

Revisiting the role of public debt in economic growth: The case of OECD countries

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Abstract

The paper empirically explores the factor of public debt which considerably changes the mechanism that transmits fiscal policy effects to economic activity in the short term. We empirically examine and determine the turning point of debt-to-GDP ratio and evaluate the impact of levels of indebtedness in public sector on current economic growth for a panel dataset of 36 countries (31 OECD member states and 5 non-OECD EU member countries). The evaluation will give us an important understanding on the current indebtedness situation by determining the threshold values for our sample of countries, which indicates a possible non-linear and concave connection between indebtedness levels in the public sector and economic growth in the short term. Our sample is divided into subgroups distinguishing between so-called developed economies, covering the period 1980–2010, and emerging economies, covering the period 1995–2010. To evaluate a possible negative correlation and concave functional form between public debt and potential economic growth, we use a panel estimation on the model is augmented a generalized economic growth model augmented with a debt variable, while also considering some methodological issues like the problems of heterogeneity and endogeneity. The results confirm the general theoretical assumption that at low levels of public debt the impact on growth is positive, whereas beyond a certain debt turning point a negative effect on growth prevails. Further, we calculated that the debt-to-GDP turning point, where the positive effect of accumulated public debt inverts into a negative effect, is roughly between 90% and 94% for developed economies. Yet, for emerging countries, the debt-to-GDP turning point is lower, namely between 44% and 45%. Therefore, we can confirm our hypothesis that the threshold value for the emerging economies is lower than for the developed ones in our sample.

Keywords: *fiscal policy, public debt, economic growth, panel analysis, turning points, OECD*

Introduction

The debate about the connection between economic growth and fiscal policy is still unsettled in academic literature and economic research due its complexity and critical importance. During the recent global financial and economic crisis (also known as the ‘Great Recession’) starting in 2008, in many countries we observe the adoption of fiscal measures in order to spur aggregate demand through the recapitalization of banks and implementation of sizeable fiscal stimulus packages. The fiscal measures taken in response to the crisis and the drop in tax revenues among countries due to the reduced economic activity have resulted in a substantial deterioration of government structural balances, and the sharp accumulation of government debt. This accumulation of public debt can be associated with a potential adverse effect on future economic growth and economic stability (see Cameron, 2010; Cecchetti *et al.*, 2010, 2011; Mencinger & Aristovnik, 2013; Van Riet, 2010).

Thus, the current debt crisis has triggered a debate among academics and policymakers whether the accumulation of public debt has adverse effects on economic growth. In the literature we found various possible factors that influence the mechanism that transmits high public debt levels to economic activity.

In particular, Kumar and Woo (2010) conclude that the detrimental effects of high persistent indebtedness levels in the public sector on economic growth are mainly associated with a reduction of growth rates of labour productivity due to a decline in investment and a slowdown in capital stock accumulation. Cecchetti *et al.* (2011) suggest that higher debt levels may hamper future credit flow availability, whereby via transmission channels having detrimental effects on growth. For instance, high public debt levels can drive up risk premiums which lead to increased financing costs that may, in turn, weaken the sustainability of public finances (Kirchner *et al.*, 2006). Perotti (1999) suggests that initial fiscal conditions represent an important determinant of the adoption of fiscal measures since at low levels of deficit and debt an increase in government spending has more of a positive influence on consumption than in opposite conditions. Cecchetti *et al.* (2010) argue that the loss of confidence in the ability of governments to repay the outstanding debt levels, the subsequent higher risk premiums for issuing government bonds and also the demographic factor of a rapidly ageing population (leading to increases in spending on state-funded pensions etc.) may consequently create unstable debt dynamics, followed by an economic downturn.

In the research we will take account of the factor of public debt which considerably changes the mechanism transmitting fiscal policy effects to levels of economic activity in the short run. The paper empirically examines and assesses the direct impact of high debt levels in the public sector on economic growth for countries in the OECD. In addition, our sample includes some non-OECD EU countries that are used to ensure the robustness of the estimated values. The evaluation will give us an important understanding on the current indebtedness situation by determining the threshold values for our sample of countries, which indicates a possible non-linear and concave connection between indebtedness levels in the public sector and economic growth in the short term. The paper contributes to the current empirical studies by augmenting the group of considered economies and reevaluating the effects of levels of indebtedness in public sector on current economic growth. Namely, the survey of various empirical findings of the transmission mechanisms regarding the effects of debt on economic activity is still inconclusive (Clements *et al.*, 2003; Cecchetti *et al.*, 2011; Herndon *et al.*, 2014; Kumar & Woo, 2010; Reinhart & Rogoff, 2010a, 2010b; Partillo *et al.*, 2002, 2004 etc.)

The paper is organized as follows: first, we provide a brief literature review on the connection between public debt and economic growth concentrating solely on empirical studies. Then the applied methodology and data from different sources used to examine the effects of public debt on economic growth are presented. The next section outlines the results of the panel analysis and presents the threshold debt-to-GDP values for a subgroup of countries. The paper concludes with a summary of the main findings and presents some limitations of the research.

Literature review

Since the economic/financial crisis started, we have noticed an upsurge of empirical studies on the transmission effects of high and persistent debt on potential economic growth in both the short and long run. Most empirical studies analyse the causal negative relationship between the accumulation of public debt and subsequent economic growth by reporting a non-linear and concave connection pattern and estimating the critical threshold value beyond which the excessive public debt levels is likely to have an adverse effects on subsequent economic activity. However, the empirical results are not robust to small changes in the time and country coverage as well as the empirical methodology applied to determine the critical threshold turning point.

One of the most influential research studies used to justify the austerity measures adopted by most governments in the EU since 2010 is by Reinhart and Rogoff (2010a, 2010b). It provides empirical evidence that a high debt-to-GDP ratio (90% or above) is on average associated with substantially slower, even negative economic growth. Their empirical findings of the negative effect of high debt

levels on economic growth beyond a certain threshold have triggered a debate among academics (see Nersisyan & Wraj, 2010). A recently published paper by Herdon *et al.* (2014) examines the findings of Reinhart and Rogoff (2010a, 2010b) and determines that their empirical findings inaccurately represent the relationship between debt and economic growth due to coding errors, the selective exclusion of available data and an unconventional weighting of summary statistics.

According to the available empirical studies the critical threshold values of public debt varies in the range between 85–100% for advanced countries and between 40–70% for emerging countries in the long run (Kumar & Woo 2010; Checherita & Rother, 2010; Cecchetti *et al.*, 2011; Reinhart & Rogoff, 2010a, 2010b). For instance, the study by Kumar and Woo (2010) concludes that a high level of public debt have detrimental effects on 5-year span of future economic growth in a sample of 38 advanced and emerging economies. The authors conclude that the lower economic activity results from detrimental effects on capital accumulation and productivity of increments of public debt.

Considering the short-term impact of public debt on growth, the interval range of the estimated threshold debt-to-GDP value varies between 50–60% for ‘new’ member states of the EU and roughly between 90–100% for advanced EU countries or ‘old’ member states (see Baum *et al.*, 2013; Mencinger *et al.*, 2014). Notwithstanding the empirical evidence, Pescatori *et al.* (2013) show that the threshold effect on growth seems to vanish in the long run, that the accumulation of debt appears to be as important as the level of indebtedness in future growth projections and that excessive debt levels are associated with an increase in output volatility.

Nevertheless, the debate on the impact of excessive public debt remains very unsettled and more research on this topic is called for, especially in terms of accounting for the heterogeneous effects of high and persistent debt on economic growth across countries. Reading of the existing empirical literature indicates a non-linear and concave functional form connection between the level of indebtedness in the public sector and economic growth (see Panizza & Presbitero, 2014). This implies an inverted U-shape relationship between public debt and growth, where beyond a certain threshold value of public debt a positive effect turn into a negative one. The research will contribute to the existing empirical literature by determining the turning point of debt-to-GDP ratio and evaluating the impact of levels of indebtedness in public sector on current economic growth in OECD countries and some non-OECD EU countries, thereby distinguishing between developed and emerging countries.

Methodology and Data

Extending our previous research (Mencinger *et al.*, 2014) and using the estimation strategy by Checherita and Rother (2010), we aim to identify the turning point beyond which the debt-to-GDP ratio has deleterious effects on growth. Assuming a non-linear and concave relationship between government debt and growth, the model is augmented with the quadratic equation in debt. The estimation process suffers from the problem of heterogeneity and endogeneity. Hence, the OLS estimator is not an appropriate estimator due to inconsistency and biased estimates of the process. To solve the problem of heterogeneity we apply a fixed effects (FE) estimator (also known as the “*within estimator*”). Using FE model allows us to remove both observable and unobservable characteristics for panels of countries that do not change over time. To tackle the problem of endogeneity we use internal instruments for both explanatory variables indicating the level of public debt across countries. Thus, the instrumental variables used in the second model specification are the lagged debt-to-GDP ratio and the lagged debt-to-GDP ratio squared. In order to obtain the estimates of our interest we employ the GMM-IV estimator (i.e, instrumental variable estimator using generalized method of moments). This is a possible approach to mitigate the problem of *reverse causality* between public debt and economic growth. Namely, the reserve causality problem derives from the possibility that lower economic growth may lead to higher debt build ups for reasons unrelated to debt (Panizza & Presbitero, 2014).

Thus, to evaluate a possible negative correlation and concave functional form between public debt and potential economic growth we use two different model specifications. First, the fixed effects (FE) panel regression specification to control the heterogeneity is as follows:

$$g_{i,t} = \alpha_i + \beta \ln(GDP \text{ per capita})_t + \gamma_1 debt_{i,t} + \gamma_2 debt_{i,t}^2 + \delta X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (1).$$

Second, the instrumental variable (IV) dynamic panel regression specification using the generalized method of moments (i.e. GMM-IV estimator) to control for endogeneity is as follows:

$$g_{i,t} = \alpha_i + \beta \ln(GDP \text{ per capita})_{t-1} + \gamma_1 debt_{i,t} + \gamma_2 debt_{i,t}^2 + \delta X_{i,t} + \varepsilon_{i,t} \quad (2),$$

where $g_{i,t}$ and $debt_{i,t}$ are the annual change of GDP per capita and initial government debt as a share of GDP (note that subscripts i and t denote the country and time). Assuming a non-linear and concave relationship between government debt and growth, the model is augmented with the quadratic equation in debt ($debt_{i,t}^2$). Based on the theoretical assumption that the relationship is non-linear, we expect that the coefficient of the debt variable will be positive whereas the coefficient of the debt variable squared will be negative. This would imply that public debt at lower levels has a positive impact on growth, while at higher levels a negative impact prevails (concave functional form). In addition, $X_{i,t}$ represents a vector of explanatory variables to take account of the determinants of economic growth and other economic and financial factors (see Table 2 for statistical significant factors). In this regard, we will consistently follow the core determinants associated with growth in the related literature to obtain robust results (see Clements *et al.*, 2003; Checherita & Rother, 2010; Kumar & Woo, 2010; Sala-i-Martin *et al.*, 2004). The model (1) also includes country-fixed effects η_i to control the heterogeneity for unobserved country-specific effects and the unobservable error term $\varepsilon_{i,t}$.

The empirical analysis primarily includes a panel dataset of 36 countries (31 OECD member states and 5 non-OECD EU member countries). Our sample is divided into subgroups distinguishing between so-called developed and emerging economies¹. The former subgroup includes a sample of 24 developed economies, namely, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. The latter sample is composed of 12 emerging countries, including Czech Republic, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Turkey, Mexico, Bulgaria and Romania². For advanced countries we will cover the 1980–2012 period, while for emerging countries the target time period is 1999–2012 due to the lack of available data.

The source of the data on gross central government debt³ as a percentage of GDP showing the level of indebtedness in public sector is Economic Outlook from the OECD database. Other sources of the data are Penn World Table (PWT) version 7.1 of Heston *et al.* (2012) for openness, IMF's World Economic Outlook database for government structural balance, and World Bank's World Development Indicator (WDI) database for all other data observations used in the empirical research.

In particular, our aim is to identify the turning point beyond which the debt-to-GDP ratio has deleterious effects on growth. According to the available empirical studies the critical threshold values of public debt varies in the range between 85–100% for advanced countries and between 40–70% for emerging

¹ We divided our sample according to IMF's classification with expectation including Czech Republic, Slovenia and Slovakia in the group of 'emerging economies'.

² In both subgroups we excluded Chile, Cyprus, Israel and Estonia because comparable data was unavailable.

³ See OECD, 2010; Eurostat, 2011; IMF, 2011 for a detailed description of the narrow concept of government debt.

countries in the short run. Accordingly, these hypotheses will be applied to and tested on both sub-groups.

Empirical results

In this section we determine the turning point of debt-to-GDP ratio and evaluate the impact of levels of indebtedness in public sector on current economic growth in OECD countries and some non-OECD EU countries, thereby distinguishing between developed and emerging countries. Before presenting the obtained empirical results we show stylised facts to illustrate the connection between public debt and economic growth in both subgroups of countries. Figure 1 illustrates a preliminary descriptive summary from the obtained annual data of public debt and economic growth for 24 developed economies, covering the period 1980–2010, and 12 emerging economies, covering the period 1995–2010. Similar to Reinhart & Rogoff, (2010a, 2010b) we divided the sample of each subgroup of countries in four categories regarding the level of public debt in a particular year. Referring to the interpretation in the literature, we formed the following groups according to the debt-to-GDP ratio: 1) low level (below 30%); 2) middle-low level (between 30 and 60%); 3) middle-high level (between 60% and 90%); and 4) high level (more than 90%) (see Reinhart & Rogoff, 2010a, 2010b). The bars show the average GDP growth per capita rates for each of the four debt categories. Figure 1 indicates a threshold effect between public debt and growth already at a lower level of debt-to-GDP ratios, especially for the subgroup comprising emerging economies with a substantial lower average GDP growth per capita⁴. Figure 1 indicates a possible lower threshold value for emerging economies than for the advanced economies as a group of countries. As shown below, this pattern is consistent with the results obtained using an econometric analysis.

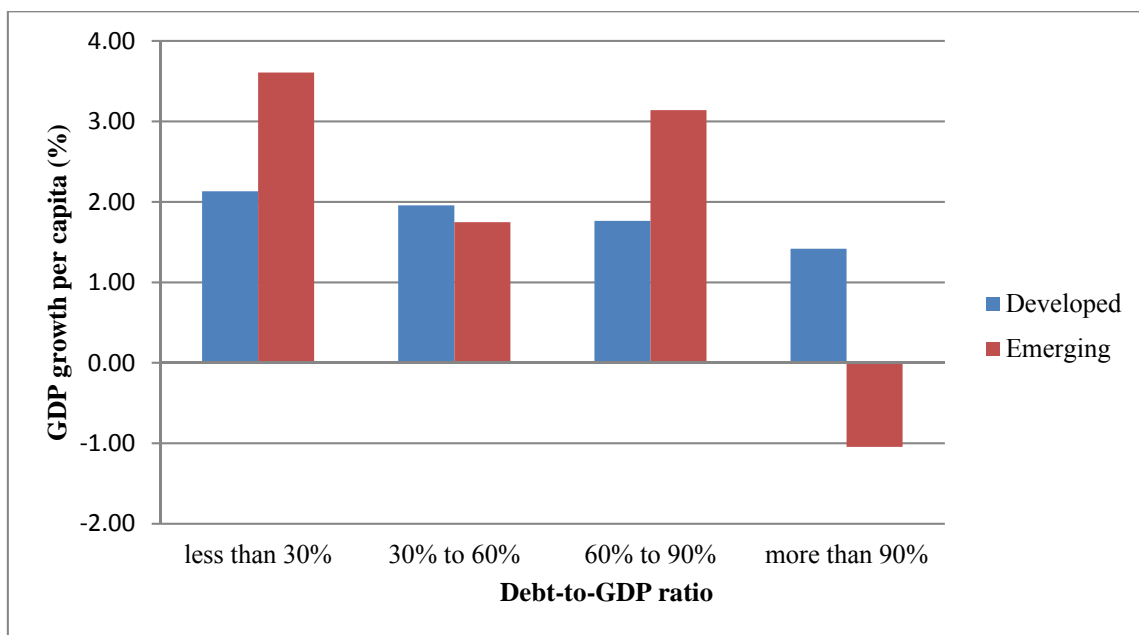


Figure 1: Connection between average GDP growth per capita and different indebtedness levels in public sector for developed and emerging economies OECD and non-OECD EU countries

Sources: WDI, 2012; OECD, 2013; own calculations

⁴ Note that a substantial lower/negative average GDP growth rate for emerging countries in the fourth bracket where public debt is above 90% accounts only one country at a particular point in time (Bulgaria), where any possible inference of casual effect on growth is rather questionable.

As described in the previous section, to evaluate a possible negative correlation and nonlinearity between public debt and potential economic growth for both subgroup of economies, we use two different panel model specifications in order to partially control the problem of heterogeneity and endogeneity. Specifically, we used the core determinants of economic growth and other economic and financial factors to obtain statistically significant robust results on the short-term impact of levels of indebtedness in public sector on potential economic growth in our sample, distinguishing between developed and emerging countries.

Table 1 indicates statistically significant coefficients of debt and debt squared variable and other control variables included in both panel regression models for both subgroup of countries. Columns 1 and 2 show the estimates for the FE panel regression specification and estimators for the subgroup of developed economies. Column 3 presents the empirical results for emerging countries obtained from IV-GMM regression model. We omitted presenting the results obtained from the FE panel regression of the later subgroup of countries due to statistical insignificant results. As shown in Table 1 by the first-stage Shea partial R-square statistics, both instruments (the lagged levels of debt and debt squared) used in the IV-GMM estimation approach in models 2 and 3 may potentially satisfy both required conditions of instrument validity, such as that the endogenous variables are highly correlated with the instrument, and exogeneity so that the instruments are not correlated with the error term (Baum *et al.*, 2013; Cameron & Trivieri, 2010). All the coefficients of explanatory variables are in line with expectations according to economic theory (Clements *et al.*, 2003; Checherita & Rother, 2010; Kumar & Woo, 2010).

Table 1: Panel regression on developed and emerging OECD and non-OECD EU countries

Dependent variable	Developed countries		Emerging countries
	(1) FE	(2) GMM-IV	(3) GMM-IV
	GDP growth per capita	GDP growth per capita	GDP growth per capita
ln(GDP per capita)	-1.2737*** (0.1905)		
Debt	0.0935*** (0.0188)	0.0715*** (0.0143)	0.3471** (0.1096)
Debt squared	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.0039** (0.0013)
Government total expenditures	-0.3538*** (0.0299)	-0.2780*** (0.0374)	-1.6653*** (0.2700)
Inflation	-0.1203*** (0.0233)	-0.1154*** (0.0165)	0.2415** (0.0779)
Government revenues	0.1763*** (0.0461)	0.2259*** (0.0354)	1.4788*** (0.3030)
Population growth	-1.5421*** (0.3593)		
Gross fixed capital formation	0.2388*** (0.0476)		
Lagged ln(GDP per capita)		-1.5150*** (0.1667)	-1.7992*** (0.4461)
Government savings		0.0576** (0.0219)	
Government structural balance			-1.2469*** (0.2532)
Openness			0.0161* (0.0063)
Constant	15.8401*** (2.8373)	16.3870*** (1.8802)	19.6700*** (5.4500)
Number of observations	548	533	114
R-squared	0.342	0.319	0.495
Shea partial R-squared		0.94	0.79
Turning point	93.5	89.5	44.5

Note: Standard errors are in parentheses

Levels of significance: * p<0.05, ** p<0.01, *** p<0.001

Sources: IMF, 2012; Heston *et al.*, 2012; OECD, 2013; WDI, 2012, own calculations

To summarize, the results across all models indicate that the connection between public debt-to-GDP and annual GDP growth has a non-linear relationship with a possible critical threshold point beyond which the debt-to-GDP ratio has deleterious effects on growth for the developed and emerging economies included in our sample. Namely, the coefficient of the quadratic debt-to-GDP variable is negative, indicating a concave (i.e. inverted U-shaped) relationship between economic growth and public debt. Further, the calculated debt-to-GDP turning point⁵, where the positive effect of accumulated public debt inverts into a negative effect, is roughly between 90% and 94% for developed countries when we consider both models. The results are comparable with the estimated threshold values for developed countries in previous empirical studies (Kumar & Woo, 2010; Checherita & Rother, 2010; Reinhart & Rogoff, 2010a, 2010b etc.). For emerging countries, the debt-to-GDP turning point is substantially lower, namely between 44% and 45%. Therefore, we can confirm our previously stated hypothesis that the threshold value for emerging countries is lower than for advanced ones. These findings are in line with the conjecture that the combination of high levels of debt in public sector is associated with a severe and sustain contraction of economic activity.

However, we should note that the estimated threshold values do not provide the level to be targeted to support the growth projections. In fact, those results represent an additional argument for implementing fiscal consolidation strategies to reduce public debt. In this context, it is reasonable to assume that our research provides direct evidence of nonlinearity between public debt and economic growth. The obtained results thus imply that unstable debt dynamics may increase the risk of a detrimental effect on capital accumulation and productivity growth, which would potentially trigger an adverse effect on economic growth (Cecchetti *et al.*, 2010, 2011). Note that we need to implement more rigorous empirical methodologies to address the growth prospects of both subgroups and individual countries. Hence, the research may contribute to a better understanding of the problem of high public debt and its effect on economic activity. As a result, the knowledge gained could be used to tackle the problem in a timely fashion so as to preserve a stable macroeconomic environment in the future.

Conclusion

The paper empirically explores the factor of public debt which considerably changes the mechanism that transmits fiscal policy effects to economic activity in the short term. We examined and evaluate the direct effect of higher indebtedness in the public sector on economic growth for countries in the OECD. In addition, our sample includes some non-OECD EU countries that are used to ensure the robustness of the estimated values. Our examination will shed light on the current debt problem by identifying a possible non-linear relationship between the level of public debt and economic growth, with an explicit focus on determining the threshold values for our sample of countries. In the research we will take account of the factor of public debt which considerably changes the mechanism transmitting fiscal policy effects to levels of economic activity in the short run.

The paper empirically examines and assesses the direct impact of high debt levels in the public sector on economic growth for countries in the OECD. In addition, our sample includes some non-OECD EU countries that are used to ensure the robustness of the estimated values. The evaluation will give us an important understanding on the current indebtedness situation by determining the threshold values for our sample of countries, which indicates a possible non-linear and concave connection between indebtedness levels in the public sector and economic growth in the short term. The paper contributes to the current empirical studies by augmenting the group of considered economies and reevaluating the effects of levels of indebtedness in public sector on current economic growth.

⁵ Note that we obtained the threshold value of the quadratic function by taking the partial derivative with respect to debt.

Our results across all models indicate that the connection between public debt-to-GDP and annual GDP growth has a non-linear relationship with a possible critical threshold point beyond which the debt-to-GDP ratio has deleterious effects on growth for the developed and emerging economies included in our sample. The results are in line with the general theoretical conjecture that at low levels of public debt the impact on growth is positive, whereas beyond a certain debt turning point a negative effect on growth prevails. Further, we calculated that the debt-to-GDP turning point, where the positive effect of accumulated public debt inverts into a negative effect, is roughly between 90% and 94% for developed economies. Yet, for emerging countries, the debt-to-GDP turning point is lower, namely between 44% and 45%. We can confirm our hypothesis that the threshold value for the emerging countries is lower than for the developed ones in our sample.

Nevertheless, we must note some limitations and further avenues for research. First, our model specification was not subject to robustness tests which could confirm the validity of our results. It would also be desirable to calculate the confidence intervals for the critical threshold values and control for other potential variables. Second, we did not take the possibility of outliers in the data into account, which may bias the results. Finally, our research could be extended to determine the channels through which the impact of public debt is indirectly transmitted to growth and by looking at and examining, besides the connection between public debt and growth, the effects of indebtedness in non-financial sectors (i.e. households and the corporate sector) on economic growth.

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