IS THE REINHART-ROGOFF DEBT THRESHOLD APPLICABLE TO ITALY?

Dr. Yu Hsing
Joseph H. Miller Endowed Professor in Business
Department of Management & Business Administration
College of Business
Southeastern Louisiana University
Hammond, Louisiana 70402, USA
E-mail: yhsing@selu.edu

ABSTRACT

This paper employs an extended production function to examine the relationship between central government debt and economic growth in Italy. The results show that the threshold of the central government debt ratio for Italy is estimated to be 105.00%, which is greater than the 90% debt threshold proposed by Reinhart and Rogoff. Besides, a higher growth rate of labor employment or investment/GDP ratio would raise the growth rate. Hence, the debt threshold proposed by Reinhart-Rogoff underestimates the debt threshold for Italy. The finding suggests that the debt ratio of 131.09% in 2019 is well above the debt threshold and is likely to be unsustainable.

Keywords: Fiscal Policy, Government Debt, Reinhart-Rogoff Hypothesis, Debt Threshold.

INTRODUCTION

During and after the global financial crisis, many countries engaged in fiscal expansion to stimulate their economies. Italy is no exception. The central government debt ratio rose rapidly from a low of 98.13% in 2007 to 110.10% in 2009. The debt ratios continued to rise and reached 130.27% in 2014 and then stabilized around 130% - 131% after 2014. Whether a higher government debt ratio would increase or reduce the growth rate of real GDP has been studied extensively. Reinhart and Rogoff (2010a, 2010b) show that the threshold or turning point of the government debt ratio is 90%. Beyond 90%, a further increase in the debt ratio tends to reduce the growth rate.

The purpose of this paper is to test whether the Reinhart-Rogoff hypothesis may apply to Italy. Is it possible to have a debt threshold or turning point of 90% of GDP for Italy? This paper has several different aspects. First, a production function is extended to include the government debt ratio. Second, the paper uses a quadratic function to test whether there may be an inverted U-shape relationship and a turning point. Third, the GARCH process is employed in empirical work to correct for potential autoregressive conditional heteroskedasticity.

LITERATURE SURVEY

Based on a sample of forty-four advanced and developing countries covering many 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, using the same data sample developed by Reinhart and Rogoff and different specifications, 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. Égert (2015a, 2015b) 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) find no support for the 90% debt threshold. Using the post-WWII data developed by Reinhart and Rogoff, they show that the debt threshold maybe around 30%. Beyond 30%, the growth rate will decline by 1 percentage point.

Based on a sample of 18 OECD countries during 1980-2008, Cecchetti, Mohanty, and Zampolli (2011) find that the government debt threshold is 85%, suggesting that an increase in the government debt ratio beyond 85% tends to harm economic growth. They also show that when the corporate debt ratio is greater than 90% of GDP, there will be an adverse effect on growth.

Checherita-Westphal and Rother (2012) examine the relationship between government debt and economic growth using a sample of 12 countries in the euro area. They find a threshold or turning point in the range of 90% - 100%, indicating that an increase in the government debt ratio tends to reduce economic growth if the debt ratio is greater than 90% - 100%. The threshold would start in the range of 70% - 80% based on the confidence interval.

Baum, Checherita-Westphal, and Rother (2013) investigate the relationship between government debt and growth for twelve countries in the euro area. A higher debt ratio increases economic growth but has no impact when the debt ratio reaches about 67%. When the debt ratio is greater than 95%, a higher debt ratio reduces economic growth.

Afonso and Jalles (2013) examine the impact of government debt on economic growth for 155 advanced and developing countries during 1970 – 2008. The debt threshold is estimated to be 59% for the eurozone and 79% for emerging economies. If the debt ratio increases by 10%, the growth rate would decrease by 0.2% if the debt ratio is over 90% and increase by 0.1% if the debt ratio is below 30%.

Chirwa (2017) studies the relationship among government debt, growth, and other related variables for ten countries in the euro area. The threshold is estimated to be 70% in the long run whereas government debt and economic growth have a negative relationship in the short run.
Woo and Kumar (2015) show that if a 10-percentage point increase in the initial debt ratio tends to reduce the growth rate of real per capita GDP by 0.2 percentage points. A higher initial government debt ratio tends to cause a larger negative effect. The negative effect isowing tothe decrease in labor productivity growth.

Lechtenberg (2017) analyzes the subject using a sample of 10 countries. Australia, Canada, Chile, Germany, and New Zealand have had low and declining debt ratios, and a higher debt ratio would not cause economic growth to decline in these countries. On the other hand, debt thresholds are found for France, Greece, Italy, the U.K., and the U.S. A higher debt ratio

beyond the threshold tends to reduce economic growth in Greece, Italy, the U.K., and the U.S. but increase the economic growth rate for France.

Comparing with public debt between Belgium and Italy, Sapir (2018) examines how these two countries have handled the debt issue. In the early 1990s, both countries have accumulated relatively high levels of public debt. After the Maastricht treaty took effect in 1993, both countries have improved their financial position to reduce the debt level to be eligible for the adoption of the euro. Before the launch of the euro, however, Italy's debt position became worse mainly because Italy's efforts stalked and did not pay enough attention to growth performance. During and after the global financial crisis and the Greek sovereign debt crisis, Italy took austerity measures, caused real GDP to decline, and raised the debt level. On the other hand, during the crisis, Belgium committed to fiscal discipline and debt sustainability.

Reviewing Italy's public debt during 1861-2018, Bastasin, Mischitelli, and Toniolo (2019) indicated that the relatively high public debt may not be sustainable and that the government needs to improve education, cut red tape, pursue investment-oriented fiscal expansion, and engage in structural reforms to enhance business competitiveness to promote growth.

Using a large sample consisting of many advanced and developing countries, Swamy (2020) reveals that a 10-percentage point increase in the government debt ratio tends to result ina decrease in the average growth rate by 23 basis points and that the relationship between government debt and economic growth is nonlinear. The impact of government debt on economic growth varies by country, depending upon several major macroeconomic factors and debt regimes.

Jacobs, Ogawa, Sterken, and Tokutsu (2020) explore the relationship between public debt and economic growth for 27 EU members and 4 OECD countries during 1995-2013. They show that economic growth Granger causes public debt, but not vice versa. 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. Besides, they indicate that high-debt economies show greater impacts of economic growth on the debt ratio and that the low-debt countries exhibit greater effects of the debt ratio on economic growth.

The Model
Applying Ram (1986, 1989) and Goel, Payne, and Ram (2008), the growth rate of real GDP can be expressed as:

$$GY = w(GL, GK, DY) \hspace{4cm} (1)$$

Where
GY = the growth rate of real GDP(Y) in Italy,
GL = the growth rate of labor (L),
GK = the growth rate of capital (K), and
DY = the government debt-to-GDP ratio.
Due to the lack of data for capital, the growth rate of capital can be substituted by the ratio of investment spending to gross domestic product (IY) (Ram, 1986, 1989).

$$GY = z(GL, IY, DY) \hspace{4cm} (2)$$

The coefficient of GL measures the elasticity of Y with respect to L, and the coefficient of IY represents the marginal product of capital. The coefficient of GL and IY is expected to be positive, and the sign of the coefficient of DY is unclear. When DY is relatively low, an increase in the government debt ratio for infrastructural improvements may enhance economic growth. When the debt ratio is relatively high, a further increase in the debt ratio tends to raise the interest rate, cause the local currency to appreciate, hurt exports, and crowd out private spending. There may be a threshold or an inverted U-shaped relationship between GY and the government debt ratio. An analysis of the data also finds that growth rates declined a great deal due to the global financial crisis. Hence, a binary variable (B) is also added to the estimated equation:

$$GY = \delta_0 + \delta_1 GL + \delta_2\, IY + \delta_3\, DY + \delta_4 DY^2 + \delta_5 B + \varepsilon \qquad (3)$$

An inverted U-shaped relationship between GY and the debt ratio suggests that the sign of DY should be positive and the sign of DY^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:

$$DY^* = \delta_3/2\delta_4 \qquad\qquad\qquad\qquad\qquad (4)$$

Where, δ_3 is the coefficient of DY and δ_4 is the coefficient of DY^2.

EMPIRICAL RESULTS

The data were collected from the World Economic Outlook, International Financial Statistics, and Eurostat. 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. Central government debt is measured as a percent of gross domestic product. The sample ranges from 1981 to 2019. The data for the government debt ratio or the growth rate before 1981is not available.

Figure 1 shows the growth rates of real GDP over time. It appears that growth rates of real GDP were less than 2% after the year 2006 and were negative in 2008 and 2009 due to the global financial crisis. Figure 2 describes the central government debt as a percent of GDP. The debt ratio declined during 1996-2007, rose during 2008-2013, leveled off after 2013, and reached 131.09% in 2019. Figure 3 exhibits a scatter diagram between the debt ratio and the growth rate of real GDP. It seems that the relationship is nonlinear. With a few outliers, the relation was positive when the debt ratio was relatively small and negative when the debt ratio was relatively high.

Table 1 presents the estimated regression and related statistics. The GARCH process is employed in empirical work to correct for autoregressive conditional heteroskedasticity. Approximately 58.60% of the variation in the growth rate of real GDP in Italy can be explained by the five independent variables. These five explanatory variables have the expected sign and are significant at the 1% or 10% level. The growth rate of real GDP in Italy is positively affected by the growth rate of labor, the investment/GDP ratio, and the central government debt ratio and negatively affected by the central government debt ratio squared and the binary variable for years 2008 and 2009.

A 1 percentage point increase in labor would result in an increase in the growth rate by 0.5031 percentage points. If the investment-GDP ratio rises 1 percentage point, the growth rate would increase by 0.3388 percentage points. The quadratic relationship between the growth rate and the central government debt ratio indicates that the critical value of the central government debt ratio corresponding to the turning point is estimated to be 104.997%. During 2008-2009, growth rates of real GDP in Italy declined by 5.5745 percentage points.
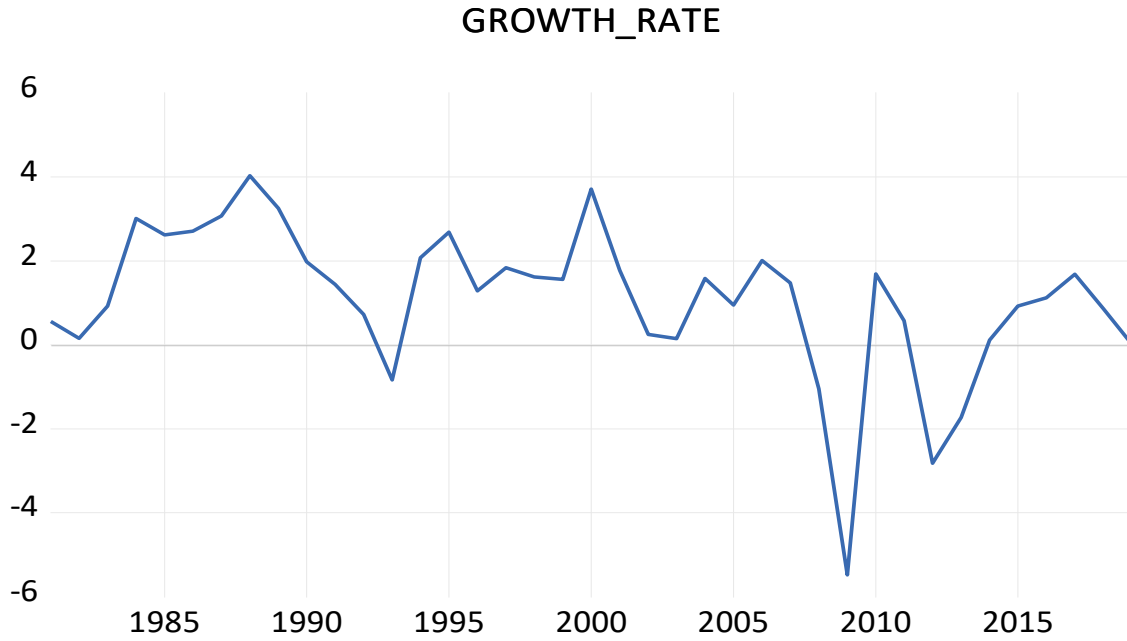
GROWTH_RATE

Figure 1. Growth rates of real GDP over time
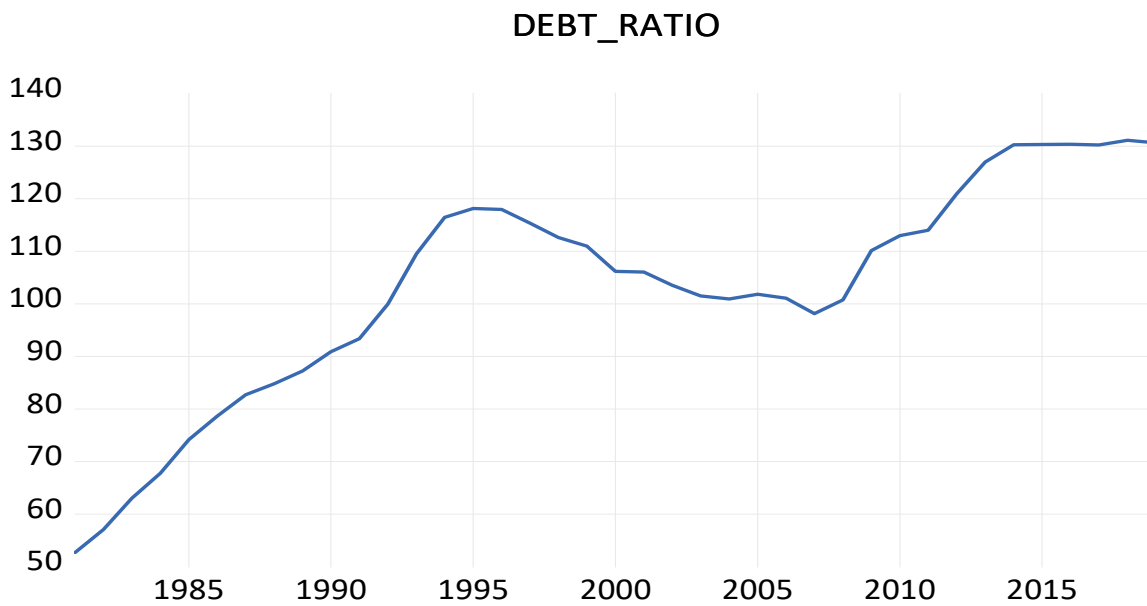
DEBT_RATIO
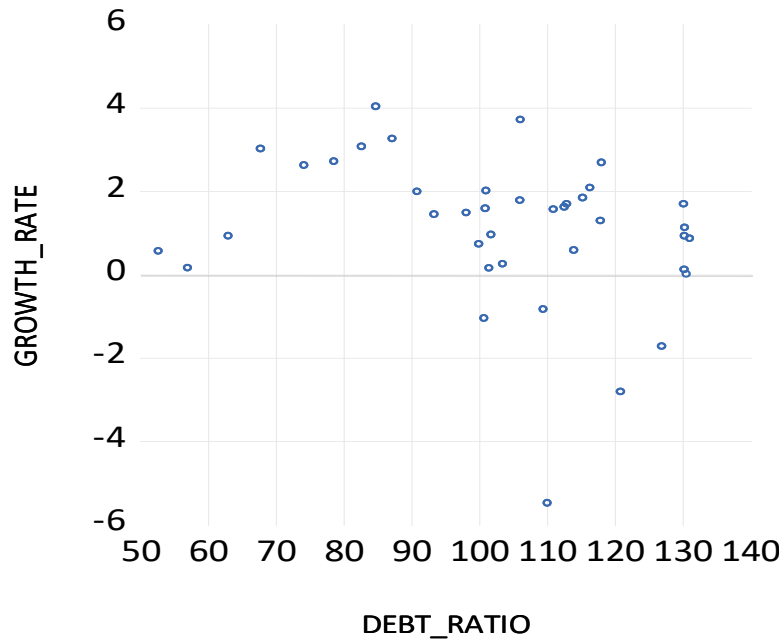

Figure 2. The government debt ratio over time

Figure 3. Scatter diagram between the debt ratio and the growth rate of real GDP

Table 1. Estimated regression for the growth rate of real GDP in Italy

Variable	Coefficient	Probability
Intercept	-83.2978	0.0000
The growth rate of labor	0.5031	0.0010
Investment/GDP ratio	0.3388	0.0735
Central government debt ratio	33.4988	0.0001
Central government debt ratio squared	-3.5990	0.0002
Binary variable	-5.5745	0.0000
R squared	0.5860	
Sample period	1981-2019	
Number of observations	39	
Methodology	GARCH	

Notes: The binary variable equals 1 during 2008-2009 and 0 otherwise.

To sum up, the results in this paper show that the growth rate of real GDP has a positive relationship with the growth rate of labor, the investment/GDP ratio and a negative relationship with the binary variable during the global financial crisis during 2008-2009. The growth rate and the debt ratio exhibit a quadratic relationship with a threshold or turning point at 105.00%.

In comparison, the finding of a threshold or turning point of 105.00% in this study is less than the 115% threshold estimated by Minea and Parent (2012) but greater than the 90% threshold proposed by Reinhart and Rogoff (2010a, 2010b) and other findings (Égert, 2015a, 2015b; Lee, Park, Seo and Shin, 2017; Cecchetti, Mohanty, and Zampolli, 2011; Checcherita-Westphal and Rother, 2012; Baum, Checcherita-Westphal and Rother, 2013; Afonso and Jalles, 2013; Chirwa, 2017). The result in this study is in contrast with the results reported by Wu and

Kumar (2015) and Swamy (2020), which show that a higher government debt ratio hurts the growth rate.

SUMMARY AND CONCLUSIONS

This paper has applied an extended production function to examine the relationship between the central government debt ratio and the growth rate of real GDP in Italy. Reinhart-Rogoff (2010a, 2010b) suggests that when the debt ratio is greater than 90% of GDP, a further increase in the debt ratio would slow down the growth rate. The main focus is to test whether the Reinhart-Rogoff hypothesis may apply to Italy.

Results show that their relationship is nonlinear and that there is a turning point or threshold estimated to be 105.00%. When the debt ratio increases and is less than 105.00%, the growth rate would rise. Conversely, when the debt ratio increases and is greater than 105.00%, the growth rate would decline. Comparing with the current debt ratio of 131.09% in 2019, a further increase in the debt ratio would hurt economic growth. The estimated threshold suggests that the debt threshold of 90% proposed by Reinhart and Rogoff does not apply to Italy.

Besides, the growth rate of real GDP is positively associated with the growth rate of employment and the investment/GDP ratio, and it declined during the global financial crisis during 2008-2009.

Hence, to promote economic growth, Italy's debt ratio needs to decrease because the current debt ratio is unsustainable. To pursue fiscal discipline and to reduce government deficits and debt, government spending needs to slow down or decline, and taxes need to increase. To enhance growth, authorities need to improve human capital by providing more training and quality education.

REFERENCES

Afonso, A., & Jalles, J. T. (2013). Growth and productivity: The role of government debt. *International Review of Economics and Finance*, 25(January), 384–407.

Bastasin, C., Mischitelli, M., & Toniolo, G. (2019). Living with high public debt: Italy 1861-2018. SEP Working Paper 11.

Baum, A., Checherita-Westphal, C., & Rother, P. (2013). Debt and growth: New evidence for the euro area.*Journal of International Money and Finance*, 32(February), 809-821.

Cecchetti, S. G., Mohanty, M. S., & Zampolli, F. (2011). The real effects of debt. Bank for International Settlements, Bis Working Papers No. 352.

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*, *56*(7), 1392-1405.

Chirwa, T. G. (2017). Public debt and economic growth nexus in the Euro area: A dynamic panel ARDL approach. UNISA Economic Research Working Paper 19/2017.

Égert, B. (2015a). The 90% Public debt threshold: The rise and fall of a stylized fact.*Applied Economics*, *47*(34-35), 3756-3770.

Égert, B. (2015b). Public debt, economic growth, and nonlinear effects: Myth or reality? *Journal of Macroeconomics*, *43*(March), 226-238.

Goel, R. K., Payne, J. E., & Ram, R. (2008). R&D expenditures and US economic growth: A disaggregated approach. *Journal of Policy Modeling*, *30*(2), 237-250.

Herndon, T., Ash, M., & Pollin, R. (2014). Does high public debt consistently stifle economic growth? A critique of Reinhart and Rogoff.*Cambridge Journal of Economics*, *38*(2), 257-279.

Jacobs, J., Ogawa, K., Sterken, E., & 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), 1377-1394.

Lechtenberg, L. (2017). The debt-to-GDP threshold effect on output: A country-specific analysis. *Aisthesis*, *8*(1), 26-34.

Lee, S., Park, H., Seo, M. H., & Shin, Y. (2017). Testing for a debt-threshold effect on output growth. *Fiscal Studies*, *38*(4), 701-717.

Minea, A., & Parent, A. (2012). Is high public debt always harmful to economic growth? Reinhart and Rogoff and some complex nonlinearities. CERDI, working paper, halshs-00700471.

Ram, R. (1986). Government size and economic growth: A new framework and some evidence from cross-section and time-series data. *American Economic Review*, *76*(1), 191-203.

Ram, R. (1989). Government size and economic growth: A new framework and some evidence from cross-section and time-series data: reply. *American Economic Review*, *79*(1), 281-284.

Reinhart, C. M., & Rogoff, K. S. (2010a). Growth in a time of debt.*American Economic Review*, *100*(2), 573-78.

Reinhart, C. M., & Rogoff, K. S. (2010b). Debt and growth revisited. MPRA Paper No. 24376.

Sapir, A. (2018). High public debt in euro-area countries: comparing Belgium and Italy. (No. 2018/15). Bruegel Policy Contribution.

Swamy, V. (2020). Debt and growth: Decomposing the cause and effect relationship. *International Journal of Finance & Economics*, *25*(2), 141-156.

Woo, J., & Kumar, M. S. (2015). Public debt and growth. *Economica*, *82*(328), 705-739.