



Public debt, economic growth and nonlinear effects: Myth or reality?



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ABSTRACT

This paper puts a variant of the Reinhart–Rogoff dataset to a formal econometric testing to see whether public debt has a negative nonlinear effect on growth if public debt exceeds 90% of GDP. Using nonlinear threshold models, we show that finding a negative nonlinear relationship between the public debt-to-GDP ratio and economic growth is extremely difficult and sensitive to modelling choices and data coverage. In the very rare cases when nonlinearity à la Reinhart and Rogoff can be detected, the negative nonlinear correlation kicks in at very low levels of public debt (between 20% and 60% of GDP). These results, based on bivariate regressions for central government debt from 1946 to 2009, are confirmed on a shorter dataset including general government debt (1960–2010) using a multivariate growth framework and Bayesian model averaging.

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1. Introduction

The financial and economic crisis prompted by the unwinding US subprime mortgage market resulted in deep economic recession in many countries of the world. Governments and central banks reacted to the Great Recession by firing heavy artillery: fiscal and monetary policy expansion, unprecedented in size and in the way they were co-ordinated across countries, were swiftly enacted in advanced and emerging markets, and banking sector bailouts prevented the collapse of the financial system. While these actions certainly helped smooth the cycle, discretionary fiscal loosening and banking sector bail-outs contributed to a large extent to a sharp increase in many countries' public debt-to-GDP ratio. It is against this background that Reinhart and Rogoff (2010) pointed out the existence of strong negative correlation between high public debt and economic growth. Using simple descriptive statistics, they demonstrated forcefully that economic growth slows down considerably if the public debt-to-GDP ratio exceeds 90%. A number of econometric studies broadly confirmed, for a similar set of countries for the post-war period, that the turning point beyond which economic growth slows down sharply is around

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90% of GDP (see [Cecchetti et al. \(2011\)](#) and [Padoan et al. \(2012\)](#) for OECD countries and [Checherita and Rother \(2012\)](#) and [Baum et al. \(2013\)](#) for euro area countries¹).

Nevertheless, [Herndon et al. \(2013, 2014\)](#) shed light on a number of flaws in the calculations of Reinhart and Rogoff and showed that economic growth did not decline sharply above the 90% in the Reinhart and Rogoff dataset. Recent econometric studies also pointed out that a country coverage matters substantially for the threshold effect. According to [Caner et al. \(2010\)](#), the tipping point is 77% if a larger set of developing and emerging economies is analysed. [Elmeskov and Sutherland \(2012\)](#) estimated the threshold at 66% for a narrow sample of OECD countries. Other researchers could not identify a robust negative nonlinear relationship between public debt and growth ([Minea and Parent, 2012](#); [Baglan and Yoldas, 2013](#); [Eberhardt and Presbitero, 2013](#); and [Pescatori et al., 2014](#)).² Finally, in a recent contribution, [Panizza and Presbitero \(2014\)](#) argue that a negative correlation between debt and growth does not imply causality, as lower growth can result in a higher public debt to GDP ratio.

This paper seeks to contribute to the literature aimed at analysing the existence of threshold effects. We first formally test the thresholds proposed for central government debt by [Reinhart and Rogoff \(2010\)](#) and then seek to identify the thresholds endogenously on the basis of the testing procedure proposed by [Hansen \(1999\)](#) for the period 1946–2009.³ We then embed the growth–debt relationship in a general multivariate growth framework using general government debt and combine it with Bayesian model averaging to gauge the impact of model uncertainty on the presence of threshold effects for 1960–2010.

Our results are extremely sensitive to the estimation setup (bivariate vs. multivariate growth framework; exogenous vs. endogenous thresholds and the parametrisation of the threshold models), data coverage (time dimension and country coverage considered), the data frequency used (annual data vs. different multi-year averages) and the definition of public debt (central vs. general government debt). We also show that if a negative nonlinear effect can be detected, they kick in at very low levels of public debt (between 20% and 60% of GDP).

The paper is organised as follows. Section 2 provides some stylised facts about the public debt–growth nexus by focusing on the Reinhart–Rogoff dataset. Section 3 presents empirical results for the variant of the Reinhart–Rogoff dataset. Section 4 embeds the debt–growth relationship in a multivariate growth framework and provides results using Bayesian model averaging. Finally, Section 5 summarises and provides some policy implications.

2. Stylised facts

In their influential paper, [Reinhart and Rogoff \(2010\)](#) rely on descriptive statistics to show that public debt as a share of GDP may have a detrimental effect on the rate of growth of real GDP. More specifically, they argue that the crucial public debt-to-GDP ratio is 90%, beyond which growth slows down considerably. Their charts and tables are meant to prove this claim: average and median annual GDP growth rates are shown relative to the level of the central government debt-to-GDP ratio for the period from 1946 to 2009. For a group of selected advanced countries, average GDP growth drops from around 3% to below 2% as public debt passes the threshold of 90% of GDP. The fall is more dramatic if growth is measured in terms of the median, rather than the average: a public debt-to-GDP ratio higher than 90% is associated with zero GDP growth. A similar pattern can be observed if only data for the US are considered: public debt exceeding the threshold of 90% goes in tandem with a decline in annual growth from about 3.5% to well below zero. The drop is again more pronounced if the median and not the average growth rate is looked at. The conclusion is strikingly similar for a group of selected emerging market economies: growth slows down by an annual 2 percentage points when public debt moves from below to above 90% of GDP.

Data on central government debt can be obtained from the data appendix of another paper of the same authors ([Reinhart and Rogoff, 2011](#)). Real GDP growth rates are available for a number of countries for the same time period from the Barro–Ursúa macroeconomic dataset ([Barro and Ursúa, 2012](#)). Putting these two datasets together enables us to broadly replicate the Reinhart and Rogoff data coverage on selected advanced economies. But there are some differences. First, our data excludes Ireland and includes Switzerland. Second, the emerging market country coverage of our data differs substantially from theirs. We have data on GDP growth for 16 out of the 24 countries included in their empirical investigation. But we also have data for five additional developing countries.⁴

We use our dataset to replicate and extend the results of [Reinhart and Rogoff \(2010\)](#). Figures hereafter show average and median real GDP growth as the central government debt-to-GDP ratio varies for the group of advanced economies and two groups of emerging markets, the first including the 16 countries covered in [Reinhart and Rogoff \(2010\)](#) and the second containing all emerging countries for which data are available.

¹ [Kumar and Woo \(2010\)](#) look at a group of developed and emerging countries. But [Panizza and Presbitero \(2013\)](#) argue that what [Kumar and Woo \(2010\)](#) show as a nonlinear effect is indeed a linear effect. [Panizza and Presbitero \(2013\)](#) also gives a detailed literature overview.

² [Kourtellis et al. \(2012\)](#) show that public debt and economic growth are negatively correlated in countries with weak political institutions.

³ The working paper version of this paper ([Égert, 2012](#)) also investigates secular time series starting typically at the end of the 19th century and in some cases in 1790.

⁴ The advanced countries this paper covers include: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, USA. Our group of emerging market economies include: Argentina, Brazil, Chile, Colombia, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Singapore, South Africa, Sri Lanka, Turkey, Uruguay, Venezuela. The five additional countries are: China, Egypt, Korea, Russia, Taiwan. The countries covered by Reinhart and Rogoff but excluded from our dataset are: Bolivia, Costa Rica, Ecuador, El Salvador, Ghana, Kenya, Nigeria and Thailand.

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