Analyzing the Impact of Local Government Debt on Business Innovation in China

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Abstract. In the critical stage of China's economic development towards "risk prevention" and "stable growth", the importance of preventing debt risk and incentivizing business innovation has gradually become more prominent, so it is necessary to study the impact of local government debt (LGD) on business innovation. Based on the existing studies on the relationship between LGD and business innovation, this paper summarizes and analyzes them in an attempting to clarify the mechanisms through which LGD acts on business innovation. The study shows that LGD crowds out enterprise research and development (R&D) investment by increasing financing constraints, inhibiting business innovation by weakening enterprise risk-taking capacity, and positively and negatively affecting business innovation through debt investment in different industries and debt-service dependence. In addition, this paper shows that LGD has a stronger crowding-out effect on exploratory innovation of enterprises and on enterprises that are not state-owned, large enterprises and those located in areas with low financial levels. The above conclusions can provide reference for preventing debt risk, promoting business innovation and boosting economic development.

Keywords: Local government debt (LGD); business innovation; financing constraints.

1. Introduction

As China's economy shifts from a stage of rapid growth to a stage of high-quality development, improving quality and efficiency of development has become the key to economic growth and social progress. Innovation is the first driving force leading development and plays an important role in realizing high-quality economic and social development. However, to realize the transformation from the traditional growth mode of economy to the technology-intensive economic growth mode, it is necessary to further deepen the institutional reform, vigorously promote scientific and technological progress, and optimize the allocation of resources through the market mechanism, so as to mobilize the enthusiasm of micro market players [1]. As the most basic unit in the market and an important main body of innovation, the technological level of enterprises directly determines the micro foundation of high-quality economic development. Along with the further deepening of China's supply-side structural reform and the comprehensive implementation of the innovation-driven development strategy, the importance of business innovation has gradually been highlighted [2].

Due to the existence of strong economic intervention by the state, local governments actively adopt various financial policies such as financial subsidies, transfer payments, loan policies and tax incentives to support the innovative activities of enterprises. How to enhance the innovation power of enterprises has also gradually become one of the main contents of scholars' research. However, statistics show that most enterprises in China have low or even no level of innovation investment, and the amplitude of innovation investment among enterprises is large [3]. The reasons for this may lie in the high-risk, long-term and lack of collateral characteristics of business innovation and the special characteristics of the general environment of business innovation in China.

Currently, the influencing factors of business innovation are becoming increasingly complex and diversified. Relevant studies show that enterprise growth, enterprise scale and profitability (net interest rate on total assets), enterprise financing constraints, risk-taking ability, science and technology expenditure and social fixed asset investment will all affect the innovation performance of enterprises to a certain extent [4]. Among them, business innovation needs long-term sustainable supply of research and development (R&D) funds, while China's enterprise R&D faces more serious

financing constraints, and it is difficult to obtain bank credit fund support, which has become a consensus in the academic community [3]. However, bank credit funds, as the main source of debt for local governments, are subject to the intervention of government fiscal policy.

As a concrete implementer of the innovation-driven development strategy, the borrowing behavior of local governments has a non-negligible role in the innovative activities of enterprises in the region. In recent years, the rapid expansion of local government debt (LGD) may affect business innovation through a variety of channels. Therefore, in the new stage of economic development, studying the impact of LGD on business innovation is one of the important bases for assessing the economic effects of policy stimulus and measuring the risk of LGD.

2. LGD in China

2.1. Background Description

LGD refers to the four levels of government, namely, provincial, local or municipal, city and township, as the debtor, which undertakes the obligation to pay back funds to the creditor in accordance with the agreement or contract. It corresponds to central government debt. Also, when the local government in the current fiscal revenue cannot satisfy the needs of its own functions, it uses its own credibility as a guarantee to borrow debt to obtain revenue, which needs to be repaid by the government with future fiscal revenue. This kind of revenue obtained through borrowing is LGD [5].

Compared with other ways for local governments to obtain financial revenues, such as tax revenues and general financial transfer revenues, LGD has greater flexibility and targeting. Meanwhile, the increase of revenues from debt will not have a direct negative impact on residents' consumption and enterprise investment, and there is no time lag when it is used for economic operation. Therefore, under the conditions of the modern market economy, LGD has become an important tool for local governments to obtain financial revenue and a major way to regulate economic and social development. After the reform of the fiscal system based on the tax-sharing system in 1994, local governments were incentivized by both the economy and political performance to rapidly expand the scale of their expenditures, thus creating fiscal deficits [6]. In order to satisfy the expanding demand for expenditure, local governments have resorted to a variety of means of financing to borrow debt, thus providing funds for economic construction while also causing LGD to accumulate in large quantities, which has gradually led to an expansion in the scale of debt [7].

After the outbreak of global financial crisis in 2008, under the pressure of economic downturn, in order to ensure stable GDP growth and maintain the momentum of economic development, the central government has implemented a proactive fiscal policy, encouraging local governments to carry out public investment, which has led to an increase in the debt level year by year [8]. Although this is of positive significance for improving government functions, enhancing public service capacity and revitalizing the local economy, on the other hand, in the long run, the many problems (For example, short-term borrowing, illegal borrowing, disorderly borrowing, and unscientific borrowing) that have arisen in the process of local governments and the excessive scale of debt have brought negative impacts on China's fiscal system and financial system [9], which have led to enterprises facing stricter financing constraints and higher external enterprise risks [2].

2.2. Features of LGD in China

2.2.1 Large scale and rapid growth

According to data from the Ministry of Finance, the national LGD balance was 16.47 trillion yuan in 2017, while by the end of 2022, its size had already risen to 35.01 trillion yuan. Figure 1 shows that the size of LGD balance is increasing every year. Figures 2 and 3 show that the debt rate and debt ratio of LGDs have increased year by year over the past five years, indicating that LGDs are experiencing increased debt pressure, but that their risks are generally controllable.

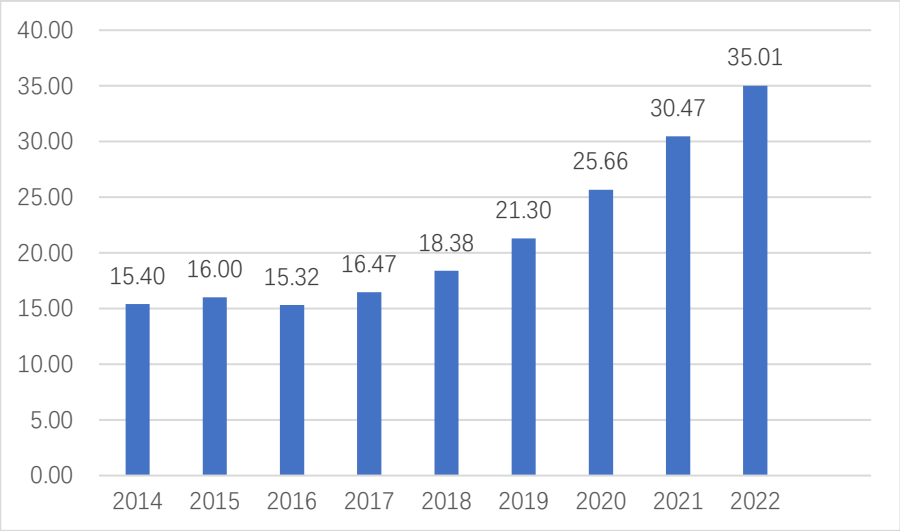


Fig. 1 LGD balance (trillion yuan)

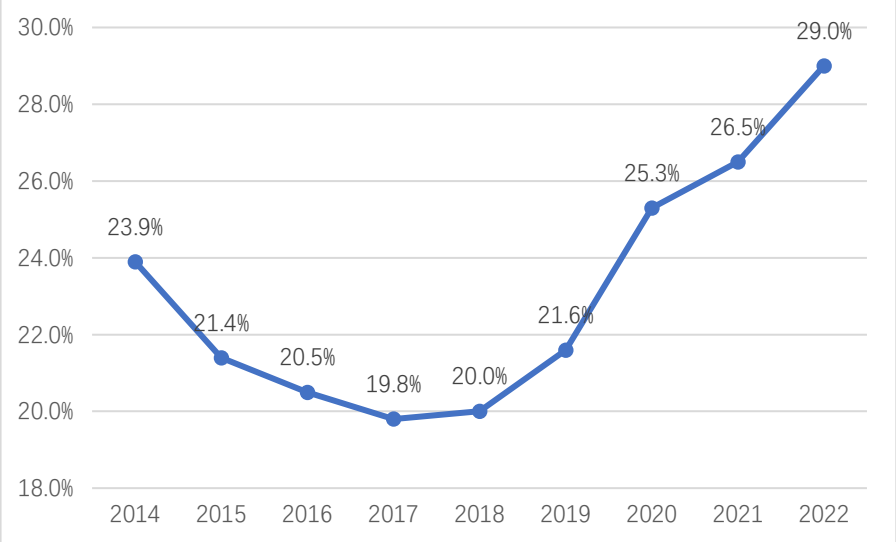


Fig. 2 Trend of LGD rate

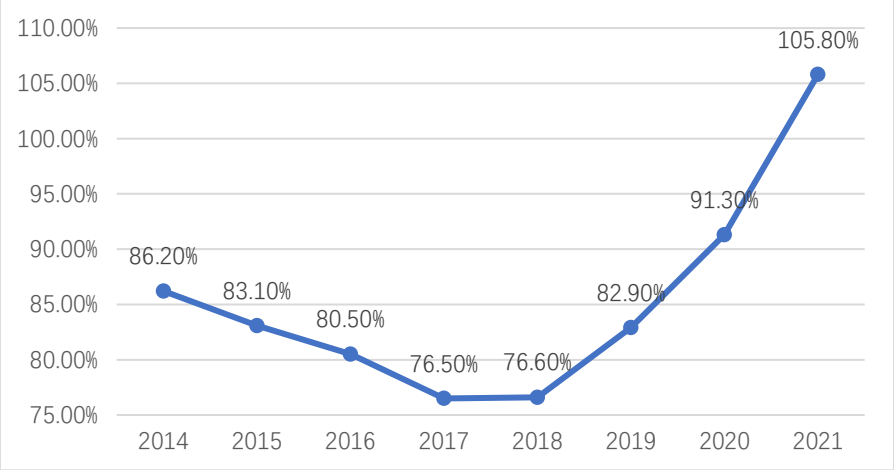


Fig. 3 Trend of LGD ratio

At the end of 2021, the LGD ratio was 105.8%, exceeding 100% for the first time, indicating that LGDs have insufficient financial resources in the face of the triple difficulties of revenue pressure, expenditure rigidity and tightening of borrowing.

In addition to its large scale, the growth rate of LGDs has also remained high [7]. Since 2017, LGD balances have been growing rapidly at an average annual rate of 16.3%, much higher than the

nominal economic growth rate of 7.8% over the same period, leading to climbing debt ratios and accumulating debt risks.

2.2.2 Structurally dysfunction

According to the Fiscal Risk Matrix proposed by Polackova [10], besides the explicit debt at the legal level, LGD should also include the implicit debt it incurs as a public subject. In the Opinions of the State Council of the Central Committee of the Communist Party of China on preventing and resolving the risks of hidden debt of local governments, an authoritative definition of implicit debt was given for the first time. Statistics show that explicit debt is superior to implicit debt, both in terms of debt size and debt stability [3]. Since local governments do not directly and publicly disclose local debt data, existing local government debt studies mainly use municipal bonds and national debt data for calculation [4]. If considering all kinds of implicit liabilities borrowed in disguise in the form of government-purchased services, Public-Private-Partnership (PPP), defaulted project payments, and so on[8], the total amount of local debt has risen sharply, and the debt ratio has already exceeded the 100 % warning line for the debt ratio of the government.

The diversification of the forms of debt borrowing, the long-term nature of input projects and the lagging legal system have made it difficult for the Government to strictly restrain and supervise the responsible units for debt borrowing, and it has not been able to guarantee the rate of return on the borrowed funds. All of this has resulted in the blind expansion of the scale of debt and the formation of high levels of debt that are inconsistent with the capacity of local economic development and debt-servicing ability, ultimately leading to an insolvent situation [9]. Some regions rely on land concessions to finance repayment, triggering a vicious circle; some areas can only borrow new money to pay back old money, or even overdue. This not only seriously affects the creditworthiness of the Government, but also poses a threat to social credit and social stability.

2.2.3 Diverse sources and uses

In order to meet high local financial expenditures, local governments use various forms of borrowing. In terms of the main borrowing bodies, they mainly include financing platforms, government departments and agencies, institutions and state-owned enterprises, accounting for 39%, 24%, 22% and 15% respectively [7], among which the directly establishment of financing platforms accounts for the largest proportion of borrowings. In terms of borrowing sources, they mainly include bank loans, local government bonds, medium-term notes and funds from financial institution and so on. Relevant data show that bank loans represent more than 56% of the total debt, demonstrating the heavy reliance of local governments on bank loans. In contrast, bond financing accounts for only about 10% of LGD.

LGDs are mainly used for urban public infrastructure construction and road transportation, thereby increasing the value of lands to promote local economic development and fiscal revenue growth. Revenue from land concessions is the main source of repayment of LGD, based on the assumption that land and house prices will continue to rise with the risk associated with real estate price bubbles or economic cycles [6].

2.3. Economic Impact

The current literature on the impact of LGD on economic growth focuses on macroeconomic aspects. Most scholars have demonstrated that LGD negatively affects capital accumulation and economic growth by altering long-term interest rates to drive higher distortionary taxes and inflation, dampening investment and consumption growth [11]. A few scholars study that LGD can support economic growth through channels such as increasing liquidity, promoting infrastructure construction and stimulating competition among officials. There is also the view that there is an inverted U-shaped relationship between LGD and economic growth, with its effect on economic growth depending on whether the level of debt exceeds the debt equilibrium point [3].

In addition, some scholars analyze the economic consequences of LGD at the micro level. For example, it has been found that LGD pressure weakens ESG (Environmental, Social and Governance)

performance by exacerbating financing constraints and reducing green innovation capacity [12]. There are studies showing that the expansion of LGD significantly crowds out enterprises' leverage [13]. It has also been argued that an increase in debt efficiency affects enterprises' total factor productivity in a non-linear way [14]. It has been shown that government financing affects the cost of debt financing of micro enterprises through two channels, rice competition and capital competition, and government debt increases the cost of debt financing of enterprises [4].

In recent years, some scholars have studied the impact of LGD on business innovation. Certain studies used the sum of bonds issued by local government financing vehicles (LGFVs) and bank loans as the data of LGD, and concluded that LGD is unfavorable to business innovation. Most of the conclusions concluded that LGD inhibits business innovation [15]. Based on the existing studies on the relationship between LGD and business innovation, this paper analyzes and discusses the impact of LGD on business innovation.

3. Effect of LGD on Business Innovation

3.1. LGD Inhibits Business Innovation through Financing Constraints

Research has shown that financing constraints are important for corporate innovation [4]. The theory of financing constraints suggests that due to the incompleteness of the capital market, enterprises have difficulty in achieving optimal levels of investment as a result of restrictions on the availability of capital. The reasons why financing constraints inhibit enterprises' innovation more significantly are mainly summarized as follows: firstly, whether it is for internal R&D such as paying R&D personnel, purchasing relevant equipment and so on or acquiring external R&D results through external procurement or merger and acquisition (M&A), enterprises' innovation activities require a large amount of capital investment. Second, innovation carries a high degree of risk. Innovation cycles are generally longer, with higher failure rates, and innovation outputs are highly uncertain, making it difficult to realize returns in the short run. Third, compared with investment in fixed assets, corporate investment in innovation is more vulnerable to financing constraints. Fourth, even if innovation activities are successfully implemented, due to the public goods nature of knowledge and technology, enterprises are unable to exclusively enjoy all the benefits of innovation outcomes, often resulting in market failures. Thus, the greater the financing constraints, the lower the enterprise's spending on R&D activities and the less innovative its output will be [16].

Many studies have proved that LGD is competitive with enterprise financing and that LGD has a crowding-out effect on enterprise financing. In terms of access to financial resources, local governments and enterprises are in a competitive demand relationship. According to the theory of preferential financing, the sources of business innovation inputs include internal and external financing. When internal funds are insufficient, enterprises can only seek external financial support for innovation. China's financial system is relatively underdeveloped, and due to the high cost of equity financing, bank credit financing becomes the first choice for innovation financing [3]. Local governments are also highly dependent on bank loans for their fiscal revenues and have a relatively large credit advantage. Local governments have strong administrative intervention ability and special land mortgage mode, as well as direct participation or holding part of the local commercial banks, so they can prioritize the acquisition of resources through the formulation of credit policy [2], which makes the local government in the acquisition and allocation of credit resources have a relative advantage. The homogeneity of funding sources and limitations of credit resources determine the existence of competitive effects between LGD and enterprise financing. As the scale of LGD expands, the structure of credit resource allocation is constantly tilted towards local governments, crowding out the financial resources of enterprises, making it more difficult for enterprises to borrow funds, and thus inhibiting business innovation.

In terms of the objective of credit transactions, the bank's preference for the investment of credit resources determines the allocation structure of credit resources, namely, relatively higher loan returns and lower loan risks [2], so that local governments and enterprises are in a price competition

relationship. LGD is more secure because of the credit guarantee of government departments and its "implicit guarantee" quality, therefore it becomes the best credit subject for banks. Compared with government debt, the intangible assets of innovation projects are poorly collateralizable, and innovation activities are highly specialized and confidential. Under the high degree of information asymmetry in the traditional financial market, enterprises and credit institutions are prone to information imbalance, which leads to a series of problems such as lack of trust, subject discrimination and risk expectations of enterprises by credit institutions. Therefore, commercial banks are more likely to allocate credit funds to local governments and local government financing platforms to ensure a return on their funds. LGD increases the demand for financing in the capital market. In order to obtain credit funds and attract potential bond investors, enterprises have to raise their own borrowing rates or bond yields, or even borrow at very high costs in the private sector [1]. As a result, market competition for credit resources has intensified and market interest rates have been pushed up, leading to higher financing costs for enterprises and increased financing constraints, which in turn raise the cost of innovation for enterprises and inhibit business innovation.

In terms of the duration of the debt borrowing, the LGD is mainly invested in the field of local public infrastructure, which has a long project construction cycle and large capital demand, thus forming a long-term occupation of bank credit funds, which undoubtedly further aggravates the financing constraints of enterprises. Business innovation has the attribute of quasi-public goods, and the high risk of innovation input and the uncertainty of innovation output are not in accordance with the enterprise's pursuit of short-term profit, which forms the crowding-out effect on innovation input within the enterprise [3]. Enterprises as debtors are in a weaker position compared to local governments and their financing platforms, and innovative input financing is in a weaker position than fixed-asset financing. As a result, it is difficult for enterprises to obtain long-term financing, and "short-term debt and frequent borrowing" is extremely common [17]. Even if enterprises have a strong urge to innovate and are occasionally able to break the crowding-out effect of financing to obtain bank credit, it is unlikely that all of their limited financing resources will be invested in risky business innovations.

3.2. LGD Inhibits Business Innovation through Risk Tolerance

From the perspective of risk taking, unlike traditional investment projects, innovation investment projects are characterized by both high risk and high return. The innovation process of enterprises is a process of constant trial and error with setbacks and tolerance of failures. Thus, a higher risk-taking ability is indispensable for business innovation. A study discussed the impact of risk tolerance on business innovation using a sample of IPO-listed enterprises with venture capital and found that listed enterprises with greater failure tolerance have better innovation performance. Some scholars found that there is a significant difference between corporate venture capital (CVC) and independent venture capital (IVC) in fostering corporate innovation, and that CVC with a wealth of knowledge about the industry it invests in and a higher tolerance for risk is conducive to enhancing corporate innovation activities. Others have focused on the impact of managers' personal characteristics on innovation activities and concluded that managers with a flight license are more risk-averse and also have a positive impact on enterprises' innovation [4].

Since the promulgation of the new Budget Law in 2014, China's local debt management mechanism has gradually matured. The risk of LGD is generally controllable, and the risk of hidden debt has been mitigated. However, under the impact of the 2020 epidemic, a series of related adjustment policies have pushed up local debt risks. Since 2021, along with the gradual stabilization of the economy, the policy control of local debt has returned to normal, but the structural and regional problems of local debt are still prominent, especially the hidden debt risk and the evolution of regional debt risk.

Since LGD mainly originates from banks and other financial institutions, there is a double helix structure between the risk caused by irrational expansion of debt and the risk of the financial sector. The risks of the two sectors are inter-transformed and interdependent, eventually breaking through

geographical limitations, transmitting to the real economic sector, which impacts on the whole macroeconomic system. Therefore, the concentrated release of LGD risk will ultimately damage the external operational stability of enterprises and weaken their risk-bearing capacity. It brings great uncertainty to the normal operation of enterprises, thus weakening their motivation to innovate and making their innovative activities more cautious. The empirical results find that the negative correlation coefficient between LGD and business innovation is more significant in the group of weak risk-taking ability, which reveals the transmissibility of this influence mechanism [4].

3.3. The Impact of LGD Invested in Different Fields on Business Innovation

The investment of LGD in different sectors has different impacts on innovation activities, regional industrial upgrading and economic growth. In terms of debt investment, local government explicit debt is mainly used for public investment such as infrastructure construction, and accounts for a high proportion of gross fixed capital formation. In addition, it will be used to compensate for the funding gap brought by tax cuts and fee reductions and to replenish the capital of small and medium-sized banks [16]. Studies have shown that LGD investment in traditional infrastructure, such as transportation, storage and postal services and water production and supply, helps enterprises to improve the production and operation of the "hardware" facilities. By reducing production and transportation costs, expanding the market size of products, it promotes the continuous accumulation of physical and human capital, increases the marginal rate of return on capital, which in turn stimulates the innovation initiative of enterprises [2].

However, over-indebtedness of local governments to cover the financing gap of infrastructure projects may discourage innovative enterprise activities. First, overinvestment in infrastructure leads to higher interest rates in financial markets. Rising financing costs make enterprises choose “short and quick” projects and give up innovative R&D projects with long payback cycles, which means that in the short term, the crowding-out effect of infrastructure investment exceeds the scale effect of the product market, thus reducing R&D investment and inhibiting business innovation. Second, excessive investment and repeated construction will not only lead to the decline of enterprise profitability and serious waste of resources, but also cause violent economic fluctuations and deteriorate the external economic environment, thus increasing the difficulty of business innovation and inhibiting innovation. Thirdly, the massive borrowing by local governments for infrastructure construction will inevitably lead to a massive increase in demand for infrastructure-related cement, steel and other high-investment industries. However, the development model of growth driven by solidified debt investment is not conducive to the implementation of the innovation-driven strategy [16].

Infrastructure projects with a long construction period do not generate sufficient cash flow, and project revenues are difficult to cover the cost of capital, so debt repayment relies mainly on local government revenues. Along with the expansion of the scale of LGD, the rapid growth of land finance has led to a sustained rise in land prices. The continuous rise in housing prices made the real estate industry maintain higher profit margins than other industries, and land transfer revenues also became an important source of LGD repayment. It laid the groundwork for local governments to obtain more land mortgages, but at the same time drove the private sector’s preference for real estate investment. The large-scale real estate investment occupied a large amount of social resources, leading to higher market interest rates and higher raw material prices, which to some extent triggered a real estate market bubble. Similarly, the high-yield, short-cycle profit model of the real estate market attracted a large number of non-real estate enterprises. They invested more capital originally used for their main enterprise into real estate-related industries. According to statistics, the number of listed companies directly involved in the real estate industry in China accounts for 60.53% of listed companies. The large amount of real estate investment with high rate of return distorts the investment structure of enterprises, crowds out the limited credit resources of enterprises, thus reduces the capital investment for innovation, and weakens the long-term innovation motivation of enterprises, ultimately inhibiting business innovation.

However, in fact, there is also a positive effect of real estate investment by enterprises on innovation activities, which mainly manifests itself in the increase in the quantity of collateral available to enterprises when they invest in the real estate sector. When house prices rise, the properties owned by enterprises can alleviate their financing constraints in conducting R&D activities, thus promoting corporate innovation [16].

In terms of debt structure heterogeneity, the main investment direction of both explicit and implicit debt is infrastructure construction, but the scale of implicit debt is more massive compared to explicit debt. It is more inclined to stimulate real estate investment to drive the next round of expansion of the scale of land finance, and thus its investment crowding-out effect on business innovation is more obvious.

4. Discussion

4.1. LGD and Different Models of Business Innovation

According to the dual innovation theory, business innovation can be divided into two modes: exploitative innovation and exploratory innovation, which have obvious differences in terms of risk, cost, and effect of action due to the different features of the enterprise and the innovation technology adopted. Therefore, ignoring the difference between the two may conceal some of the micro facts [18].

Exploitation innovation is based on the current products and markets, mainly through the processing and improvement of existing products and services to satisfy the demand of consumers in the existing market, with a shorter R&D cycle, lower risk, and predictable results, which can bring stable cash inflow to the enterprise in the short term. Exploratory innovation, on the other hand, is based on the long-term development of the enterprise, focusing on the exploration of new products and new markets. It is a kind of drastic, fundamental and radical innovation, which can bring core competitiveness for the enterprise, but it requires larger capital investment and longer investment cycle, higher information cost, stronger dependence on external parties, and hence higher risk. Based on the different features of exploitative and exploratory innovations, the impact of LGD on the two types of innovations is also somewhat different.

When facing large financial constraints, the characteristics of exploratory innovation make it difficult to be favored by enterprises, which will present low motivation and insufficient investment incentives to invest in exploratory innovation, ultimately leading to a significant reduction in exploratory innovation activities. Therefore, LGD will have obvious crowding-out effect on the exploratory innovation of enterprises. As for exploitation innovation, it faces lower financing constraints compared with exploratory innovation because it can bring returns to enterprises in the short term with lower risks. Enterprises can usually adopt a variety of means to obtain funds for exploitative innovation. Thus, exploitative innovation is less sensitive to the increased financing constraints of enterprises caused by the expansion of LGD, which implies that the crowding-out effect of LGD on exploratory innovation is stronger than that of exploitative innovation.

4.2. LGD and Different Businesses

In China, there exists a natural difference between state-owned enterprises (SOEs) and private enterprises for listed companies. Due to their advantages in system and property rights, SOEs are more easily taken care of in terms of credit and policies, and have superior financing accessibility and weaker financing constraints [2]. Some studies have proved that the crowding-out effect of LGD on the financing of listed companies is more obvious in non-state-owned enterprises [4].

Enterprises are categorized into large and small enterprises based on the size of their development (total assets of the enterprise). Also, regions are categorized into high and low financial levels based on the level of financial development of the region where the enterprise is located (regional bank loans as a share of GDP).The studies proved that small enterprises located in regions with high financial level have more abundant credit resources and less constrained financing, while large

enterprises located in regions with low financial level are more vulnerable to the crowding-out effect of LGD on enterprise financing when they carry out innovative activities [19].

5. Conclusion

"Risk prevention" and "stable growth" are two goals China is currently facing that need to be balanced, while the prevention of debt risk and the implementation of an innovation-driven development strategy are important aspects of "risk prevention" and "stable growth", respectively. Since the global financial crisis in 2008, the economic consequences of government debt, especially its impacts on microenterprises, have attracted the attention of academics and government regulators. In recent years, a number of studies have started to focus on the impacts of LGD on the behavior of microenterprises, which also includes its impacts on business innovation. However, existing studies are generally based on a certain influencing factor or mechanism and construct models to validate them. Therefore, based on the existing studies on the relationship between LGD and business innovation, this paper summarizes and classifies them, further discusses and analyzes the impact of LGD on business innovation, trying to clarify the paths and mechanisms through which LGD acts on business innovation. The main conclusions of this paper are as follows. Firstly, LGD reduces enterprise R&D investment through financing constraints, which in turn inhibits business innovation. Secondly, the risk evolution of LGD undermines the external operational stability of enterprises, weakens their risk-bearing capacity, and then inhibits corporate innovation. Third is that the debt investment and repayment reliance of LGD have both positive and negative impacts on business innovation. In addition, this paper also analyzes the differences in the impact of LGD on business innovation. First, according to the difference of business innovation modes, the crowding-out effect of LGD on enterprise exploratory innovation is stronger. Second, according to the difference of the enterprise's asset management authority, development scale and the financial level of the region where it is located, the crowding-out effect of LGD on the innovation of non-state-owned enterprises, large enterprises and enterprises located in low-financial level regions is stronger.

Based on the above conclusions, this paper puts forward the following policy recommendations. The first is to build a gradually complete government financing regulatory system, strengthen the debt limit, and incorporate land concession revenues and expenditures into the management of governmental fund budget process. Meanwhile, a debt risk precaution and early warning system should be constructed to prevent the outbreak of financial risks. Second is to strengthen the local government debt regulation, promote the "hidden debt manifestation" path. By promoting the transformation of financing platforms, its financing function and local government completely divorced, to improve the enterprise financing channels blocking situation. Third, should improve the enterprise investment and financing environment, promote the rational allocation of financial resources. The Government needs to relax credit constraints or give innovative enterprises tax incentives and other support to stimulate business innovation.

Moreover, the limitations of the current researches on the impact of LGD on business innovation also provides a new direction for future research. First, the data on LGD scale in the studies are mainly municipal bonds issued by LGFVs or debt balances of LGFVs, but these data are only a part of LGDs as well as certain LGFVs have not yet issued bonds, so other ways of measuring the debt scale can be considered in the future. Second, current research data on business innovation is mainly based on listed company data spanning 2009-2020 in Shanghai and Shenzhen, but listed companies have better financing than most unlisted companies. Therefore, in the future, the impact of LGD on innovation of unlisted enterprises could be analyzed under consideration.

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