Local Government Debt, a Time-bomb for China's Economy?

Zhou Ming Matt, Wang Man Cang, Ni Ming Ming

Abstract

China's national audit office reported huge debt accumulated at all levels of local governments in recent years. This paper aims to explain the factors contributing to the local government debt in China with empirical study on the economic development data. The relationship of government debt and economic ratios is examined with the auto-regressive linear equation constructed between the local government debt, fiscal income, GDP growth rate and CPI. Granger causality test is performed to find the granger cause of local government debt from previous year's data. From the analysis, the risk of local government debt is evaluated from the global settings. Policy implications and suggestions are presented at the end.

I.   Introduction

When Detroit filed for bankruptcy in 2011, its debt was $18 billion. By comparison, China's national audit office reported that 36 selected cities and local governments owning an average of $17.4 billion each, roughly the same size of debt with Detroit. Hence many researchers have asked the question, whether the huge local government debt would become a time-bomb for China and lead to another financial crisis in the future.

On the other hand, China's economy has grown enormously in the past three decades with an annual GDP increase of about 10%. It's reasonable to assume that the huge amount of economic development is fueled by significant public financing efforts including all levels of government debt in China. In particular, the centralized financial budgeting system established from the 1994 tax reform has set the shared ownership for the tax revenues between central and local governments. The central government has got the most stable and lucrative taxes such as sales and excise taxes while the local governments are poorly funded, which has then raised various forms of debt to support and fuel the local economic growth since then.

The national audit office of China has reported that all levels of the government debt had a total of 30 trillion Yuan ($4.78 trillion), or about 130% of its annual income by the end of June 2013. 59% of them were owned by the local governments. According to the data, the central government debt has been kept stable while the local government debt

has grown significantly in recent years, which is widely viewed as a threat to the economy and may spin out of control. Though Chinese government has recognized the serious of the debt problem and taken measures to address the issues, the debt problem wouldn't be resolved soon due to the complexity of the issues and huge size.

Ph.D. candidate, School of Economics and Management, Northwest University, Xian, China, mingzhou@stumail.nwu.edu.cn; Professor of Finance, Northwest University, Xian, China, wang-mc@163.com; Ph.D., School of Economics and Management, Northwest University, Xian, China, 297257001@qq.com

This paper studies the relationship of government debt and economic ratios with with the auto-regressive linear equation constructed between the local government debt, fiscal income, GDP growth rate and CPI. Furthermore, granger causality test is performed to find the granger cause of local government debt from previous year's data. It proceeds with the analysis of the result with the global settings. Policy implications and suggestions are discussed with the concluding remarks presented afterwards.

II.   Literature Review

Many researchers have expressed cautionary views on economic growth with high level of government debt. Orszag, Rubin and Sinai (2004) made the claim that rising debt levels could alert investors and cause interest rates to spike so that higher return can be guaranteed for investors to keep financing the debt. The interest rate spike would lead to financial market disturbance or "disarray". Manasse and Roubini (2005) have reviewed the academic literature on sovereign debt defaults and found that exposure to currency risk dominates the probability of debt default or financial crisis. Carment Reinhart and Kenneth Rogoff have analyzed economic data and financial crises across dozens of countries and hundreds of years. Their work published in the book, The Time is Different: Eight Centuries of Financial Folly (2009), has gained much attention about the Growth in a Time of Debt (GITD). The conclusion is that there is no association between debt and growth at low or moderate levels of debt, while the economic growth will be negatively impacted when the threshold of 90% (government debt to the GDP) is crossed. Irons and Bivens studied the United States economy data and argued (2010) that the GITD "90% threshold" for gross government debt should not be used as a guide for U.S. fiscal policy. They found that U.S. has only exceeded the 90% threshold in six of the two hundred and eighteen years, all of them are in the 1940s WWII period. And if removing the defense spending contributions, the GDP growth is nearly double that of the low-debt years. Pescatori et al. (2014) developed econometric models to test the existence of a threshold debt level. It's been claimed that as the United States can borrow in own currency and have independent monetary and exchange rate policies, using the simple ratio of public debt to GDP as a predictor variable is not wise.

The local government debt (short-named as LGD) issues in China have been a hot topic recently. With the rising level of debts, many scholars have shared the concerns. Liu Shangxi and Guo Yanhong (2003) stated that local and central government in China would be ultimately responsible for the fiscal risks if the local debts couldn't be paid back in time. High level of LGD would increase the pressure on fiscal policies and lead to reduced income for the local governments. Zhang Li (2011) reported the relationships between the local government official promotion and raising debt levels for local infrastructure investment. Fan Jiangyong and Mo Jiawei (2014) have found that local governments are strongly motivated to raise debts due to the direct increase on GDP and indirect effect on industrial growth from the leverage of capital investment. The authors reckoned that the model of raising debts for large infrastructure development and economic growth would lead to higher housing cost and endanger risks, hence is not sustainable. Given that there's little information about detailed LGD data, Wu Yanrui (2014) has collected data from China's regional economies and examined the impact of LGD to regional growth in China. It's concluded with an optimistic view that the risk of LGD in China is lower than that observed in most studies of OECD economies, hence the anxiety should be reduced.

III.   Data and Methodology

Generally local governments are not allowed to borrow from the public directly by law in China. Due to the shared ownership of local tax revenues with the central government and lack of funding for regional development, local governments have borrowed through the so-called shadow banks or agencies, such as state-owned enterprises (SOEs) and government controlled financial institutions. Such practice has escalated recently and led to an enormous debt with little transparency. For this reason, the national audit office conducted two nation-wide audits of government debt, in 2011 and 2013.

Figure 1: GDP, Local Government Debt and Fiscal Income Growth in China
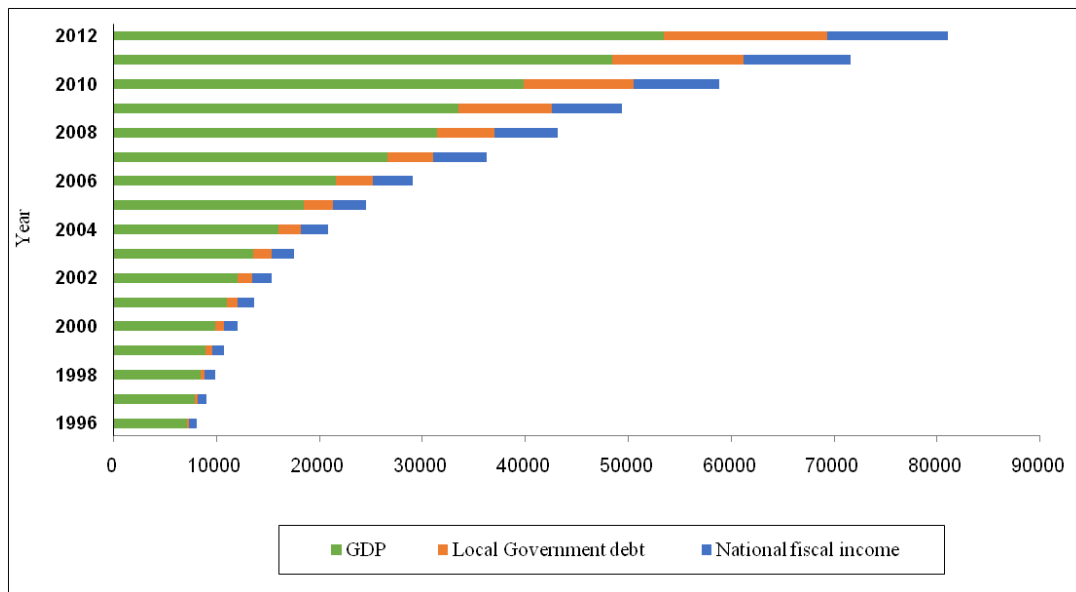
As shown in Figure 1, the amount of local government debts, GDP and national fiscal incomes are displayed from 1996 to 2012 based on the data obtained from the China Economics and Social Development Statistics database and report from national audit office. It appears that the LGD has increased along with the GDP and fiscal incomes over the years.

The ratios of LDG to GDP and fiscal incomes along with the GDP increase rate are illustrated in figure 2 for the same period. It's clear that local government debt in China has grown significantly since 2008, when the government decided to make huge capital investment in responding to the global financial crisis. Meanwhile, the GDP increase shows the downward trend from the peak of 14.2% in 2007 to 7.7% in 2012.

Figure 2: Ratios of Local Government Debt and GDP Increase in China
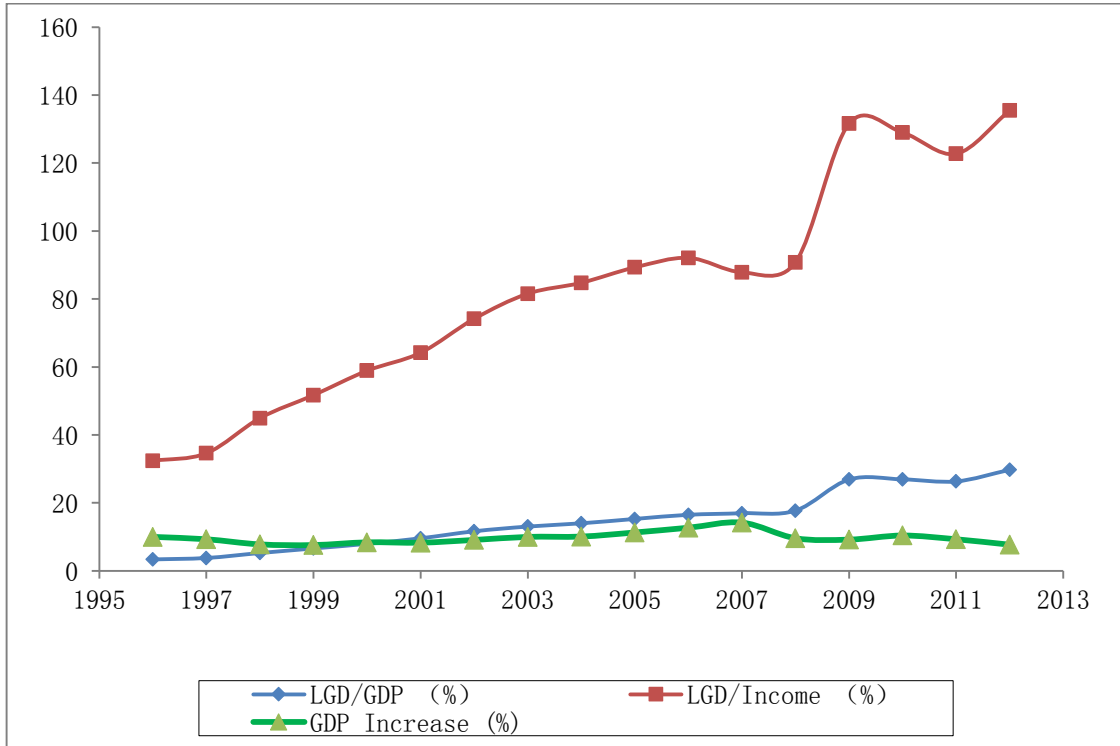
     To find out the relationships between government debt (referred as Debt), fiscal income (referred as Income), fiscal expense (referred as Expense), GDP and interest rate (referred as R), we assume that the change of government debt is the net difference of fiscal income and fiscal expense after the payout of interest on existing debt，as described below

$$\frac{dDebt(t)}{dt} = -[Income(t) - Expense(t) - Debt(t) * R(t)] \qquad (1)$$

If Y is used to represent the yield, and P stands for the Price, then

$$GDP(t) = Y(t) * P(t) \qquad\qquad (2)$$

If we use DR to represent the ratio of government debt to GDP, then

$$\frac{dDR(t)}{dt} = \frac{d[Debt(t)/GDP(t)]}{dt} = \{\frac{dDebt(t)}{GDP(t)} - \frac{Debt(t)}{GDP(t)}[\frac{dY(t)}{Y(t)} + \frac{dP(t)}{P(t)}]\}/dt \quad (3)$$

we plug in equation (1) into (3), and it becomes

$$\frac{dDR(t)}{dt} = FR(t) - [YR(t) + IR(t) - R(t)] * DR(t) \qquad\qquad (4)$$

in which we have defined the following variables:

Debt-to-GDP ratio: DR(t) = Debt(t) / GDP(t)
Economic growth ratio: YR(t) = dY(t) / Y(t)
Inflation rate: IR(t) = dP(t) / P(t)
Fiscal deficit ratio: FR(t)=[Expense(t)-Income(t)] / GDP(t)

If we assume the four ratios including YR, IR, FR and R are constant, then Equation (4) is a first order differential equation on DR(t). The solution is

$$DR(t) = \frac{FR}{YR + IR - R} + ce^{-(YR+IR-R)t} \qquad (5)$$

in which, c can be any constant.

This means that the government debt will converge if the sum of economic growth rate and inflation rate is higher than the interest rate; otherwise, the government debt will grow out of control.

In China, the government debt usually has a fixed interest rate set by the state owned bank. Hence we should examine the economic growth ratio and inflation rate. With empirical data, the natural logarithm system is used to model the relationship between local government debt, GDP growth ratio, CPI and national financial income in this paper. The following auto-regressive linear equation is constructed:

$$Ln(Debt_t)= k_0 + k_1(GDPGrowth_t) + k_2 Ln(Income_t) + k_3 (CPI_t) + u \qquad (6)$$

Description of variables:

Debt: Local government debt （trillion RMB Yuan）in period t.
GDPGrowth: Gross Domestic Product growth ratio (%) in period t.
Income: National fiscal income （trillion RMB Yuan）in period t.
CPI: Consumer Price Index (%) in period t.

The Consumer Price Index is introduced to reflect the impact of inflation. The increase of CPI will discourage government spending and may impact debt level.

IV.   Results and Analysis

Eviews software is used to perform the analysis using the ordinary least square method. The result is listed as below.

$$Ln(Debt)= 0.015 *GDPGrowth + 1.48 * Ln(Income) – 0.041 * (CPI) – 0.0045 \quad (7)$$

The result above shows the calculated result. From the R square value (0.995) and F statistics (892.27) ，we can see the estimated equation is pretty good.

Based on the time series data above, Augmented Dickey-Fuller unit root testing (ADF) is conducted to verify the stability of the time series. Table 1 shows that for variable Ln(Debt), Ln(GDPGrowth), Ln(Income) and CPI, the critical value of unit root test statistics at 1%, 5%, and 10% significance levels are less than the value of T-statistic, and therefore the null hypothesis cannot be rejected, namely variable Ln(Debt), Ln(GDP), Ln(Income), CPI are non-stationary series. For each variable in the first order difference, the critical value of unit root test statistics is greater than the value of T-statistic. Hence after the first order difference, the time series of delta Ln(Debt), delta Ln(GDPGrowth), delta Ln(Income) and delta CPI are stable with the same integration order level, which meets the co-integration test requirement.

Table 1: ADF Unit Root Testing Result

Variable	T-statistic	1% level	5% level	10% level	Stable?	Integration order level
Ln(Debt)	-1.225219	-3.920350	-3.065585	-2.673459	No	1st order
$\triangle$Ln(Debt)	-4.264533	-3.959148	-3.081002	-2.681330	Yes	
GDPGrowth	-1.635215	-3.9203495	-3.065585	-2.673459	No	1st order
$\triangle$GDPGrowth	-3.164997	-3.959148	-3.081002	-2.681330	Yes	
Ln(Income)	0.770552	-3.920350	-3.065585	-2.673459	No	1st order
$\triangle$Ln(Income)	-3.626722	-4.004425	-3.098896	-2.690439	Yes	
CPI	-1.488997	-4.004425	-3.098896	-2.690439	No	1st order
$\triangle$CPI	-4.055509	-3.769597	-3.004861	-2.642242	Yes	

Next, the residual (e_t) is inspected according to the estimation results and the residual time series. Table 2 displays the result of Augmented Dickey-Fuller unit root testing on the residual.

Table 2: Residual Testing Result

Residual	T-statistic	1% level	5% level	10% level	stable?
e_t	-3.064736	-3.959148	-3.081002	-2.681330	Yes

As the T-statistic value of -3.064736 is close to or less than the critical value of unit root test statistics at 5% and 10% significance levels, the residual (e_t) is considered as a stationary series. The results show that during the period from 1996 to 2012, Ln(Debt) has co-integration relationship with GDPGrowth, Ln(Income) and CPI with the co-integration vector of (0.015, 1.48, -0.041). Thus there is a long-term equilibrium relationship between Ln(Debt), GDPGrowth,

Ln(Income) and CPI.

To further analyze the cause-effect relationship between the variables of Ln(Debt), GDPGrowth, Ln(Income) and CPI, the Granger causality test is performed with Eviews and here is the result：

Table 3: Granger Causality Test Result

	Lags: 1		Lags: 2		Lags: 3	
Null Hypothesis:	F-Statistic	Prob.	F-Statistic	Prob.	F-Statisti	Prob.
GDPRATE does not Granger Cause LNDEBT	0.54765	0.4724	31.8717	5.E-05	14.3306	0.0023
LNDEBT does not Granger Cause GDPRATE	0.08609	0.7738	0.29891 0.7480		0.17221	0.9118
LNINCOME does not Granger Cause LNDEBT	2.89658	0.1125	4.64112	0.0375	6.56409	0.0192
LNDEBT does not Granger Cause LNINCOME	3.45749	0.0857	2.02944 0.1821		0.4900	0.7001
CPI does not Granger Cause LNDEBT	0.34873	0.5650	3.21221	0.0837	3.41354	0.0820
LNDEBT does not Granger Cause CPI	4.84415	0.0464	3.84090	0.0579	8.37952	0.0102

From the result, it's clear that at Lag 1 the null hypothesis is accepted, but since lag 2 the null hypothesis is rejected. The probabilities that the GDP growth rate doesn't granger cause Ln(Debt), and the Ln(Income) doesn't granger cause Ln(Debt) are below 5%，hence the GDP growth rate and Ln(Income) are considered as the Granger cause for Ln(Debt) after the 2nd year; similarly, CPI doesn't Granger cause Ln(Debt), but Ln(Debt) is the Granger cause for CPI.

V.   Policy implications

From the above analysis, it's interesting to find that the government debt level grows as the fiscal income and GDP growth rate increase. This implies that local government official's intent to raise more debt when they have more fiscal income and become more confident on their financial status, or when they see a better GDP growth coming out from the previous investments. This explains that the local government have leveraged the debts for fast economic growth. It's also interesting to find that CPI has a negative impact on the local government debt. When CPI increases, it increases the cost for local governments to borrow, and purchase raw materials for the local infrastructure development projects. Considering the budget and other fiscal constraints, local government officials tend to raise less debts.

Prior to 2008, the increase of global leverage and debt issues were largely led by the developed countries; but after that, the developing countries are considered by the international community as playing the major role for the rising global leverage. This means that developing

countries may become the protagonist of the next financial crisis. As the world's largest developing country and 2nd largest economy, China's increasing leverage and particularly, LGD issues have been on alert.

To deal with the threat, the local governments are setting up various alarm systems that can evaluate the debt default risk from time to time by collecting different economic data and analyzing their combined impact to the debt pay back capabilities of the governments. However, this type of alarm system cannot resolve the debt problem on its own. To increase the transparency of financial data, one resolution is to allow local governments to issue bonds, which will help reduce the risks from uncertainty. In 2014, ten provinces and municipalities including Beijing, Jiangsu, Shanghai, Shenzhen, Guangdong, Zhejiang, Jiangxi, Shandong, Ningxia and Qingdao received approval from the Ministry of Finance for the first time 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 addition, it's been suggested to add debt reduction progress as part of the performance evaluation matrix along with the economic development and environment protection for local government official promotion. This may help reverse the trend of debt accumulation from the management level. Finally, the reform of tax revenues system with the re-balanced responsibilities and ownership between central and local governments can significantly change the way local governments finance regional economic development activities, and may resolve the local debt issues ultimately. In summary, we think the local debt problem in China should be resolved with further balance of financial authority and responsibilities between the local and central governments, prudent investment and increased transparency on government fiscal spending, reforms on local official promotion mechanism from GDP-driven to a more balanced sustainable development approach.

VI.   Concluding Remarks

After the Greek debt crisis broke out and Detroit filed for bankruptcy, China's rapid increase of debt accumulated at all levels of local governments has brought much attention. Based on the Economics and Social Development data, the local government debt issues are analyzed and the auto-regressive linear equation is constructed to study the relationship between local government debt level, the fiscal income, GDP growth rate and CPI. From the equation, it's interesting to find that the government debt level grows as the fiscal income and GDP increases. This explains that the local governments have leveraged the debts extensively for economic growth. It's also interesting to find that CPI has a negative impact on the local government debt amount. Further analysis shows that Ln(Debt) has co-integration relationship with GDPGrowth, Ln(Income) and CPI with the co-integration vector of (0.015, 1.48, -0.041). The GDP growth rate and Ln(Income) are the granger causes for Ln(Debt) after the 2nd year，which implies that the local governments have determined the amount of debt to be raised by considering the GDP growth rate and fiscal income from the two years before.

According to the national audit office, China's growth rate in 2015 has gone down below 7% for the first time in last 25 years. It's apparent that China's economic growth is slowing down with the annual GDP increase of 10% during the last several decades to about 7% in recent years. The GDP-driven economic development has led to the economic boom with wide-spread pollution and large amount of debts accumulated at all levels of governments. Chinese government has begun to

take serious measures such as promoting thrifty with reduced spending budget, and eliminating debts aggressively on a pre-set schedule. Based on the research, the government debt would converge if the economic growth were maintained at a modest level with the interest rate kept low. It's reasonable to state that the LGD issues in China are manageable though caution and close monitoring on the status should be remained in the coming years.

References

Afonso, A. & Jalles, J. T. (2013),"Growth and Productivity: The Role of Government Debt", *International Review of Economics and Finance*, Vol. 25(C), 384–407.

Anthony, G. Y. & Wu, F. L.(1996), "The New Land Development Process and Urban Development in Chinese Cities", *International Journal of Urban and Regional Research,* Volume 20, Issue 2, 330–353, June.

Afonso, A., Arghyrou, M. G. & Kontonikas, A. (2014), "Pricing Sovereign Bond Risk In The European Monetary Union Area: An Empirical Investigation", *International Journal of Finance & Economics*, Volume 19, Issue 1, 49–56, January.

Baum, A. & Checherita-Westphal, C. & Rother, P. (2013), "Debt and Growth: New Evidence from the Euro Area", *Journal of International Money and Finance*, Vol. 32(0), 809–821.

Cai, H. & Treisman, D. (2005), "Does Competition for Capital Discipline Governments? Decentralization, Globalization, and Public Policy", *American Economic Review,* Vol. 95(3), 817–830.

Checherita-Westphal, C. & Rother, P. (2012), "The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area"，*European Economic Review*, Elsevier, vol. 56(7), 1392–1405.

Cochrane, J. H. (2011), "Understanding policy in the great recession: Some unpleasant fiscal arithmetic," *European Economic Review*, Elsevier, vol. 55(1), 2–30, January.

Diamond, P. A. (1965), "National Debt in a Neoclassical Growth Model", *American Economic Review*, Vol. 55(5), 1126–1150.

Fan, J. & Mo, J. (2014), Analysis of Local Debts, "Land Supply and Local Industrial Growth", *Economic Research* [China], 1: 41–55.

Faraglia, E. & Marcet, A. & Scott, A. (2010), "In Search of a Theory of Debt Management", *Journal of Monetary Economics,* Elsevier, vol. 57(7), pages 821-836, October.

Furceri, D. & Zdzienicka, A., "How costly are debt crises?," *Journal of International Money and Finance*, 2012，Elsevier, vol. 31(4), pages 726–742.

Ghosh, A. R. & Kim, J. I. & Mendoza, E. G. & Ostry, J. D. & Qureshi, M. S. (2013), "Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies," *Economic Journal*, Royal Economic Society, vol. 0, pages F4–F30, 02.

Kourtellos, A. & Stengos, T. & Tan, C. M. (2013), "The effect of public debt on growth in multiple regimes," *Journal of Macroeconomics*, Elsevier, vol. 38(PA), pages 35-43.

National Audit Office (2011), Local Government Debt Audit Result in China, Pub. 35 from http://www.audit.gov.cn/n1992130/n1992150/n1992500/2752208.html.

National Audit Office (2013), Local Government Debt Audit Result of 36 Cities, Pub. 24 from http://www.audit.gov.cn/n1992130/n1992150/n1992500/3291665.html.

National Audit Office (2013), Local Government Debt Audit Result in China, Pub. 32 from http://www.audit.gov.cn/n1992130/n1992150/n1992500/3432077.html

Panizza, U. & Presbitero, A. F. (2013), "Public Debt and Economic Growth in Advanced Economies: A Survey," *Swiss Journal of Economics and Statistics*, Swiss Society of Economics and Statistics (SSES), vol. 149(II), pages 175–204, June.

Reinhart, C. M., and K. Rogeoff (2010), "Growth in a Time of Debt", *American Economic Review*, Vol. 100(2), 573–578.

Reinhart, C. M., V. R. Reinhart, K. S. Rogoff (2012), "Public Debt Overhangs: Advanced-Economy Episodes Since 1800", *Journal of Economic Perspective*, Vol. 26(3), 69–86.

Teles, V. K. & Caio, C. M. (2014), "Public debt and the limits of fiscal policy to increase economic growth," *European Economic Review,* Elsevier, Vol. 66(C), 1–15.

Xu, J. G., and Zhang, X. (2013), "the Current Status, Sourcing and Risk Analysis of Government Debt in China", *Southern China Economy* [China], Issue 1.