

Local Government Borrowing's Expansionary Monetary Effect and Its Policy Synergy

Na Li, Rong Liu*

All governments face increasingly frequent issues arising from aggregate supply and demand against currency circulation and financial stability, and public finance and banking authorities employ a variety of policy instruments to keep the economy stable and coordinated. How to avoid policy conflicts and maximize effectiveness in policy portfolio of local government borrowing, which is taken as a major macro-control instrument, is a subject that needs in-depth study. This paper probes into local government borrowing's monetary effect and transmission mechanism and its best synergistic model with monetary policy by the construction of a NK-DSGE model covering financial frictions, multi-period bonds and borrowing rules. The findings are as follows. (1) The shocks of one-percent local government borrowing (bond duration=5 years) push up the money multiplier by 0.39% to produce expansionary monetary effect, and the longer the bond duration, the greater the effect. (2) In the context of physical and financial shocks, monetary policy adopts a moderately tight reverse synergy with local government borrowing, effectively restraining its expansionary monetary effect for better economic stability and recovery. (3) For bonds with longer maturities, raising the risk sensitivity of local government borrowing rules benefits the improvement of welfare.

Keywords: local government borrowing, monetary policy, money supply, expansionary monetary effect

1. Introduction

In response to Covid-19 and the downward pressure on the economy, the issuance of local government bonds in China reached RMB 6.44 trillion in 2020, an increase of 47.71% over the same period last year.¹ Bond funds have become a driver for

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¹ As of December 2020, the cumulative issuance of local government bonds was RMB 6443.813 billion (data from China Bond.com.cn).

investment, employment and growth. Such a large-scale issuance of government bonds is an unprecedented measure for the bond market and even the entire financial market, and it tests market tolerance and monetary policy regulation. Looking back on history, the rapid expansion of local government debt in China began after the subprime mortgage crisis in 2008, and was made by the proactive fiscal policy of stimulating the economy with investment. The impact of the global financial crisis on China's economy was well avoided with borrowing and investment, but local governments accumulated a large amount of debt stock. Under promotion incentives, mismatch between authorities and expenditure responsibilities and soft budget constraints, local debt balance had risen rapidly, and debt risks were mounting. Meanwhile, the size of bank loans expanded rapidly, the macro leverage ratio was high, the money supply soared, and asset prices climbed: the proportion of bank loans in GDP grew by 76.2%, and the macro leverage ratio rose from 145.4% to 248.7%, or up 103.3 percentage points over the decade after 2008; M2/GDP took only seven years to go from 1.49 to 2.02.¹ In view of this, is local government debt related to the deepening of economy monetization?

For a long time, the growth of local government debt in China is inseparable from the support of the banking system (Mao *et al.*, 2019), and to clarify local government borrowing's monetary effect transmission mechanism, the business relations with commercial banks must be examined. According to the endogenous money supply theory, commercial banks can create deposit money through asset expansion (Sun, 2019), and it has a causal effect on money supply. So what role does local government borrowing play in this creation of endogenous money? As shown in Figure 1, the local off-balance sheet debt represented by city investment bonds had certain volatility synchronization with M2, especially from Q4 2010 to Q2 2015 and from Q4 2017 to Q3 2020; Local on-balance sheet debt represented by local government bonds also had strong synchronization with M2 from Q3 2015 to Q4 2016 and from Q4 2018 to Q3 2020.

There are several possible reasons for the synchronization between local government borrowing and the money supply. First, it is resulted from the endogenous mechanism of money supply. Local borrowing drives the asset expansion of commercial banks, and then increases the creation of deposit money. Second, the difficulty of local borrowing is influenced by monetary policy to form synchronization. Local borrowing behavior changes synchronously due to the direct impact of monetary policy tightening or not, especially the local off-balance sheet debt represented by city investment bonds. Third, the synergy of monetary policy with local borrowing creates synchronization. To lower the cost of local borrowing and its shocks on the bond market, monetary policy should be appropriately relaxed to synergize with it, a case where monetary policy is in a passive position, which is more possibly seen in local on-balance sheet debt represented by local government bonds. Fourth, it is a

¹According to the data of Wind Information.

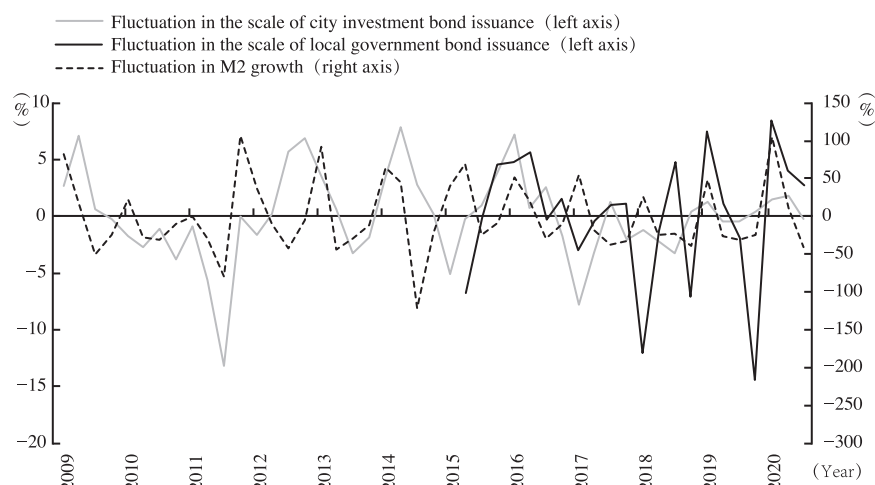


Figure 1. Relationship between Fluctuations in the Scale of Local Bond Issuance and in M2

Note: The units of left and right vertical axes are %. The data in the figure are quarterly values obtained by taking the log values after X-12 quarterly adjustment and performing HP filtering. The data of city investment bonds and M2 ranged from Q1 2009 to Q3 2020. The data of local government bonds started from Q1 2015 when local governments had legal borrowing right and ended in Q3 2020.

Source: CCDC, Wind Information.

combination of the above possibilities.

Notably, when local government borrowing has an endogenously expansionary monetary effect, the effect may be stronger to deepen economic monetization if monetary policy is appropriately relaxed to synergize with it. Therefore, it is urgent to verify if local government borrowing has the monetary effect, and then examine the following questions. First, what is the mechanism and impact of local government borrowing on the money supply and economic monetization? Second, does the synergy of monetary policy with local government borrowing mean a loss of independence? Third, what rules should be followed for the synergy? These questions need in-depth study. Government debt is a natural bridge connecting public finance and banking, and a combination of fiscal policy and monetary policy (Gao, 2020). Only by handling well the relationship between borrowing and monetary policy can we avoid conflicts of policy instruments and seek ways to complement each other.

Based on the above analysis, and by the construction of a NK-DSGE model covering financial frictions, multi-period bonds and borrowing rules based on the GK model (Gertler and Karadi, 2011) and features of local government borrowing in China, this paper probes into the mechanism and dynamic effect of local government borrowing and money supply and economic monetization, and the synergistic mechanism between local government borrowing and monetary policy as well. The specific structure is as follows. The second part is a literature review and puts forward this paper's possible contributions; the third part depicts stylized facts; the fourth part

is the theoretical model construction, parameter calibration and model applicability evaluation; the fifth part analyzes the monetary effect mechanism of local government borrowing; the sixth part is the simulation and welfare analysis of the synergy between local government borrowing with monetary policy, and discusses the independence of monetary policy; the seventh part is the conclusion and policy proposals.

2. Literature Review and Contribution

Literature on the monetary effect of government debt can be divided into two categories. One is to directly study government debt and examine its impact on the money supply, inflation and monetary policy (Mitra, 2007; Leith and Wren-Lewis, 2011; Bhattarai *et al.*, 2014; Martin, 2015; Chen *et al.*, 2015; Zhang and Liu, 2015; Zhang, 2016; Miao *et al.*, 2017); The other is to indirectly examine the related impact of government debt in the studies of the relationship between fiscal policy and monetary policy, because the judgment of policy zoning (fiscal policy-led or monetary policy-led) is based on the correlation between fiscal surplus and the next issue of government debt (Helton *et al.*, 2013; Burgert and Schmidt, 2014; Ma, 2016; Rong and Cai, 2015). Besides, some literature inquires into the monetary effect of fiscal deficit, fiscal policy, fiscal expenditure expansion, fiscal decentralization and local government competition (Fischer *et al.*, 2002; Xu and Zhang, 2004; Pekarski, 2011; Jia and Guo, 2012; Lin and Chu, 2013; Hu and Guo, 2013; Yang *et al.*, 2014; Guo, 2016; Yang, 2017).

The literature directly working on government debt and money supply is few, and the possible reasons are: first, money supply is an intermediate variable, and literature on the monetary effect of government debt may directly focus on the impact of government debt on the final variable inflation; second, as the quantity-based monetary policy is gradually replaced by the price-based monetary policy, literature on government debt and monetary policy pays more attention to the impact of government debt on market interest rates as well as the crowding out effect on private investment. For this reason, literature on government debt and inflation and monetary policy actually implies the factors of government debt and money supply. Looking at the existing literature, it is generally believed government borrowing has an expansionary monetary effect, revealed in that government borrowing increases the money supply (Jin, 2003; Feng and Peng, 2006; Zhao and Zhou, 2009; Zhang, 2016), and drives up inflation (Sargent and Wallace, 1981; Ahking and Miller, 1985; Mitra, 2007; Lin and Chu, 2013; Bhattarai *et al.*, 2014; Guo, 2016; Yang, 2017).

Most of the literature holds that government borrowing has an expansionary monetary effect, but the mechanism described is different. Some believe that government borrowing under a public finance-led system leads to deficits or debt monetization through seigniorage channels, and then causes inflation (Sargent and Wallace, 1981; Leeper, 1991; Mitra, 2007; Lin and Chu, 2013; Yang, 2017); Others

take that government borrowing under a public finance-led system determines the price level through a “wealth effect” mechanism (Woodford, 2001; Cochrane, 2005) that can influence inflation dynamics along with the seigniorage mechanism (Hu and Guo, 2013; Bhattarai *et al.*, 2014).

Literature on local government liabilities explains the monetary effect mechanism more from the bank credit perspective, while some believe the substantial control of local governments over local finance is equivalent to the decentralized transfer of money creation functions from the central government to local governments, which results in inflation (Feng and Peng, 2006); Others argue the monetization of local government borrowing is premised on the participation of the central bank, such as commercial banks selling subscribed government bonds to the central bank or mortgage loans to the central bank (Zhou, 2009), or the central bank being forced to apply loose monetary policy to grow money supply (Sun and Zhu, 2011; Chen and Deng, 2019); Zhang (2016) analyzed from the asset structure perspective that local debt swap influenced money supply by changing the distribution of commercial bank assets between loans and bonds.

From the above-mentioned, foreign literature, in analyzing the monetary effect of government borrowing, focuses more on the studies of central government debt or sovereign debt and spares less attention to local government debt, which is consistent to the stylized fact that foreign government debt is mainly the central government debt. However, local government debt accounts for a large proportion of the total government debt in China, and the mechanism of its monetary effect differs largely from that of central government debt, so it is necessary to study its monetary effect based on the features of local government debt in China. What's more, there are deficiencies in domestic literature on the monetary effect of local government debt, which are as follows. Firstly, “monetary effect” studies are limited to “monetization”. One is to understand the “monetary effect” only as the “monetization” of excess issuing of base money, making its analysis always premised on the participation of the central bank, with a neglect of commercial banks' significance to the broad sense of money creation, and weakening the explanatory power of conclusions on the commonly seen economic monetization; The other is only concerned about the “monetization” of financial institutions directly controlled by local governments (such as local government-controlled commercial banks), and lacks discovery and understanding of the generality and universality of local government borrowing's monetary effect. Secondly, since there may be a two-way causal relationship between government debt and macroeconomic variables such as money supply and market interest rates, and the availability of data on local government debt in China is limited, it is essential to apply scientific and proper research approaches, and the construction of DSGE model is a good choice. However, the DSGE model constructed by existing literature fails to focus on local government debt in setting and to reflect the mechanism characteristics of local government debt's

monetary effect of in China. Thirdly, literature concerning the synergy between fiscal policy and monetary policy is rich, while that on the synergy between local government borrowing and monetary policy is few. Currently, local government borrowing has increasingly become a normal instrument for national macro-control, and in-depth study must be done to serve a theoretical basis for policy management.

In this regard, the possible contributions of this paper are as follows. Firstly, based on bank credit channels, this paper analyzes the impact of local government borrowing on money multiplier and money supply to reveal the generality and universality of its expansionary monetary effect. Secondly, the borrowing behavior of local governments is the breakthrough point of research, a new perspective to explain the economic monetization. Thirdly, with a simulation of different external shock scenarios, it is proved that the optimal synergistic model of two policy instruments is to have monetary policy following local government borrowing and take moderately tight measures for reverse synergy, through which a theoretical basis is created for practicing macro-control policy.

3. Stylized Facts of Local Government Borrowing's Monetary Effect

The Bayesian vector autoregressive (BVAR) model with seven variables: the scale of local government borrowing, credit premium, money multiplier, money supply, economic monetization, asset prices and physical prices, is constructed for analysis. The ranking of variables under structural constraints is consistent with the dynamic mechanism of the theoretical model in this paper to ensure stylized facts are comparable to the theoretical simulation results.

The variables used in the BVAR model are expressed by the issuance of city investment bonds, net interest margin of commercial banks, money multiplier, M2, M2/GDP, real estate price and Consumer Price Index respectively. The real estate price is obtained by dividing the sales volume of commercial housing by the sales area. The data are from the National Bureau of Statistics and Wind Information, and the fluctuations from Q4 2010 to Q3 2020 are obtained based on the data availability after the X-12 seasonal adjustment, logarithm taking and HP filtering. After the stationarity test and Granger causality test, each variable's impulse response under shocks of local government borrowing is studied based on Jeffreys Prior, and the results are shown in Figure 2.

From the impulse response results, the shocks of one-percent local government borrowing push up the credit premium by 0.38%, the money multiplier by 0.22%, the money supply by up to 0.47%, the economic monetization by up to 0.25%, asset prices by 0.10% and physical prices by 0.21%. In view of the small size of city investment bonds relative to the total amount of money, the above results reveal that local government borrowing has a significant impact on money supply, economic monetization and prices, and the stylized fact of monetary effect in local government

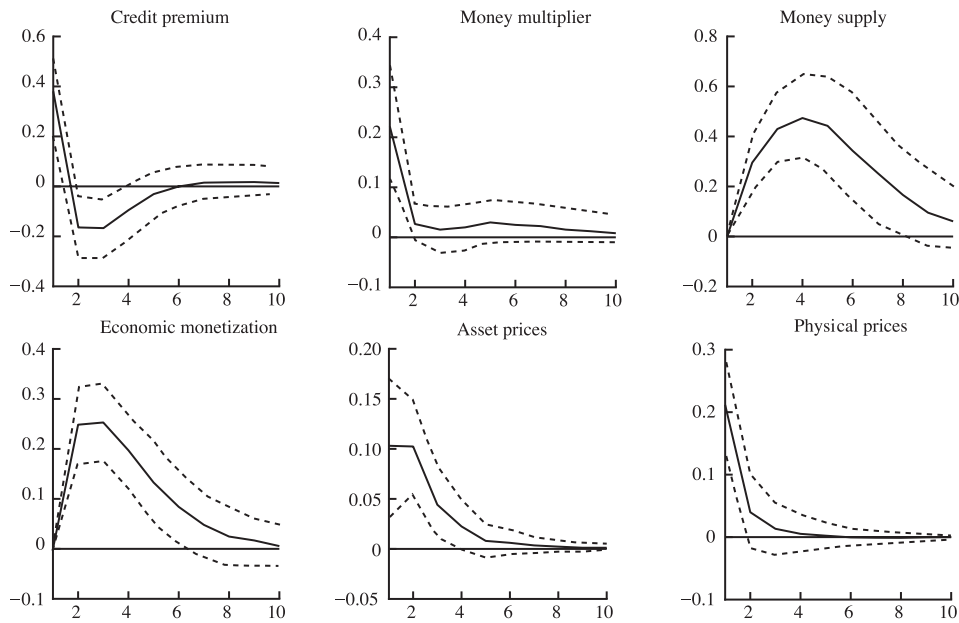


Figure 2. Impulse Response under the Impact of Local Government Borrowing in the BVAR Model

Note: The dotted line in the figure is the confidence interval of 90% confidence; the horizontal axis indicates the duration; and the vertical axis unit is %.

borrowing is verified. For further explanation, this paper probes into the monetary effect transmission mechanism of local government borrowing by constructing a theoretical model including financial frictions, multi-period bonds and borrowing rules.

4. Theoretical Model¹

This paper introduces financial frictions by the execution cost and makes bank credit channels the core of illustrating the transmission mechanism, and constructs the NK-DSGE model. The model setting highlights the following features of local government borrowing in China. Firstly, public investment is introduced into the production function and its sources of funding are linked to borrowing. Under the “Chinese-style” decentralization framework, the investment impulse of local governments triggers the debt expansion (Chen and Chen, 2014), and a large amount of public investment after 2015 also relies on the issuance of local government bonds. Secondly, local government bonds are set as assets held by the banking system. According to the data of the National Audit Office (NAO), by the end of June 2013, banks and other financial institutions constituted 67.7% of the sources of local government debt.² After 2015, commercial

¹ Limited by page space, parameter calibration and model applicability evaluation are not listed. Interested parties may request from the author.

² Data from the *Audit Results of Nationwide Governmental Debts* (announced on December 30, 2013).

banks were still the primary holders of local government bonds, registering 84.83% by the end of 2020.¹ Thirdly, traditional tax rules are replaced with debt risk-based borrowing rules. Local governments in China do not have the power to decide on taxes and cannot best respond to the debt scale by tax adjustment, so traditional tax rules fail to accurately depict the revenue and expenditure operation of local governments in China. To maintain financial sustainability, the central government has launched a quota management system for local government borrowing according to the *Implementation Opinion of the Ministry of Finance on Local Government Debt Quota Management*, and debt risks-targeted borrowing rules are formed. This feature is embodied in the model.

4.1. Household, Commercial Bank and Manufacturer Sectors

The household, commercial bank and manufacturer sectors of this model are largely the same as those set by Gertler and Karadi (2011), and is not to be repeated. The differences are in the following aspects.

Firstly, c_t in the household sector represents effective consumption that is composed of private consumption c_t^c and local government consumption c_t^g , namely $c_t = c_t^c (c_t^g)^{\vartheta}$, and parameter ϑ is used to measure the relative importance of private consumption and local government consumption. The use of s_t^c in household budget constraints indicates the central government's subsidies to the household sector. $tr_t = m_t - m_{t-1} / \pi_t$ is the seigniorage tax on currency issued by the central bank, assuming it is all transferred to households.

Secondly, the government investment expenditures g_t are brought into the production function of intermediate manufacturers, and the output elasticity is expressed by ϖ . A_t and ζ_t are exogenous variables, representing total factor productivity and capital quality, respectively.

4.2. Local Government

Referring to the research of Mei and Wen (2020), assuming that local governments pursue the maximization of inter-temporal expenditure scales, the objective function is expressed as:

$$\max_{\{c_t^g, s_t\}} E_t \sum_{i=0}^{\infty} \beta^i \left[(1-\gamma) \log c_{t+i}^g + \gamma \log g_{t+i} \right] \quad (1)$$

In which γ measures the preference of local governments for public investment g_t .

¹ Data from *China's Bond Market Overview (2020)* published by China Bond Research and Development Center of CCDC, April 2021.

Local governments finance their public consumption and investment through lump sum tax and borrowing. Local government budget constraints are set as:

$$\theta_t \tau_t + s_t^g + q_t^b b_t = c_t^g + g_t + (1 + r_t^b) q_{t-1}^b b_{t-1} \quad (2)$$

In which θ_t is the tax sharing ratio of local governments, and s_t^g is the transfer payment from the central government to local governments. Public investment g_t is divided into current investment $\tilde{g}_t$ and discretionary investment, and the latter is used for counter-cyclical adjustment. Current public investment $\tilde{g}_t$ is subject to exogenous processes. Local government public investment is set as:

$$g_t = \tilde{g}_t + \rho^g (y_t - \bar{y}) \quad (3)$$

$$\log \frac{\tilde{g}_t}{\bar{g}} = \rho^g \log \frac{\tilde{g}_{t-1}}{\bar{g}} + u_t^g \quad (4)$$

In which, $\rho^g < 0$ indicates the response of local public investment to output fluctuations and u_t^g reflects the shocks of local government on public investment expenditures. Local governments in China have no power to decide on taxes, and faced with the shocks of expenditures, they generally close the capital gap with borrowing, so the expenditure fluctuations in public investment are closely related to the amount of local government borrowing. What's more, the central government applies a quota management policy for local government borrowing to keep fiscal sustainability and avoid excess borrowing. That is, the new quota is allocated in the principle of positive incentives, and more arrangements are made in areas with stronger public finance and low debt risks, and vice versa, less arrangements. gb_t expresses the log growth rate of local government debt, i.e., $gb_t = \log b_t - \log b_{t-1}$. Z_t reveals the debt risks of local governments, and combined with China's local government management, it is expressed by debt rates. That is, the debt balance is divided by the financial resources at this level to get: $Z_t = b_t / (\theta_t \tau_t)$. Debt risk-based borrowing rules are set as:

$$gb_t = \rho^b gb_{t-1} + \kappa^Z (Z_{t-1} - \bar{Z}) + \kappa^g \log \left(\frac{g_t}{\bar{g}} \right) + u_t^b \quad (5)$$

$\kappa^g > 0$ measures how responsive local borrowing is to the fluctuation in public investment expenditures, and higher values mean larger dependence of public investment on borrowing. $\kappa^Z < 0$ measures the extent of the central government's control over the risk of local government borrowing. If the local government debt rate Z_{t-1} in the

previous period deviates positively over the steady debt rate $\bar{Z}$, it means that the debt risk grows and the risk deepens with larger deviance. As a result, the new borrowing quota allocated by the central government to local governments will decrease ($\kappa^Z < 0$) to control the risk until the debt rate returns to be steady. When the debt rate is lower than the steady-state value, the central government will enlarge the distribution of new borrowing quota to form a positive incentive mechanism with “reward and punishment”. Multi-period bonds are introduced in accordance with the approach of Woodford (2001).

4.3. Central Government and Monetary Policy

The central government uses taxes for household subsidies and transfer payments to local governments, and maintains a balanced budget: $(1 - \theta_\tau) \tau_t = s_t^g + s_t^c$. Assuming the ratio of the central government’s transfer payments to local governments to local government consumption expenditures is kept fixed at θ_s , local governments will maintain a scale of consumption expenditures to acquire more central transfer payments: $s_t^g = \theta_s c_t^g$. Monetary policy is set by the Taylor Rule.

5. Analysis of Local Government Borrowing’s Monetary Effect Mechanism

On the basis of the theoretical model construction, this paper simulates the impulse response of economic variables to the shocks of local government borrowing, and intuitively explains the generation and transmission mechanisms of the monetary effect. As shown in Figure 3, the supply of new local bonds rises when the economic system is positively impacted by one-percent local government borrowing, and the resulting increased demand for funds will push up market interest rates. For one thing, higher deposit interest rates raise the opportunity cost of holding cash, and households are willing to increase the supply of savings deposits and reduce cash. For another, loan rates rise earlier and larger than the deposit interest rates, bringing about an increase in the credit premium of commercial banks. This will motivate commercial banks to raise leverage for asset expansion, thus increasing the demand for savings deposits. By a combined action of deposit supply and demand, cash circulating outside the banking system is constantly transformed into the banking system, moving up the money multiplier of the entire economic system and then the money supply.

Commercial banks’ asset expansion will bring about an increase in credit positions, raising up scales of investment and capital stock, which is conducive to the rise of output. Under the shocks of local government borrowing, however, banks prefer local bonds for expanding assets, which leads to a decline in the proportion of credit in bank assets, producing a crowding out effect on private investment and capital. It is observed that credit positions, private investment and capital only rise in the short term, as credit

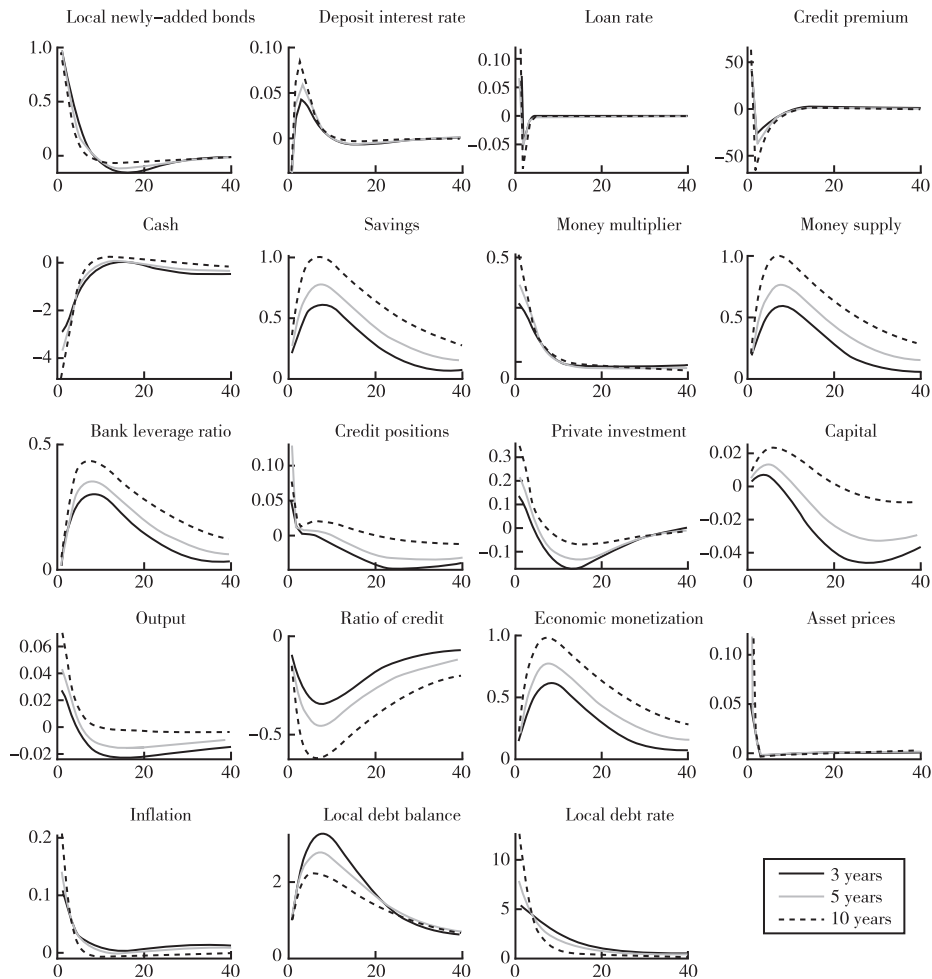


Figure 3. Impulse Response to Shocks of Local Government Borrowing in Different Bond Durations

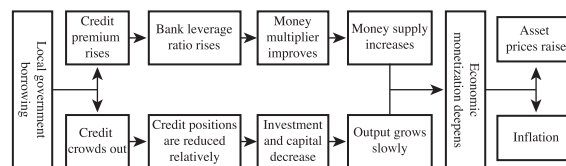


Figure 4. Expansionary Monetary Effect Transmission Mechanism of Local Government Borrowing

positions decrease after period 4, investment decreases after period 5, and capital stocks shrink after period 10. Under this crowding out effect, the output initially rises less than the rate of monetary expansion and starts to fall after period 5. As is shown, the money supply is increasing under the shocks of borrowing, while the rise in output is small and turns to decline in the short term, which means economic monetization represented by the output ratio is deepening. The increase in money supply and the deepening of

economic monetization will impact on market prices, revealed by rising asset prices and inflation, and adversely affect economic stability. Meanwhile, the shocks of borrowing increases local debt stock, raising local debt rates and debt risks.

From the duration perspective, the longer the bond duration, the more outstanding the monetary expansion effect. With the shocks of one-percent local government borrowing, the money multiplier increases by 0.26% when the bond duration=3 years, 0.39% when the bond duration=5 years, and 0.51% when the bond duration=10 years. The mechanism is as follows. Firstly, the longer the bond duration, the higher the interest rates, the stronger the shocks on market interest rates, and the more room for credit premium to rise, which leads to a greater rise in bank leverage ratio, a higher rise in money multiplier and larger growth in money supply. Secondly, the absolute volume of credit positions rises more with a faster bank assets expansion, thereby driving more investment and capital stocks and greater output effect. As the supply of bond notes with longer maturities increases at the same time with the growth of output, the former increases more, so the economy is more monetized, asset prices rise higher and inflation is more serious.

Simulation results on the shocks of local government borrowing are consistent with stylized facts in the third part of this paper, and reveal the expansionary monetary effect of local government borrowing as well as the generation and transmission mechanisms (as shown in Figure 4). It is found that local government borrowing has an output effect in the short term, but at the price of economic monetization and the sacrifice of some economic stability. It is a dilemma. How to exert the output effect of borrowing while preventing the adverse impact of its expansionary monetary effect, and whether there is synergy of policy instruments to make it feasible are worth of studies. It remains to be discussed in the next part.

6. Synergistic Model of Policy Instruments¹

According to the theoretical mechanism analysis, local government borrowing has positive output effect but the adverse impact of its expansionary monetary effect weakens economic stability and output sustainability. Combined with the transmission mechanism mentioned above, to curb the adverse impact of the monetary effect, countermeasures may be considered from three aspects. Firstly, the monetary effect is eliminated from the source with a control over the scale of borrowing. This scheme needs prudent borrowing with stronger fiscal discipline and constraints. Secondly, the space for credit premium is narrowed to eliminate the incentives for bank assets expansion and reduce the rise in money multiplier, thereby restraining the monetary effect. This scheme requires the cooperation of monetary policy, and the space for interest rate spreads will be compressed by rapidly raising the benchmark interest rates.

¹ Limited by page space, welfare analysis and argument of monetary policy independence are not listed. Interested parties may request from the author.

Thirdly, the amount of base money is cut to hedge against the monetary increment caused by the increase of money multiplier. This scheme also needs the cooperation of monetary policy—to curb monetary expansion by tightening up monetary policy.

The above schemes belong to two sets of policy instruments. Firstly, the central government enhances the quota control for stronger constraints on local government borrowing. To keep public finance sustainable, this model sets borrowing rules based on debt risk indicators to limit the scale of borrowing, which is in line with local governments' debt quota management in China. The central government can adjust the tightness of borrowing constraints by regulating the absolute value of the response coefficient κ^z to debt risk indicators (as shown in equation (6)). If the absolute value of the response coefficient is reduced, the scale of borrowing is less sensitive to debt risks, meaning local governments are encouraged to grow output through moderate borrowing; If the absolute value of the response coefficient is raised, the scale of borrowing is more sensitive to debt risks, meaning local governments are encouraged to borrow prudently for risk control. Secondly, monetary policy responds appropriately to local government borrowing, and by the interest rate rule, the central bank chooses how much κ^b should the benchmark interest rates be raised according to the scale of local government borrowing (as shown in equation (7)). It can compress the space for bank credit premium while tightening monetary policy to hedge against the expansionary effect caused by the increase in money multiplier.

$$gb_t = \rho^b gb_{t-1} + \kappa^z (Z_{t-1} - \bar{Z}) + \kappa^g \log\left(\frac{g_t}{\bar{g}}\right) \quad (6)$$

$$R_t = \rho^R R_{t-1} + (1 - \rho^R) \left[\bar{R} + \kappa^\pi (\pi_t - \bar{\pi}) + \kappa^y \log\left(\frac{y_t}{\bar{y}}\right) \right] + \kappa^b gb_t \quad (7)$$

Mixing the two sets of policy instruments, four synergistic models are concluded: (1) Moderate borrowing, i.e., local governments borrow with a low absolute value of debt risk response coefficient ($\kappa^z = -0.005$, $\kappa^b = 0$). The expansionary monetary effect is not applied any substantive measures, but only as a benchmark to compare with other models. (2) A synergy of appropriate borrowing with monetary policy. That is, local government borrowing still applies a low absolute value of debt risk response coefficient, and the resulting expansionary monetary effect is handled with monetary policy by raising benchmark interest rates ($\kappa^z = -0.005$, $\kappa^b = 0.2$). (3) Prudent borrowing, i.e., local governments borrow with a high absolute value of debt risk response coefficient ($\kappa^z = -0.01$, $\kappa^b = 0$). This model reduces the scale of borrowing by stronger constraints on borrowing to weaken the expansionary monetary effect. (4) A synergy of prudent borrowing with monetary policy. That is, local government borrowing adopts a high absolute value of debt risk response coefficient, at the same time as monetary

policy controls the expansionary monetary effect by raising benchmark interest rates ($\kappa^Z = -0.01$, $\kappa^b = 0.2$). Clearly, this model has the strongest policy strength and the largest control over the monetary effect. Next, this paper evaluates the actual effect of these models by means of simulation and welfare analysis. The simulation is carried out on both physical and financial shocks, and the independence of monetary policy in the models is discussed to make sure the evaluation results comprehensive.

6.1. Physical Shocks

As shown in Figure 5, as the economic system is hit by one-percent negative technology shocks, the productivity drops, the output shrinks, residents' consumption and private investment decline, and the shortage of supply causes the inflation to rise. Inflation-targeted monetary policy curbs aggregate demand by raising benchmark interest rates and keep prices stable. Output-targeted fiscal policy advances output recovery by expanding public investment. Local governments enlarge the scale of borrowing to support the growth of public investment, and the debt rate rises. As mentioned earlier, the increased scale of local government bonds will push up the credit premium, and then the money multiplier will rise to produce the expansionary

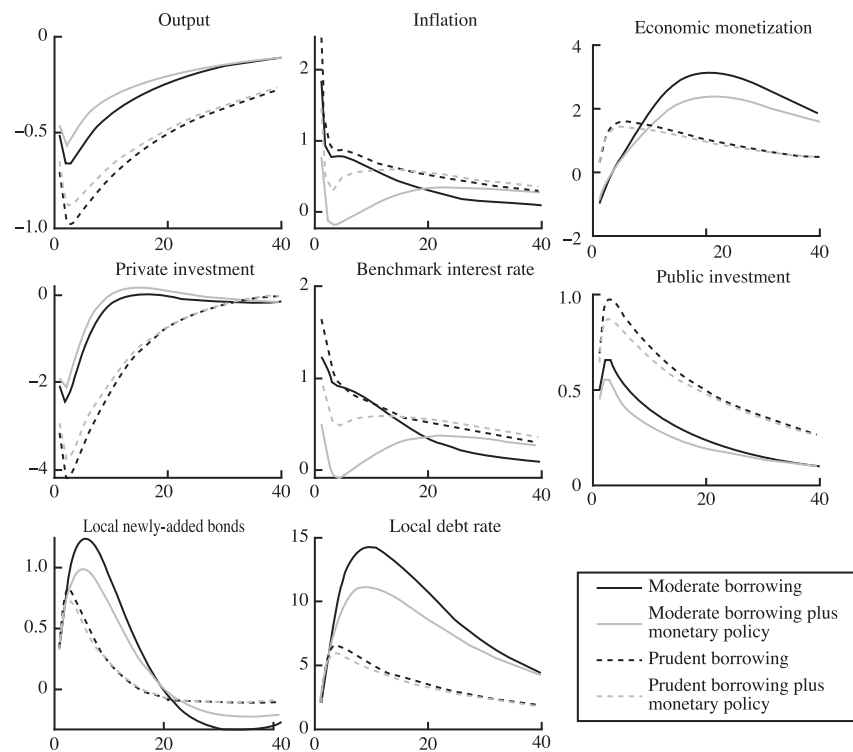


Figure 5. Impulse Response to Physical Shocks in Different Models

monetary effect, and inflation will be further aggravated.

Moderate borrowing ($\kappa^Z = -0.005$, $\kappa^b = 0$) is adopted in the first scenario. At this time, the absolute value of the response coefficient of local government borrowing to debt risks is low and borrowing constraints are not strong, so the scale of borrowing is naturally the largest, and the debt rate is the highest. Despite the good recovery effect on output, inflation and economic monetization are serious. The synergy of moderate borrowing with monetary policy ($\kappa^Z = -0.005$, $\kappa^b = 0.2$) is applied in the second scenario. While debt constraints remain unchanged, inflation is effectively restrained with the common function of monetary policy and economic monetization is obviously improved, with the best output recovery effect and lower debt risks. Prudent borrowing ($\kappa^Z = -0.01$, $\kappa^b = 0$) is adopted in the third scenario. At this time when debt constraints are enhanced and the scale of borrowing and debt rate indicators decline significantly, debt risks are low. However, the limited borrowing space forces more public investment to be replaced by tax, making the real economy which is already short of supply capacity, even worse. Supply falling short of demand leads to more serious inflation and slower recovery of output. The synergy of prudent borrowing with monetary policy ($\kappa^Z = -0.01$, $\kappa^b = 0.2$) is used in the fourth scenario. As monetary policy are also part of the action to curb the expansionary monetary effect, inflation is mitigated compared with the third scenario but it is still not as good as the second scenario, and the output recovery is not satisfactory.

Based on the above analysis, the cooperation of monetary policy benefits lowering local debt rates—be it moderate borrowing or prudent borrowing. In spite of the higher debt rates of moderate borrowing than prudent borrowing, faced with downside risks to the entire economic system, it will not be worth the loss if public finance only considers its own safety. A moderate relax of tolerance for debt risks is a response to hard economic times. Among the four synergistic models, the second one, namely the synergy of moderate borrowing with monetary policy, exerts the best effect on physical shocks. Moderate borrowing ensures sufficient space for fiscal policy and helps the recovery of the supply capacity of the economic system through public investment and tax cuts, so the economic recovery is realized rapidly. At the same time, the adverse impact of borrowing's expansionary monetary effect is alleviated with the proactive cooperation of monetary policy to reach the best policy effect. When responding to external shocks, a single policy instrument is hard to attend to one side without neglecting the other. Only the good synergy of policy instruments can maximize the policy effectiveness.

6.2. Financial Shocks

As shown in Figure 6, when the economic system is impacted by a five-percent negative capital quality, the aggregate social output shrinks, the scale of private capital decreases, asset prices fall, the credit spread narrows, the credit is tightened up, and the economy falls into deflation. Inflation-targeted monetary policy addresses deflationary

risks by stimulating aggregate demand by interest rate cuts. Output-targeted fiscal policy boosts economic recovery by expanding public investment. Increased local government expenditures lead to a rise in the scale of local government borrowing and in debt rates.

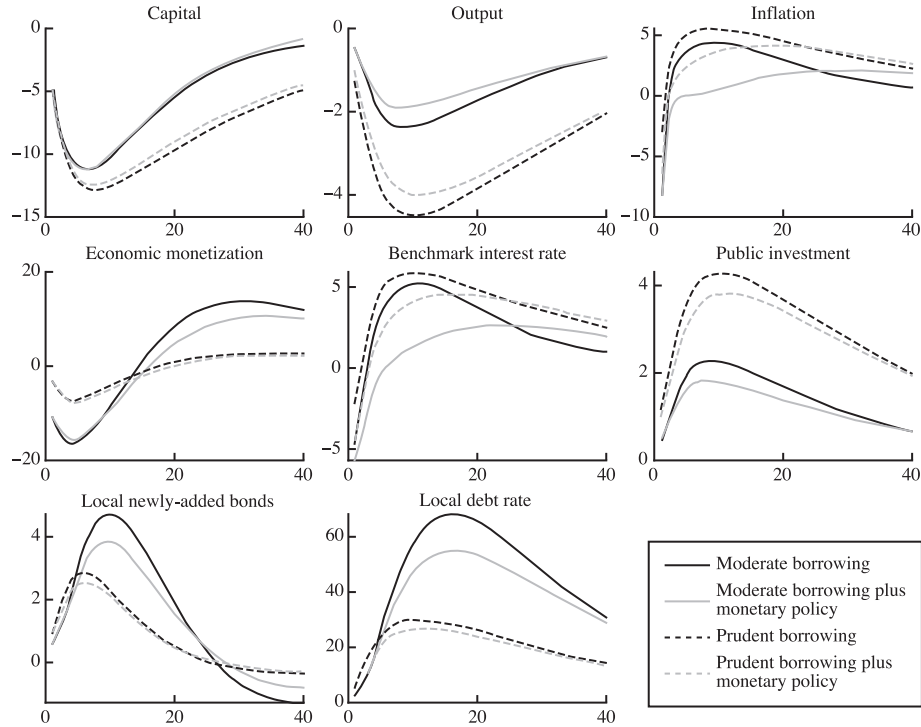


Figure 6. Impulse Response to Financial Shocks in Different Models

Moderate borrowing ($\kappa^Z = -0.005$, $\kappa^b = 0$) is adopted in the first scenario. At this time as the absolute value of the response coefficient of local government borrowing to debt risks is low, the scale of borrowing rises the most and the debt rate registers the highest. Deflation remains serious, in spite of the good output recovery effect. It is because local government borrowing will push up market interest rates. However, at this time, with the negative impact of capital quality, the rise in loan rates is limited but that in deposit interest rates is larger, leading to a decline in the credit premium and then a more severe credit shrink. The decreased money multiplier causes a narrowing of money supply, and deflation is exacerbated, only that the price volatility is small. The synergy of moderate borrowing with monetary policy ($\kappa^Z = -0.005$, $\kappa^b = 0.2$) is applied in the second scenario. The output recovery effect is the best and debt risks are lower than in the first scenario, when deflation is more severe as monetary policy tightens to hedge against local government borrowing. Prudent borrowing ($\kappa^Z = -0.01$, $\kappa^b = 0$) is adopted in the third scenario. Debt risks are low as debt constraints are enhanced and the scale of borrowing and debt rate indicators decline

significantly. The reduced scale of borrowing avoids pushing up deposit interest rates and aggravating the credit shrink, by which deflation is alleviated. At the same time, however, due to the limited borrowing space, more public investment has to be completed by raising taxes, which is not helpful for the output recovery. The synergy of prudent borrowing with monetary policy ($\kappa^Z = -0.01$, $\kappa^b = 0.2$) is used in the fourth scenario. As monetary policy tightens as local governments borrow, deflation is worse than in the third scenario and the output recovery is less than satisfactory.

Based on the above analysis, the cooperation of monetary policy enhances the policy effect to a certain extent—be it moderate borrowing or prudent borrowing. The synergy of moderate borrowing with monetary policy should be applied if the priority is on the rapid output recovery, and the response coefficient of monetary policy to bond issuance should be relaxed to reduce the price decline; And the synergy of prudent borrowing with monetary policy should be used in the case of poor tolerance for deflation.

7. Conclusions and Policy Proposals

This paper probes into local government borrowing's monetary effect transmission mechanism and the models for its synergy with monetary policy by constructing the DSGE model covering financial frictions, multi-period bonds and borrowing rules. It is concluded that local government borrowing has an expansionary monetary effect which pushes up the money multiplier and money supply and deepens economic monetization, and eventually leads to asset prices and inflation. As a result, the expansionary monetary effect of local government borrowing reduces economic stability and output sustainability. It is a better choice for monetary policy to adopt moderately tight reverse synergy to curb the adverse impact of the monetary effect. Monetary policy raising the benchmark interest rate according to the issuance of local government bonds can effectively reduce the space for credit premium to eliminate incentives for the expansion of bank assets, preventing the money multiplier from rising, and tightening money policy can hedge against borrowing-caused money increment to maintain the overall stability of money supply. It avoids a single policy instrument to attend one thing and lose another, and can resolve dilemmas. From the simulation effect of external shocks and welfare analysis, the synergy of policy instruments is able to achieve price stability and output recovery in a better way, and improve the welfare as well. Studies have proved the reverse synergy advocated in this paper has not impacted the independence of monetary policy. Based on the above conclusions, following proposals are made.

Firstly, build a model of reverse synergy between monetary policy and local government borrowing. The making of monetary policy should target at the issuance of local government bonds, take moderately tight hedging measures in time according to the scale of issuance, and form a model of reverse synergy between the two. When the issuance of borrowing enlarges, monetary policy should tighten to curb the resulting rise in bank

credit premium, thereby weakening its expansionary monetary effect as well as crowding out effect on private credit, so the money supply and economic monetization are stabilized.

Secondly, develop a regulation mechanism for the synergy of local government borrowing and monetary policy. It should be flexibly adjusted according to the type of external shocks and the bond duration. When supply insufficiency leads to high inflation, the response coefficient should be properly raised to strongly curb the aggravation of inflation caused by the expansionary monetary effect; When deflationary pressure is brought about by sluggish demand, the response coefficient should be lowered properly to reduce the decline in prices. Furthermore, the synergistic response coefficient should be appropriately increased with the extension of the bond duration, given that the longer the bond duration, the greater the expansionary monetary effect.

Thirdly, establish a smooth information sharing mechanism between local government bond issuance and monetary management authorities. There is a lag in the transmission of monetary effect. In the case of information asymmetry, monetary policy can only take countermeasures according to ex post money supply and inflation, which will become more passive for huge scales of local government bonds. Information sharing enables monetary management authorities to prepare for the possible expansion of money supply due to the issuance of local government bonds in advance, and take timely measures to reach better synergistic effect of policy instruments.

Fourthly, improve the maturity and risk management mechanism of local government bonds. In terms of welfare level, this paper finds that the “moderate borrowing plus monetary policy” model is a better choice for 3-year and 5-year bond duration, while the “prudent borrowing plus monetary policy” model is a better choice for 10-year bond duration. It may be considered to add the duration classification into the government debt quota management, and select the corresponding debt risk response coefficient according to the bond duration for differential control over newly-added bond quota. For bonds with shorter duration, the response coefficient can be reduced and the debt rate tolerance can be properly relaxed; For long-term bond issues, it should be prudent to improve the response coefficient and control the scale of issuance to avoid adverse impact on long-term welfare.

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