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Does the Reinhart-Rogoff Hypothesis Apply to China?

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Abstract

This paper finds that the threshold of the government debt ratio for China is 33.638%. A higher debt ratio would raise the growth rate if the debt ratio is up to 33.638% whereas a higher the debt ratio would reduce the growth rate if the debt ratio is greater than 33.638%. In addition, a higher ratio of employment change to GDP or a higher investment-to-GDP ratio raises the growth rate. Therefore, the debt threshold of 90% proposed by Reinhart and Rogoff does not apply to China.

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1. Introduction

Like many other countries, China's authorities engaged in fiscal and monetary policies to stimulate or stabilize its economy. During and after the global financial crisis, China increased its government borrowing from 0.025% of GDP in 2008 to 1.740% in 2009. The government debt ratio rose from 27.000% of GDP in 2008 to 34.346% of GDP in 2009. The discount rate dropped from 3.330% in 2007 to 2.790% in 2008 in order to reduce the cost of borrowing by banks. To pursue fiscal expansion, in 2019, government borrowing went up to 6.096% of GDP, and government debt rose to 55.567% of GDP. Although the 55.567% debt ratio is still below the 60% threshold based on the EU standard, a major concern is whether more government debt would help or hurt its economic growth.

This paper attempts to test whether the threshold of the 90% debt ratio proposed by Reinhart and Rogoff (2010a, 2010b) would apply to China. Because the results vary significantly by country (Herndon, Ash and Pollin, 2014; Égert, 2015a, 2015b) and because China's government debt ratio in the available sample ranges from a low of 20.448% in 1997 to a high of 56.567% in 2019, it would be interesting to test the hypothesis that China may have a different threshold or turning point well below 90%. The paper has several different aspects. An extended production function (Ram, 1986, 1989; Goel, Payne and Ram, 2008) is employed in studying the impact of government debt on economic growth. An interactive dummy variable is employed to determine whether there would be a threshold or turning point.

Several recent studies have examined the relationship between government debt and economic growth. In their seminal works, Reinhart and Rogoff (2010a, 2010b) indicate that the relationship between government debt and the growth rate is relatively weak if the debt ratio is less than 90% whereas a debt ratio greater than 90% results in a decrease in the growth rate. This threshold or turning point for the debt ratio is comparable in emerging and advanced economies.

Based on the data sample used by Reinhart and Rogoff (2010a, 2010b) with different methodologies and specifications, Minea and Parent (2012) reveal that the threshold for the debt ratio is estimated to be 115%. Herndon, Ash and Pollin (2014) cannot confirm the 90% debt threshold and indicate that the effect of public debt on economic growth differs considerably by country and period. Égert (2015a, 2016b) indicates that the 90% debt threshold cannot be confirmed and that the thresholds or negative links may exist at a much lower debt level between 20% and 60%. The magnitude of the thresholds is uncertain. A nonlinear relationship is not robust and sensitive to model specifications. Parameter estimates vary across countries. Lee, Park, Seo and Shin (2017) cannot confirm the existence of the 90% debt threshold and find that the debt threshold may be around 30%. Countries with a debt ratio greater than 30% would experience a decrease in the growth rate by 1 percentage point.

Other previous studies show mixed results. Schclarek (2005) reveal that the negative relationship between public external debt and economic growth applies to developing but not industrialized countries. Eberhardt and Presbitero (2015), Woo and Kumar (2020), Swamy (2020), and Gunarsa, Makin and Rohde (2019) indicate that government or public debt and economic growth have a negative relationship without a threshold or turning point. Sun (2019) shows that the maximum

sustainable public debt for China is 93.43%. Given the present gross government debt ratio of 55.567% in 2019, China's central government debt is sustainable in the short and medium terms.

2. The Model

Extending Ram (1986, 1989), Goel, Payne and Ram (2008) and other studies, the growth rate of real GDP in China can be expressed as:

$$\dot{Y} = f(dL/Y\,, dK/Y\,, D) \tag{1}$$

where

Y = real GDP,
$\dot{Y}$ = the growth rate of real GDP,
dL/Y = change in labor divided by Y,
dK/Y = change in capital divided by Y, and
D = the government debt-to-GDP ratio.

Due to lack of the data for capital, change in capital can be substituted by investment (I) (Ram, 1986, 1989).

$$\dot{Y} = g(dL/Y\ , I/Y\,,\ D) \tag{2}$$

The coefficient of dL/Y measures the marginal product of labor, and the coefficient of I/Y measures the marginal product of capital. The sign of the first two explanatory variables is expected to be positive, and the sign of the debt ratio is unclear. Countries with relatively low government debt may have room to increase debt-financed spending, improve infrastructures, and promote economic growth. If countries with relatively high government debt engage in more debt-financed spending, economic growth may be adversely affected mainly due to the crowding-out effect.

There may be a nonlinear relationship between $\dot{Y}$ and the debt ratio. That being the case, the following equation can be considered:

$$\dot{Y} = g(dL/Y\ , I/Y\,,\ D, D \times B, B) \tag{3}$$

where B is a dummy variable corresponding to a threshold of the debt ratio. An inverted U-shape relationship between $\dot{Y}$ and the debt ratio suggests that the sign of D should be positive, the sign of $D \times B$ should be negative, and the value of the coefficient of D should be less than the value of $D \times B$ in absolute value.

3. Empirical Results

The data were collected from the IMF's *World Economic Outlook* and *International Financial Statistics*. The growth rate of real GDP is expressed as a percent. Gross government debt is measured as a percent of gross domestic product. Labor employment is measured in millions. Real GDP is measured in billions. I/Y is measured as a percent. The sample ranges from 1995 to 2019. The data for the debt ratio before year 1995 are not available. The ADF cointegration test shows that these time series variables are cointegrated and have a long-term stable relationship.

Figure 1. The Debt-to-GDP Ratio over Time

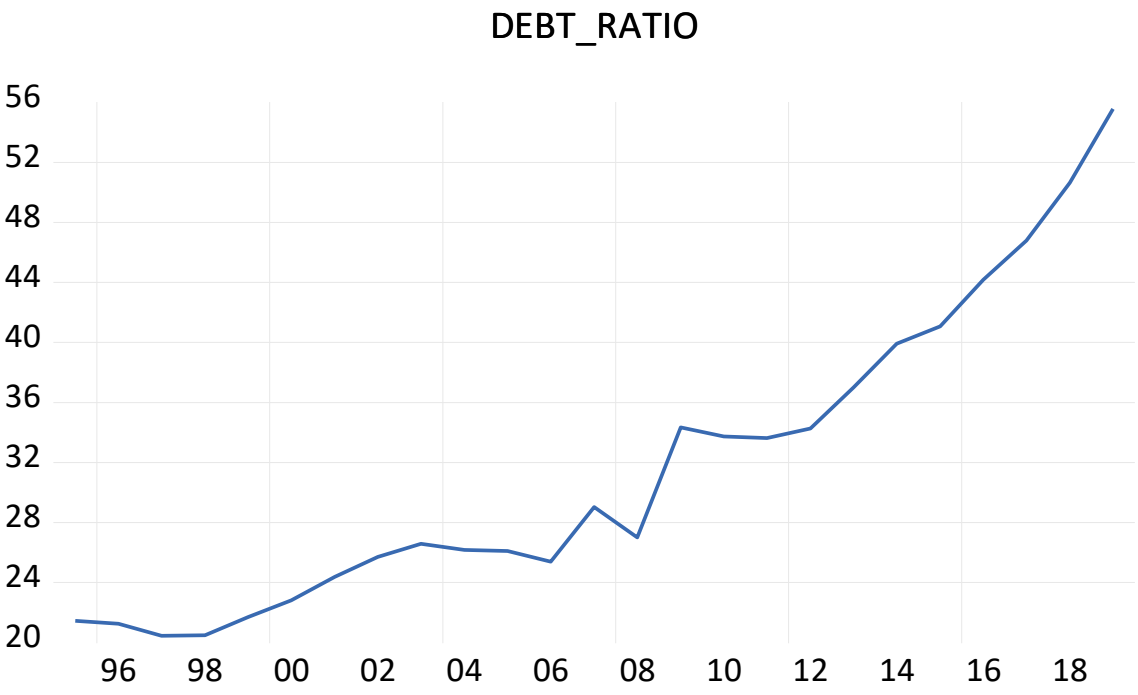

Figure 2. Scatter Diagram between the Growth Rate of Real GDP and the Debt-to-GDP Ratio

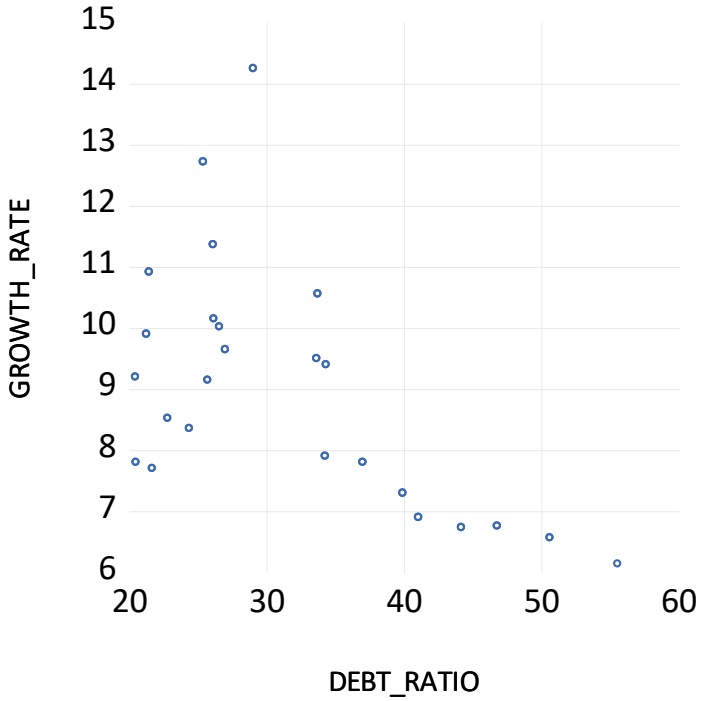

Figure 1 shows the government debt-to-GDP ratio during the sample period. The debt ratio exhibits a rising trend from a low of 20.448% in 1997 to a high of 55.567% in 2019. The global financial crisis caused the debt ratio to rise from 27% in 2008 to 34.346%in 2009. Figure 2 presents a scatter diagram between the growth rate of real GDP and the government debt-to-GDP ratio. They seemed to exhibit a positive relationship when the debt ratio was relatively low and a negative relationship beyond a certain threshold.

Table 1 presents empirical results. The GARCH process is applied in empirical estimation in order to correct for potential autoregressive conditional heteroscedasticity. As shown, approximately 55.79% of the change in the growth rate can be explained by the five right-hand side explanatory variables. All the coefficients are significant at the 1% or 5 level. The positive significant coefficient of the debt ratio suggests that a higher debt ratio has a positive impact on the growth rate when the debt ratio is below the threshold. The negative significant coefficient of the interactive term of the debt ratio implies that beyond the threshold, a higher debt ratio reduces the growth rate. Below the threshold, a one percentage point increase in the debt ratio would lead to an increase in the growth rate by 0.2755 percentage points. Above the threshold, a one percentage point increase in the debt ratio reduces the growth rate by 0.0179 percentage points. When dL/Y rises one unit, real GDP would increase by 3.5399 percentage points. A one percentage-point increase in the investment/GDP ratio would raise the growth rate by 0.2959 percentage points.

Table I. Estimated Growth Rate of Real GDP in China

Variable	Coefficient	Probability
Constant	-9.8870	0.0011
Change in labor/GDP ratio	3.5399	0.0337
Investment/output ratio	0.2959	0.0000
Debt ratio	0.2755	0.0005
Debt ratio x dummy variable	-0.2934	0.0001
Dummy variable	4.1794	0.0375
R-squared	0.5579	
Akaike info criterion	2.7025	
Schwarz criterion	3.1593	
Sample period	1995-2019	
Methodology	GARCH	

Notes: The dummy variable is equal to 1 if the debt ratio is equal to or greater than 33.638% and zero otherwise.

In comparison, the finding of an inverted-U shape relationship in this paper is in contrast with the results reported by Eberhardt and Presbitero (2015), Kumar and Woo (2015), Gunarsa, Makin and Rohde (2019) and Swamy (2020), who indicate that the debt ratio and the growth rate have a negative relationship. The magnitude of the threshold for China is generally consistent with Égert (2015a, 2015b) and Lee, Park, Seo and Shin (2017) but is much lower than the thresholds proposed by Reinhart and Rogoff (2010a, 2010b), Minea and Parent (2012), and Sun (2019).

4. Summary and Conclusions

This paper has examined the relationship between government debt and economic growth for China based on an extended production function during 1995-2019. A threshold or turning point for the debt ratio in China is confirmed. In addition, a higher ratio of employment change to GDP and a higher investment/GDP ratio contribute to economic growth. Recent higher debt ratios in China suggests that further fiscal expansion would reduce economic growth.

There are some policy implications. Individual countries may exhibit unique economic conditions and different relationships between the debt ratio and economic growth. China's current debt ratio of 55.567% in 2019 is relatively small compared with some advanced countries such as Greece, Italy, Spain and the U.S. and is below the EU standard of 60%. But, an increase in the current debt ratio would dampen economic growth. Enhancing human capital through more education and training would raise labor productivity and growth. The government may provide incentives to encourage businesses to invest more in high tech equipment to increase productivity and growth.

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