficient than state-owned firms. The findings in Table 12 support this conjecture: the coefficient estimates on LGD are significantly positive for all firms and private firms, but not for state-owned firms. These results suggest that LGD leads to resource misallocation, which undermines private firm innovation and impedes economic growth under China's unique politico-economic structure.

After showing that LGD is associated with capital misallocation, I next explore the moderating role of private banking. In particular, I exploit the heterogeneity of the banking industry in terms of ownership across prefecture cities in China and estimate the effect of LGD on industrial output and capital productivity deviation. Table 13 presents my estimations. Column (1) to column (4) focus on industrial value added ($Vaindst$). I observe that while the presence of high state-owned banks' market share worsens the crowding effects of LGD on industrial output, the presence of higher proportions of private banks mediates these effects. In column (5) to column (8), I replace the dependent variable with capital productivity deviation ($CP\_Deviation$). I find consistent results: while the presence of high proportion of state-owned banks worsens the resource misallocation brought by LGD expansion, the presence of higher private banks' market share moderates these effects. My findings presented in Table 13 suggest that private banking plays a crucial role in addressing the adverse effects of LGD on industrial output and capital productivity, while the presence of a high proportion of state-owned banks exacerbates these effects.

Overall, my results presented in Table 11 to Table 13 provide additional evidence that LGD leads to capital misallocation in China, resulting in the crowding out of private firm innovation and ultimately undermining the economy. I find that the adverse effect of LGD is moderated by private banking, highlighting the significance of the development of private banking in facilitating efficient resource allocation and alleviating the adverse impact of LGD on the economy.

5. Conclusion

In this paper, I investigate the effect of local government debt (LGD) on firm innovation and the moderating role of private banking in China. My study provides compelling evidence that LGD has a negative effect on firm innovation in China, with private firms being disproportionately affected while state-owned firm are spared from the effect. My analysis demonstrates that financial constraints resulting from LGD expansion lead to the crowding out effect on private firm innovation. Furthermore, my results indicate that state control over the banking sector contributes to LGD's crowding out effect, and that private banking effectively mitigates the negative impact of LGD on innovation. In addition, I show that surging LGD is associated with resource misallocation, and while state-owned banks exacerbate the phenomenon, private banking addresses the adverse effects of LGD on the economy.

My findings highlight the importance of private banking in facilitating efficient capital allocation and promoting innovation. Although China's banking system has been instrumental in boosting the investment-driven economic growth model in the past three decades, the discrimination against private firms in the credit market has hindered the economy. As China is transiting to a new economic growth model driven by consumption and innovation, innovative and efficient private firms would play a pivotal role in this process. Therefore, it is crucial to further develop the banking industry to improve resource allocation and facilitate economic growth. My findings underscore the implications of China's unique politico-economic structure and offer insights for policymakers seeking to promote innovation and financial development in China.

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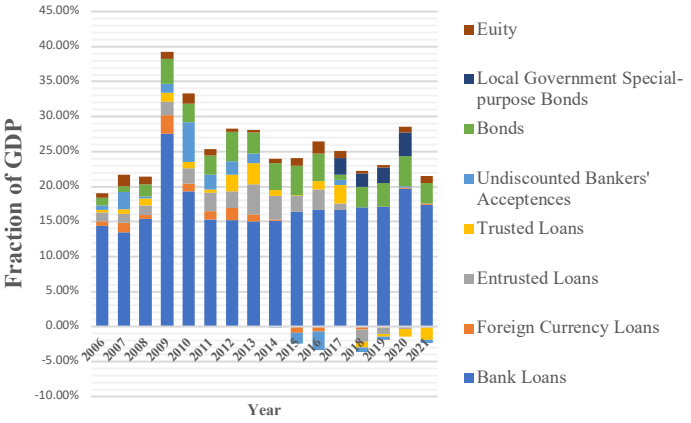
Appendix: Figures and Tables

(1)



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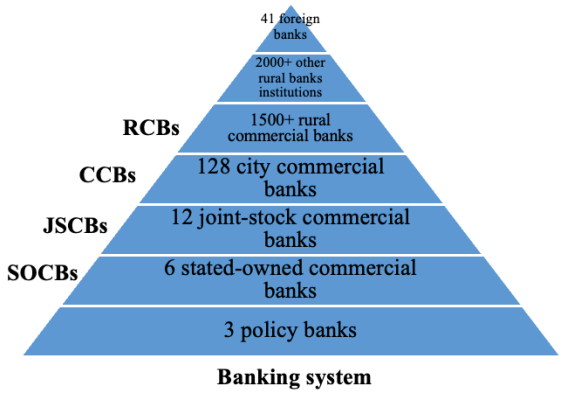
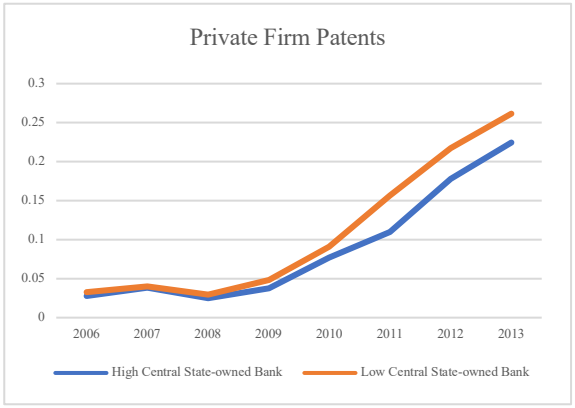


Figure 1. Banking system in China. (1): Total social financing relative to GDP. Total social financing is also referred to as aggregate financing to the real economy. Data from China's National Bureau of Statistics (NBS). (2): Banking system in China in terms of number and fraction of banking assets. Data from China Banking and Insurance Regulation Committee (CBIRC).

(1)



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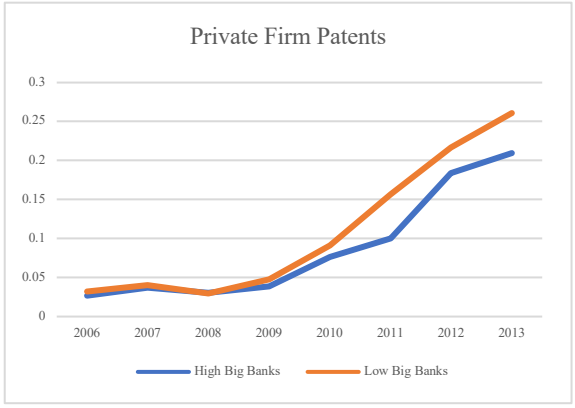

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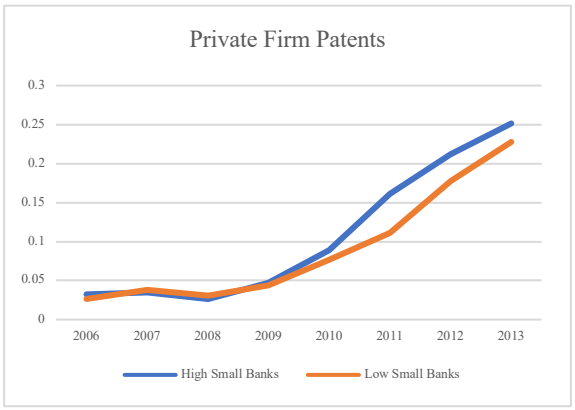

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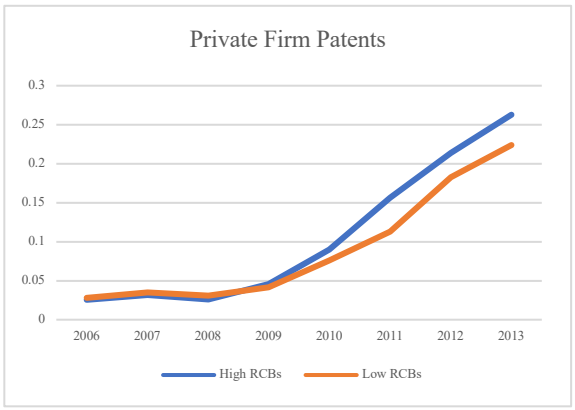

Figure 2. Private Firms' Patents by City-level Banking Ownership Structure. (1): The city-level mean of private firm patents in cities with high market share of central state-owned banks and low market share of central state-owned banks. (2) The city-level mean of private firm patents in cities with high market share of big banks and lower market share of big banks. (3) The city-level mean of private firm patents in cities with high market share of small banks and low market share of small banks. (4) The city-level mean of private firm patents in cities with high market share of rural commercial banks and low market share of rural commercial banks. *High Central State-owned Bank* indicates the group of cities with above the industry median HHI_Cstate and have a matched city with HHI_Cstate below the industry median, and *Low Central State-owned Bank* indicates the matched group of cities. *High (low) Big banks, High (low) Small banks,* and *High (low) RCBs* are defined in similar methods. Patents of firm i in year t is measured as the natural logarithm of one plus a firm i's total number of patent application in year t.

Table 1 Definition of Variables

This table presents variable definitions.

Variables	Definition
Measure of Innovation	
$\boldsymbol{Patents_{i,t}}$	Natural logarithm of one plus a firm *i*'s total number of patent application in year *t*.
$\boldsymbol{Yinv_{i,t}}$	Natural logarithm of one plus a firm *i*'s total number of Invent Patents application in year *t*.
$\boldsymbol{Yum_{i,t}}$	Natural logarithm of one plus a firm *i*'s total number of Utility Model Patents application in year *t*.
$\boldsymbol{Ydes_{i,t}}$	Natural logarithm of one plus a firm *i*'s total number of Design Patents application in year *t*.
$\boldsymbol{log\ (1 + R\ \&\ D)_{i,t}}$	Natural logarithm of one plus a firm *i*'s R & D investment in year *t*.
$\boldsymbol{R\ \&\ D\_Ratio_{i,t}}$	The ratio of R & D investment to firm revenue multiple by 100 of firm *i* in year *t*.
Measure of LGD	
$\boldsymbol{LGD_{c,t}}$	Natural logarithm of the ratio of city c's total local government debt to city *c*'s GDP in year *t*.
Measure of Banking Industry by Ownership Structure	
$\boldsymbol{HHI\_Cstate_{c,t}}$	$HHI\_Cstate = \sum_{c=1}^{C_i} (\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI$
$\boldsymbol{HHI\_Big_{c,t}}$	$HHI\_Big = \sum_{b=1}^{B_i} (\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI$
$\boldsymbol{HHI\_Small_{c,t}}$	$HHI\_Small = \sum_{s=1}^{S_i} (\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI$
$\boldsymbol{HHI\_RuralC_{c,t}}$	$HHI\_RuralC = \sum_{r=1}^{R_i} (\#branch_k / \sum_{k=1}^{K_i} \#branch_k)^2 / HHI$
Measure of Firm Characteristics	
$\boldsymbol{Leverage_{i,t}}$	The ratio of total debt to total assets of firm *i* in year *t*.
$\boldsymbol{log\_debt_{i,t}}$	Natural logarithm of firm *i's* total debt in year *t*.
$\boldsymbol{log\_interestExp_{i,t}}$	Natural logarithm of firm *i's* total interest payment in year *t*.
$\boldsymbol{interestRate_{i,t}}$	Natural logarithm of the ratio of financing cost to total debt of firm *i* in year *t*.
$\boldsymbol{financialExp_{i,t}}$	Natural logarithm of the ratio of financing cost to total debt of firm *i* in year *t*.
$\boldsymbol{assets_{i,t}}$	Natural logarithm of firm *i's* total assets in year *t*.
$\boldsymbol{log\_age_{i,t}}$	Natural logarithm of firm *i's* age in year *t*.
$\boldsymbol{log\_FixA2TA_{i,t}}$	Natural logarithm of the ratio of fixed assets to total assets of firm *i* in year *t*.

$\boldsymbol{Vaindst_{i,t}}$	Natural logarithm of industrial value added of firm *i* in year *t*.
Measure of City Characteristics	
$\boldsymbol{log\_GDP_{c,t}}$	Natural logarithm of city *c*'s GDP in year *t*.
$\boldsymbol{log\_POP_{c,t}}$	Natural logarithm of city *c*'s population in year *t*.
$\boldsymbol{GROWTH_{c,t}}$	GDP growth rate of city *c*'s GDP in year *t*.
$\boldsymbol{GOVBAL2Y_{c,t}}$	The ratio of government balance to GDP of city *c*'s in year *t*.

Table 2 Summary Statistics

This table presents descriptive statistics for the sample cities and firms. Panel A summarizes my data for LGD by year. Panel B reports banking competition in the sample by year. Panel C reports the descriptive statistics for the sample cities. Panel D reports the descriptive statistics for the sample firms. Panel E compares the difference between state firms and private firms. The sample consists of 846,555 firm-year observations for 260 cities over an 8-year period from 2006 to 2013. All variables are winsorized at the 1st and 99th percentiles. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Panel A: Local Government Debt

	Local Government Debt (Billion RMB)					Country Sum of Government Debt	
Year	Mean	Std	Min	Median	Max	Billion RMB	(% GDP)
2006	4.881	19.276	0.000	0.000	173.465	1249.468	5.750%
2007	8.066	29.299	0.000	0.358	267.848	2073.020	7.971%
2008	11.648	40.873	0.000	1.123	382.689	2981.830	9.650%
2009	21.376	66.659	0.000	2.690	589.369	5493.721	15.851%
2010	28.050	86.932	0.000	3.417	788.953	6703.883	17.139%
2011	32.138	99.462	0.000	4.268	950.795	8259.586	16.753%
2012	40.025	120.939	0.013	5.724	1145.027	9926.270	18.677%
2013	48.284	140.268	0.015	7.200	1303.169	12408.990	20.615%

Panel B: Banking Competition

	HHI_Cstate		HHI_Bigbanks		HHI_Smallbanks		HHI_RuralCbanks	
Year	Mean	Std	Mean	Std	Mean	Std	Mean	Std
2006	0.788	0.197	0.786	0.198	0.212	0.197	0.174	0.195
2007	0.758	0.196	0.755	0.197	0.242	0.197	0.204	0.197
2008	0.787	0.168	0.785	0.168	0.212	0.168	0.181	0.169
2009	0.780	0.163	0.778	0.163	0.219	0.163	0.187	0.164
2010	0.769	0.160	0.766	0.160	0.231	0.160	0.196	0.161
2011	0.758	0.152	0.755	0.152	0.242	0.152	0.209	0.155
2012	0.745	0.155	0.742	0.155	0.254	0.155	0.220	0.158
2013	0.737	0.152	0.734	0.153	0.262	0.153	0.226	0.156

Panel C: City-level Descriptive Statistics

Variable	N	Mean	Std	Min	Median	Max
log_POP	2027	5.875	0.703	2.868	5.907	7.996

log_GDP	2027	4.536	0.959	1.948	4.456	7.678
GROWTH	1999	13.110	3.274	5.000	13.225	24.000
GOVBAL2Y	2027	-8.154	5.943	-22.000	-6.786	5.000

Panel D: Firm-level Descriptive Statistics

Variable	N	Mean	Std	Min	Median	Max
log(1+ R & D)	478167	0.803	2.284	0.000	0.000	9.006
R & D_Ratio	477881	0.149	0.575	0.000	0.000	3.722
Patents	798124	0.144	0.484	0.000	0.000	2.485
Yinv	798124	0.055	0.254	0.000	0.000	1.609
Yum	798124	0.103	0.398	0.000	0.000	2.197
Ydes	798124	0.031	0.192	0.000	0.000	1.386
Leverage	796373	0.540	0.275	0.012	0.550	1.291
log_Debt	796615	9.867	1.677	5.257	9.844	13.999
log_interestExp	541250	6.290	1.903	0.693	6.378	10.247
interestRate	773303	0.036	0.083	-0.002	0.014	0.630
financialExp	791957	0.052	0.132	-0.034	0.021	1.019
Age	846555	2.119	0.731	0.000	2.197	3.871
Assets	846298	10.676	1.389	7.858	10.547	14.434
FixA2TA	794118	0.341	0.224	0.005	0.305	0.926
Vaindst	453681	9.136	1.556	3.892	9.208	12.323

Panel E: State Firms Vs. Private Firms

	State Firms		Private Firms		Difference	
Variable	Mean	Std	Mean	Std	T_value	P_value
log(1+ R & D)	0.580	1.891	0.568	1.876	5.507***	0.000
Patents	0.063	0.308	0.093	0.385	-17.583***	0.000
Yinv	0.029	0.177	0.038	0.203	-10.183***	0.000
Yum	0.051	0.274	0.072	0.329	-11.725***	0.000
Ydes	0.008	0.088	0.018	0.132	-15.672***	0.000
Leverage	0.591	0.318	0.537	0.288	41.429***	0.000

log_Debt	9.456	1.933	9.046	1.643	54.447***	0.000
log_interestExp	5.819	2.118	5.560	1.843	19.173***	0.000
interestRate	0.054	1.766	0.063	0.987	-3.759***	0.000
financialExp	0.039	0.136	0.062	0.175	-16.436***	0.000
Age	18.213	12.984	7.544	6.280	276.656***	0.000
Assets	10.159	1.617	9.864	1.318	47.944***	0.000
FixA2TA	0.381	1.834	0.354	0.739	16.440***	0.000
log_vaindst	8.933	1.727	8.773	1.542	40.771***	0.000

Table 3 The Effect of Local Government Debt on Firm Innovation

Panel A reports the OLS estimates of the effects of local government debt on firm innovation. The dependent variables include the log value of firm R & D spending ($log\,(1+R\,\&\,D)$), the ratio of R & D spending to revenue ($R\,\&\,D\_Ratio_{i,t}$), and the log value of one plus the total number of patent application ($Patents$), and the log value of one plus the total number of patent application in different categories including Invent Patents ($Yinv$,), Utility Model Patents (Yum), and Design Patents ($Ydes$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Panel B reports the Poisson Pseudo-likelihood estimates of the effects of local government debt on firm innovation. The dependent variables include the total number of patent application ($N\_Patents$), and the total number of patent application in different categories including Invent Patents (N_Yinv,), Utility Model Patents (N_Yum), and Design Patents (N_Ydes).Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Panel A OLS Regression						
VARIABLES	log(1+ R & D)	R & D_Ratio	Patents	Yinv	Yum	Ydes
	(1)	(2)	(3)	(4)	(5)	(6)
LGD	-0.0445***	-0.0053***	-0.0128***	-0.0039***	-0.0104***	-0.0006
	(0.0076)	(0.0020)	(0.0012)	(0.0006)	(0.0009)	(0.0004)
log_age	0.1841***	0.0351***	-0.0244***	-0.0168***	-0.0170***	0.0015
	(0.0184)	(0.0050)	(0.0027)	(0.0014)	(0.0020)	(0.0009)
assets	0.2942***	0.0297***	0.0529***	0.0201***	0.0355***	0.0087***
	(0.0097)	(0.0027)	(0.0016)	(0.0008)	(0.0012)	(0.0006)
log_FixA2TA	0.0509***	0.0078***	0.0063***	0.0020***	0.0046***	0.0014***
	(0.0056)	(0.0016)	(0.0011)	(0.0005)	(0.0008)	(0.0004)
log_POP	-0.0107	-0.0333***	0.0204***	0.0039	0.0242***	-0.0052**
	(0.0283)	(0.0083)	(0.0055)	(0.0027)	(0.0044)	(0.0022)
log_GDP	-0.7464***	-0.1874***	-0.0252*	0.0487***	-0.0298***	-0.0375***
	(0.0753)	(0.0202)	(0.0134)	(0.0065)	(0.0101)	(0.0045)
GROWTH	0.0040**	0.0013***	0.0038***	0.0007***	0.0026***	0.0013***
	(0.0018)	(0.0005)	(0.0003)	(0.0002)	(0.0003)	(0.0001)
GOVBAL2Y	0.0321***	0.0035***	0.0012*	0.0007*	0.0008	0.0004
	(0.0036)	(0.0009)	(0.0007)	(0.0004)	(0.0005)	(0.0002)
Constant	1.6219***	1.0358***	-0.3494***	-0.4229***	-0.2379***	0.1706***
	(0.4357)	(0.1157)	(0.0835)	(0.0409)	(0.0641)	(0.0282)
Sample	All	All	All	All	All	All
Observations	382,150	382,125	657,891	657,891	657,891	657,891
R-squared	0.673	0.625	0.564	0.506	0.517	0.456
Firm FE	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Panel B Poisson Pseudo-likelihood Regression						

VARIABLES	N_Patents	N_Yinv	N_Yum	N_Ydes
	(1)	(2)	(3)	(4)
LGD	-0.0092*	-0.0183***	-0.0185***	0.0136
	(0.0054)	(0.0070)	(0.0065)	(0.0095)
log_age	0.2657***	0.2647***	0.3098***	0.2482***
	(0.0170)	(0.0228)	(0.0206)	(0.0290)
assets	0.3428***	0.3254***	0.3330***	0.3175***
	(0.0116)	(0.0156)	(0.0138)	(0.0189)
log_FixA2TA	0.0519***	0.0490***	0.0554***	0.0554***
	(0.0077)	(0.0100)	(0.0090)	(0.0137)
log_POP	-0.1835***	-0.2467***	-0.1303***	-0.2692***
	(0.0272)	(0.0367)	(0.0325)	(0.0504)
log_GDP	0.7146***	1.1195***	0.4514***	-0.1301
	(0.0644)	(0.0883)	(0.0756)	(0.1110)
GROWTH	0.0031	-0.0057**	0.0081***	0.0170***
	(0.0020)	(0.0027)	(0.0024)	(0.0038)
GOVBAL2Y	-0.0281***	-0.0310***	-0.0286***	-0.0179**
	(0.0036)	(0.0047)	(0.0043)	(0.0074)
Constant	-6.5367***	-9.5871***	-5.8742***	-2.1182***
	(0.4169)	(0.5738)	(0.4878)	(0.7197)
Sample	All	All	All	All
Observations	204,941	122,695	156,878	72,922
Firm FE	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Table 4 The Effect of Local Government Debt on State Firms and Private Firms

This table report OLS estimates of the effects of local government debt on firm innovation on state firms and private firms. The dependent variables include the log value of firm R & D spending ($log\ (1 + R\ \&\ D)$), the ratio of R & D spending to revenue ($R\ \&\ D\_Ratio_{i,t}$), and the log value of one plus the total number of patent application ($Patents$), and the log value of one plus the total number of patent application in different categories including Invent Patents ($Yinv$,), Utility Model Patents (Yum), and Design Patents ($Ydes$).The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Columns (1), (3), (5), (7), and (9) includes state firms only, and column (2), (4), (6), (8), and (10) includes private firms only. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	log(1+ R & D)		R & D_Ratio		Patents		Yinv		Yum		Ydes	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	0.0173	-0.0487***	0.0154*	-0.0067***	-0.0079*	-0.0128***	-0.0004	-0.0039***	-0.0071**	-0.0105***	0.0003	-0.0006
	(0.0324)	(0.0079)	(0.0087)	(0.0021)	(0.0046)	(0.0013)	(0.0025)	(0.0006)	(0.0034)	(0.0009)	(0.0014)	(0.0005)
log_age	0.2376***	0.1559***	-0.0078	0.0351***	-0.0078	-0.0269***	-0.0058	-0.0182***	0.0002	-0.0196***	-0.0043	0.0004
	(0.0816)	(0.0195)	(0.0198)	(0.0054)	(0.0129)	(0.0029)	(0.0070)	(0.0014)	(0.0102)	(0.0021)	(0.0030)	(0.0010)
assets	0.3496***	0.2815***	0.0225	0.0280***	0.0162**	0.0549***	-0.0014	0.0209***	0.0138**	0.0365***	0.0032	0.0089***
	(0.0521)	(0.0098)	(0.0155)	(0.0028)	(0.0069)	(0.0017)	(0.0037)	(0.0008)	(0.0054)	(0.0012)	(0.0021)	(0.0006)
log_FixA2TA	0.0478*	0.0503***	0.0003	0.0077***	0.0088*	0.0059***	-0.0008	0.0021***	0.0063*	0.0043***	0.0012	0.0014***
	(0.0272)	(0.0058)	(0.0072)	(0.0017)	(0.0048)	(0.0011)	(0.0024)	(0.0005)	(0.0037)	(0.0008)	(0.0015)	(0.0004)
log_POP	0.0157	-0.0157	-0.0603	-0.0304***	0.0444	0.0177***	0.0037	0.0030	0.0411	0.0226***	-0.0086	-0.0052**
	(0.1573)	(0.0288)	(0.0478)	(0.0085)	(0.0321)	(0.0057)	(0.0153)	(0.0028)	(0.0291)	(0.0045)	(0.0089)	(0.0023)
log_GDP	-0.7194*	-0.6770***	-0.1162	-0.1864***	0.0999	-0.0297**	0.0547*	0.0515***	0.0724	-0.0323***	0.0269*	-0.0397***
	(0.3723)	(0.0782)	(0.1005)	(0.0212)	(0.0626)	(0.0139)	(0.0325)	(0.0068)	(0.0486)	(0.0106)	(0.0163)	(0.0047)
GROWTH	0.0045	0.0046**	0.0000	0.0016***	0.0041***	0.0037***	0.0023***	0.0004**	0.0030**	0.0025***	0.0004	0.0013***
	(0.0089)	(0.0019)	(0.0022)	(0.0005)	(0.0014)	(0.0004)	(0.0008)	(0.0002)	(0.0012)	(0.0003)	(0.0004)	(0.0001)
GOVBAL2Y	0.0323*	0.0309***	0.0027	0.0035***	-0.0011	0.0017**	0.0002	0.0008**	-0.0026	0.0012**	0.0005	0.0003

	(0.0178)	(0.0036)	(0.0045)	(0.0010)	(0.0029)	(0.0007)	(0.0017)	(0.0004)	(0.0023)	(0.0006)	(0.0010)	(0.0002)
Constant	0.3664	1.4556***	0.9836*	1.0291***	-0.8461**	-0.3188***	-0.2513	-0.4367***	-0.7389**	-0.2160***	-0.0998	0.1829***
	(2.1438)	(0.4522)	(0.5629)	(0.1214)	(0.4060)	(0.0867)	(0.2084)	(0.0424)	(0.3363)	(0.0666)	(0.0998)	(0.0297)
Sample	State	Private	State	Private	State	Private	State	Private	State	Private	State	Private
LGD Cofficient Diff.	Private-State		Private-State		Private-State		Private-State		Private-State		Private-State	
	-0.066***		-0.022***		-0.005***		-0.004***		-0.003***		-0.001***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	19,326	359,159	19,321	359,139	29,240	625,145	29,240	625,145	29,240	625,145	29,240	625,145
R-squared	0.736	0.677	0.674	0.630	0.722	0.562	0.660	0.506	0.659	0.516	0.605	0.456
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 5 The Effect of Local Government Debt on Firms Debt Financing

This table report OLS estimates of the effects of local government debt on firm debt financing. The dependent variables include firm leverage ($Leverage$)and the log value of firm debt (log_debt). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Columns (1) and column (4) include all firms. Columns (2) and column (5) include state firms only, and column (3) and column (6) include private firms only. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	Leverage			log_debt		
	(1)	(2)	(3)	(4)	(5)	(6)
LGD	-0.0027***	-0.0001	-0.0027***	-0.0170***	-0.0047	-0.0173***
	(0.0006)	(0.0025)	(0.0007)	(0.0022)	(0.0067)	(0.0024)
log_age	0.0087***	0.0023	0.0093***	0.0285***	0.0052	0.0279***
	(0.0012)	(0.0055)	(0.0013)	(0.0041)	(0.0176)	(0.0044)
assets	-0.0260***	-0.0424***	-0.0249***	0.8785***	0.8312***	0.8819***
	(0.0010)	(0.0058)	(0.0010)	(0.0037)	(0.0209)	(0.0038)
log_FixA2TA	-0.0079***	0.0058	-0.0081***	0.0093***	0.0747***	0.0076**
	(0.0007)	(0.0037)	(0.0007)	(0.0030)	(0.0158)	(0.0031)
log_POP	-0.0237***	-0.0124	-0.0255***	-0.0343***	0.0553	-0.0399***
	(0.0023)	(0.0120)	(0.0024)	(0.0084)	(0.0364)	(0.0085)
log_GDP	-0.0654***	0.0106	-0.0719***	-0.1342***	0.0634	-0.1426***
	(0.0054)	(0.0251)	(0.0056)	(0.0172)	(0.0709)	(0.0179)
GROWTH	0.0012***	-0.0004	0.0014***	0.0054***	-0.0020	0.0057***
	(0.0001)	(0.0007)	(0.0002)	(0.0005)	(0.0020)	(0.0005)
GOVBAL2Y	-0.0013***	-0.0023*	-0.0013***	-0.0051***	-0.0062	-0.0051***
	(0.0003)	(0.0013)	(0.0003)	(0.0011)	(0.0039)	(0.0012)
Constant	1.2956***	1.0829***	1.3272***	1.3214***	0.5606	1.3558***
	(0.0338)	(0.1655)	(0.0349)	(0.1103)	(0.5006)	(0.1142)
Sample	All	State	Private	All	State	Private
LGD Cofficient Diff.		Private-State			Private-State	
		-0.003***			-0.013***	

P_value		(0.000)			(0.000)	
Observations	690,878	31,166	656,437	690,878	31,166	656,437
R-squared	0.703	0.774	0.705	0.907	0.946	0.905
Firm FE	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Table 6 The Effect of Local Government Debt on Firms' Financial Cost

This table report OLS estimates of the effects of local government debt on firm financial cost. The dependent variables include the log value of total interest payment ($log\_interestExp$) and the log value of the ratio of total interest payment to total debt ($interestRate$), and interest rate as the log value of the ratio of financing cost to total debt ($log\_financialExp$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of total assets, the log value of firm age, and the log value of the ratio of fixed assets to total assets. City-level controls include the log value of GDP, the log value of total population, GDP growth rate, and the ratio of government balance to GDP. Columns (1), (4), and (7) include all firms. Columns (2), (5), and (8) include state firms only, and column (3), (6), and (9) include private firms only. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	log_interestExp			log_interestRate			log_financialExp		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LGD	-0.0021	-0.0171	-0.0004	0.0189***	-0.0099	0.0215***	0.0230***	0.0160	0.0239***
	(0.0046)	(0.0206)	(0.0048)	(0.0050)	(0.0203)	(0.0052)	(0.0044)	(0.0192)	(0.0046)
log_age	0.1758***	0.1030**	0.1620***	0.1478***	0.0888**	0.1365***	0.1705***	0.1615***	0.1620***
	(0.0086)	(0.0425)	(0.0090)	(0.0089)	(0.0441)	(0.0092)	(0.0085)	(0.0411)	(0.0088)
assets	0.6091***	0.4952***	0.6066***	-0.2426***	-0.2889***	-0.2488***	-0.2089***	-0.1815***	-0.2153***
	(0.0061)	(0.0371)	(0.0063)	(0.0063)	(0.0383)	(0.0064)	(0.0059)	(0.0369)	(0.0060)
log_FixA2TA	0.0733***	0.1216***	0.0703***	0.1067***	0.0940***	0.1050***	0.1295***	0.1073***	0.1284***
	(0.0044)	(0.0259)	(0.0044)	(0.0047)	(0.0313)	(0.0048)	(0.0043)	(0.0256)	(0.0044)
log_POP	-0.0580***	-0.0878	-0.0555***	-0.0006	-0.0852	0.0054	0.0838***	-0.0768	0.0949***
	(0.0155)	(0.0997)	(0.0157)	(0.0168)	(0.1017)	(0.0170)	(0.0149)	(0.0772)	(0.0152)
log_GDP	-0.0111	0.5583***	0.0020	0.1055**	0.4789**	0.1235***	0.1230***	0.0944	0.1428***
	(0.0403)	(0.1961)	(0.0416)	(0.0413)	(0.1960)	(0.0427)	(0.0391)	(0.1830)	(0.0406)
GROWTH	0.0137***	-0.0053	0.0141***	0.0106***	-0.0018	0.0110***	0.0127***	0.0007	0.0131***
	(0.0011)	(0.0050)	(0.0012)	(0.0012)	(0.0052)	(0.0012)	(0.0012)	(0.0053)	(0.0012)
GOVBAL2Y	-0.0044**	0.0136	-0.0070***	-0.0016	0.0167*	-0.0040*	0.0003	0.0220**	-0.0021
	(0.0021)	(0.0097)	(0.0022)	(0.0023)	(0.0100)	(0.0023)	(0.0022)	(0.0091)	(0.0023)
Constant	-0.3203	-1.3716	-0.3622	-2.0458***	-2.8646**	-2.0906***	-3.1070***	-2.3669**	-3.1978***
	(0.2364)	(1.2274)	(0.2430)	(0.2454)	(1.2315)	(0.2528)	(0.2332)	(1.1274)	(0.2410)
Sample	All	State	Private	All	State	Private	All	State	Private
LGD Cofficient Diff.		Private-State			Private-State			Private-State	

		0.017***			0.031***			0.008***	
P_value		(0.000)			(0.000)			(0.000)	
Observations	465,995	18,438	444,125	465,867	18,438	444,003	568,528	21,896	543,147
R-squared	0.802	0.870	0.802	0.652	0.707	0.655	0.650	0.726	0.652
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 7 The Effect of Local Government Debt and External Financial Dependence

This table report OLS estimates of the heterogenous effects of local government debt on firm innovation and external financial dependence. The dependent variables include the log value of firm R & D spending ($log\ (1 + R\ \&\ D)$) and the log value of one plus the total number of patent application ($Patents$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). EFD represents the extent of external financial dependence based on whether firms are in industries with external financial need above or below the industry mean. EFD indicates high or low external financial dependence. Column (1) and column (7) include all firms with high external financial dependence, and column (2) and column (8) include all firms low external financial dependence. Column (3) and column (9) include state firms with high external financial dependence, and column (5) and column (11) include state firms with low external financial dependence. Column (4) and column (10) include private firms with high external financial dependence, and column (6) and column (12) include private firms with low external financial dependence. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	log(1+ R & D)						Patents					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	-0.0509***	-0.0287**	-0.0006	-0.0520***	0.0464	-0.0399***	-0.0138***	-0.0094***	-0.0081	-0.0134***	-0.0073	-0.0100***
	(0.0109)	(0.0113)	(0.0696)	(0.0111)	(0.0343)	(0.0122)	(0.0018)	(0.0017)	(0.0102)	(0.0019)	(0.0053)	(0.0018)
log_age	0.1522***	0.1891***	0.1492	0.1325***	0.2783***	0.1630***	-0.0281***	-0.0297***	-0.0233	-0.0304***	-0.0175	-0.0314***
	(0.0248)	(0.0296)	(0.1707)	(0.0256)	(0.0927)	(0.0328)	(0.0037)	(0.0041)	(0.0213)	(0.0039)	(0.0167)	(0.0045)
assets	0.3314***	0.2508***	0.4921***	0.3126***	0.2803***	0.2409***	0.0602***	0.0319***	0.0395***	0.0608***	-0.0168*	0.0359***
	(0.0143)	(0.0144)	(0.0918)	(0.0145)	(0.0712)	(0.0149)	(0.0023)	(0.0022)	(0.0118)	(0.0023)	(0.0093)	(0.0024)
log_FixA2TA	0.0684***	0.0196**	-0.0572	0.0716***	0.0833**	0.0184**	0.0091***	0.0017	0.0056	0.0088***	0.0023	0.0012
	(0.0087)	(0.0088)	(0.0560)	(0.0089)	(0.0377)	(0.0092)	(0.0016)	(0.0016)	(0.0089)	(0.0016)	(0.0061)	(0.0017)
log_POP	0.0470	-0.0335	0.0721	0.0466	-0.1757	-0.0302	0.0206**	0.0226***	0.0137	0.0186**	0.0630	0.0168**
	(0.0418)	(0.0447)	(0.3196)	(0.0423)	(0.1478)	(0.0469)	(0.0083)	(0.0082)	(0.0655)	(0.0084)	(0.0419)	(0.0084)
log_GDP	-0.9126***	-0.5151***	-1.6596**	-0.7881***	-0.1978	-0.5410***	-0.0370*	-0.0079	0.2321**	-0.0410**	-0.0130	-0.0120
	(0.1110)	(0.1045)	(0.7321)	(0.1135)	(0.4428)	(0.1110)	(0.0194)	(0.0171)	(0.1087)	(0.0199)	(0.0805)	(0.0180)
GROWTH	0.0064**	0.0019	0.0150	0.0067**	0.0007	0.0031	0.0030***	0.0040***	0.0052*	0.0028***	0.0025	0.0040***
	(0.0031)	(0.0025)	(0.0206)	(0.0031)	(0.0110)	(0.0026)	(0.0006)	(0.0005)	(0.0030)	(0.0006)	(0.0018)	(0.0005)
GOVBAL2Y	0.0364***	0.0326***	0.0813**	0.0348***	0.0194	0.0321***	0.0016	0.0008	-0.0008	0.0020*	-0.0025	0.0019*
	(0.0053)	(0.0053)	(0.0390)	(0.0053)	(0.0201)	(0.0057)	(0.0010)	(0.0010)	(0.0057)	(0.0011)	(0.0035)	(0.0010)
Constant	1.9862***	0.8173	4.2540	1.5150**	-0.8941	1.1184*	-0.3274***	-0.2458**	-1.5901**	-0.2918**	0.0331	-0.2215*
	(0.6409)	(0.6245)	(4.3979)	(0.6534)	(2.4428)	(0.6632)	(0.1207)	(0.1098)	(0.7276)	(0.1239)	(0.5354)	(0.1148)

EFD	High	Low	High	High	Low	Low	High	Low	High	High	Low	Low
Sample	All	All	State	Private	State	Private	All	All	State	Private	State	Private
LGD Cofficient Diff.	High-Low		Private-State		Private-State		High-Low		Private-State		Private-State	
	-0.022***		-0.051***		-0.086***		-0.004***		-0.005***		-0.003***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	188,488	149,741	5957	179471	9,812	136,314	353,061	276446	10,517	338,031	15,243	256,346
R-squared	0.701	0.747	0.762	0.702	0.746	0.753	0.607	0.654	0.772	0.603	0.728	0.654
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 8 The Effect of Local Government Debt and Cash Flow

This table report OLS estimates of the heterogenous effects of local government debt on firm innovation and cash flow. The dependent variables include the log value of firm R & D spending ($log\ (1 + R\ \&\ D)$) and the log value of one plus the total number of patent application ($Patents$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Cash Flow represents the adequacy of cash flow based on whether firms' cash flow was above or below the industry mean. Column (1) and column (7) include all firms with high cash flow, and column (2) and column (8) include all firms low cash flow. Column (3) and column (9) include state firms with high cash flow, and column (5) and column (11) include state firms with low cash flow. Column (4) and column (10) include private firms with high cash flow, and column (6) and column (12) include private firms with low cash flow. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	log(1+ R & D)						Patents					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	-0.0454***	-0.0478***	0.0052	-0.0500***	0.0496	-0.0542***	-0.0081***	-0.0133***	-0.0044	-0.0081***	-0.0090	-0.0133***
	(0.0118)	(0.0116)	(0.0497)	(0.0123)	(0.0621)	(0.0120)	(0.0018)	(0.0023)	(0.0076)	(0.0019)	(0.0087)	(0.0024)
log_age	0.3344***	0.0356	0.3381***	0.2984***	0.0542	0.0364	-0.0264***	-0.0242***	-0.0011	-0.0265***	-0.0109	-0.0284***
	(0.0258)	(0.0310)	(0.1221)	(0.0275)	(0.1580)	(0.0331)	(0.0038)	(0.0050)	(0.0190)	(0.0040)	(0.0216)	(0.0054)
assets	0.3193***	0.2903***	0.4069***	0.3017***	0.2619***	0.2871***	0.0420***	0.0783***	0.0157	0.0442***	0.0132	0.0802***
	(0.0142)	(0.0157)	(0.0806)	(0.0145)	(0.0830)	(0.0161)	(0.0020)	(0.0033)	(0.0104)	(0.0020)	(0.0113)	(0.0034)
log_FixA2TA	0.0576***	0.0544***	0.0869*	0.0555***	-0.0148	0.0571***	0.0059***	0.0119***	0.0136**	0.0052***	-0.0081	0.0121***
	(0.0090)	(0.0086)	(0.0445)	(0.0093)	(0.0397)	(0.0089)	(0.0014)	(0.0021)	(0.0069)	(0.0015)	(0.0074)	(0.0022)
log_POP	0.0990**	-0.2449***	0.2723	0.0826**	-0.1526	-0.2345***	0.0207***	0.0138	0.0010	0.0192***	0.1138**	0.0064
	(0.0389)	(0.0529)	(0.2548)	(0.0394)	(0.1970)	(0.0549)	(0.0069)	(0.0127)	(0.0451)	(0.0071)	(0.0463)	(0.0131)
log_GDP	-1.1458***	-0.1739	-0.8254	-1.0735***	-0.5677	-0.1029	-0.0039	0.0050	0.1871**	-0.0162	-0.0064	0.0158
	(0.1150)	(0.1078)	(0.5266)	(0.1204)	(0.6793)	(0.1121)	(0.0184)	(0.0246)	(0.0909)	(0.0191)	(0.1185)	(0.0258)
GROWTH	0.0130***	-0.0067**	0.0000	0.0142***	-0.0111	-0.0070**	0.0040***	0.0017**	0.0052**	0.0039***	0.0035	0.0014**
	(0.0029)	(0.0027)	(0.0140)	(0.0030)	(0.0140)	(0.0028)	(0.0004)	(0.0007)	(0.0021)	(0.0005)	(0.0022)	(0.0007)
GOVBAL2Y	0.0261***	0.0329***	0.0431	0.0233***	-0.0267	0.0360***	-0.0001	0.0050***	-0.0020	0.0006	0.0002	0.0053***

	(0.0054)	(0.0057)	(0.0263)	(0.0055)	(0.0303)	(0.0059)	(0.0009)	(0.0014)	(0.0042)	(0.0010)	(0.0048)	(0.0015)
Constant	2.6895***	0.1995	-1.2576	2.6513***	1.6821	-0.2117	-0.3393***	-0.7252***	-1.0378*	-0.2808**	-0.7465	-0.7457***
	(0.6761)	(0.6364)	(3.1701)	(0.7058)	(3.5990)	(0.6617)	(0.1123)	(0.1600)	(0.5853)	(0.1166)	(0.7209)	(0.1672)
Cash Flow	High	Low	High	High	Low	Low	High	Low	High	High	Low	Low
Sample	All	All	State	Private	State	Private	All	All	State	Private	State	Private
LGD Cofficient Diff.	High-Low		Private-State		Private-State		High-Low		Private-State		Private-State	
	0.002***		-0.055***		-0.104***		0.005***		-0.004***		-0.004***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	188,488	143,570	10,285	184,205	5,690	135,158	414,589	214,173	17,430	392,342	8,223	202,615
R-squared	0.701	0.701	0.756	0.730	0.750	0.703	0.638	0.587	0.753	0.637	0.706	0.585
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 9 The Effect of Local Government Debt on Firm Innovation by Banking Ownership Structure

This table report OLS estimates of the heterogenous effects of local government debt on firm innovation by banking ownership structure in the local credit market. The dependent variable in Panel A and Panel B is the log value of firm R & D spending (log (1+R & D)), and the dependent variable in Panel C and Panel D is the log value of one plus the total number of patent application (Patents). The independent variable LGD_(c,t) is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets (assets), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets (log_FixA2TA). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate (GROWTH), and the ratio of government balance to GDP (GOVBAL2Y). Panel A and Panel C present the effect of LGD on firm innovation subsampled by matched cities in terms of central state-owned banks' market share (HHI_Cstate) and big banks' market share (HHI_Big), Panel B and Panel D present the effect of LGD on firm innovation subsampled by matched cities in terms of small banks' market share (HHI_Small) and RCBs' market share (HHI_RuralC). In Panel A and Panel C, columns (1) and column (7) include all firms located in cities with high central state-owned banks' market share (HHI_Cstate) and high big banks' market share (HHI_Big), respectively; columns (2) and column (8) include all firms located in cities with low central state-owned banks' market share (HHI_Cstate) and low big banks' market share (HHI_Big), respectively; column (3) and columns (9) include state firms located in cities with high central state-owned banks' market share (HHI_Cstate), and high big banks' market share (HHI_Big), respectively; column (5) and columns (11) include state firms located in cities with low central state-owned banks' market share (HHI_Cstate) and low big banks' market share (HHI_Big), respectively; column (4) and columns (10) include private firms located in cities with high central state-owned banks' market share (HHI_Cstate) and high big banks' market share (HHI_Big), respectively; column (6) and columns (12) include private firms located in cities with low central state-owned banks' market share (HHI_Cstate) and low big banks' market share (HHI_Big), respectively. In Panel B and Panel D, columns (1) and column (7) include all firms located in cities with high small banks' market share (HHI_Small) and high RCBs' market share (HHI_RuralC), respectively; columns (2) and column (8) include all firms located in cities with low small banks' market share (HHI_Small) and low RCBs' market share (HHI_RuralC), respectively; column (3) and columns (9) include state firms located in cities with high small banks' market share (HHI_Small) and high RCBs' market share (HHI_RuralC), respectively; column (5) and columns (11) include state firms located in cities with low small banks' market share (HHI_Small) and low RCBs' market share (HHI_RuralC), respectively; column (4) and columns (10) include private firms located in cities with high small banks' market share (HHI_Small) and high RCBs' market share (HHI_RuralC), respectively; column (6) and columns (12) include private firms located in cities with low small banks' market share (HHI_Small) and low RCBs' market share (HHI_RuralC), respectively. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Panel A: The Effect of Local Governmnet Debt on Firms' R & D by State-owned Banks' Market Share

VARIABLES	log(1+ R & D)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	-0.0419***	-0.0291***	0.0526	-0.0547***	0.0075	-0.0330***	-0.0366**	-0.0350***	0.1057	-0.0535***	0.0016	-0.0387***
	(0.0123)	(0.0110)	(0.0589)	(0.0126)	(0.0417)	(0.0116)	(0.0149)	(0.0107)	(0.0685)	(0.0154)	(0.0420)	(0.0113)
HHI_Cstate	High	Low	High	High	Low	Low						
HHI_Big							High	Low	High	High	Low	Low
Sample	All	All	State	Private	State	Private	All	All	State	Private	State	Private
LGD Cofficient Diff.	High-Low		Private-State		Private-State		High-Low		Private-State		Private-State	
	-0.013***		-0.107***		-0.041***		-0.002***		-0.159***		-0.040***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	130,437	207,286	7,133	121,076	8,751	196,575	114,997	208,827	5,761	107,210	8,758	198,047
R-squared	0.751	0.703	0.774	0.756	0.755	0.706	0.745	0.703	0.776	0.749	0.754	0.706

Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Panel B: The Effect of Local Governmnet Debt on Firms' R & D by Private Banks' Market Share												
VARIABLES	log(1+ R & D)											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	-0.0067***	-0.0284**	0.0136	-0.0114*	0.0559	-0.0392***	-0.0619***	-0.0666***	0.065	-0.0751***	0.0397	-0.0793***
	(0.0117)	(0.0123)	(0.0443)	(0.0123)	(0.0539)	(0.0127)	(0.0151)	(0.0123)	-0.0589	-0.0158	(0.0536)	(0.0127)
HHI_Small	High	Low	High	High	Low	Low						
HHI_RuralC							High	Low	High	High	Low	Low
Sample	All	All	State	Private	State	Private	All	All	State	Private	State	Private
LGD Cofficient Diff.	High-Low		Private-State		Private-State		High-Low		Private-State		Private-State	
	0.022***		-0.025***		-0.095***		0.005***		-0.140***		-0.119***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	160,071	164,621	6,918	151,191	9,549	153,049	148,820	182,223	5,789	141,328	10,575	169,309
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.715	0.708	0.756	0.718	0.755	0.713	0.703	0.690	0.750	0.706	0.748	0.694
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Panel C: The Effect of Local Governmnet Debt on Firms' Patent by State-owned Banks' Market Share												
VARIABLES	Patents											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	-0.0113***	-0.0079***	-0.0105**	-0.0162***	0.0016	-0.0087***	-0.0118***	-0.0110***	-0.0100*	-0.0152***	-0.0004	-0.0124***
	(0.0018)	(0.0018)	(0.0069)	(0.0019)	(0.0078)	(0.0019)	(0.0020)	(0.0018)	(0.0079)	(0.0021)	(0.0077)	(0.0018)

HHI_Cstate	High	Low	High	High	Low	Low						
HHI_Big							High	Low	High	High	Low	Low
Sample	All	All	State	Private	State	Private	All	All	State	Private	State	Private
LGD Cofficient Diff.	High-Low		Private-State		Private-State		High-Low		Private-State		Private-State	
	-0.003***		-0.006***		-0.010***		-0.001***		-0.005***		-0.012***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	251,564	349,008	11,706	237,016	12,994	333,705	233,136	352,974	10,313	220,256	13,029	337,550
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.626	0.587	0.764	0.623	0.732	0.585	0.625	0.587	0.761	0.622	0.729	0.586
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel D: The Effect of Local Governmnet Debt on Firms' Patent by Private Banks' Market Share

VARIABLES	Patents											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LGD	-0.0104***	-0.0119***	-0.0013	-0.0112***	-0.0103	-0.0114***	-0.0046*	-0.0141***	0.0114	-0.0053**	-0.0108	-0.0141***
	(0.0019)	(0.0018)	(0.0073)	(0.0020)	(0.0068)	(0.0019)	(0.0025)	(0.0018)	(0.0103)	(0.0026)	(0.0068)	(0.0019)
HHI_Small	High	Low	High	High	Low	Low						
HHI_RuralC							High	Low	High	High	Low	Low
Sample	All	All	State	Private	State	Private	All	All	State	Private	State	Private
LGD Cofficient Diff.	High-Low		Private-State		Private-State		High-Low		Private-State		Private-State	
	0.002***		-0.001***		-0.001***		0.010***		-0.017***		-0.003***	
P_value	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Observations	260,900	302170	10,007	248,250	15,054	284,913	245,853	330,071	8,351	235,247	16,595	311,015
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.607	0.6	0.741	0.604	0.746	0.598	0.597	0.592	0.714	0.596	0.746	0.589

Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 10 The Moderating Role of Private Banking on Private Firm Innovation

This table report OLS estimates of the moderating role of private banking in private firm innovation. The dependent variable in column (1) and column (4) is the log value of one plus the total number of patent application ($Patents$), the dependent variable in column (2) and column (5) is firm leverage ($Leverage$), and the dependent variable in column (3) and column (6) is the log value of firm debt (log_debt). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. $LGD_{c,t} * HHI\_SmallH$ is the cross item of $LGD_{c,t}$ and HHI_SmallH . $LGD_{c,t} * HHI\_RuralCH$ is the cross item of $LGD_{c,t}$ and $HHI\_RuralCH$. Where HHI_SmallH equals 1 for cities with small banks' market share (HHI_Small) above the industry median and have a matched city with HHI_Small below the industry median and equals 0 for the matched cities. $HHI\_RuralCH$ is defined in similar methods. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	Patents	Leverage	log_debt	Patents	Leverage	log_debt
	(1)	(2)	(3)	(4)	(5)	(6)
LGD	-0.0242***	-0.0053**	-0.0227***	-0.0255***	-0.0052**	-0.0241***
	(0.0038)	(0.0024)	(0.0072)	(0.0039)	(0.0024)	(0.0073)
LGDxHHI_SmallH	0.0195***	0.0045**	0.0095			
	(0.0043)	(0.0020)	(0.0064)			
LGDxHHI_RuralCH				0.0234***	0.0047**	0.0128**
				(0.0042)	(0.0020)	(0.0058)
log_age	-0.0263***	0.0094***	0.0282***	-0.0267***	0.0093***	0.0280***
	(0.0035)	(0.0016)	(0.0052)	(0.0035)	(0.0016)	(0.0053)
assets	0.0551***	-0.0249***	0.8821***	0.0555***	-0.0248***	0.8823***
	(0.0038)	(0.0030)	(0.0112)	(0.0038)	(0.0030)	(0.0111)
log_FixA2TA	0.0061***	-0.0080***	0.0077	0.0063***	-0.0080***	0.0078
	(0.0016)	(0.0023)	(0.0081)	(0.0016)	(0.0023)	(0.0081)
log_POP	0.0145*	-0.0261***	-0.0413**	0.0116	-0.0266***	-0.0429**
	(0.0087)	(0.0090)	(0.0194)	(0.0084)	(0.0090)	(0.0194)
log_GDP	-0.0173	-0.0693***	-0.1370***	-0.0255	-0.0711***	-0.1403***
	(0.0347)	(0.0142)	(0.0441)	(0.0342)	(0.0142)	(0.0437)
GROWTH	0.0032***	0.0012***	0.0054***	0.0030***	0.0012***	0.0053***
	(0.0011)	(0.0004)	(0.0015)	(0.0011)	(0.0004)	(0.0015)
GOVBAL2Y	0.0018	-0.0012*	-0.0051*	0.0022	-0.0011	-0.0049*
	(0.0017)	(0.0008)	(0.0026)	(0.0017)	(0.0008)	(0.0026)

Constant	-0.3675*	1.3166***	1.3337***	-0.3015	1.3301***	1.3635***
	(0.2046)	(0.0982)	(0.2788)	(0.2021)	(0.0987)	(0.2777)
Sample	Private	Private	Private	Private	Private	Private
Observations	547,827	576,900	576,900	563,103	591,673	591,673
R-squared	0.572	0.707	0.905	0.568	0.708	0.906
Firm FE	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Table 11 The Effect of Local Government Debt on Industrial Output

This table report OLS estimates of the heterogenous effects of local government debt on industrial output. The dependent variable is the log value of industrial value added ($Vaindst$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). City-level controls include the log value of GDP, the log value of total population, GDP growth rate, and the ratio of government balance to GDP. EFD represents the extent of external financial dependence based on whether firms are in industries with external financial need above or below the industry mean. Columns (1) includes all firms, column (2) includes state firms only, column (3) includes private firms only, column (4) includes firms with high external financial dependence, and column (5) includes firms with low external financial dependence. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	Vaindst				
	(1)	(2)	(3)	(4)	(5)
LGD	-0.0993***	-0.0166	-0.1027***	-0.0983***	-0.0915***
	(0.0218)	(0.0236)	(0.0228)	(0.0191)	(0.0213)
log_age	0.0171	-0.0649	0.0315**	0.0573***	-0.0927***
	(0.0143)	(0.0491)	(0.0148)	(0.0158)	(0.0226)
assets	0.2541***	0.2562***	0.2587***	0.2968***	0.1887***
	(0.0180)	(0.0456)	(0.0181)	(0.0190)	(0.0227)
log_FixA2TA	0.0150*	0.0367	0.0172*	0.0046	0.0143
	(0.0087)	(0.0274)	(0.0088)	(0.0092)	(0.0126)
log_POP	0.1698**	0.1157	0.1731**	0.1902***	0.0792
	(0.0753)	(0.1044)	(0.0765)	(0.0715)	(0.0649)
log_GDP	-1.3981***	-0.1736	-1.4874***	-1.6640***	-0.8983***
	(0.2285)	(0.3673)	(0.2311)	(0.2178)	(0.2073)
GROWTH	0.0052	-0.0037	0.0044	0.0021	0.0056
	(0.0093)	(0.0163)	(0.0092)	(0.0093)	(0.0082)
GOVBAL2Y	0.0271**	0.0025	0.0308***	0.0347***	0.0117
	(0.0108)	(0.0155)	(0.0112)	(0.0108)	(0.0107)
Constant	13.1350***	7.1517***	13.5602***	13.9908***	11.9289***
	(1.2804)	(2.0405)	(1.2974)	(1.2329)	(1.1667)
Sample	All	State	Private	EFD High	EFD Low
Observations	352,284	17,405	331,511	172,700	137,760

R-squared	0.614	0.691	0.614	0.658	0.673
Firm FE	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Table 12 The Effect of Local Government Debt on Capital Productivity

This table report OLS estimates of the heterogenous effects of local government debt on capital productivity. The dependent variable is the percentage deviation of capital productivity from the industry mean ($CP\_Deviation$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Columns (1) and column (2) include all firms, columns (3) and column (5) include state firms only, and column (5) and column (6) include private firms only. Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	CP_Deviation					
	(1)	(2)	(3)	(4)	(5)	(6)
LGD	0.0463***	0.0365***	0.0504*	0.0348	0.0372***	0.0270***
	(0.0050)	(0.0051)	(0.0302)	(0.0305)	(0.0065)	(0.0065)
log_age		0.1416***		0.0739		0.1357***
		(0.0108)		(0.0731)		(0.0130)
assets		0.0513***		-0.0861		0.0405***
		(0.0080)		(0.0695)		(0.0099)
log_FixA2TA		0.0209***		0.0132		-0.0073
		(0.0060)		(0.0413)		(0.0074)
log_POP		0.1179***		0.0870		0.1190***
		(0.0194)		(0.1227)		(0.0357)
log_GDP		0.6757***		0.4309*		0.7970***
		(0.0426)		(0.2403)		(0.0515)
GROWTH		-0.0041***		0.0237***		-0.0055***
		(0.0013)		(0.0070)		(0.0018)
GOVBAL2Y		-0.0028		0.0125		0.0093***
		(0.0025)		(0.0118)		(0.0035)
Constant	0.0200***	-5.3654***	0.2014***	-2.3032	0.0864***	-5.8592***
	(0.0019)	(0.2727)	(0.0069)	(1.5875)	(0.0026)	(0.3619)
Sample	All	All	State	State	Private	Private
Observations	672,238	654,462	23,455	22,398	438,875	423,867
R-squared	0.585	0.594	0.708	0.711	0.608	0.618
Firm FE	YES	YES	YES	YES	YES	YES

City FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Table 13 The Role of Banking Ownership Structure on Capital Misallocation

This table report OLS estimates of the role of banking industry in the relationship between LGD and industrial output and capital productivity. The dependent variable in column (1) to column (4) is the log value of industrial value added ($Vaindst$), and the dependent variable on column (5) to column (8) is the percentage deviation of capital productivity from the industry mean ($CP\_Deviation$). The independent variable $LGD_{c,t}$ is the log value of the ratio of local government debt to GDP. $LGD_{c,t} * HHI\_CstateH$ is the cross item of $LGD_{c,t}$ and $HHI\_CstateH$. $LGD_{c,t} * HHI\_BigH$ is the cross item of $LGD_{c,t}$ and HHI_BigH. $LGD_{c,t} * HHI\_SmallH$ is the cross item of $LGD_{c,t}$ and HHI_SmallH. $LGD_{c,t} * HHI\_RuralCH$ is the cross item of $LGD_{c,t}$ and $HHI\_RuralCH$. $HHI\_CstateH$ equals 1 for cities with central state-owned banks' market share (HHI_Cstate) above the industry median and have a matched city with HHI_Cstate below the industry median and equals 0 for the matched cities. HHI_BigH, HHI_SmallH, and $HHI\_RuralCH$ are defined in similar manner. Firm-level controls include the log value of firm total assets ($assets$), the log value of firm age (log_age), the log value of the ratio of firm fixed assets to total assets ($log\_FixA2TA$). City-level controls include the log value of GDP (log_GDP), the log value of total population (log_POP), GDP growth rate ($GROWTH$), and the ratio of government balance to GDP ($GOVBAL2Y$). Coefficients are reported with standard errors clustered at the firm levels in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

VARIABLES	Vaindst				CP_Deviation			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LGD	-0.0867***	-0.0894***	-0.1381***	-0.1576***	0.0195*	0.0230**	0.0572***	0.0627***
	(0.0244)	(0.0246)	(0.0260)	(0.0288)	(0.0116)	(0.0112)	(0.0112)	(0.0119)
LGDxHHI_CstateH	-0.0517**				0.0394***			
	(0.0263)				(0.0114)			
LGDxHHI_BigH		-0.0571**				0.0380***		
		(0.0257)				(0.0110)		
LGDxHHI_SmallH			0.0597**				-0.0360***	
			(0.0264)				(0.0113)	
LGDxHHI_RuralCH				0.1168***				-0.0566***
				(0.0271)				(0.0120)
log_age	0.0227	0.0233	0.0132	0.0145	0.1313***	0.1323***	0.1430***	0.1417***
	(0.0150)	(0.0149)	(0.0150)	(0.0146)	(0.0142)	(0.0143)	(0.0142)	(0.0139)
assets	0.2669***	0.2742***	0.2420***	0.2680***	0.0558***	0.0528***	0.0497***	0.0505***
	(0.0186)	(0.0187)	(0.0192)	(0.0191)	(0.0131)	(0.0133)	(0.0134)	(0.0135)
log_FixA2TA	0.0152*	0.0190**	0.0190**	0.0180**	0.0201*	0.0133	0.0219**	0.0187*
	(0.0090)	(0.0087)	(0.0090)	(0.0091)	(0.0108)	(0.0102)	(0.0109)	(0.0110)
log_POP	0.1211*	0.0929	0.1121	0.1113*	0.1138**	0.1280***	0.1405**	0.1313***

	(0.0647)	(0.0617)	(0.0716)	(0.0672)	(0.0516)	(0.0495)	(0.0597)	(0.0508)
log_GDP	-1.3128***	-1.2978***	-1.6583***	-1.5149***	0.6395***	0.6377***	0.7825***	0.7000***
	(0.2303)	(0.2458)	(0.1821)	(0.2153)	(0.0939)	(0.0944)	(0.0948)	(0.0971)
GROWTH	0.0052	-0.0051	0.0157**	0.0126	-0.0022	0.0006	-0.0039	-0.0046
	(0.0099)	(0.0091)	(0.0079)	(0.0083)	(0.0040)	(0.0033)	(0.0046)	(0.0043)
GOVBAL2Y	0.0248**	0.0347***	0.0296***	0.0303***	-0.0000	-0.0079	-0.0012	-0.0054
	(0.0118)	(0.0113)	(0.0108)	(0.0117)	(0.0070)	(0.0051)	(0.0075)	(0.0076)
Constant	12.8223***	12.9649***	14.9801***	14.0020***	-5.1738***	-5.2682***	-6.0743***	-5.5960***
	(1.2749)	(1.3568)	(1.0422)	(1.1998)	(0.5796)	(0.5900)	(0.5917)	(0.5956)
Sample	All	All	All	All	All	All	All	All
Observations	328,648	316,036	315,521	326,492	609,100	595,055	576,345	591,694
R-squared	0.629	0.632	0.627	0.626	0.604	0.612	0.602	0.599
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES