

An Empirical Study on the Relationship Among Taxation, Government debt and Economic Growth

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Abstract

This paper focus on the relationship between taxation, government debt and GDP growth based on VAR model. The empirical results show (1)economic growth mainly depends on productive factors, government debt and taxation has weak influence on economic growth. (2)economic growth has great effect on taxation both in the long term and in the short term. (3)government debt relays on economic growth heavily in the long term, short-term impact of GDP on debt is relatively small, long-term impact of GDP is greater, impact of taxation on debt is weak.

Keywords

Taxation, Government debt, Economic growth, Impulse response.

1. Introduction

By 2017, the scale of China's GDP has reached 82 trillion yuan, total tax revenue has exceeded 14 trillion yuan, total government debt of central and local governments is nearly 30 trillion yuan, government funds and social security funds are nearly 12 trillion yuan. The resources allocated through public sectors account for 68% of the total social resources. Besides government funds and social security funds which is for special use, taxation and government debt reach 44 trillion yuan, accounting for 54% of the total social resources. Both in theory and in practice, there is a very important relationship among taxation and government debt and economic growth. So, whether such a huge scale of taxation and government debt is reasonable, whether it will restrain economic growth to a certain extent, whether it will incur a huge debt risk, these questions are not easy to answer. The relationship among taxation, government debt and economic growth is both a theoretical issue and a practical issue. In addition, whether taxation can substitute government debt or government debt can substitute taxation to a certain degree, if any, how to substitute, these problems make taxation, government debt and economic growth have a crisscross and complicated relationship.

A certain scale of tax revenue is the base for economic growth because it provides basic public infrastructure for economic development. However, if the scale of tax revenue is too large, it will reduce the supply of labor and capital to a certain degree and decrease consumer demand. Therefore, taxation is a double-edged sword for economic growth, which can promote economic growth, and which may also inhibit supply and demand.

As a main means to cover the fiscal deficit, government debt has gradually become a common policy tool in modern countries. Judging by the impact of government debt on economic growth, government debt with consumption nature will increase total social demand in the short term, and have a certain positive effect on economic growth, but its long-term effect is negative. Government debt with production nature will have crowding-out effect on social production and consumption in the short term, but it will increase supply and promote economic growth in the long term. Judging by the scale of government debt, government debt with reasonable scale should be beneficial to economic growth, while government debt with excessive scale may inhibit economic growth. Therefore, how to coordinate the debt with Consumption nature and debt with production nature and

how to set a reasonable debt scale, are important issues that can not be avoided in the policy decision-making of government debt.

Because of different caliber of government debt, it is difficult to obtain complete data to research government debt, especially local government debt. There are few empirical studies on government debt. Chinese government declared to employ the debt balance management system in 2006. Central Audit Office issued the audit report on local government debt in 2010, which provides important debt data of both central government and local government. The empirical conclusions of the relationship between government debt and economic growth are very similar. The research of Lu Jian [1] shows that government debt has a very significant and positive impact on economic growth in the short term, but in the long run, low-debt burdent provinces have a significant positive impact on economic growth, and high-debt burdent provinces have a significant negative impact on economic growth. The research of Zhu Wenwei and Chen Yong [2] shows that local government debt is positively correlated with regional economic growth.

There is no obvious difference in the empirical study on the relationship between taxation and economic growth in China. Guo Qingwang and Lu Bingyang [3] show that the rapid increase of tax revenue has a negative impact on economic growth. Li Yongyou [4] Empirical analysis shows that China's taxation has a significant negative effect on the economy even when considering government expenditure.

As China's market economic system is still in the process of development and improvement, compared with European and American countries and emerging market economy countries, China's economic development has its distinct characteristics, government still play a important role to a certain degree in the process of economic development, which means, the productive nature of taxation and government debt is still significant. Therefore, it is deficient to study the relationship between taxation and economic growth or relationship between government debt and economic growth independently. Only by putting taxation, government debt and economic growth into an framework can their mutual relationship be revealed.

2. Empirical Research

In this paper, RGDP represents economic growth rate, ldebt and cdebt represent local debt and central debt independently, debt represents total debt of central government and local government, tax represents total tax revenue, RTAX represents tax burden, RDEBT represents government debt burden. Local debt data for 2000-2013 are derived from the report of the National Audit Office and the caculation based on the report of the National Audit Office. Central debt data for 2000-2004 are derived from the data of the Ministry of Finance website. Other data are from the websites of China Macro and the website of Ministry of Finance.

Table 1. Dataset of 2000-2017.

year	GDP	ldebt	cdebt	Debt	tax
2000	100280	4940	17416	22356	12582
2001	110863	6586	20016	26602	15301
2002	121717	8780	23214	31994	17636
2003	137422	11091	26415	37506	20017
2004	161840	14010	29615	43625	24166
2005	187319	17697	32614	50311	28779
2006	219439	22355	35015	57370	34804
2007	270232	28239	52075	80314	45622
2008	319516	34870	53272	88142	54224
2009	349081	56461	60238	116699	59522
2010	413030	67110	67548	134658	73211
2011	489301	80384	72045	152429	89739
2012	540367	96282	77566	173848	100614

2013	595244	114302	86747	201049	110531
2014	643974	154074	95055	249129	119175
2015	689052	147568	106600	254168	124922
2016	744127	153164	120067	273231	130361
2017	827122	164706	134770	299476	144360

The basic assumption of Var model is the stability of time series. In order to ensure the validity of regression and avoid the occurrence of pseudo-regression, time series data needs to satisfy the stationarity test first. This paper uses the commonly used ADF method to test the stationarity of sequences:

Table 2. Results of Stationarity Test.

	rgdp	rdebt	rtax	drgdp	drdebt	drtax
adf	-2.94679	-2.28659	-2.946898	-5.153304	-4.16977	-5.568365
1%	-4.728363	-4.72836	-4.728363	-2.740613	-2.74061	-2.740613
5%	-3.759743	-3.75974	-3.759743	-1.96843	-1.96843	-1.96843
10%	-3.324976	-3.32498	-3.324976	-1.604392	-1.60439	-1.604392
p	0.177	0.4153	0.177	0.001	0.0005	0
Check Type	c,t,1	c,t,1	c,t,1	0,0,1	0,0,1	0,0,1
	Nonstationary	Nonstationary	Nonstationary	Stationary	Stationary	Stationary

As can be seen from Table 2, the ADF test values of GDP growth rate, tax burden rate and debt burden rate are all greater than the critical values at the significant levels of 1%, 5% and 10%, and there are unit roots, all the time series of rgdp, rdebt and rtax are unstable. However, the first-order difference is stable at the significant level of 10%, and all the time series of economic growth rate, tax burden rate and debt burden rate are one-order single integral at the significant level of 1%. So, there may be a long-term equilibrium relationship among them, that is, cointegration relationship.

Table 3. Results of Cointegration Test.

Trace Test	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
	None *	0.812536	41.38063	29.79707	0.0015
	At most 1 *	0.632644	16.26806	15.49471	0.0382
	At most 2	0.079753	1.246703	3.841466	0.2642
Maximum Eigenvalue	Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
	None *	0.812536	25.11256	21.13162	0.0130
	At most 1 *	0.632644	15.02136	14.26460	0.0379
	At most 2	0.079753	1.246703	3.841466	0.2642

Table 3 shows that the trajectory test results reject the original hypothesis that there is no co-integration relationship and there is a maximum co-integration relationship, which indicates that there are two co-integration relationships among economic growth rate, tax burden rate and debt burden rate at the 5% significant level. At the same time, the maximum eigenvalue test supports the result of trajectory test.

Lag period must be designed to set VAR model . If the lag period K is too small, it will lead to inconsistent of parameters estimation. In VAR model, increasing lag variables properly can eliminate the existence of autocorrelation, but the larger lag period K will lead to reduced degrees of freedom, which affect the effectiveness of parameter estimation. In this paper, the AKaike information criterion AIC is used to select the lag period. The lag period k is designed to be 2 by testing, and the model is set to VAR (2). The result of parameter estimation is expressed in matrix form as follows:

$$\begin{pmatrix} GDP \\ DEBT \\ TAX \end{pmatrix} = \begin{pmatrix} 6.804624 \\ -6.341101 \\ 3.878107 \end{pmatrix} + \begin{pmatrix} 0.025785 & 0.096512 & 0.332085 \\ 5.690286 & -0.026182 & -3.632530 \\ 0.03492 & 0.123002 & 0.489004 \end{pmatrix} \begin{pmatrix} GDP(-1) \\ DEBT(-1) \\ TAX(-1) \end{pmatrix} + \\
 \begin{pmatrix} 0.094014 & 0.017324 & -0.249328 \\ -2.424909 & 0.071662 & 3.120268 \\ 0.295594 & 0.027635 & -0.384514 \end{pmatrix} \begin{pmatrix} GDP(-2) \\ DEBT(-2) \\ TAX(-2) \end{pmatrix} \tag{1}$$

The test results of the VAR model show that the eigenvalues are all in the unit circle (see Fig. 1), and the residual sequence obeys normal distribution, and there is no heteroscedasticity and autocorrelation, that is, there is no deviation in Var model.

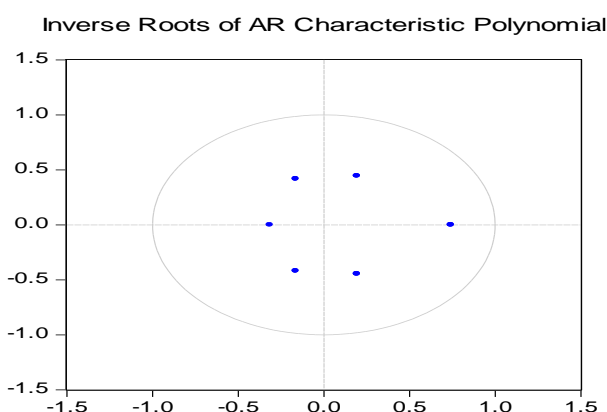


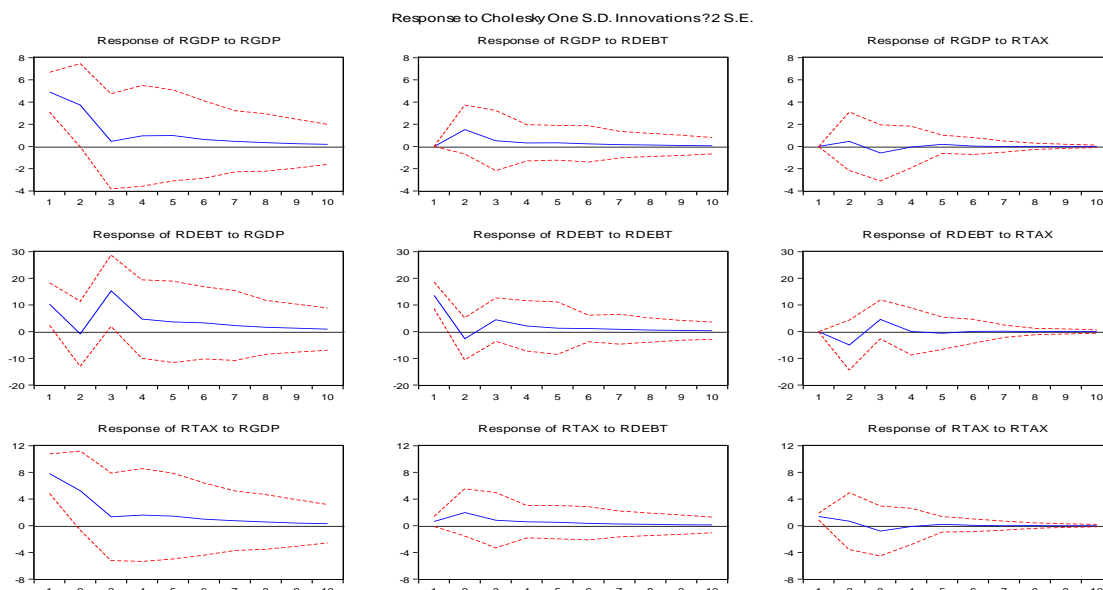
Fig. 1 Inverse Roots of AR Characteristic Polynomial

3. Impulse Response Analysis

Since the OLS parameters estimators of VAR model is only consistency, it is difficult to interpret the single parameter estimators economically, so it is necessary to analysis the impulse response of the system. Impulse response function (PRF) is the response of an endogenous variable to an random error shock. It describes the impact of a standard deviation shock on the current and future values of the endogenous variable, Figure 2 shows the results of inpluse response.

Given a standard deviation shock to GDP, thers is a obvious fluctuation effect on government debt from the first phase to the fourth phase, a weak decline fluctuation from the fourth phase to the eighth phase, and a rapidly decline after the eighth phase. It is a positive impact throughout the shock response period. The economic interpretation is that economic growth will have a greater impact on government debt in the short term. In the long run, a greater GDP growth rate will lead to a smaller scale of government debt. Because economic growth leads to a larger scale of taxation revenue, and thus reduces the demand for government debt. Given a standard deviation shock on GDP, there is a positive impact on taxation, a rapid downward trend from the first phase to the forth phase, and gradually decline trend from the fourth to the eighth phase, the economic interpretation is GDP has a long-term positive effect on tax revenue, tax revenue increases with the economic growing, but growth rate of tax revenue is declining.

Given a standard deviation shock on government debt, there is a obvious positive fluctuation effect on GDP from the first phase to the forth phase and a rapid decline from the fourth phase to the sixth phase, which means that government debt promotes economic growth strongly in the short-term, but weakly on the medium-term, possibly because government debt can obviously increases demand and thus stimulate economic growth in the short term, but government debt has crowding-out effect in the long run. Given a standard deviation shock on debt, there is an obvious fluctuation effect on taxation from the first phase to the third phase, and a rapid decline from the fourth phase to the sixth phases. The impulse response of government debt to taxation and GDP has a similar trend. The economic interpretation is that government debt can promote economic growth strongly in the short term, but weakly in the long run.



Given a standard deviation shock on tax revenue, there is a positive fluctuations impact on GDP from the first phase to the second phase, a negative impact on GDP from the third phase to the fourth phases, and rapidly decline after the fourth phase. Generally speaking, assuming that other variables remain unchanged, the excessive tax revenue will slow down the economy growth, and the reasonable tax revenue can guarantee a sustained and stable economic growth; given a standard deviation shock on taxation, there is a negative impact on government debt from the first phase to the second phase, and a positive effect from the third phase to the fourth period. In the long run, large tax revenue will lead to small scale of government debt, while small scale of government debt is in favor of debt service.

4. Conclusion and Suggestion

1. Economic growth mainly depends on productive factors. Government debt as a tool has an obvious impact on economic growth in the short term, and increase the scale of GDP in the medium term, which may be due to the productive nature of debt. The contribution of tax to GDP fluctuate in the short term. Because of the substitution effect and income effect of taxation, taxation maybe put a povitive effect or a negative effect on GDP. Taxation and government debt have a weak positive effect on economic growth In the long run. Therefore, special attention should be paid to the short-term and long-term effects of taxation and government debt.

Local governments compete the scale of GDP fiercely, which leads to local governments pursue GDP growth rate crazily, the scale of GDP increased seven times in the passed 17 years, and the production characteristics of taxation and government debt were outstanding. As an important legal system, tax collection is strictly enforcemented. So as a policy tool, government debt is much more flexible than government debt, but after the implementation of the debt balance management system in 2006, government debt as a policy tool is not so convenient to use. Therefore, taxation and government debt have impact on economic growth, but economic growth is mainly dependent on productive factors.

2. The impact of GDP on government debt fluctuates in the short run. GDP growth may increase demand for investment, and thus affect the scale of debt. In the short run, government debt and taxation may have a substitution effect. Government is under the pressure of debt servicing, which will increase the scale of taxation in the long run. Therefore, to use debt tool properly, it needs to focus on the relationship between government debt and taxation, and the impact of potential debt risks on the economy. At present, the increasing scale of government debt in China is to some extent due to the investment demand of local government, and the result of local government's pursuit of GDP growth. So, increasing the scale of government debt is the result of substitution effect of

taxation to a certain extent. By the end of 2017, the cumulative amount of government debt has reached nearly 30 trillion, such huge scale of government debt leads to explicit or hidden debt risk. How to prevent debt risk is an important issue when use debt tools.

3. The impact of GDP on taxation is obvious. It has a long-term positive effect on taxation. Economic development is the base of taxation revenue. In this sense, only economic growth can guarantee the effective supply of public goods. Public goods provides infrastructure for economic development. Government debt will effect the scale of taxation in the long run, probably because taxation is under the pressure of debt service. Tax growth rate has been increasing in the passed 20 years, the average tax elasticity coefficient before 2007 was higher than 1.5, until 2013 was lower than 1. Greater tax elasticity coefficient means that taxation will put a crowding-out effect on private investment.

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