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Is there Any Debt Threshold in Indonesia?
Test of the Reinhart-Rogoff Hypothesis

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Abstract: Extending Ram (1986, 1989), Smyth and Hsing (1995), and Goel, Payne and Ram (2008), this study finds that a higher government debt-to-GDP ratio raises the growth rate of real GDP if the debt ratio is up to 39.3221% and reduces the growth rate of real GDP if the debt ratio is greater than 39.3221%. In addition, a higher growth rate of employment, a higher investment-to-GDP ratio, and a higher growth rate of real M2 raise the growth rate of real GDP. Therefore, the Reinhart-Rogoff debt threshold of 90%does not apply to Indonesia.

JEL Classification: E62

Keywords: Government debtratio, Reinhart-Rogoff hypothesis, fiscal policy, debt threshold

Introduction

Indonesia's authorities engaged in fiscal and monetary policies to stimulate or stabilize its economy. During the global financial crisis, Indonesia increased its government deficit from –0.0761% of GDP in 2008 to -1.4742% in 2009. Its structural balance also rose from -0.281% of GDP in 2008 to –1.764% of GDP in 2009. The general government debt ratio actually declined from 30.252% of GDP in 2008 to 26.483% of GDP in 2009. M2 money rose 12.95% during 2008-2009 to provide more liquidity to the banking and financial sectors. These statistics suggest that Indonesia pursued fiscal prudence because the deficit-to-GDP ratio was less than 3% and because the debt ratio was less than 60% as the EU expects its members to achieve. In conducting fiscal policy, a major concern is whether more government debt would help or hurt the growth rate of real GDP in the long run.

Several recent studies have examined the subject. Smyth and Hsing (1995) employ an extended production function to estimate the turning point or the threshold of the debt ratio for the U.S. during 1960-1991. Explanatory variables included in the regression consists of the debt ratio, the debt ratio squared, the growth rate of employment, the growth rate of capital, and

the growth rate of real money supply. They find that the threshold for the total debt ratio is 48.90% and the threshold for the public debt ratio is 38.40%. In addition, a higher growth rate of employment, a higher growth rate of capital, and a higher growth rate of real M2 money result in a higher growth rate of real GDP.

Reinhart and Rogoff (2010a, 2010b) show that there is a weak relationship between government debt and the growth rate when the debt ratio is less than 90% whereas a debt ratio greater than 90% causes the growth rate to decline. This threshold for the debt ratio is comparable in advanced and emerging economies. However, based on advanced econometric techniques, Minea and Parent (2012) find that the threshold for the debt ratio is 115%.

Checcherita-Westphal and Rother (2012) use a sample of 12 euro area countries to examine the relationship between debt and growth. They find a threshold or turning point in the range of 90% - 100%, suggesting that government debt reduces economic growth if the debt ratio is greater than 90% - 100%. Based on the confidence intervals, the threshold would start in the range of 70% - 80%.

In another study, Baum, Checcherita-Westphal, and Rother (2013) study the relationship between growth and debt for 12 euro area countries. A higher debt ratio increases the growth rate but has no effect on the growth rate when the debt ratio reaches about 67%. When the debt ratio is greater than 95%, a higher debt ratio causes the growth rate to decline.

Chirwa (2017) examines the relationship between growth, debt and other relevant variables for 10 Euro area countries. The threshold is found to be at the 70% in the long run whereas government debt and growth have a negative relationship in the short run.

Based on a sample 154 countries, Swamy (2015) finds that a 10-percentage point increase in the government debt ratio leads to 2 to 23 basis point decrease in the average growth rate and that debt and growth have a nonlinear relationship.

Woo and Kumar (2015) reveal that if the initial debt ratio increases 10 percentage points, the growth rate of real per capita GDP will decline about 0.2 percentage points. Higher debt ratios lead to larger negative effects. The negative effect mainly due to decline in labor productivity growth.

Shahor (2018) studies the relationship between debt and growth for Israel during 1983-2013. The relationship exhibits an inverted U-shape. The threshold or the turning point of the debt ratio is 130% and greater.

This paper attempts to examine whether government debt affects economic growth in Indonesia and determine whether the Reinhart-Rogoff

threshold of the 90% debt ratio would apply to Indonesia. The paper has several different aspects. An extended production function including the growth rate of real money supply (Smyth and Hsing, 1995) is employed in studying the impact of government debt on economic growth. A quadratic form for the debt ratio is considered to test if there would be a threshold or a turning point. Due to lack of the data for capital stock, the ratio of investment spending to gross domestic product is used (Ram, 1986, 1989).

The Model

Extending Ram (1986, 1989), Smyth and Hsing (1995), Goel, Payne and Ram (2008), and other studies, the growth rate of real GDP can be expressed as:

$$\dot{Y} = f(\dot{L}, \dot{K}, \dot{M}, D) \tag{1}$$

where

$\dot{Y}$ = the growth rate of real GDP,

$\dot{L}$ = the growth rate of labor employment,

$\dot{K}$ = the growth rate of capital,

$\dot{M}$ = the growth rate of real money supply, and

D = the government debt-to-GDP ratio.

Due to lack of the data for capital, the growth rate of capital can be substituted by the ratio of investment (I) to gross domestic product (Ram, 1986, 1989).

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

The coefficient of $\dot{L}$ is the elasticity of output with respect to labor, and the coefficient of I/Y is the partial derivative of Y with respect to K or the marginal product of capital. We expect that the sign of the first three explanatory variables to be positive and that the sign of the debt ratio is unclear. There may be a turning point or an inverted U-shaped relationship between $\dot{Y}$ and the debt ratio. That being the case, the following equation can be considered:

$$\dot{Y} = g(\dot{L}, I/Y, \dot{M}, D, D^2) \tag{3}$$

An inverted U-shaped relationship between $\dot{Y}$ and the debt ratio suggests that the sign of D should be positive and the sign of D^2 should be negative.

The critical value of the debt ratio corresponding to the maximum growth rate of real GDP is given by:

$$D^* = \alpha_1/2\alpha_2 \tag{4}$$

where α_1 is the coefficient of D and α_2 is the coefficient of D^2.

Empirical Results

The data were collected from the IMF's *World Economic Outlook* and*International Financial Statistics* and the Federal Reserve Bank of St. Louis.The growth rate of real GDP is expressed as a percent. Government debt is measured as a percent of gross domestic product. The growth rate of labor employment is expressed as a percent. Investment spending as a percent of GDP is used as the data for capital are not available. Real M2 is used to represent the real money supply. The growth rate of real M2 is expressed as a percent. The debt ratio, the debt ratio squared, and the investment-to-GDP ratio are transformed to a log scale to reduce potential multicollinearity problems. Other variables are not transformed to a log scale because of actual or potential negative values before or after the transformation. The sample ranges from 2000 to 2018. The data for the debt ratio before year 2000 are not available.

Figure 1 shows the government debt-to-GDP ratio during the sample period. It appears that the debt ratio declined from a high of 87.437% in 2000 to a low of 22.96% in 2012 and then rose to 29.633% in 2018. Even during the global financial crisis in 2008-2009, the debt ratio did not rise.
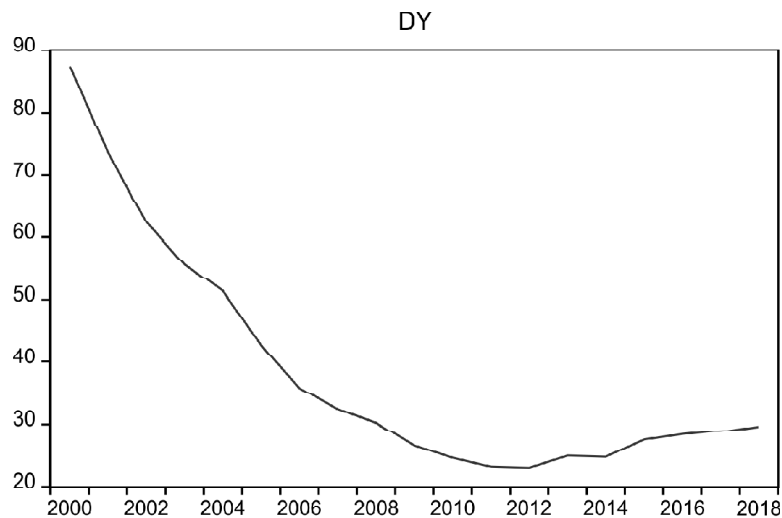

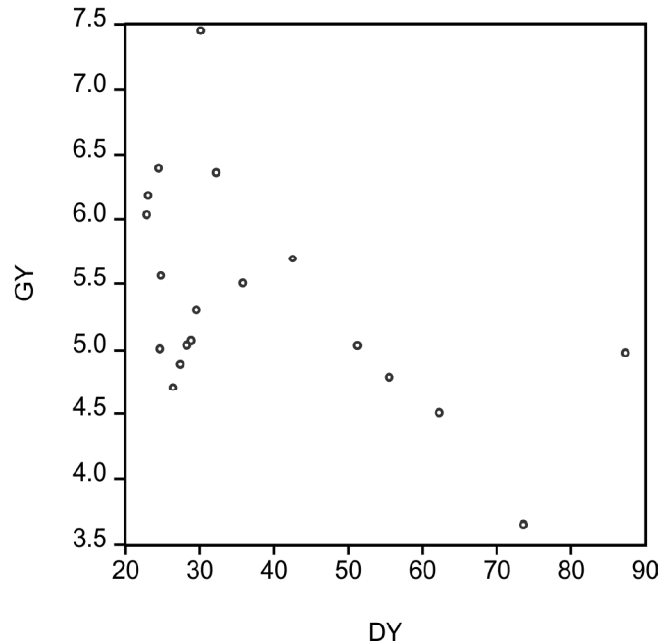**Figure 1:** The Debt-to-GDP Ratio (DY) over Time

Figure 2: Scatter Diagram between the Growth Rate of Real GDP (GY) and the Debt-to-GDP Ratio

Figure 2 shows 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 when the debt ratio was relatively high. Hence, the quadratic form in equation (3) is employed in empirical estimation.

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 46.07% of the change in the growth rate of real GDP can be explained by the five right-hand side explanatory variables. All the coefficients are significant at the 1% level. The positive significant coefficient of the debt ratio and the negative significant coefficient of the debt ratio squared suggest that the quadratic function exhibits an inverted-U shape. Based on equation (4), the critical value or the turning point is estimated to be 39.3221%.

When labor employment rises one percentage point, real GDP would increase by 0.2849 percentage points. A one unit increase in the log of the investment/GDP ratio would raise the growth rate by 1.7187 percentage points. A one percentage point increase in real M2 would lead to an increase in the growth rate by 0.0837 percentage points.

If the linear form is estimated, all the coefficients are significant at the 1% level and have the signs as reported in Table 1. However, the coefficient for the debt ratio squared is estimated to be -0.000681, which is so small that the estimated critical value or the turning point may not be precise. Therefore, the linear form is not reported here.

Table 1
Estimated Growth rate of Real GDP in Indonesia

Variable	Coefficient	z-Statistic	Probability
Constant	28.7190	-778.4591	0.0000
Employment growth	0.2849	4.398818	0.0000
Log (investment/GDP ratio)	1.7187	31.45375	0.0000
M2 growth	0.0837	4.137607	0.0000
Log (debt ratio)	14.8759	4054.988	0.0000
Log (debt ratio squared)	-2.0257	-551.1245	0.0000
R-squared	0.4607		
Akaike info criterion	2.5594		
Schwarz criterion	2.2291		
Sample period	2000-2018		
Methodology	GARCH		

In comparison, the results in this paper are different from the findings of previous studies. Reinhart and Rogoff (2010a, 2010b) show that the threshold for the debt ratio is 90% whereas the threshold of the debt ratio for Indonesia is estimated to be 39.3221%. Kumar and Woo (2015) and Swamy (2015) indicate that the debt ratio and the growth rate have a negative relationship whereas this paper finds that the relationship may be positive or negative depending upon the level of the debt ratio. The thresholds reported by Minea and Parent (2012), Checherita-Westphal and Rother (2012), Baum, Checherita-Westphal, and Rother (2013), Chirwa (2017), and Shahor (2018) are much higher than the threshold of 39.3221% estimated for Indonesia.

Summary and Conclusions

This paper has examined the relationship between government debt and economic growth for Indonesia based on an extended production function during 2000-2018. The threshold or the turning point of the debt ratio for Indonesia is found to be 39.3221%, suggesting that a debt ratio below 39.3221% would raise the growth rate whereas a debt ratio greater than 39.3221% would reduce the growth rate. In addition, a higher employment growth, a higher investment/GDP ratio, and a higher growth of real M2

contribute to economic growth. The debt ratio in Indonesia ranges from a low of 22.96% in 2012 to a high of 87.437% in 2000. It suggests that the highest debt ratio in Indonesia is still below the 90% threshold. The estimated debt threshold of 39.3221% for Indonesia suggests thatthe Reinhart-Rogoff hypothesis does not apply to Indonesia.

There are some policy implications. Individual countries may exhibit unique economic conditions and different relationships between the debt ratio and economic growth.Indonesia has maintained fiscal discipline during the global financial crisis and kept the debt ratio below the threshold of 39.3221% since 2006. The debt ratio of 29.633% in 2018 implies that Indonesia's government debt is sustainable.

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