

On the relationship between economic growth and government debt for Bulgaria. Test of the Reinhart-Rogoff hypothesis

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Abstract. *Based on an extended production function, this paper finds that the turning point of the government debt ratio for Bulgaria is estimated to be 45.2631%, suggesting that an increase in the debt ratio beyond 45.2631% will cause the growth rate of real GDP to decline. This turning point for Bulgaria is far less than the 90% turning point proposed by Reinhart and Rogoff. Therefore, the Reinhart-Rogoff hypothesis does not apply to Bulgaria.*

Keywords: fiscal policy, government debt ratio, Reinhart-Rogoff hypothesis, debt threshold.

JEL Classification: E62.

Introduction

Bulgaria has shown a declining trend of the government debt ratio in the long run from a high of 79.406% in 1999 to a low of 14.086% in 2010. Even during the global financial crisis, its debt ratios remained relatively low at 14.72% in 2008 and 14.579% in 2009. Although its debt ratio rose to 27.357% in 2016, the Bulgarian government pursued fiscal prudence to lower it to 19.156% in 2019. Relatively low debt ratios in recent years were attributable to relatively low budget deficits as evidenced by less than 3% of government borrowing or structural balance as percent of GDP since 2015.

Whether a higher government debt ratio would increase or reduce the growth rate of real GDP has been studied extensively. The focus point is whether there would be a turning point beyond which a further increase in the debt ratio would reduce the growth rate of real GDP. Reinhart and Rogoff (2010a, 2010b) show that the turning point of the government debt ratio is 90%. When the government debt ratio is below 90%, the negative impact of a higher debt ratio on the growth rate of real GDP is weak. When the government debt ratio is greater than 90%, a further increase in the debt ratio tends to reduce the growth rate of real GDP.

The purpose of this paper is to test whether the Reinhart-Rogoff hypothesis may be applicable to Bulgaria. This paper differs from most previous studies in several aspects. First, a theoretical model based on an extended production function is presented. Second, a quadratic function is employed to determine whether there may be a turning point. Third, the GARCH process is used in empirical work in order to correct for potential autogressive conditional heteroskedasticity.

Literature survey

Based on a sample of forty-four advanced and developing countries covering about 200 years, Reinhart and Rogoff (2010a, 2010b) find that there is a weak relationship between the growth rate and the debt ratio 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%. Herndon, Ash and Pollin (2014) use the same data compiled by Reinhart and Rogoff and find that for 20 advanced countries, the negative effect of the public debt ratio above 90% on economic growth cannot be confirmed. According to Herndon, Ash and Pollin, during 1946-2009, countries with public debt ratios over 90% recorded an average growth rate of 2.2% instead of -0.1% as presented by Reinhart and Rogoff. The relationship between the economic growth rate and the public debt ratio differs substantially by country and period.

Using a sample of 18 OECD countries during 1980-2008, Cecchetti, Mohanty and Zampolli (2011) show that the threshold of the government debt ratio is about 85%, implying that a rising government debt ratio beyond 85% would have an adverse effect on economic growth. They also indicate that if the corporate debt ratio is greater than 90% of GDP, there will be a negative impact on economic growth.

Checherita-Westphal and Rother (2012) use a sample of 12 countries in the euro area to examine the relationship between growth and government debt. They find a threshold or turning point in the range of 90-100%, suggesting that more 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%.

Baum, Checherita-Westphal, and Rother (2013) study the relationship between growth and government debt for twelve countries in the euro area. 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.

Afonso and Jalles (2013) investigate the relationship between economic growth and government debt for 155 advanced and developing countries during 1970-2008. According to their results, the turning point is 59% for the euro zone and 79% for emerging economies. If the debt ratio rises 10%, the growth rate would decline by 0.2% if the debt ratio is greater than 90% of GDP and rise by 0.1% if the debt ratio is less than 30% of GDP.

Chirwa (2017) examines the relationship between growth, government debt and other relevant variables for ten countries in the euro area. 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 growth and government debt 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 government debt ratios lead to larger negative effects. The negative effect is mainly due to decline in labor productivity growth.

Velichkov (2016) evaluates the effect of government debt on economic growth for Bulgaria. He reveals that more government debt promotes economic growth in the short run but has a negative impact on economic growth in the long run. He does not present the threshold for the debt ratio beyond which more debt would affect economic growth negatively.

Lechtenberg (2017) studies the subject based on a sample for 10 individual countries. Australia, Canada, Chile, Germany and New Zealand have had low and declining debt ratios, and a higher debt ratio would not cause the growth rate of real GDP to decline. On the other hand, debt thresholds are found for France, Greece, Italy, the UK and the US. Beyond the debt thresholds, a higher debt ratio reduces the growth rate in Greece, Italy, the UK and the US but increases the growth rate for France.

Shahor (2018) studies the relationship between growth and government debt 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.

Jacobs, Ogawa, Sterken and Tokutsu (2020) examine the relationship between economic growth and public debt for 27 EU members and 4 OECD countries during 1995-2013. They find that more public debt does not Granger cause economic growth. Instead, economic growth Granger causes public debt. Slow economic growth causes more public debt. In high-debt economies, slow economic growth increases public debt, which causes a higher long-term interest rate, dampens interest-rate sensitive private spending, and increases public debt. In addition, they show that the effect of economic growth on the debt ratio is greater for high-debt economies and that the effect of the debt ratio on economic growth is greater for low-debt countries.

The model

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

$$\dot{Y} = w(\dot{L}, \dot{K}, D) \quad (1)$$

where:

\dot{Y} – the growth rate of real GDP;

\dot{L} – the growth rate of labor employment;

\dot{K} – the growth rate of capital;

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 spending (I) to gross domestic product (Ram, 1986, 1989).

$$\dot{Y} = z(\dot{L}, I/Y, D) \quad (2)$$

In a linear form, the coefficient of \dot{L} measures the elasticity of output with respect to labor, and the coefficient of I/Y represents the partial derivative of Y with respect to K or the marginal product of capital. The sign of the first two explanatory variables should be positive, and the sign of the debt ratio is unclear. A lower and rising government debt ratio for infrastructural improvements may be conducive to economic growth whereas a higher and rising debt ratio may raise the interest rate, crowd out private spending, cause the Bulgarian lev to appreciate, and hurt exports.

There may be a turning point or an inverted U-shaped relationship between \dot{Y} and the government debt ratio. That being the case, the following equation can be considered:

$$\dot{Y} = f(\dot{L}, I/Y, D, D^2) \quad (3)$$

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 (turning point) of the debt ratio corresponding to the maximum growth rate of real GDP is given by:

$$D^* = \alpha_1 / 2\alpha_2 \quad (4)$$

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 World Economic Outlook and International Financial Statistics published by the International Monetary Fund. The growth rate of real GDP is expressed as a percent. 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 is not available. Government debt is measured as a percent of gross domestic product. The sample ranges from 1998 to 2019. The data for the government debt ratio before 1998 is not available.

Figure 1 exhibits growth rates of real GDP during the sample period of 1998-2019. Growth rates were mostly positive except for -0.494% in 1999 and -3.586% in 2009 during the global financial crisis. Figure 2 shows the scatter diagram between the growth rate of real GDP and the government debt ratio. It seems that they may have a positive relationship when the debt ratio is relatively low and a negative relationship when the debt ratio is relatively high.

Figure 1. *The growth rate of real GDP*

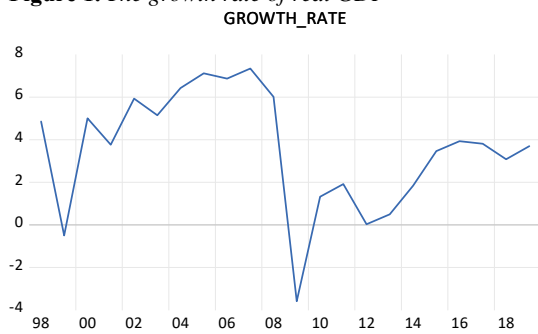


Figure 2. *Scatter diagram between the growth rate and the debt ratio*

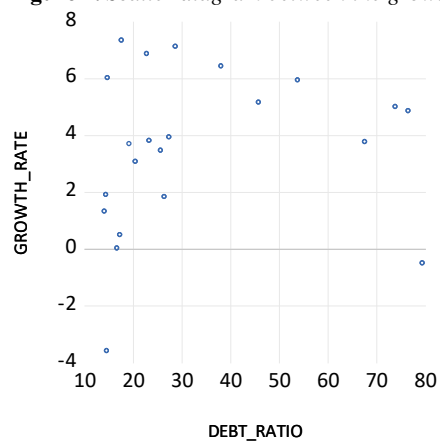


Table 1 presents the estimated regression and related statistics. As shown, the value of R squared is estimated to be 34.71%, and all the coefficients have the expected signs and are significant at the 1% level. Based on equation (4), the turning point or the critical value is calculated to be 45.2631%, which is far below the turning point of 90% proposed by Reinhart and Rogoff (2010). There may be several reasons why the turning point for

Bulgaria is much lower than 90%. First, the European Union recommends its member countries to pursue a government debt ratio no greater than 60%. As a member of the European Union, it is natural for Bulgaria to aim at a debt ratio below 60%. Second, the Bulgarian government has kept the government debt ratio at a relatively low level in order to reduce potential financial or political risk. Countries with huge sovereign debt might face potential default and high political and financial risk. Third, a rising government debt is expected to raise the interest rate and reduce consumption spending, investment spending, and net exports.

Table 1. *Estimated regression*

Variable	Coefficient	Probability
Constant	-4.253636	0.0000
Growth rate of employment	0.029125	0.0000
Investment/GDP ratio	0.025765	0.0000
Debt ratio	0.403475	0.0000
Debt ratio squared	-0.004457	0.0000
R squared	0.347391	
Akaike info criterion	4.443437	
Schwarz criterion	4.790587	
Sample period	1998-2019	

If the debt ratio squared is not included in the estimated equation, all the coefficients have the positive sign and are significant at the 1% level, and the value of R squared is 16.58%, which is much less than 34.71% when the debt ratio squared is included in the estimated equation in Table 1.

In comparison, the finding in this paper is different from and similar to some of previous studies. Reinhart and Rogoff (2010a, 2010b) show that the threshold for the government debt ratio is 90% whereas the threshold of the debt ratio for Bulgaria is estimated to be 45.2631%. Kumar and Woo (2015) and Swamy (2015) indicate that the growth rate and the debt ratio 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 Cecchetti, Mohanty and Zampolli (2011), Minea and Parent (2012), Checherita-Westphal and Rother (2012), Baum, Checherita-Westphal, and Rother (2013), Afonso and Jalles (2013), Chirwa (2017), and Shahor (2018) are higher than the threshold of 45.2631% estimated for Bulgaria. The estimated threshold of 45.2631% for Bulgaria is close to the threshold of 47.4452% for Italy reported by Lechtenberg (2017).

Summary and conclusions

This paper has examined the impact of the government debt ratio on the growth rate of real GDP for Bulgaria using an extended production function. The growth rate of real GDP is specified as function of the growth rate of employment, the ratio of investment spending to nominal GDP, and the government debt ratio. A quadratic form is used for the debt ratio to test whether a turning point may exist.

The results show that the turning point is estimated to be 45.2631%. The growth rate and the debt ratio have a positive relationship when the debt ratio is up to 45.2631% whereas they have a negative relationship when the debt ratio is greater than 45.2631%. The

government debt ratio in 2019 was 19.156%, indicating that there would be room for the Bulgarian government to engage in fiscal expansion to raise the debt ratio slightly to stimulate its economy due to the worldwide pandemic crisis. The lower turning point for Bulgaria also indicates that a criterion which is applicable to advanced countries may not apply to emerging or developing countries. Hence, Bulgaria's efforts to maintain fiscal discipline are appropriate.

To stimulate the economy and enhance income convergence, the government may consider increasing automatic fiscal stabilizers and public investment spending, allowing small deficits in support of growth-oriented programs as long as the government debt ratio would be kept at a relatively low level. The Bulgarian government may strengthen active labor market policies, worker importation agreements, training programs to mitigate labor shortages, and business involvement to streamline university curricula to address the demand for skilled workers (International Monetary Fund, 2020).

References

- Afonso, A. and Jalles, J.T., 2013. Growth and productivity: The role of government debt, *International Review of Economics and Finance*, 25 (Issue C), pp. 384-407.
- Baum, A., Checherita-Westphal, C. and Rother, P., 2013. Debt and growth: New evidence for the euro area. *Journal of International Money and Finance*, 32, pp. 809-821.
- Cecchetti, S.G., Mohanty, M.S. and Zampolli, F., 2011. The real effects of debt. Bank for International Settlements, Bis Working Papers No. 352.
- Checherita-Westphal, C. and 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*, 56(7), pp. 1392-1405.
- Chirwa, T.G., 2017. Public debt and economic growth nexus in the Euro area: A dynamic panel ARDL approach.
- Goel, R.K., Payne, J.E. and Ram, R., 2008. R&D expenditures and US economic growth: A disaggregated approach. *Journal of Policy Modeling*, 30(2), pp. 237-250.
- Herndon, T., Ash, M. and Pollin, R., 2014. Does high public debt consistently stifle economic growth? A critique of Reinhart and Rogoff. *Cambridge Journal of Economics*, 38(2), pp. 257-279.
- International Monetary Fund, 2020. Bulgaria: Staff concluding statement of the 2020 article IV mission, February 14, 2020.
- Jacobs, J., Ogawa, K., Sterken, E. and Tokutsu, I., 2020. Public Debt, Economic Growth and the Real Interest Rate: A Panel VAR Approach to EU and OECD Countries. *Applied Economics*, 52(12), pp. 1377-1394.
- Lechtenberg, L., 2017. The debt-to-GDP threshold effect on output: A country specific analysis. *Aisthesis, the Interdisciplinary Honors Journal*, 8 (1), pp. 26-34.
- Minea, A. and Parent, A., 2012. Is high public debt always harmful to economic growth? Reinhart and Rogoff and some complex nonlinearities.

- Ram, R., 1986. Government size and economic growth: A new framework and some evidence from cross-section and time-series data. *The American Economic Review*, 76(1), pp. 191-203.
- Ram, R., 1989. Government size and economic growth: A new framework and some evidence from cross-section and time-series data: Reply. *The American Economic Review*, 79(1), pp. 281-284.
- Reinhart, C.M. and Rogoff, K.S., 2010a. Growth in a time of debt, *American Economic Review*, 100(2), pp. 573-78.
- Reinhart, C.M. and Rogoff, K.S., 2010b. Debt and growth revisited.
- Shahor, T. (2018). The impact of public debt on economic growth in the Israeli economy. *Israel Affairs*, 24(2), pp. 254-264.
- Swamy, V., 2015. The Dynamics of Government Debt and Economic Growth. Available at SSRN 2595106.
- Velichkov, N., 2016. Effects of Government Debt on Macroeconomic Activity (The Case of Bulgaria). *Economic Alternatives*, 1, pp. 24-32.
- Woo J., and Kumar, M.S., 2015. Public debt and growth. *Economica*, 82(328), pp. 705-739.