LOCAL GOVERNMENT DEBT AND ECONOMIC GROWTH IN CHINA

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Abstract: China's local government debt (LGD) has recently become the focus of economic policy debates. However, information about LGD and its impact on economic growth in the Chinese economy is scarce. This paper attempts to present an empirical investigation of the impact of China's LGD on economic growth. It is probably the first academic paper on China in this area and thus contributes to the general literature on the relationship between government debt and economic growth. The paper first provides an assessment of LGD in China's regional economies using recently released auditing statistics and other secondary information available. It then applies conventional growth analysis techniques to examine the impact of LGD on regional growth in China. Various scenario and sensitivity analyses are also conducted to accommodate the inadequacy and potentially poor quality of debt statistics.

Key Words: Local government debt, regional growth, China

JEL Codes: O11, O53, H74

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1. Introduction

Since the onset of the global financial crisis in 2007, government debt particularly local government debt (LGD) has attracted considerable attention worldwide.[1] Especially the bankruptcy of the City of Detroit has generated a lot of anxieties among policy makers. China is no exception. The country's National Audit Office (NAO) conducted nation-wide auditing of government debts in the regions twice in 2011 and 2013, respectively (NAO 2011, 2013). The 2013 auditing results show that China's total government debt to GDP ratio (hereafter the debt-GDP ratio) in 2012 was about 39% which is below the 60% level set by the Euro convergence criteria.[2] The Chinese government debt alarm seems to be off for the time being.

Economists have for a long time debated about the role of government debt in economic development (Krueger 1987, Krugman 1988). In general, the theoretical literature points to a negative effect of debt on economic growth (Modigliani 1961, Sait-Paul 1992, Corsetti et al. 2010). Early empirical studies mainly focused on the role of external debt in developing economies. For example, Smyth and Hsing (1995) found a non-linear impact of external debt on growth and two IMF working papers showed a negative impact of external debt on growth after the debt-GDP ratio reached certain

[1] For the coverage by the media, examples include the Economist (2009) and Foreign Affairs (Rajan 2012).

[2] The Euro convergence criteria is also known as the Maastricht criteria (ECB 2014).

level such as 20-40% (Pattillo et al. 2002, Clements et al. 2003). The debate was recently reinvigorated by the work of Reinhart and Rogoff (2010) who argued that economic growth disappears as government debt-GDP ratio reaches 90 per cent or the so-called *threshold debt level* in selected OECD economies. Their finding has been challenged and hence stimulated a series of studies in this area (Reinhart et al. 2012, Baum et al. 2013).[3] Some authors pointed out the errors of the Reinhart and Rogoff estimation (Afonso and Jalles 2013, Herndon et al. 2014). Others developed econometric models to test the existence of the threshold debt level (Egert 2013, Pescatori et al. 2014).

However there is generally a dearth of empirical investigations of the role of government debt in economic growth in China, not to mention the information about LGD. Fan and Lv (2012) is probably the first paper published which presented a review of China's government debt situation. The authors concluded with an optimistic view about China's government debt. However they did call for further reforms of China's fiscal and financial system in the long run. A marginally related paper by Tsui (2011) presented a more pessimistic picture about China's LGD. The author linked LGD with investment in large infrastructure projects in China and reckoned that the country's rapid expansion in infrastructure development engenders risks and hence is not sustainable.

This paper aims to extend the literature by presenting an empirical examination of China's LGD and its impact on economic development. It is probably the first empirical

[3] For a survey of the literature, see Panizza and Presbitero (2013).

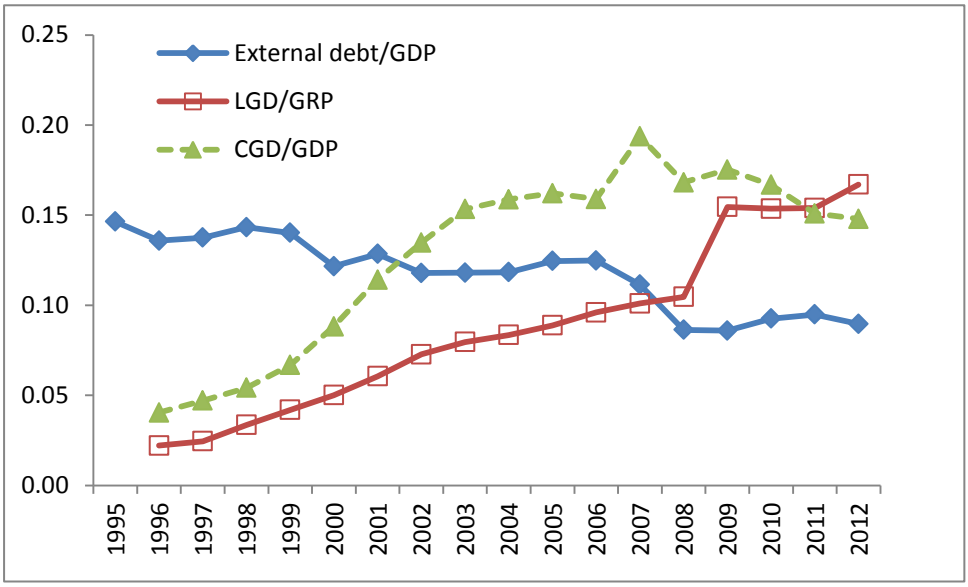
paper on this topic (both papers by Fan and Lv (2012) and Tsui (2011) are descriptive). The rest of the paper begins with the presentation of some stylized facts about government debt in China in Section 2. This is followed by description of the analytical techniques and data issues in Section 3. The empirical findings are discussed in Section 4. Some further analyses are explored in Section 5 with the concluding remarks being presented in Section 6.

2. Stylized Facts about Government Debt in China

Government debt in the People's Republic of China has emerged since the introduction of economic reforms in the late 1970s. After decades of isolation from the rest of the world, the country's central government took foreign loans of about 3.53 billion Yuan (about US$2.2 billion) in 1979 according to the Editorial Board (2013). Since then foreign borrowing had increased steadily and peaked with a total amount of 35.8 billion Yuan (about US$6.1 billion) in 1993. In 1981 Chinese governments started borrowing from the public domestically. As a result government debt grows rapidly. China's local governments are generally prohibited from borrowing from the public directly. However there are exceptions. For example, in 1979 eight counties or districts borrowed from the public (NAO 2011). These became possible only with the permission from the central government. Over time it is reported that more local governments are permitted to increase their government debts. Though local governments cannot borrow from the public directly, they can borrow through their

agencies such as state-owned enterprises (SOEs) and government controlled financial institutions. The consequence of such practice is the escalation of government debt in the regions with little transparency. For this reason, the central government conducted two nation-wide auditing of government debts in 2011 and 2013, respectively. To improve transparency, in early 2014, ten provinces/cities (Beijing, Jiangsu, Shanghai, Shenzhen, Guangdong, Zhejiang, Jiangxi, Shandong, Ningxia and Qingdao) were approved by the Ministry of Finance to issue local government bonds directly. This represents a major change in public finance and governance and may have implications for regional economic development in China.

In general, with the largest foreign reserve, China's external debt is modest with a steadily declining debt-GDP ratio in recent years (Figure 1). However domestic debts owned by both central and local governments have been rising. In 2012, China's total government debt was almost equally shared between the central and local governments. The central government debt (CGD) as a proportion of GDP peaked in 2007 and remained stable at around 16 per cent in the past decade (Figure 1). LGD over gross regional product (GRP) or debt-GRP ratio has maintained an upward trend, particularly in recent years. On average the debt-GRP ratio of the regions exceeded that of the central government during 2011 and 2012. This was probably one of the reasons which triggered the nation-wide auditing of government debt in 2011 and 2013. The debt-GRP ratio however varies considerably among the regions. It ranges from the lowest 7.9 per cent in Shandong to the highest 48.2 per cent in Guizhou in 2012 (Figure 2).

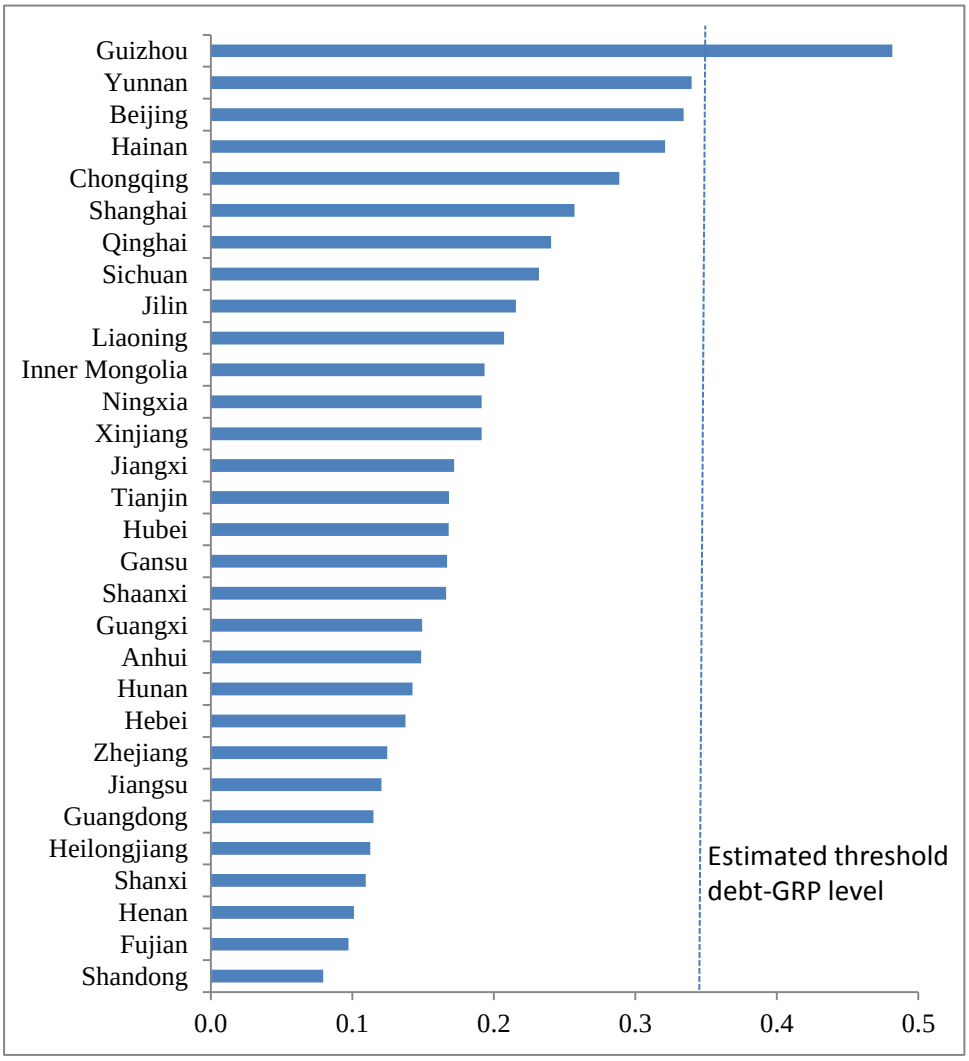


Notes: LGD and CGD are short for the local government debt and central government debt.
Source: author's own work using data from NBS (various years).

Figure 1 Government debt over GDP ratios, 1995-2012

Overall, China's government debt-GDP ratio was about 40 per cent in 2012 which is still well below the OECD average of 107.1 per cent, not to mention 216.5 per cent in Japan in the same year (OECD 2014). However, the assessment of government debt is complicated due to its coverage. In the official auditing reports in both 2011 and 2013, information about three types of government debts was collected. These include 1) debts directly owned by the governments, 2) guarantees by the governments and 3) governments' contingent liabilities. So far government debt mentioned in this study refers to the first category which has the dominant share over total debt of both central and local governments (Figure 3). At the end of June 2013, the share of guarantees and contingent liabilities over total debt of local governments is much bigger than that of the central government (Figure 3). It is also reported that in recent years governments actually paid a maximum of about 19.13 per cent of total guarantees and of about 14.64

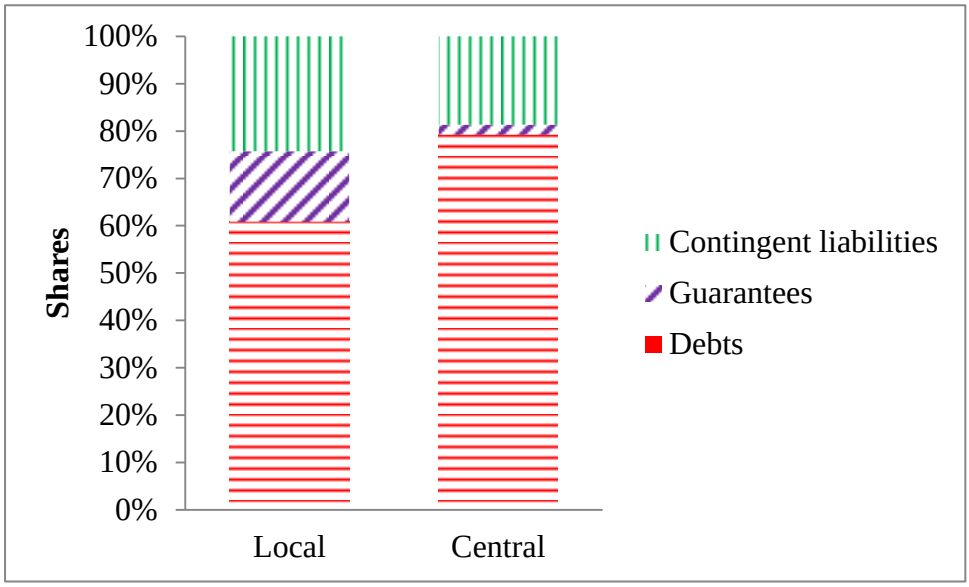
per cent of contingent liabilities (NAO 2013). In the long run, there are certainly risks involved in the management of government guarantees and contingent liabilities.



Sources: Author's own estimates.

Notes: Tibet is excluded due to missing data.

Figure 2 Debt-GRP Ratios by Region, 2012



Sources: Author's own estimates.

Figure 3 Government Debt Composition (End of June 2013)

3. Modelling the Impacts of Government Debt on Economic Growth

To contribute to the understanding of LGD and its impacts, this section presents an empirical study of the effect of LGD on regional economic growth. The modelling and data issues are discussed first. Preliminary analytical results are then followed.

The Model

The effect of government debt on regional economic growth can be examined by adopting the conventional techniques for growth analysis which are well developed in the literature (Barro 1991, Levine and Renelt 1992). These techniques have also been applied to the analysis of economic growth in China (Liu 2002, Chen and Wu 2012). This study will extend the existing literature by incorporating government debt related

variables in the growth equation.[4] Symbolically, a standard growth regression can be expressed as

$$y_{it} = \alpha_i + \beta \ln(Y_{i,t-k}) + \gamma D_{it} + \emptyset D_{it}^2 + \Sigma \delta_j X_{ijt} + \varepsilon_{it} \qquad (1)$$

where *y*, *Y* and *D* represent the growth rates, per capita income and debt level for the i^{th} region in period *t*, respectively. The lagged *Y* is used as a proxy for the initial income level. In the literature, researchers typically focused on five-year growth intervals (Barro 1991, Sala-i-Martin 1997). Therefore in this study a lag of five years is chosen for the initial income variable. A squared term is included to reflect potential nonlinear relationship between growth and debt level. This non-linear relationship has been examined by a large pool of studies recently (Reinhart and Rogoff 2010, Pescatori et al. 2014).

X is a set of region-specific control variables which may affect regional economic growth. The choice of these variables is widely discussed in the literature of cross-country studies.[5] In the case of an individual country like China, the selection of these variables is also partly dictated by the availability of regional economic statistics. In addition, the empirical estimation of equation (1) will have to deal with the problem of endogeneity as the relationship between economic growth and government debt could be bidirectional (Misztal 2010, Afonso and Hauptmeier 2009). Thus several

[4] The existing literature considered the effect of external debt on economic growth in cross country analysis (Clements et al. 2003, Pattillo et al. 2002).

[5] More than 60 country-specific variables were considered by Sala-i-Martin (1997). For a regional study, the number of variables would be much small.

optional estimation techniques are considered. These include the fixed and random effect models, the instrumental variable (IV) approach and GMM methods.

Description of Variables

The dependent variable is the real growth rate (y) of GRP. The initial income variable (Y) is measured by the real GRP per capita with a lag of five years. It is expressed in 2005 constant prices. The precise measure of LGD level (D) is controversial. In the literature, both gross and net debt values have been considered. The most popular indictor of the level of government debt is the debt-GDP ratio in a country or the debt-GRP ratio in a region. The empirical analysis in this study begins with the adoption of this definition which defines D as the ratio of LGD over GRP. The corresponding models are called the *baseline models*. These will be extended by adopting an alternative measure of debt level, namely the ratio of LGD over government revenue. The relevant models are regarded as the *alternative models*.

Five control variables (X) are considered in this study. The first one is a variable capturing population growth in the regions (*pop*) which may have a positive coefficient. Population growth could reflect aggregate demand and hence may be positively correlated with economic growth. The second control variable represents infrastructure development (*inf*) which is measured as the geometric mean of the density of railway lines and highways. The density here refers to both length per capita and length per square kilometer of land. The third variable captures the ratio of regional export values over GRP (*ex*). The fourth variable is the ratio of senior high school enrolment which is

used as a proxy for regional human capital (*hk*). Finally the fifth control variable is measured by the ratio of capital formation over GRP (*cap*). The last four variables are also expected to have positive coefficients.

Summary information about the chosen variables is presented in Table 1. As it is shown in the table, China's regions on average achieved an annual growth rate of 12.35 per cent during 2010-2012.[6] Table 2 also illustrates that the average LGD-GRP ratio is 18.79 per cent while the mean ratio of LGD over government revenue is 180 per cent. There are also considerable regional variations which are reflected in the large range between the minimum and maximum values and the magnitude of standard deviation in Table 1.

Table 1 Summary Statistics of the Variables

Variables	Mean	Standard deviation	Min	Max
Growth	0.1235	0.0213	0.0746	0.1740
Debt/GRP	0.1879	0.0948	0.0661	0.5642
Debt/revenue	1.8000	0.6932	0.8754	4.8142
log(GRP pc)	9.6642	0.5466	8.5275	11.0631
Infrastructure	0.2292	0.0469	0.1325	0.3188
Population growth	0.0081	0.0147	-0.0520	0.0563
Capital/GRP	0.6169	0.1373	0.3803	0.9252
Human capital	0.9060	0.1314	0.6224	1.3307
Export/GRP	0.1476	0.1808	0.0132	0.7037

Source: Author's own estimates.

[6] It should be noticed that there is inconsistency between China's national growth rate and regional growth rates.

Preliminary Estimation Results

Empirical estimation of model (1) starts with the simple version without the control variables (X) and the sample covers the period of 2010-2012 for 30 Chinese regions (Tibet is excluded due to missing data). The results from the pooled regression (PR) and fixed effect (FE) models are presented in Table 2. The random effect (RE) model is also considered. However, the Hausman test statistics show that the FE model is preferred to the RE model and hence the RE modelling results are not reported in the table. The FE modelling result shows a negative coefficient of the initial income variable which implies growth convergence in Chinese regions. It also demonstrates a nonlinear relationship between government debt and regional economic growth. The derived turning point or threshold level is a debt-GRP ratio of 35 per cent.

Table 2 Estimation Results of the Baseline Models

	Pooled regressions		Fixed effect models	
	(1)	(2)	(3)	(4)
Debt	0.1288 (0.0817*)	0.0761 (0.3367)	0.3716 (0.0389**)	0.4388 (0.0287**)
$Debt^2$	-0.2144 (0.1026)	-0.1300 (0.3576)	-0.5351 (0.0483**)	-0.6042 (0.0393**)
log(initial income)	-0.0207 (0.0000***)	-0.0338 (0.0000***)	-0.1200 (0.0000***)	-0.1161 (0.0000***)
Infrastructure		0.0678 (0.1660		-0.0415 (0.8787)
Population		0.3674 (0.0218**		0.2180 (0.0681*)
Investment		0.0207 (0.2181		-0.0314 (0.4759)
Human capital		0.0247 (0.2000		-0.0344 (0.2023)
Trade		0.0237 (0.2263		-0.0524 (0.4916)
Constant	0.3091 (0.0000***)	0.3843 (0.0000***)		
Adjusted R^2	0.2676	0.3386	0.8233	0.8229
Log likelihood			317.17	321.21
Hausman test			73.31 (0.0000***)	59.37 (0.0000***)
LM	3.6008 (0.0578*)	4.4092 (0.0357**)		
Threshold level	0.3004	0.2928	0.3472	0.3631

Sources: Author's own estimates.

Notes: p-values are in parentheses.

The second set of the estimated models extends the simple version of model (1) by incorporating region-specific control variables which can be called the augmented model. The estimation results confirm the non-linear relationship between government debt and economic growth implying a threshold debt-GRP ratio of 36 per cent (Table 2). The estimated threshold debt/GRP level in both the simple and augmented models is much lower than the controversial 90 per cent level reported by Reinhart and Rogoff (2010). However, in the empirical literature, the estimated threshold level for developing economies is generally smaller than that for the developed economies. For example, Pattillo et al. (2002) derived a figure of 35-40 per cent over the period of 1969-98 and Clements et al. (2003) reported a number of 20-25 per cent for developing economies. It is also noticed that the coefficients of the control variables are either significant or insignificant with the wrong sign. In addition, the estimated coefficient of the initial income variable is statistically significant with the right sign. It thus again implies growth convergence among the Chinese regions in recent years.

The above-derived threshold debt-GRP level is well beyond the current mean (16.7 per cent) of the Chinese regions for the recent decade (see Figure 1). At the provincial level, only Guizhou's debt-GRP ratio (48.2 per cent) passed the estimated threshold level in 2012 (Figure 2). Several regions' debt-GRP ratio was close to the threshold level too. These include Yunnan (34.0 Per cent), Beijing (33.4 per cent) and Hainan (32.1 per cent). Therefore the optimistic view about China's regional debt conditions by scholars such as Fan and Lv (2012) is supported here. It seems that most Chinese regional economies are yet to reach the turning point of the debt-GRP ratio. This is of

course based on the narrow definition of government debt as government guarantees and contingent liabilities are not taken into consideration.

4. Further Analyses

Empirical exercises in the preceding section potentially suffer from several shortcomings due to possible bias in the definition of government debt, the limitation of a small sample and the problem of endogeneity. These issues are addressed one by one in this section.

4.1 Alternative Measure of Government debt

The measurement of government debt is controversial. In the preceding section, the conventional practice of using the debt-GRP ratio is adopted. An alternative measure is to use the ratio of government debt over government revenue or the *D-R ratio*. The exercises in Section 3 are repeated and the results are reported in Table 3. Clearly the new results confirm the findings in Section 3. A threshold D-R ratio of 266-270 per cent is observed. In consistency with the definition of debt-GRP ratio, Guizhou is the only region which passed the estimated threshold D-R ratio in 2012 (with an actual ratio of 325 per cent). Other regions with a D-R ratio close to the threshold level include Yunnan (262 per cent), Jilin (247 per cent) and Qinghai (244 per cent). It should be pointed out that Guizhou, Yunnan and Qinghai are all less developed western regions in the country. Overall it can be concluded that the two measures of LGD lead to

consistent estimates and hence findings.

4.2 An Extended Database

A main weakness in the above-mentioned exercises so far is the short period of three years covered by the sample. To extend the database, the mean growth rates of LGD during 2010-2012 and growth rate of total government debt during 2003-2012 are combined to generate a dataset covering 10 years (2003-2012) for all 30 regions. The regressions are rerun using the extended database for both measures of government debt. The results are presented in Table 4. To save space only the results of the augmented model are reported. It is shown that none of the estimated coefficients of the debt-GRP ratio variables is statistically significant (Table 4). However, the models involving the D-R ratio variables are acceptable and the findings are consistent with those from the baseline models.

Table 3 Results with Alternative Measure of Government debt

	(5)	(6)	(7)	(8)
Debt	0.0214 (0.0604)*	0.0170 (0.1665)	0.0399 (0.0101)**	0.0439 (0.1115)
$Debt^2$	-0.0034 (0.1300)	-0.0027 (0.2688)	-0.0075 (0.0029)***	-0.0081 (0.0037)***
log(initial income)	-0.0158 (0.0004)***	-0.0307 (0.0001)***	-0.1108 (0.0000)***	-0.1071 (0.0000)***
Infrastructure		0.0742 (0.1272)		-0.0239 (0.9272)
Population		0.3589 (0.0214)**		0.1582 (0.1723)
Investment		0.0197 (0.2326)		-0.0214 (0.6071)
Human capital		0.0251 (0.1862)		-0.0400 (0.1268)
Trade		0.0274 (0.1663)		-0.0572 (0.4322)
Constant	0.2505 (0.0000)***	0.3409 (0.0000)***		
Adjusted R^2	0.2791	0.3526	0.84	0.84
Log likelihood			321.05	324.68
Hausman test			78.56 (0.0000)***	62.04 (0.0000)***
LM test	2.7441 (0.09762)*	3.7415 (0.05308)*		
Threshold level	3.1105	3.1716	2.6600	2.7099

Source: Author's own estimates.

Notes: p-values are presented in the parentheses.

Table 4 Estimates with the Extended Database

	(9)	(10)	(11)	(12)
Debt	-0.0327 (0.4173)	0.0864 (0.1082)	0.0063 (0.1469)	0.0208 (0.0005)***
$Debt^2$	0.0595 (0.5092)	-0.0278 (0.7692)	-0.0013 (0.1705)	-0.0036 (0.0010)***
log(initial income)	-0.0276 (0.0000)***	-0.0652 (0.0000)***	-0.0270 (0.0000)***	-0.0611 (0.0000)***
Infrastructure	0.0806 (0.0063)***	0.2136 (0.0000)***	0.0719 (0.0146)**	0.1860 (0.0003)***
Population	0.0975 (0.3878)	0.3265 (0.0072)***	0.0991 (0.3788)	0.2450 (0.0437)**
Investment	0.0366 (0.0029)***	0.0750 (0.0000)***	0.0306 (0.0122)**	0.0829 (0.0000)***
Human capital	0.0467 (0.0001)***	0.0320 (0.0394)**	0.0453 (0.0001)***	0.0262 (0.0912)*
Trade	0.0500 (0.0000)***	0.0620 (0.0065)***	0.0480 (0.0000)***	0.0591 (0.0092)***
Constant	0.3039 (0.0000)***		0.2967 (0.0000)***	
Adjusted R^2	0.1476	0.4750	0.1516	0.4810
Log likelihood		833.9700		835.6900
Hausman test		29.0300 (0.0003)***		29.6300
LM test	65.6883 (0.0000)***		72.8379 (0.0000)***	
Threshold level		1.5540	2.5000	2.8889

Source: Author's own estimates.

Notes: p-values are presented in the parentheses.

4.3 Endogeneity

In the field of studies of government debt, a major stream of the literature has focused on the causality between government debt and economic growth. Thus the exercises conducted in this study may suffer from the problem of endogeneity. To deal with this matter, several optional estimation methods can be attempted. These include the use of lags and instrumental variables (IVs) and hence relevant estimation techniques. The extended database makes it possible to introduce lags in the model. First, an IV measuring the mean debt-GRP ratio of neighbouring regions of each province is introduced to replace the debt variable in the models. The estimation results are reported in Table 5 which only covers regressions using the extended sample and augmented model. The debt variables have the expected sign and nonlinearity is also confirmed. For the first measure of debt, none of the estimated coefficients is statistically significant (model 13, Table 5). Thus the model is poorly fitted. For the second measure of debt, the estimated model is much better with the expected sign for the estimated coefficients and a nonlinear relationship between government debt and economic growth (model 16, Table 5).

Second, the lagged debt variable is also added as an IV. The regressions are repeated using three IVs, namely, the mean debt-GRP ratio of neighbouring regions, the 1^{st} order lagged debt variable and the 2^{nd} order lagged debt variable (Models 14 and 17, Table 5). For both debt measures, the estimation results are consistent with those of the baseline models. Finally, a two stage least square (2SLS) method is employed (Models 15 and 18, Table 5). The mean debt-GRP ratio of neighbouring regions and all

exogenous variables are used as the IVs. Once again the results are in general consistent with those of the baseline models. For the first measure of government debt, the estimated threshold debt level ranges from 26.14 per cent to 38.04 per cent. For the second measure of government debt, the estimated threshold value ranges from 259 to 288 per cent.

Table 5 Results of Models with IVs, Lagged Variables and 2SLS

Variables	IV only	IV and lags	2SLS
	Debt level measure I		
	(13)	(14)	(15)
Debt	4.2102 (0.2328)	0.4093 (0.0796)*	0.1799 (0.0598)*
$Debt^2$	-6.5445 (0.2409)	-0.5380 (0.1474)	-0.3441 (0.1041)
log(initial income)	-0.3193 (0.1480)	-0.0851 (0.0000)***	-0.0147 (0.0001)***
Infrastructure	0.6706 (0.1464)	0.2494 (0.0000)***	0.0215 (0.3980)
Population	1.3157 (0.2008)	0.4040 (0.0041)***	-0.0625 (0.5345)
Investment	0.1969 (0.1384)	0.0846 (0.0000)***	0.0487 (0.0001)***
Human capital	-0.0941 (0.4732)	0.0221 (0.2170)	0.0361 (0.0004)***
Trade	-0.1888 (0.4324)	0.0424 (0.1281)	0.0245 (0.0070)***
Threshold level	0.3217	0.3804	0.2614
	Debt level measure II		
	(16)	(17)	(18)
Debt	0.1070 (0.0002)***	0.0985 (0.0002)***	0.0374 (0.0071)***
$Debt^2$	-0.0186 (0.0002)***	-0.0171 (0.0002)***	-0.0072 (0.0117)**
log(initial income)	-0.0826 (0.0000)***	-0.0804 (0.0000)***	-0.0138 (0.0003)***
Infrastructure	0.1471 (0.0347)**	0.1509 (0.0236)**	-0.0016 (0.9560)
Population	0.2671 (0.1024)	0.2649 (0.0906)*	0.0083 (0.9338)
Investment	0.1213 (0.0000)***	0.1176 (0.0000)***	0.0379 (0.0054)***
Human capital	-0.0095 (0.6884)	-0.0060 (0.7904)	0.0428 (0.0000)***
Trade	0.0109 (0.7483)	0.0156 (0.6285)	0.0217 (0.0186)**
Threshold level	2.8794	2.8796	2.5929

Sources: Author's own estimates.

Notes: p-values are in parentheses.

4.4 A Dynamic Model

(to be done)

5. Conclusion

This paper adopts traditional growth regression analysis to examine the impact of government debt on economic performance in China's regional economies. The empirical findings confirm the existence of a non-linear relationship between economic growth and local government debt (LGD). The threshold level of government debt in China is found to be much lower than that observed in most studies of OECD economies. It is also shown that almost all Chinese regions have not reached the threshold level debt yet. This may help reduce the anxiety about China's LGD for the time being.

(more discussions)

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