Jurisdiction Competition, Land Revenue and Local Government Debt Risk in China

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Abstract: Local government debt risk has become a lasting and severe issue in China due to jurisdiction competition. Based on jurisdiction competition theory developed by Tiebout (1956), this paper constructs a local debt model to expound local government behavior from the perspectives of public good competition and public land collateral. Theoretical propositions show that current local debt risk is positively associated with future land revenue and future central government bailout, whereas current local debt risk is negatively associated with current land revenue and future central government bailout. Nevertheless, relationship between local debt risk and local public good competition is different due to local government preference. Employing the local debt databases of China's 30 provinces during the period 2001-2011, we find that the lagged and current land revenue and central government fiscal transfer significantly and positively impact local debt risk and local debt solvency. Hence, volatility of land revenue and central government bailout are vital to local debt risks. Second, teacher amount per capita and medical employees per capita are significantly positive with local debt risk, while their impacts are less than that of land revenue and central government fiscal transfer. Thus, jurisdiction completion contributes to local debt risk. Urban road line length per capita and urban water line length per capital, however, are significantly negatively associated with local debt risk, which is converse to our theoretical proposition.

Key words: jurisdiction competition, public good, land revenue, local government debt risk, central government fiscal transfer

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1. Introduction

1.1 Background

The risk of local debt in China keeps sharply rising recently, albeit local debt plays an important role in urban infrastructure construction, capital attraction and economic development. According to the No.32 announcement of the National Audit Office of China, up to the end of June 2013, local governments at all levels bear the responsibility for the debt payment of 20,698.865 billion *yuan*, guarantee responsibility for the obligation of 2,925.649 billion *yuan* and bailout responsibility for the debt of 6,650.456 billion *yuan*, accounting for 53.22% of the GDP of 2013 (56,884.5 billion *yuan*) in total, whereas the debt ratio of the end of 2012 is merely 39.43% (See Table 1).[1] In particular, while the global financial crisis occurs, in order to realize the target growth, the large-scale local debts are issued by the Ministry of Finance of China and local governments, which leads to higher debt ratios in some regions. In terms of the No.32 announcement of the National Audit Office of China, at the end of June 2013, the total debt balance of province, prefecture and county-level governments is 10,578.905 billion *yuan*, an increase of 3,867.954 billion *yuan* compared with 2010, which implies 19.97% of the annual average increase. The growth rates of local debt at province, prefecture and county-levels were 14.41%, 17.36% and 26.59% respectively over the period of 2010-2012. At the end of 2012, the number of local governments whose debt ratios exceed 100% is 3, 99, 195 and 3,465 respectively, at province, prefecture, county and town–levels. In addition, there 2 province-level governments, 31 prefecture-level governments, 29 county-level governments and 148 town-level governments have to borrow new debts for the payment of old debts at a percentage of more than 20%, respectively. Employing the debt database of a Chinese Western province during the period 2000-2010, Miu and Fu (2012) find that local government debt risk shows a long-term growth trend and the short-term volatility after 2007. Overall, local debt risk not only exists, but also exacerbates in many regions. Thus, it is pressing for China to prevent local debt crisis.

Table 1 Scale of Sovereign Debts in China Unit: 100 million *yuan*

Year	Gov. level	Responsibility for Debt Payment	Contingent Liability	
			Guarantee Responsibility	Bailout Responsibility
2012	Central	94376.72	2835.71	21621.16
	Local	96281.87	24871.29	37705.16
	Total	190658.59	27707.00	59326.32
June, 2013	Central	98129.48	2600.72	23110.84
	Local	108859.17	26655.77	43393.72
	Total	206988.65	29256.49	66504.56

On the other hand, the scale and payment of local debt rely heavily on land revenue, whereas the growth of land revenue decreases, which undermines debt solvency of local governments. In terms of the No.32 announcement of the National Audit Office of China, at the end of 2012, 11 province-level governments, 316 prefecture-level governments and 1,396 county-level governments committed to pay 3,486.524 billion *yuan* with land revenue, accounting for 37.23%

[1] http://www.cnao.gov.cn/main/articleshow_ArtID_1335.htm

of 9,364.266 billion *yuan* of the total responsible debts at three levels. In recent years, the enforcement of China's land tender, auction and listing system, along with the rising housing price and land price, leads to the rising land revenue. Land revenue has increased to 3210 billion *yuan* in 2011 from 130 billion *yuan* in 2001 at an annual rate of 146%. Nevertheless, in 2010, China's central government implemented tightening policies like purchase number restriction, interest rate enhancement and mortgage lending limitation to curb housing price, which results in falling land revenue growth, rising debt payment pressure and exacerbating local government debt risk. Except for Tibet, the ratios of land revenue to fiscal revenue in 30 provinces of China decrease from 48.9% in 2010 to 36.3% in 2011. In particular, a great deal of local governments are experiencing fiscal deficit and limited land reserve, they have to raise land prices. If price bubble bursts, debt solvency of local governments plummets, local debt crisis will occur (Hong and Guo, 2012). Accordingly, Wang (2009) argues that land revenue is unstable and unsustainable, which is not able to become a reliable source for debt payment. For this reason, exploring the relationship between land revenue and local debt crisis is pivotal to prevent local debt crisis in China.

1.2 Literature review

The existing literature has studied local debt crisis from four aspects of causes, consequences, governance and contagion.

First of all, a stream of literature studies causes of local debt crisis. Some of them theoretically expound causes of local debt crisis. Cole and Kehoe (1996) develop a three-sector recursive model of consumers, bankers and governments, which indicates that the optimal strategy for governments is to repay their old debts if they can sell new debts, otherwise they defaults. However, whether governments default exists a crisis zone, which depends on debt maturity. Cuadra and Sapriza (2008) construct a two-sector game model of sovereign governments and foreign lenders and verify that length of tenure of ruling party and degree of conflict between different parties affect sovereign interest rate and default rate. Facchini and Testa (2008) develop a two-period model of public goods provided by federal government and state governments and document that it is optimal not to borrow when state governments confront a hard budget constraint; if bail-out commitment of federal government is not credible, provision of local public goods by local debts exceeds first best provision of public goods at first stage; when state defaults have a negative externality on federation, federal bail-out may be in place while states are likely to run budget deficits and benefit from the bail-out. Based on agency theory, Chang and Chen (2013) develop a party behavior model and testify that economic growth helps to reduce expansive fiscal policy, while the government runs deficits and accumulates more debts in downturns. When public support is driven up by non-economic factors, the need for the use of expansive fiscal policies disappears. A policymaker who gains more pay is restrained from excessive public spending. Unfortunately, the above four theoretical models don't consider the impact of local governments' competition on local debt risk. Moreover, they focus on the effects of fiscal revenue while neglect the effects of government collateral. Another body of literature empirically investigates the causes of local debt crisis. Though many economists analyze the causes of China's local debt crisis from political, economic and financial points of view (Lin et al, 2005; Tsui, 2011; Liu and Huang, 2012; Sun, 2013), He and Man (2012) employ a dataset of 340

financing platform firms of local governments during the period of 2002 to 2010, and find that land revenue is significantly positive associated with local debt size, whereas they don't consider the impact of variation of land price and debt size on local debt crisis.

Second, a stand of literature examines consequences of local debt crisis. Using an unbalanced panel database of 154 countries from 1970 to 2008, Furceri and Zdzienicka (2012) find that debt crises significantly reduce output by about 10 percent after eight years, while debt crises tend to be more detrimental than banking and currency crises. Employing a panel database of 155 countries during the period 1970-2008, Afonso and Jalles (2013) find that debt ratio(debt/GDP) has negative effects on economic growth and productivity, whereas debt maturity is positive associated with the economic growth and productivity for the OECD countries. Using the historical dataset spanning from 1800 to 2008, Reinhart and Rogoff (2013) find that central government debt after three years of banking crisis increases by approximately 86%, the fiscal burden of banking crisis extends beyond the cost of the bailouts and systematic banking crises are typically preceded by asset price bubbles, large capital inflows and credit booms. Using the banking databases of Indonesia, Malaysia, Philippine, Thailand and South Korea during the period of 1997-1998, Benmelech and Dvir (2013) find that debt obligations issued three years prior to East Asian financial crisis have a negative effect on the probability of bank failure, which implies short-term debt is reflection of distress in financial institutions rather than causes. Employing the daily OTC databases of five strike prices of European-style dollar-euro option across from January 2, 2006 to April 30, 2010, Hui and Chung (2011) investigate the impact of sovereign debt crisis on volatility in EURO and find that when strike prices of the options turn into out-of-the-money from in-the-money, the currency option volatility is monotonously positive related with sovereign CDS spread and information flow from the sovereign CDS market to the currency option market. Using the databases of 378 important banks from Bankscope, stock price from DataStream and MSCI indices during the period of 2006-2010, Hoque (2013) finds that short-term funding significantly increases bank performance in credit crisis; banks with higher capital, tangible equity, deposit and lower agency problem perform better in sovereign debt crisis. Using Greek database of sovereign debt from January 2005 to June 2011, Bhanot et al. (2013) find that sovereign yield spreads are positively associated with negative abnormal returns on financial stocks in the Portugal, Spain and Netherlands. These abnormal returns are driven in part by ratings downgrades and other unfavorable news announcements about Greece. A country's stock returns can be contagious via news events. Employing Hecke (2013) collects dataset of 13 EMU countries and nominal interest rates on 10-year government bonds from IMF's International Finance Statistics during 1995-2009, find that debt accumulation by subnational governments (SNG) spills over onto sovereign risk premiums when the restrictions on SNG borrowing are weak and when investors believe that subsovereign debts are backed by the center.

Third, a body of literature focuses on the governance of local debt crisis. Using the dataset of 44 countries of IMF's Government Financial Statistics regarding subnational borrowing regimes and fiscal outcomes over the period 1982-2000, Singh and Plekhanov (2005) assess market discipline, administrative constraints, rule-based controls and cooperative arrangements and believe that no single institutional arrangement is optimal, the appropriateness of specific arrangements depends on the degree of vertical fiscal imbalance, the existence of any bailout precedent, and the quality

of fiscal reporting. Freedman et al. (2010) examines the short-run multiplier effect of fiscal stimulus measures and long-run crowding-out effects of higher debt ratios in this financial crisis. They find multipliers of two-year stimulus range from 0.2 to 2.2. A 10 percentage point increase in the US debt to GDP ratio raises the US tax burden and world real interest rates in the long run, thereby reducing US and rest of the world output by 0.3-0.6 percent and 0.2-0.3 percent, respectively. Enderlein et al. (2012) construct 9 indicators of government actions and negotiation behavior and analyze a sample of debt defaulting data from 31 developing countries and emerging countries over the period 1980-2007. They find political institutions significantly affect government coercive behavior, while economic and financial factors play a minor role. By studing fiscal consolidation episodes in 21 OECD countries from 1981-2008, Heylen et al. (2013) find that fiscal consolidation programs contribute to lower public debt ratio, the more efficient governments adopt the programs, the more effective in bringing down debt ratio.

Lastly, a family of literature investigates contagion effects of local debt crisis. Using a daily market-closing interest rate spread dataset of sovereign debt of 34 countries and US from January 1, 1991 to December 31, 2000, Gande and Parsley (2005) examine the spillover effects of sovereign debt market and find positive ratings events abroad have no discernible impact on sovereign spreads, whereas negative ratings events are associated with an increase in spreads. Thus, the spillover effect is asymmetric. Using daily data of 15 EMU countries over the period of 2003-2010, Grammatikos and Vermeulen (2012) use GARCH models to identify the transmitted channels of the financial and sovereign debt crises and find that non-financials of US rather than financials transmit to Europe, while sovereign debt crisis has a significant effect on European stock returns at last stage of crisis. On the contrary，using the dataset from 31 eveloped and emerging economies during the period 1999-2011, Beirne and Fratzscher (2013) explore the pricing and contagion of European sovereign debt risk and find there exists fundamentals contagion, fundamentals are the main explanations for the rise in sovereign risk, but regional spillovers and contagion are less important. Using the database for 48 European banks from Thomson Datastream in 2010, Mink and Haan (2013) investigate the contagion effect of news about Greece sovereign debt and its bailout on bank stock abnormal return. They find that only news about Greek bailout leads to contagion effect of bank stock abnormal returns, whereas news about Greece doesn't. The findings imply that market cares more about European governments' willingness to bailout rather than the Greek default transmission. Employing the database of daily frequency of yields on 10-year government bonds issued by five EMU countries (i.e. Greece, Ireland, Italy, Portugal and Spain) from 1 January 1999 until 31 December 2010, Gómez-Puig and Sosvilla-Rivero (2013) find sovereign crisis in one country transmits to others through the banking system in a case of increased international financial activity in the euro area; macroeconomic imbalances lead to government debt devaluation and rising sovereign spreads; the private sector's indebtedness has been suggested as the main causes of debt crises in Ireland and Spain.
Using the database of Eurozone countries during the period 1999-2011, Grauwe and Ji (2013) find that debt spreads of the peripheral Eurozone countries is positively associated with negative self-fulfilling market sentiments，which shows no connection to higher debt to GDP ratios and fiscal space variables. This indicates that Eurozone countries are more fragile and more susceptible to self-fulfilling liquidity crises than stand-alone county.

In sum, the extant theoretical models fail to consider the effects of jurisdiction competition on local debt crisis. In addition, they don't take the collateral effects of government assets into account. The remainder of this paper is organized as follows: based on jurisdiction competition, Section 3 develops a local debt model combining with government's collateral land revenue. Section 4 utilizes China's local debt databases to investigate the effect of jurisdiction competition and volatility of land revenue on local debt risk. Section 5 presents conclusions and policy implications.

2. The Model

In order to analyze the effects of jurisdiction competition and government collateral assets on local debt risk, based on jurisdiction competition model of Tiebout (1956) and party-agent model of Chang and Chen (2013), this paper views public land revenue as government collateral asset and develops a local debt model combining jurisdiction competition and government collateral assets.

2.1 Assumptions

For simplicity, we assume: (1) there exists a single-party government of political regime and local governments are agents of central government; (2) only two counterparts of local governments exist at the same level;（3）local officials compete for promotion and local governments compete for local public goods and household consumption; (4) competition of local governments for local public goods is characterized by Cournot competition and expectation for supply of public goods is rational; (5) X of common goods is numeraire, its price is standardized into 1; (6) local governments and local officials share the same utility function; (7) local governments' utility function is logarithmically additive. (8) tenure of local official is T; (9) time discount factor of local officials is η; (10) local governments can repay old debts by issuing new debts with an interest rate r; (11) there is only income tax levied on household, and tax rate is τ; (12) public land is owned by local governments and can be collateralized for debts; (13) central government can bailouts local governments via fiscal transfer.

2.2 Model Setup

Under the regime of single-party government, local officials have to perform better than their rivals for promotions. According to assumption (3), the utility function of local officials can be written as: $U[O(G_{it}-G_{jt}, X_{it}-X_{jt})]$, where $O(G_{it}-G_{jt}, X_{it}-X_{jt})$ represents the promotion opportunities of local officials. Promotion opportunity hinges on the comparisons of local public goods provision ($G_{it}-G_{jt}$) and household consumption ($X_{it}-X_{jt}$)[2]. In addition, i and j stand for competing local governments at the same level, respectively. Accordingly, current fiscal expenditure includes current expenditure of public goods and debt repayment in previous period. As public land can be taken as collateral for local debt financing, land revenue spontaneously can be used to repay local debts. Consequently, current fiscal revenue consists of tax, land revenue and current debt obligation. Thus, budget constraints of local governments are

[2]For simplicity，we take the difference of local GDP ($Y_{it}-Y_{jt}$) and local public goods ($G_{it}^{*}-G_{jt}^{*}$) instead of their ratios (Y_{it}/Y_{jt}，G_{it}^{*}/G_{jt}^{*}) as jurisdiction competition.

changed into: $p_t^G G_t + (1+r)D_{t-1} = p_t^l L_t + \tau Y_t + D_t$, where D_t denotes new local debt obligations at time t; p_t^l and L_t denote land transfer price and transfer area at time t, respectively; p_t^G is the price of public goods at time t and Y_t denotes local GDP at time t. In addition, as land can be collateralized, current local debt obligation is the increasing function of future land revenue, namely, $D'(pL) > 0$. More specifically, current local debt obligations can be expressed as: $D_t = \eta_0 p_t L_t + \eta_1 p_{t+1} L_{t+1} + \eta_2 p_{t+2} L_{t+2} + \cdots + \eta_n p_{t+n} L_{t+n} (\eta_1, \eta_2, \cdots \eta_n > 0)$. In terms of assumption (4), the reaction function of public goods supplied by government i to government j can be written as: $G_{it} = f(G_{jt}^e)$, where G_{jt}^e denotes the expectation of government i on public goods supply of government j. Similarly, the reaction function of public goods supplied by government j to government i can be written as: $G_{jt} = f(G_{it}^e)$. Meanwhile, we can obtain: $G_{it}^e = G_{it}^*$, $G_{jt}^e = G_{jt}^*$, where G_{it}^* and G_{jt}^* denote the optimal supply of local public goods by governments i and j, respectively. Hence, public goods price of Cournot equilibrium can be expressed as: $p_{Gt}^* = \dfrac{k}{G_{it}^* + G_{jt}^*}$, where $k > 0$. Finally, because households consume all after-tax income, we can get $X_t = (1-\tau)Y_t$.

To sum up, the utility function of representative government i can be expressed as:

$$\underset{X_{it}, G_{it}^*}{Max} \sum_{t=1}^{T} \eta^{-(t-1)} [\alpha \ln(X_{it} - X_{jt}) + \beta \ln(G_{it}^* - G_{jt}^*)] \qquad (\alpha, \beta > 0)$$

$$s.t. \quad P_{Gt}^* G_{it}^* + (1+r)D_{it-1} = P_{it}^l L_{it} + \tau Y_{it} + D_{it}, \quad P_{Gt}^* G_{jt}^* + (1+r)D_{jt-1} = P_{jt}^l L_{jt} + \tau Y_{jt} + D_{jt}$$

$$P_{Gt}^* = \frac{k}{G_{it}^* + G_{jt}^*} \ (k > 0), \quad X_{it} = (1-\tau)Y_{it}, \quad X_{jt} = (1-\tau)Y_{jt}$$

From the first order condition, it yields:

$$D_{it}^* = \frac{k[(2\alpha+\beta)G_{jt}^* + \beta G_{it}^*](G_{it}^* - G_{jt}^*)}{\beta(G_{it}^* + G_{jt}^*)^2} - (P_{it}^l L_{it} - P_{jt}^l L_{jt}) - (Y_{it} - Y_{jt}) + (1+r)(D_{it-1} - D_{jt-1}) + D_{jt} \qquad (1)$$

Equation 1 indicates that the optimal scale of local debts not only relies on the difference of local public goods ($G_{it}^* - G_{jt}^*$), but also depends on the differences of land transfer revenue ($P_{it}^l L_{it} - P_{jt}^l L_{jt}$), GDP ($Y_{it} - Y_{jt}$) and lagged debt size ($D_{it-1} - D_{jt-1}$) between local governments.

In the light of Equation 1, we can obtain the scale of lagged local debts:

$$D_{it-1} = -\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](G_{it}^{*}-G_{jt}^{*})}{\beta(1+r)(G_{it}^{*}+G_{jt}^{*})^{2}} + \frac{(P_{it}^{l}L_{it}-P_{jt}^{l}L_{jt})+(Y_{it}-Y_{jt})+(D_{it}-D_{jt})}{(1+r)} + D_{jt-1} \qquad (2)$$

Equation 2 implies that the scale of lagged local debts is not only positively associated with the difference of current local debt, but also positively associated with the differences of current land revenue, public goods and GDP between local governments. In other words, local governments will increase their current debts in the event that they can expect their future land revenue, public goods and GDP are greater than that of their rivals.

Similarly, variation of local debt is as follows:

$$\Delta D_{it}^{*} = \frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](G_{it}^{*}-G_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}} - (P_{it}^{l}L_{it}-P_{jt}^{l}L_{jt}) - (Y_{it}-Y_{jt}) + r(D_{it-1}-D_{jt-1}) + \Delta D_{jt} \qquad (3)$$

Comparing Equation 3 with Equation 1, local governments increase their debt obligation provided that their rivals increase debt,

To analyze local debt risk, we divide Equations 1-3 by Y_t at both sides, and obtain thress competitive debt ratios[3]:

$$d_{it}^{*} - d_{jt} = \frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](g_{it}^{*}-g_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}} - (p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt}) - (1-y_{jt}) + (1+r)(d_{it-1}-d_{jt-1}) \qquad (4)$$

$$d_{it-1} - d_{jt-1} = -\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](g_{it}^{*}-g_{jt}^{*})}{\beta(1+r)(G_{it}^{*}+G_{jt}^{*})^{2}} + \frac{(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})+(1-y_{jt})+(d_{it}-d_{jt})}{(1+r)} \qquad (5)$$

$$\Delta d_{it}^{*} - \Delta d_{jt} = \frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](g_{it}^{*}-g_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}} - (p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt}) - (1-y_{jt}) + r(d_{it-1}-d_{jt-1}) \qquad (6)$$

where d_{it}, Δd_{it} and d_{it-1} denote current debt ratio, variation of debt ratio and lagged debt ratio of government i, respectively; g_{it}^{*} and g_{jt}^{*} denote the optimal expenditure ratios of public goods ($\frac{G_{it}^{*}}{Y_{it}}$ and $\frac{G_{jt}^{*}}{Y_{it}}$) by governments i and j, respectively ; $p_{it}^{l}l_{it}$ and $p_{jt}^{l}l_{jt}$ denote land revenue ratios ($\frac{P_{it}^{l}L_{it}}{Y_{it}}$ and $\frac{P_{jt}^{l}L_{jt}}{Y_{it}}$); d_{it-1} and d_{jt-1} are lagged debt ratios; y_{jt} and d_{jt} denote GDP ratio ($\frac{Y_{jt}}{Y_{it}}$)and rival's debt to own GDP ($\frac{D_{jt}}{Y_{it}}$).

2.3 Propositions

[3] This paper refers the differences of debt ratios as to competitive debt ratios (hereinafter the same).

From Equation 1-6, we can derive Proposition 1:

Proposition 1： If all the above assumptions hold, then $\frac{\partial(d_{it}^{*}-d_{jt})}{\partial(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})}<0$,

$\frac{\partial(d_{it-1}-d_{jt-1})}{\partial(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})}>0$, $\frac{\partial(\Delta d_{it}^{*}-\Delta d_{jt})}{\partial(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})}<0$; $\frac{\partial(d_{it}^{*}-d_{jt})}{\partial(d_{it-1}-d_{jt-1})}>0$; if $\frac{\alpha\text{-}\beta}{3\alpha+\beta}<\frac{G_{jt}^{*}}{G_{it}^{*}}$, then

$\frac{\partial(d_{it}^{*}-d_{jt})}{\partial(g_{it}^{*}-g_{jt}^{*})}>0$, $\frac{\partial(d_{it-1}-d_{jt-1})}{\partial(g_{it}^{*}-g_{jt}^{*})}<0$, $\frac{\partial(\Delta d_{it}^{*}-\Delta d_{jt})}{\partial(g_{it}^{*}-g_{jt}^{*})}>0$; if $\frac{\alpha\text{-}\beta}{3\alpha+\beta}>\frac{G_{jt}^{*}}{G_{it}^{*}}$, then

$\frac{\partial(d_{it}^{*}-d_{jt})}{\partial(g_{it}^{*}-g_{jt}^{*})}<0$, $\frac{\partial(d_{it-1}-d_{jt-1})}{\partial(g_{it}^{*}-g_{jt}^{*})}>0$, $\frac{\partial(\Delta d_{it}^{*}-\Delta d_{jt})}{\partial(g_{it}^{*}-g_{jt}^{*})}<0$

Proposition 1 implies that the higher the current land revenue ratio is, the less the local debt ratio and the local debt risk. Second, in order to repay debts, the more the lagged local debts are, the more the current local debts are. Third, if $\frac{\alpha\text{-}\beta}{3\alpha+\beta}<\frac{G_{jt}^{*}}{G_{it}^{*}}$, which implies $\alpha<\beta$, the utility of local public goods is more than that of GDP, then the resulting spread of ratios of current local public goods provision is positively associated with the spreads of current local debt ratios, but negatively associated with the spreads of lagged local debt ratios. Apparently, local debt risk runs in line with local public expenditure ratios. Conversely, if $\frac{\alpha\text{-}\beta}{3\alpha+\beta}>\frac{G_{jt}^{*}}{G_{it}^{*}}$, which implies $\alpha>\beta$, the utility of pubic goods is less than that of GDP. Thus, local debt ratios and local debt risks are decreasing with ratios of local public goods provision.

The above model does not take the relation between central government and local governments into account. Under local debt crisis, if central government could bailout, local governments confront soft budget constraints; if not, budget constraints of local governments are hard. Thus, the model above refers to as local debt model with hard budget constraints. While budget constraints are soft, local governments tend to be over-indebtedness, which easily give rise to local debt crisis. When local governments could expect central government bailouts, current local debts are increasing function of future central bailouts (B), that is $D'(B)>0$. Specifically, current local debts can be written as: $D_t=\lambda_0 B_t+\lambda_1 B_{t+1}+\lambda_2 B_{t+2}+\cdots+\lambda_N B_{t+N}$, where $\lambda_1,\lambda_2,\cdots\lambda_N>0$. Thus , budget constraints of local governments have been changed into:

$P_{Gt}^{*}G_{it}^{*}+(1+r)D_{it-1}=P_{it}^{l}L_{it}+\tau Y_{it}+D_{it}+B_{it}$, $P_{Gt}^{*}g_{jt}^{*}+(1+r)D_{jt-1}=P_{jt}^{l}L_{jt}+\tau Y_{jt}+D_{jt}+B_{jt}$.

On the other hand, whether central government can bailout not only relies on its fiscal resources, but also depends on its financing capacity. We further assume that the maximum of fiscal transfer from central government is $\overline{B}$, then $B_{it}+B_{jt}\le\overline{B_t}$. In terms of Equations 2 and 3, we can obtain

the optimal local debt spreads under soft budget constraints:

$$D_{it}^{*}-D_{jt}=\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](G_{it}^{*}-G_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}}-(P_{it}^{l}L_{it}-P_{jt}^{l}L_{jt})-(Y_{it}-Y_{jt})-(B_{it}-B_{jt})+(1+r)(D_{it-1}-D_{jt-1}) \quad (7)$$

$$D_{it-1}-D_{jt-1}=-\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](G_{it}^{*}-G_{jt}^{*})}{\beta(1+r)(G_{it}^{*}+G_{jt}^{*})^{2}}+\frac{(P_{it}^{l}L_{it}-P_{jt}^{l}L_{jt})+(Y_{it}-Y_{jt})+(D_{it}-D_{jt})+(B_{it}-B_{jt})}{(1+r)} \quad (8)$$

$$\Delta D_{it}^{*}-\Delta D_{jt}=\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](G_{it}^{*}-G_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}}-(P_{it}^{l}L_{it}-P_{jt}^{l}L_{jt})-(Y_{it}-Y_{jt})-(B_{it}-B_{jt})+r(D_{it-1}-D_{jt-1}) \quad (9)$$

Similarly, dividing Equations 7-9 by Y_t, competitive debt ratios under soft budget constraints can be derived:

$$d_{it}^{*}-d_{jt}=\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](g_{it}^{*}-g_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}}-(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})-(1-y_{jt})-(b_{it}-b_{jt})+(1+r)(d_{it-1}-d_{jt-1}) \quad (10)$$

$$d_{it-1}-d_{jt-1}=-\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](g_{it}^{*}-g_{jt}^{*})}{\beta(1+r)(G_{it}^{*}+G_{jt}^{*})^{2}}+\frac{(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})+(1-y_{jt})+(b_{it}-b_{jt})+(d_{it}-d_{jt})}{(1+r)} \quad (11)$$

$$\Delta d_{it}^{*}-\Delta d_{jt}=\frac{k[(2\alpha+\beta)G_{jt}^{*}+\beta G_{it}^{*}](g_{it}^{*}-g_{jt}^{*})}{\beta(G_{it}^{*}+G_{jt}^{*})^{2}}-(p_{it}^{l}l_{it}-p_{jt}^{l}l_{jt})-(1-y_{jt})-(b_{it}-b_{jt})+r(d_{it-1}-d_{jt-1}) \quad (12)$$

where b_{it} and b_{jt} stand for fiscal transfer ratios of central government ($\frac{B_{it}}{Y_{it}}$ and $\frac{B_{jt}}{Y_{it}}$).

In the light of Equations 7-12, we can derive Proposition 2.

Proposition 2: if all the above assumptions hold and central government bailouts, then

$$\frac{\partial(d_{it}^{*}-d_{jt})}{\partial(b_{it}-b_{jt})}<0,\ \frac{\partial(\Delta d_{it}^{*}-\Delta d_{jt})}{\partial(b_{it}-b_{jt})}<0,\ \frac{\partial(d_{it-1}-d_{jt-1})}{\partial(b_{it}-b_{jt})}>0$$

Proposition 2 implies that competitive ratios of current local debt are negatively associated with competitive ratio of current central fiscal transfer, but positively associated with competitive ratio of forward central fiscal transfer. In other words, while local governments could expect their fiscal transfers are more than that of their competitors, local debt risk would increase.

3. Empirical Tests

3.1 Data

Since the city-level databases of local debts and land revenue prior to 2001 are not available, we assemble the province-level datasets of land transfer and local debts of 30 provinces (except for Tibet) in China from 2001 to 2011. Province-level databases of local debts solely contain new debts and repayment of principal and interest, but not accumulative debt. New debts merely include corporate bonds (i.e. financing platform firms of local governments), loans converting from national debts and local government bonds issued by the Ministry of Finance, while not

include bank loans. According to the No.32 announcement of the National Audit Office of China, till the end of June 2013, bank loans account for 50.76% of local debts (5,525.245 billion *Yuan*/1,885.917 billion *Yuan*). Thus, we collect a supplementary dataset of repayment of principal and interest of local debts, but missing data of 2007-2008. The loans from national debts and local government debts issued by Ministry of Finance data are gathered from *China Finance Yearbook* (2002-2012), repayment data comes from respective Statistical Yearbook of 30 provinces and corporate bonds data is from WIND database. The data of land transfer includes land transfer area and land transfer revenue collecting from *China Land Resources Yearbook* (2002-2012). We also collect budgetary revenue from *China Urban Statistical Yearbook* (2002-2012). For public goods, we assemble the lengths of newly-built urban road per capita, volume of mass transit, number of teachers per capita and number of sanitary institutes per thousand come from respective *Statistical Yearbook* of 30 provinces and *China Urban Statistical Yearbook* (2002-2012).

3.2 Descriptive Analysis

Table 1 shows that new debts increase slowly prior to 2009, rising from 1.385 billion yuan in 2001 to 2.601 billion yuan in 2007 with an annual rate of 31.30%. After the global financial crisis in 2008, China's central government issued local bonds 200 billion yuan to bailout, which leads to the rapid growth of new local debts since 2008. The size of local debt rockets by 4.76 times from 2.490 billion yuan to 14.344 billion yuan. Meanwhile, the rapid growth of local debts expedites debt repayment, increasing from 0.144 billion yuan in 2006 to 0.607 billion yuan in 2009 with annual growth rate of 107%. Land revenue and budgetary revenue tend to increase year by year. Due to the global financial crisis, land revenue decreases by 16.06%, from 40.710 billion yuan in 2007 to 34.173 billion yuan in 2008.

Table 1 Scale of new local debts and fiscal revenue in China during 2001-2011 unit:100 million yuan

year	Land revenue（A）	Budgetary revenue（B）	Total fiscal revenue（C=A+B）	Loans from national bonds and local government debts（D）	Corporate bonds（E）	Total debts（F=D+E）	Debt repayment（G）
2001	43.19	155.53	198.73	12.89	0.97	13.85	14.02
2002	80.54	173.54	254.08	7.11	4.17	11.28	2.78
2003	180.69	193.16	373.85	6.83	3.57	10.39	0.59
2004	213.68	238.48	452.16	2.01	2.73	4.74	0.84
2005	195.97	303.15	499.12	3.49	8.13	11.63	1.24
2006	269.06	362.10	631.16	1.96	12.77	14.73	1.44
2007	407.10	468.86	875.96	0.40	25.61	26.01	—
2008	341.73	562.87	904.61	0.00	24.90	24.90	—
2009	572.61	634.12	1210.00	66.67	76.78	143.44	6.07
2010	915.26	794.26	1710.00	61.27	65.57	126.83	11.98
2011	1070.00	1060.00	2120.00	66.67	75.08	141.75	20.15

平均	389.86	449.23	839.09	20.84	27.30	48.14	6.65

Table 2 displays that the ratio of new debts to budgetary revenue (TDTTR), land revenue and total fiscal revenue grow quickly after the 2008 financial crisis. However, the ratio of new debts to land revenue (TDTLR) is less than 26% except for 2001, 2002 and 2009. As mentioned above, we assume that new debts account half of the total debts. If new debts are collateralized on land and repaid by land revenue, then the TDTLR stays below the line of 52% since 2009, the local debt risk is under control. Similarly, as the ratio of repayment of principal and interest to land revenue (PDTLR) is 2.56% on average and its max is 23.47% in 2001, the local debts also can be solvent. Therefore, total revenue composed of budgetary revenue and land revenue has a stronger capability to repay debts. Besides, the ratio of new debts to GDP (TDTGDP) sharply rises from 0.35% in 2008 to 1.65% in 2009 after the global crisis. Although TDTGDP is small, it will rise in the event of accumulative local debts.

Table 2 Ratios of new debts to fiscal revenue for China during 2001-2011 unit：%

Year	TDTGDP	TDTFR	TDTLR	TDTTR	PDTFR	PDTLR	PDTTR
2001	0.60	20.45	140.65	16.95	13.53	23.47	8.58
2002	0.40	12.03	40.97	8.89	2.22	2.28	1.12
2003	0.28	9.78	18.62	5.80	0.69	1.51	0.43
2004	0.08	2.28	4.54	1.41	0.75	1.46	0.46
2005	0.29	8.20	13.18	4.67	0.93	1.86	0.60
2006	0.29	8.44	13.73	4.85	0.86	2.02	0.54
2007	0.35	8.69	9.70	3.88	—	—	—
2008	0.35	12.84	18.12	6.71	—	—	—
2009	1.65	52.30	45.11	20.98	7.29	3.62	2.05
2010	1.28	41.16	25.72	14.49	4.90	2.76	1.59
2011	1.14	31.71	23.89	12.12	5.10	3.30	1.66
Mean	0.61	18.90	32.20	9.16	3.23	2.56	1.15

Note : (1)TDTFR and PDTFR denote ratio of newly-issued local government debts to local budgetary revenue and ratio of repayment of principal and interest to budgetary revenue, respectively;(2) TDTLR and PDTLR denote ratio of newly-issued local debts to local land revenue and ratio of repayment of principal and interest to land revenue, respectively; (3) TDTTR、PDTTR denote ratio of newly-issued local debts to total fiscal revenue and ratio of repayment of principal and interest to total fiscal revenue, respectively

Table 3 indicates the provinces whose TDTLRs exceed 50% include Qinghai, Ningxia, Hainan, Gansu and Heilongjiang with TDTLRS of 147.43%, 112.04%, 82.00%, 70.81% and 50.85%, respectively. The provinces whose PDTLRs surpass 10% are Qinghai and Ningxia with PDTLRs of 18.75% and 10.24% , respectively. It is noteworthy that new debts account around half of total new debts. Hence, local debt risks in provinces mentioned above is rather severe should maturity of local debts approaches. Thus, the risks of newly-issued local debts concentrate on Midwestern China, while the TDTLRs and PDTLRs in developed Eastern China like Beijing, Shanghai, Guangdong, are smaller as well as the local debt risks.

Table 3 Ratios of new local debts and repayment of principal and interest to fiscal revenue of 30 provinces in China during 2001-2011 unit：%

province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Liaoning	Jilin	Heilongjiang	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Jianxi	Shandong
TDTLR	19.73	16.39	7.68	45.80	53.23	8.42	40.52	50.85	12.56	6.12	5.01	15.35	8.83	12.96	10.76
TDTTR	4.29	4.52	3.86	10.97	11.18	3.05	10.55	7.00	2.60	3.49	3.19	6.99	3.63	7.17	3.41
PDTLR	—	0.35	3.36	0.50	2.19	1.60	8.54	0.42	3.01	0.18	0.05	0.46	0.36	0.86	0.52
PDTTR	—	0.10	1.35	0.22	0.67	0.70	3.77	0.14	0.68	0.10	0.03	0.28	0.19	0.57	0.32

Province	Henan	Hubei	Hunan	Guangdong	Guangxi	Hainan	Chongqing	Sichuan	Guizhou	Yunnan	Shanxi	Gansu	Qinghai	Ningxia	Xinjiang
TDTLR	26.92	19.15	22.69	11.31	15.65	82.00	16.92	12.95	30.05	27.32	25.30	70.81	147.43	112.04	31.39
TDTTR	7.28	5.87	8.16	2.40	6.00	34.80	4.69	6.87	10.64	11.49	8.40	11.94	41.33	19.90	9.10
PDTLR	1.58	0.54	0.85	2.26	1.17	0.78	0.18	1.06	3.32	4.47	1.38	1.95	18.75	10.24	5.18
PDTTR	0.65	0.30	0.36	0.62	0.58	0.48	0.10	0.66	1.49	3.34	0.59	0.68	8.25	5.06	1.77

Table 4 depicts that except for Tibet, the ratio of land revenue to budgetary revenue (LRTFR) tends to go up as a whole with a mean of 90.95% and a maximum of 148.19% in 2010. Thus, land revenue nearly equals to budgetary revenue. Similarly, the ratio of land revenue to total fiscal revenue (LRTTFR) is inclined to rise as a whole with a mean of 41.90% and a maximum of 55.68% in 2010. Thus, land revenue is referred to as “second public finance” corresponding to non-land revenue and is crucial to local fiscal revenue in China.

Table 4 Ratios of Land revenue to fiscal revenue for China during 2001-2011 unit：%

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
LRTFR	26.15	46.96	93.78	94.49	72.68	86.08	101.63	78.88	115.98	148.19	135.59	90.95
LRTTFR	18.99	28.48	43.37	44.74	38.89	42.66	46.35	41.02	48.37	55.68	52.30	41.90

Note LRTFR、LRTFR denote ratios of land revenue to budgetary revenue and land revenue to total revenue, respectively.

Table 5 exhibits that thirteen provinces whose LRTFRs are more than 100% include Zhejiang, Yunnan, Sichuan, Jiangxi, Qinghai, Jiangsu, Anhui, Chongqing, Hainan, Hebei, Fujian, Shandong and Hubei. Eleven provinces of their LRTFRs between 50% and 100% are Hunan, Guangxi, Liaoning, Ningxia, Shanxi, Guizhou, Jilin, Tianjin, Inner Mongolia, Henan and Shanxi. Only six provinces (i.e. Beijing, Shanghai, Guangdong, Heilongjiang, Xinjiang and Gansu) have their LRTFRs lower than 40%. As a result, LRTFR of 80% of the provinces is greater than 50 percent. In terms of LRTTFR, six provinces of Zhejiang, Jiangxi, Sichuan, Jiangsu, Yunnan and Hebei have their ratios higher than 50%. Nine provinces of Fujian, Chongqing, Shandong, Henan, Hubei, Hunan, Guangxi, Liaoning and Ningxia have their ratios between 40% and 50%. However, developed regions like Beijing, Shanghai and Guangdong possess their ratios lower than 26 percent. For this reason, less developed regions hinge much more on land revenue.

Table 5 Ratios of land revenue to fiscal revenue of 30 provinces in China during 2001-2011

Unit：%

province	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Liaoning	Jilin	Heilongjiang	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Jianxi	Shandong
LRTFR	39.09	66.11	110.72	53.99	63.68	81.28	70.60	40.28	27.40	135.28	183.67	125.26	110.43	152.27	104.02
LRTTFR	26.56	35.98	51.17	33.76	34.52	42.43	38.24	26.42	21.14	56.29	63.05	53.48	49.61	58.95	48.17
Province	Henan	Hubei	Hunan	Guangdong	Guangxi	Hainan	Chongqing	Sichuan	Guizhou	Yunnan	Shanxi	Gansu	Qinghai	Ningxia	Xinjiang
LRTFR	57.24	102.56	83.82	33.54	82.75	114.02	114.21	161.37	71.94	164.46	73.32	47.49	138.17	77.17	42.26
LRTTFR	34.99	47.33	44.14	24.50	43.15	47.66	49.25	58.06	39.30	52.54	39.96	29.58	37.64	40.07	28.90

4. Empirical Tests

4.1 Econometric Model Setting

To examine the effects of jurisdiction competitions on current local debt risk, we develop a competitive debt ratio model for local governments in the light of Propositions 1 and 2.

$$\begin{aligned} d_{it}-\overline{d_t}&=\kappa_0+\kappa_1(d_{it-1}-\overline{d_{t-1}})+\kappa_2(p_{it}l_{it}-\overline{p_tl_t})+\kappa_3(b_{it}-\overline{b_t})+\kappa_4(RL_{it}-\overline{RL_t})\\ &+\kappa_5(WL_{it}-\overline{WL_t})+\kappa_6(BV_{it}-\overline{BV_t})+\kappa_7(TN_{it}-\overline{TN_t})+\kappa_8(DN_{it}-\overline{DN_t})+\varepsilon_{it}\end{aligned} \tag{13}$$

In reality, local governments at the same level are typically more than two. To illustrate jurisdiction competition, we introduce average values of all explanatory variables as rivals' variables. Hence, $\overline{d_{jt}}$ denotes average value of TDTGDP of all provinces at year t; $p_{it}l_{it}$ stands for land revenue to GDP ratio of province i in year t; $\overline{p_tl_t}$ is the mean of $p_{it}l_{it}$ of all provinces; $\overline{b_t}$ is the mean ratio of fiscal transfer to GDP of all province in year t; $\overline{RL_t}$ represents the mean of urban road line length per capita in year t; $\overline{WL_t}$ denotes the mean of urban water line length per capita in year t; $\overline{BV_t}$ denotes the mean of urban bus volume per capita in year t; $\overline{TN_t}$ is the mean of teachers per thousand persons and $\overline{DN_t}$ is the mean of medical employees per thousand per thousand persons in year t.

In Equation 13, as the lagged dependent variable is associated with the error term, the estimated results of OLS, RE and FE are biased. In order to avoid spurious regression, this paper adopts system GMM (SYS-GMM) estimator posed by Arellano and Bover(1995) and Blundell and Bover(1998). Besides, since local debts might be endogenous with land revenue and fiscal transfer, $(p_{it}l_{it}-\overline{p_tl_t})$ and $(b_{it}-\overline{b_t})$ are treated as endogenous variables while the other variables are views as exogenous variables in the process of estimation. Table 6 reports the descriptive analysis of main variables.

To explore the effects of collateral assets and central government bailouts, we institute a competitive debt ratio model for local governments in terms of Propositions 1 and 2.

$$\begin{aligned} d_{it-1}-\overline{d_{t-1}}&=\gamma_0+\gamma_1(d_{it}-\overline{d_t})+\gamma_2(p_{it}l_{it}-\overline{p_tl_t})+\gamma_3(b_{it}-\overline{b_t})+\gamma_4(RL_{it}-\overline{RL_t})\\ &+\gamma_5(WL_{it}-\overline{WL_t})+\gamma_6(BV_{it}-\overline{BV_t})+\gamma_7(TN_{it}-\overline{TN_t})+\gamma_8(DN_{it}-\overline{DN_t})+\mu_{it}\end{aligned} \tag{14}$$

By virtue of Hausman tests, we employ FE model to estimate Equation 14.

Table 6 Descriptive analysis of main variables

Variables	Max	Min	Mean	S.E	Obs.
$d_{it}-\overline{d_t}$	0.0645	-0.0137	-0.0012	0.0070	330
$p_{it}l_{it}-\overline{p_tl_t}$	0.0989	-0.0384	-0.0041	0.0215	330
$b_{it}-\overline{b_t}$	0.3701	-0.1164	-0.0090	0.0691	330
$RL_{it}-\overline{RL_t}$	1.2226	-0.2593	-0.0376	0.1986	330
$WL_{it}-\overline{WL_t}$	1.9290	-0.7798	-0.1854	0.5116	330
$BV_{it}-\overline{BV_t}$	0.3576	-0.2245	-0.0289	0.1340	330
$TN_{it}-\overline{TN_t}$	1.7538	-0.4357	-0.1187	0.3879	330
$DN_{it}-\overline{DN_t}$	24.8198	-14.7766	-0.0483	7.4184	330

4.2. Unit root tests and cointegration tests

To eliminate spurious regression, unit root tests are required to conduct. In general, unit root tests of panel data comprise of homogeneous and heterogeneous panel unit root tests. The former refers to LLC test (Levin et al., 2002), the latter includes IPS test (Im et al., 2003), Fisher-ADF and Fisher-PP tests (Maddala and Wu, 1999). This paper employs these four unit root tests. Table 7 indicates that the other variables are stationary with exception of $d_{it}-\overline{d_t}$, $b_{it}-\overline{b_t}$ and $DN_{it}-\overline{DN_t}$.

Table 7 Unit root tests of panel variables

Variables	Level Equation				Difference Equation			
	Levin-Lin	IPS	Fisher-ADF	Fisher-PP	Levin-Lin	IPS	Fisher-ADF	Fisher-PP
$d_{it}-\overline{d_t}$	-8.11	0.18	62.44	154.01***	-18.62***	-6.97***	241.21***	647.83***
	(0.17)	(0.57)	(0.39)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$p_{it}l_{it}-\overline{p_tl_t}$	-14.75***	-4.71***	190.17***	109.47***				
	(0.00)	(0.00)	(0.00)	(0.00)				

$b_{it}-\overline{b_t}$	-1.90**	1.88	71.21	59.86	-21.67***	-6.61***	305.44***	389.62***
	(0.03)	(0.97)	(0.15)	(0.48)	(0.00)	(0.00)	(0.00)	(0.00)
$RL_{it}-\overline{RL_t}$	-9.46***	0.18	84.04**	80.94**				
	(0.00)	(0.57)	(0.02)	(0.04)				
$WL_{it}-\overline{WL_t}$	-6.65**	2.16	76.14*	76.30*				
	(0.02)	(0.99)	(0.08)	(0.08)				
$BV_{it}-\overline{BV_t}$	-13.38***	-2.50***	182.05***	108.71***				
	(0.00)	(0.01)	(0.00)	(0.00)				
$TN_{it}-\overline{TN_t}$	-8.84***	0.07	93.96***	157.85***				
	(0.00)	(0.53)	(0.00)	(0.00)				
$DN_{it}-\overline{DN_t}$	-5.41	3.21	37.40	51.45	-12.07***	-2.61***	94.46 ***	237.62***
	(0.97)	(0.99)	(0.99)	(0.78)	(0.00)	(0.01)	(0.00)	(0.00)

Note: (1)the numbers in parentheses are p values; (2) ***, ** and *denote the significance levels of 1%, 5% and 10% respectively (thereinafter); (3)the estimated equation contains the intercept, the lagged variables and the time trend term.

Although all the difference variables are steady, a cointegration test should be conducted between dependent and independent variables. We employ panel cointegration tests proposed by Westerlund (2007) to implement the tests. Table 8 shows that two statistics of Gt and Pt reject the null hypothesis of “no cointegration”, albeit Ga and Pa receive the null hypothesis. Thus, we option the level equation for estimation.

Table 8 Cointegration tests of multivariates

Statistics	Values	Z value	P value
Gt	3.701	12.123	0.000
Ga	0.650	5.182	1.000
Pt	10.301	3.890	0.000
Pa	0.932	1.751	0.960

Note : (1)null hypothesis is “no cointegration”; (2)the estimated equation includes the intercept, the lagged variables and the time trend term.

4.3 Results

Table 9 shows that the coefficient signs of principle independent variables are consistent with the theoretical Propositions. Sargan tests document that instrumental variables of endogenous variables are valid. The outcomes of AR(1) and AR(2) testify that there is no serial correlation, which is in line with the autocorrelation hypothesis of Arellano and Bover(1995). In terms of model 1, first of all, the greater is the difference of land revenue ratio and its mean, the greater is the difference of local debts and its mean. This implies the local debt risk increases with the percentage of local governments’ land collateral assets. Second, the central fiscal transfer has the same effects of local debts as land revenue. It also indicates that the local debt risk rises with the percentage of central fiscal transfer. It is noteworthy that, contrary to the Propositions, the greater current land revenue and fiscal transfer are, the higher the local debt risk is. Consequently, local governments will be over-indebted and the local debt risk rises provided that land revenue and its

collateral effects are keeping enhancing. Similarly, under a single-party system, the growth of central fiscal transfer would have the same effects resulting in over-indebtedness and higher local debt risk. Third, as opposed to the Propositions, the deviation of urban road length per capita from its mean and the deviation of urban water line length per capita from its mean are negatively associated with the deviation of local debts from its mean. As a matter of fact, local debts for the constructions of urban road and water line can be repaid by charging in China, implying local debt risk can be reduced. Conforming to our Propositions, the discrepancy of teachers per thousand persons and its mean as well as the gap of medical employees per thousand persons and its mean have a positive effect in local debts, albeit the coefficient of the latter is insignificant. Accordingly, jurisdiction competition of public goods will exacerbate local debt crisis. However, among all the explanatory variables, land revenue is the most important factor followed by central fiscal transfer.

Table 9 The GMM estimated results of current local debts for 30 provinces in China during 2001-2011

Variables	$d_{it}-\overline{d_t}$
$d_{it-1}-\overline{d_t}$	0.34*** （14.23）
$p_{it}l_{it}-\overline{p_t l_t}$	0.09*** （7.76）
$b_{it}-\overline{b_t}$	0.03*** （4.34）
$RL_{it}-\overline{RL_t}$	-0.002*** （-5.47）
$WL_{it}-\overline{WL_t}$	-0.001*** （-0.54）
$BV_{it}-\overline{BV_t}$	0.04 （0.59）
$TN_{it}-\overline{TN_t}$	0.02*** （3.03）
$DN_{it}-\overline{DN_t}$	0.00*** (2.61)
Constant	-0.00 (-0.57)
Wald Chi	1895.90
Sargan Value	21.27 （1.00）
AR(1)	-3.06*** （0.00）
AR(2)	0.10 （0.92）
Obs.	300

Note : the numbers in parentheses of AR(1), AR(2) and Sargan value are p values (thereinafter).

Table 10, the deviations of forward land revenue ratio and central fiscal transfer ratio from their mean have positive effects in the deviation of current local debt ratio from its mean. Hence, local governments tend to borrow excess debts and result in higher local debt risk should they could expect the ratios of future land revenue and central fiscal transfer increase. However, as for public goods, only urban water line per capita is significantly correlated. Similarly, jurisdiction competition aggregates local debt risk as well.

Table 10 the FE estimated results of lagged local debts for 30 provinces in China's during 2001-2011

Variables	（$d_{it-1}-\overline{d_t}$）
$d_{it}-\overline{d_t}$	0.25*** （4.05）
$p_{it}l_{it}-\overline{p_tl_t}$	0.04* （1.93）
$b_{it}-\overline{b_t}$	0.03** （2.36）
$RL_{it}-\overline{RL_t}$	-0.001 （-0.26）
$WL_{it}-\overline{WL_t}$	0.004* （1.72）
$BV_{it}-\overline{BV_t}$	-0.001 （-0.41）
$TN_{it}-\overline{TN_t}$	0.01 （0.86）
$DN_{it}-\overline{DN_t}$	0.00 (0.90)
Constant	-0.00 (-0.00)
Wald Chi	4.59
R-sq: within	0.12
between	0.54
overall	0.33
Obs.	300

5. Conclusions and policy implications

Local debt risk has become a severe problem since tax-sharing reform between central government and local governments in 1994. In particular, after market-orientation reform of land in 2002, local government can borrow collateralized on land and repay the debts by land transfer

revenue, which may expose tremendous risks to local debts. Based on jurisdiction competition, land collateral asset and central fiscal transfer, this paper develops a local debt model and utilizes province-level datasets of local debts and land market during 2001-2011 to testify the Propositions.

Theoretical propositions demonstrate that current land revenue ratio is negatively associated with current local debt ratio and local debt risk, while lagged local debts are positively associated with current local debts. If $\frac{\alpha\text{-}\beta}{3\alpha+\beta} < \frac{G_{jt}^{*}}{G_{it}^{*}}$, local debt risk increases with ratios of local public goods provision, otherwise decreases if $\frac{\alpha\text{-}\beta}{3\alpha+\beta} > \frac{G_{jt}^{*}}{G_{it}^{*}}$. Local debt risk increases in the event that a local government expects it can obtain more fiscal transfer from the central government than its rival.

The empirical results show that there exists a vicious cycle between local debt risk and land venue and central fiscal transfer. In other words, the greater current land revenue and fiscal transfer are, the higher the local debt risk is. Thus, provided that land revenue is ascending, collateral effects of land become stronger, local governments incline to excessive indebtedness and local debt risk rises. Similarly, central fiscal transfer enhancement has the same effects resulting in boost of local debt risk. Second, the higher the ratios of forward land revenue and fiscal transfer are, the higher the current local debt risk is. Hence, if local governments could expect the augment of their future land revenue and fiscal transfer, they tend to borrow excess debts, which lead to higher local debt risks. Third, contrary to the Propositions, the ratios of urban road length per capita and urban water line length per capita are negatively associated with local debt risk. *De facto*, local debts for road and water construction can be repaid by charging in China, which results in lower local debt risk. In addition, teachers per thousand persons and medical employees per thousand persons have positive effects on local debt risk, while only urban water line per capita is significantly associated in the lagged debt risk model. As a result, jurisdiction competition deteriorates local debt crisis. Accordingly, to prevent local debt crisis, China's central government should first control the volatility of land revenue, then curtail down fiscal transfer and reinforce hard budget constraints of local governments, finally alleviate vicious competition across local governments.

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Appendix:

From equation 1, we can obtain:

$$\frac{\partial D_{it}}{\partial G_{it}^{*}} = \frac{2kG_{jt}^{*}[(\beta\text{-}\alpha)G_{it}^{*} + (3\alpha + \beta)G_{jt}^{*}]}{\beta(G_{it}^{*} + G_{jt}^{*})^{3}} \tag{15}$$

$$\frac{\partial D_{it}}{\partial G_{it}^{*}} = -\frac{2kG_{it}^{*}[(\beta\text{-}\alpha)G_{it}^{*} + (3\alpha + \beta)G_{jt}^{*}]}{\beta(G_{it}^{*} + G_{jt}^{*})^{3}} \tag{16}$$