The 'other half' of the public debt–economic growth relationship: a note on Reinhart and Rogoff

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Reinhart/Rogoff (2010) and Reinhart et al. (2012) document a negative relationship between public debt and economic growth. However, by classifying the observations of their data set into public debt categories and identifying public debt overhang episodes, they focus only on 'one half' of the public debt–economic growth relationship: the growth-reducing effects of high public debt. This note classifies the observations of their data set into economic growth categories and identifies low-growth episodes. In so doing, it presents the 'other half' of the public debt–economic growth relationship: the debt-increasing effects of low growth. It is argued that the presentation of 'both halves' is essential for a more fruitful research agenda and policy debate.

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1. INTRODUCTION

In two very influential papers, Reinhart/Rogoff (2010) and Reinhart et al. (2012) (henceforth RRR) investigated the relationship between public debt and economic growth. By classifying the annual observations of their data set into public debt categories and identifying public debt overhang episodes, they indicated that higher public debt-to-GDP ratios are related with lower economic growth. They also emphasised that this relationship is non-linear: although the debt-to-growth correlation is weak below the 90 per cent debt-to-GDP threshold, it becomes much stronger above it.

Herndon et al. (2013; 2014) (henceforth HAP) called these results into question. They pointed out three problems in the analysis of Reinhart/Rogoff (2010): (i) coding errors; (ii) selective exclusion of available data; and (iii) inappropriate weighting of summary statistics. They showed that when these problems are tackled, economic growth does not dramatically reduce when the public debt-to-GDP ratio passes the 90 per cent threshold. Reinhart/Rogoff (2013) responded by acknowledging the coding errors in their estimations; however, they disagreed that their weighting method is inappropriate and that they made selective exclusion of data. They themselves presented some corrected estimations according to which the negative relationship between growth and debt remains but ceases to become stronger above the 90 per cent threshold.

This note focuses on another issue of the RRR data analysis. It argues that by classifying the observations of their data set into public debt categories and identifying public debt overhang episodes, RRR focused only on 'one half' of the public debt–economic growth relationship: the growth-reducing effects of high public debt. The note classifies the observations of their data set into economic growth categories and identifies low-growth episodes. In so doing, it presents the 'other half' of the public debt–economic growth relationship: the debt-increasing effects of low growth.

RRR clearly state that their analysis does not capture causality. However, by focusing only on 'one half' of the public debt–economic growth relationship, they have induced many policy-makers to use their analysis as an empirical ground in support of policies that intend to reduce the public debt (see Herndon et al. 2014). The potential debt-increasing effects of low growth

have been relegated to the sidelines. Furthermore, the emphasis of RRR on the growth-reducing effects of high public debt has prompted most researchers in the field to explore the impact of public debt on economic growth and not vice versa. However, the related empirical studies have not so far provided strong support to the causality from public debt to economic growth.[1] This implies that the presentation of 'both halves' is essential for a more fruitful research agenda and policy debate.

The note is structured as follows. Section 2 describes the data and the methodology. Section 3 follows RRR and presents 'one half' of the public debt–economic growth relationship by grouping the annual observations into public debt categories and identifying public debt overhang episodes. Section 4 reveals the 'other half' of this relationship by classifying the annual observations into economic growth categories and identifying low-growth episodes. Section 5 concludes.

2. DATA AND METHODOLOGY

The note uses the publicly available data set that Reinhart/Rogoff (2013) employed in their errata.[2] This data set refers to 20 advanced economies over the period 1791–2009. It is an updated and improved version of the data set utilised by Reinhart/Rogoff (2010). The data set includes two different growth series for New Zealand: one comes from the Angus Maddison's

[1] Caner et al. (2010), Kumar/Woo (2010), Cecchetti et al. (2011), Checherita-Westphal/Rother (2012) and Baum et al. (2013) find that a rise in public indebtedness causes a reduction in growth when the public debt-to-GDP ratio is above specific thresholds. Nonetheless, various findings of other scholars indicate that this result is not robust. First, Panizza/Presbitero (2013) call into question the approaches used in most of the aforementioned studies to address endogeneity. By employing a different approach and making various robustness checks, Panizza/Presbitero (2014) show that there is no evidence that public debt has a causal effect on growth. Second, the empirical studies of Kourtellos et al. (2013) and Pescatori et al. (2014), which pay particular attention to the investigation of threshold effects, find no evidence for the existence of a specific public debt threshold above which a higher public debt results in lower growth. Third, some researchers report positive links between debt and growth at high levels of public indebtedness. For example, Minea/Parent (2012) find that, while a higher than 90 per cent debt-to-GDP ratio is associated with lower growth, the correlation between debt and growth becomes positive when the debt ratio becomes higher than 115 per cent; additionally, Chang/Chiang (2009), as cited in Baum et al. (2013), show that there are positive effects of the debt ratio on growth even when public indebtedness is high. Fourth, some recent studies that examine both directions of causality find that the negative relationship between public debt and economic growth is primarily explained by the adverse effects of lower growth on public indebtedness and not by the negative impact of public indebtedness on growth (see Dube 2013; Lof/Malinen 2013; Ferreira 2014).

[2] The data set is available at: www.carmenreinhart.com/user_uploads/data/41_data.xlsx (accessed 1 July 2014).

Database and the other from the New Zealand Historical Statistics. Following Reinhart et al. (2012), the series obtained from the New Zealand Historical Statistics is used.[3] Reinhart/Rogoff (2010) presented different estimations for the postwar sample (1946–2009) and the long sample (1791–2009). Therefore, in the estimations of this note results for both samples are presented.

Reinhart/Rogoff (2010) grouped the annual observations of their data set into four categories based on the public debt-to-GDP ratio: below 30 per cent, 30–60 per cent, 60–90 per cent, and above 90 per cent. They then reported the mean and the median economic growth in each of these categories. Reinhart et al. (2012) presented in detail the public debt overhang periods, which were defined as the periods in which the public debt-to-GDP ratio was higher than 90 per cent. They focused on the countries in which these periods lasted for 5 years or more. For these countries they estimated the mean economic growth below and above 90 per cent. In Section 3 these descriptive statistics approaches are applied to our data set in order to present the growth-reducing effects of high public debt.

In Section 4 the same approaches are used to show the debt-increasing effects of low growth. In particular, the annual observations are grouped into economic growth categories: very high, high, medium and low (or negative) growth; for robustness, various different thresholds are adopted. Low-growth episodes are also identified. These episodes are defined as the periods in which economic growth was lower than 2 per cent (including negative growth).[4] The mean public debt-to-GDP ratio above and below 2 per cent is then presented.

One of the main critiques to RRR by HAP is the use of an inappropriate weighting in the calculation of summary statistics. RRR produce summary statistics for each of their debt categories by counting each country as a single observation. HAP argue that this magnifies the effects of short-term high public debt episodes in the calculations of means and medians.

[3] In the case of Greece there are missing values for the public debt-to-GDP ratio in 2008 and 2009. However, in their estimations Reinhart/Rogoff (2013) classify 2008 and 2009 as years of very high public debt. Therefore, in order to be in line with their estimations, the missing values were filled in using the data from the data appendix in Reinhart et al. (2012). This appendix is available at: http://www.aeaweb.org/articles.php?doi=10.1257/jep.26.3.69 (assessed 5 July 2014).

[4] The 2 per cent threshold is arbitrary and is merely used for the purposes of our illustration.

Therefore, in their estimations HAP equally weight all the country-year observations. To check for robustness, the calculations in this note are made using both weighting approaches.

3. 'ONE HALF' OF THE PUBLIC DEBT–ECONOMIC GROWTH RELATIONSHIP

Table 1 reports the mean and the median economic growth in the four public debt categories. When the RRR weighting approach is used, the results are the same as the ones presented by Reinhart/Rogoff (2013).[5] Table 1 indicates that as public debt increases, economic growth becomes lower. However, no non-linearity is traced at the 90 per cent threshold. If any non-linearity is present, this is more likely to occur at the 30 per cent threshold in the postwar sample.[6]

<Insert Table 1 here>

Despite the non-existence of a 90 per cent threshold, the results presented in Table 1 can be interpreted as an indication of the growth-reducing effects of high public debt. Reinhart et al. (2012) argue that these effects are associated with two channels: (i) the negative impact of high public debt on private investment via crowding out, taxation, inflation or financial repression; and (ii) the rise in interest rates induced by high public debt.

In our data set, 20 public debt overhang episodes are identified.[7] Table 2 reports these episodes. 12 out of 20 countries experienced at least one episode that lasted 5 years or more. In 9 out of these 12 countries the mean economic growth was lower when the public debt-to-GDP ratio exceeded 90 per cent. Of particular interest is the fact that, as in Reinhart et al. (2012), most of the public debt overhang episodes lasted more than a decade. This led Reinhart et al. (2012) to

[5] In the long sample, there is a slight difference between the results of Reinhart/Rogoff (2013) and the results of this note. The reason is that Reinhart/Rogoff (2013) have not used in the estimation of the summary figures the period 1940–1945 for the UK and the period 1941–1944 for the US.

[6] This potential existence of non-linearity at low public debt-to-GDP ratios has been pointed out by HAP, Dube (2013) and Égert (2013).

[7] Reinhart et al. (2012) use a longer period data set, which has various differences compared with the data set utilised here. As a result, the episodes presented in Table 2 are not identical to the episodes presented in Table 1 of their paper.

argue that the negative correlation between high debt and growth cannot be primarily attributed to the cyclical effects of slowdowns on debt ratios. This is generally correct. However, that fact should not be considered as evidence against the importance of the debt-increasing effects of low growth: secular stagnation rather than cyclical slowdowns can theoretically be behind these public debt overhangs.

<Insert Table 2 here>

4 THE 'OTHER HALF' OF THE PUBLIC DEBT–ECONOMIC GROWTH RELATIONSHIP

Table 3 reports the mean and the median public debt-to-GDP ratio when economic growth varies. In almost all cases, lower economic growth is associated with higher public indebtedness. This implies that the data set can equally support the growth-reducing effects of high debt and the debt-increasing effects of low growth. Theoretically, there are two main channels through which low growth can be conducive to high public indebtedness: (i) weak economic performance places upward pressures on the public debt-to-GDP ratio since GDP is the denominator of this ratio; and (ii) low growth tends to deteriorate public budgets due to the automatic stabilisers.

<Insert Table 3>

In our sample there are 25 low-growth episodes that lasted 5 years or more (see Table 4). These episodes were experienced by 16 countries. In 13 out of these 16 countries the mean public debt-to-GDP ratio was higher for economic growth below 2 per cent. The same holds for the 3 out of 4 countries in which the duration of the low-growth episode was less than 5 years. This evidence could be regarded as an indication of the debt-increasing effects of low growth.

<Insert Table 4>

5. CONCLUSIONS

RRR clearly state that their analysis does not capture causality. However, by classifying the annual observations into public debt categories and identifying public debt overhang episodes they focused only on 'one half' of the public debt–economic growth relationship: the growth-reducing effects of high public debt. This note classified the annual observations into economic growth categories and identified low-growth episodes. In so doing, it presented the 'other half' of this relationship: the debt-increasing effects of low growth.

The presentation of 'both halves' is essential for a more fruitful research agenda and policy debate. Each 'half' has different policy implications. The growth-reducing effects of high public debt imply that the governments should focus on the reduction of their public debt to avoid low growth. The debt-increasing effects of low growth suggest that growth policies should be adopted to avoid high public indebtedness. The validity of 'both halves' needs to be equally investigated. Research should also explore in greater detail the extent to which exogenous shocks (for example, banking crises) are behind the public debt–economic growth relationship.

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Tables

Table 1: Economic growth (%) as the public debt-to-GDP ratio varies

		Public debt-to-GDP category			
		Below 30%	30-60%	60-90%	Above 90%
Long sample					
Mean	RRR weighting	3.8	3.2	3.2	2.2
	HAP weighting	3.7	3.2	2.5	2.1
Median	RRR weighting	3.8	3.0	2.6	2.3
	HAP weighting	3.9	3.1	2.5	2.4
Post-war sample					
Mean	RRR weighting	4.2	3.0	2.4	2.0
	HAP weighting	4.3	3.1	2.9	2.1
Median	RRR weighting	4.2	3.0	2.9	2.5
	HAP weighting	4.3	3.1	3.3	2.3

Table 2: Public debt overhang episodes, long sample

Country	Episode(s) lasting 5 years or more	Mean economic growth (%)		Share (%) of years above 90%
		Debt below 90%	Debt above 90%	
A. Countries where public debt-to-GDP ratio exceeded 90% for 5 consecutive years or more				
Australia	1945-1950	3.4	3.5	8.3 (9/108)
Belgium	1920-1926; 1984-2005	2.5	3.3	20.4 (33/162)
Canada	1944-1950	4.0	2.2	8.2 (7/85)
France	1880-1902; 1920-1927	3.7	1.9	35.3 (36/102)
Greece	1887-1910; 1928-1936; 1991-2009	4.0	2.5	61.5 (56/91)
Ireland	1983-1989	4.1	2.4	11.5 (7/61)
Italy	1880-1906; 1939-1944; 1993-2001	3.5	0.7	38.9 (49/126)
Japan	1999-2009	4.4	0.7	9.9 (11/111)
New Zealand	1932-1949	2.7	5.4	24.4 (19/78)
Spain	1868-1882; 1896-1909	2.9	2.2	18.7 (29/155)
UK	1831-1863; 1917-1964	2.1	1.8	45.3 (81/179)
US	1944-1949	4.0	-0.2	2.7 (6/219)
B. Countries where public debt-to-GDP ratio exceeded 90% only for 1 to 4 consecutive years				
Finland	-	3.3	1.9	3.1 (3/96)
Netherlands	-	2.9	2.0	7.5 (8/107)
C. Countries where public debt-to-GDP ratio did not exceed 90% in any year				
Austria	-	3.3	-	0 (0/110)
Denmark	-	2.8	-	0 (0/90)
Germany	-	3.3	-	0 (0/107)
Norway	-	3.3	-	0 (0/124)
Portugal	-	3.1	-	0 (0/91)
Sweden	-	2.9	-	0 (0/130)

Note: Using RRR weighting, the mean economic growth for the whole sample is 3.3% for public debt-to-GDP ratio below 90% and 2.2% for public debt-to-GDP ratio above 90%. Using HAP weighting, the respective figures are 3.3% and 2.1%.

Table 3: Public debt-to-GDP ratio (%) as economic growth varies

		Economic growth category			
		Above 6%	4-6%	2-4%	Below 2%
Long sample					
Mean	RRR weighting	48.1	47.8	53.0	59.0
	HAP weighting	45.8	45.5	50.0	60.9
Median	RRR weighting	35.1	40.6	50.2	57.8
	HAP weighting	33.1	35.6	42.4	54.7
Post-war sample					
Mean	RRR weighting	34.1	41.6	47.9	52.4
	HAP weighting	31.7	39.6	48.0	53.8
Median	RRR weighting	25.9	33.8	43.4	47.4
	HAP weighting	23.7	33.1	43.6	47.7
		Above 5%	3-5%	1-3%	Below 1%
Long sample					
Mean	RRR weighting	47.7	49.4	54.3	60.4
	HAP weighting	45.0	47.6	52.4	63.9
Median	RRR weighting	32.3	44.3	53.7	57.7
	HAP weighting	31.9	39.2	45.1	57.4
Post-war sample					
Mean	RRR weighting	35.0	45.8	51.1	51.3
	HAP weighting	33.0	46.1	49.5	54.2
Median	RRR weighting	26.4	41.0	45.3	46.5
	HAP weighting	26.5	41.8	44.2	47.5
		Above 6%	3-6%	0-3%	Below 0%
Long sample					
Mean	RRR weighting	48.1	48.6	54.7	62.0
	HAP weighting	45.8	46.5	53.4	67.6
Median	RRR weighting	35.1	46.5	56.9	57.0
	HAP weighting	33.1	37.8	46.4	59.6
Post-war sample					
Mean	RRR weighting	34.1	43.6	51.0	50.9
	HAP weighting	31.7	43.0	50.5	54.6
Median	RRR weighting	25.9	38.8	46.0	45.5
	HAP weighting	23.7	37.8	45.7	44.4

Table 4: Low growth episodes, long sample

Country	Episode(s) lasting 5 years or more	Mean public debt-to-GDP ratio (%)		Share (%) of years below 2%
		Growth above 2%	Growth below 2%	
A. Countries where economic growth fell below 2% for 5 consecutive years or more				
Australia	1914-1918; 1927-1931	46.6	56.8	24.1 (26/108)
Austria	1929-1935	41.1	51.9	33.3 (40/120)
Belgium	1930-1935	57.8	53.1	43.8 (70/160)
Canada	1929-1933	55.9	65.4	22.4 (19/85)
Denmark	1987-1993	28.9	36.5	34.9 (45/129)
Finland	1914-1918	24.2	28.0	29.2 (28/96)
France	1883-1888	61.1	94.2	34.2 (38/111)
Germany	1914-1919; 1995-1999; 2001-2005	11.6	20.2	33.8 (44/130)
Greece	1940-1944	97.9	107.9	33.1 (41/124)
Italy	1940-1945; 2001-2005	64.1	90.5	42.3 (55/130)
Netherlands	1929-1934	52.8	61.4	33.3 (43/129)
New Zealand	1985-1992	71.3	69.9	39.7 (31/78)
Norway	1881-1887	26.9	22.3	30.0 (39/130)
Portugal	1901-1906; 1911-1918; 2002-2009	34.1	57.6	41.5 (54/130)
Spain	1882-1887; 1979-1984	59.6	69.2	40.9 (65/159)
UK	1875-1879; 1916-1921; 1942-1947	87.2	100.7	43.0 (77/179)
B. Countries where economic growth fell below 2% only for 1 to 4 consecutive years				
Ireland	-	63.2	72.5	24.6 (15/61)
Japan	-	39.4	62.0	34.9 (38/109)
Sweden	-	30.1	29.6	30.8 (40/130)
US	-	26.8	31.3	26.9 (59/219)

Note: Using RRR weighting, the mean public debt-to-GDP ratio for the whole sample is 49% for economic growth above 2% and 59% for economic growth below 2%. Using HAP weighting, the respective figures are 47.5% and 60.9%.