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Abstract

This paper examines the nature of the relationship between government size and economic growth and identifies the optimal level of government size through a novel and very general non-linear panel Generalized Method of Moments approach. Using a large panel dataset we uncover a statistically significant non-linear relationship via identifying the optimal threshold of government spending that maximizes growth. Furthermore, we show that the relationship between the two variables above and below that optimal level is statistically significant, even if we split our sample to developed and developing countries. Finally, we find an asymmetric impact of government size on economic growth in developed and developing countries around the estimated threshold.

Keywords: government size, economic growth, dynamic threshold estimation
JEL Classification: E62, C23, O11, O50

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1 Introduction

The impact of government size on economic growth has been the focal point of academic research for many years (i.e. Barro (1990), Karras (1997), Gunalp and Dincer (2010) among others). Over the past decade, and especially following the recent sovereign debt crisis, the level of government spending has also been at the centre of many political debates, i.e. the implementation of the Euro Plus Pact in 2011 which has one of its primary targets the sustainability of public finances within the EU.

A very big government sector may have negative spillover effects to the economy due to financing of government spending via increasing taxes, borrowing and/or printing money. On the other hand, if government spending is very small, or even equal to zero, the economic growth is very limited due to difficulties in the provision of public goods. Therefore, an optimal level of government spending which maximizes growth exists.

The empirical literature is yet inconclusive. Several papers, using linear approaches, find that government spending and growth are negatively related (e.g. Dar and AmirKhalkhali (2002) and Guseh (2007)), whereas other studies find a positive relationship (e.g. Bose et al. (2007) and Romero-Ávila and Strauch (2008)).

However, the majority of researchers supports an inverted "U-shaped" curve relationship, also known as the BARS curve after Barro (1989), Armey (1995), Rahn and Fox (1996) and Scully (1995), between government spending and economic growth. In other words, the increase of government spending is beneficial up to a certain threshold and beyond that level the impact on growth is negative. As a result, several studies have tested the BARS curve following various estimation techniques (e.g. Karras (1997), Chen and Lee (2005), Gunalp and Dincer (2010), Zhu et al. (2010) and Altunc and Aydın (2013)).

Establishing an optimal government expenditure level suggests the analysis of a broad cross section of countries over an extended period of time meaning that rich panel datasets should be used. Furthermore, there is a prevailing issue of endogeneity, which has not been addressed in the literature, because higher growth over a period of time may incite greater government spending through the channel of higher returns from taxation.

This paper uncovers the non-linear relationship between government size and economic growth and identifies the optimal government expenditure through the novel non-linear panel GMM approach of Seo and Shin (2014) which allows for a threshold effect with endogenous independent and thresh-

old variables. Using a large dataset of 129 countries for the period 1980-2009[1], we uncover a robust and statistically significant non-linear relationship between government spending and economic growth. Furthermore, we show that this impact remains valid even if we split the sample to developed and developing countries, with asymmetric effects on the two groups.

The remainder of the paper is organised as follows. Section 2 presents the model. Section 3 analyses the results and Section 4 draws the conclusions.

2 Model

Following the endogenous growth literature (i.e. Barro (1990) and Karras (1997)) in our empirical analysis we are going to use as the dependent variable the growth rate of GDP per capita and as explanatory variables: i) general government final consumption expenditure as a share of output; ii) inflation rate as the percentage change of CPI; iii) gross capital formation to capture the share of investment to output; iv) openness to trade; and v) population growth. We use data for 129 countries from the World Development Indicators (WDI), as reported by the World Bank, and we perform a dynamic panel threshold estimation to estimate the optimal level of government spending for the average country in our sample. The model we use is:

$$\begin{aligned} GROWTH_{i,t} = \; & a_i + \phi GROWTH_{i,t-1} + \beta_1 GOV_{i,t} I(GOV_{i,t} \leq \gamma) \\ & + \beta_2 GOV_{i,t} I(GOV_{i,t} > \gamma) + \delta X_{i,t} + \nu_t + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where a_i is the individual effect for each country which captures individual heterogeneity, ν_t is the common time effect which captures comovement of the series due to external shocks and ε_{it} is the remainder error term. GOV is the government final consumption expenditure as a share of GDP and serves as the threshold variable where the threshold is given by the parameter γ. $I(\cdot)$ is the indicator function which takes the value 1 when the argument in the parenthesis is true and 0 otherwise. The inflation, capital formation, openness to trade and population growth variables are in the vector $X_{i,t}$.

Model (1) is estimated by the novel GMM method of Seo and Shin (2014) which allows for endogenous and threshold variables and uses Arellano and Bond (1991) type instruments. The method proceeds in three steps: i) first differencing (1) removes the individual heterogeneity, ii) for a selected parameter value of γ, lags of the independent variables are used as instruments to get estimates of $\theta = (\phi, \beta_1, \beta_2, \delta)$. iii) step (ii) is repeated for $\gamma' s$ belonging

[1] We use all the available countries in the World Bank dataset with observations for all the variables we consider for the period under consideration.

in a strict subset of the support of GOV and the final set of estimates is the $\hat{\theta}$ and $\hat{\gamma}$ which minimize a GMM-type objective function.

Compared with other methods in the threshold literature, namely the static method of Hansen (1999) (used by Christie (2014)) and the GMM method of Kremer et al. (2013), the applied one here has the advantage that it allows for endogenous independent and endogenous threshold variables. This is empirically relevant because higher growth over a period of time may incite greater government spending through the channel of higher returns from taxation. We estimate the model using five year averaged data and time dummies to abstract from business cycle influences (see Levine et al. (2000)).[2]

3 Results

Table 1 presents the results from the estimation of model (1).[3] The first column shows the results for the full sample, whereas columns two and three present the results for developing and developed countries respectively.[4]

Regarding the full sample, we find that the optimal threshold level of government size is 18.04%. This falls within the range reported in the related literature. For example, Karras (1997), in a sample of 20 European countries, finds that the optimal level of government spending is equal to 16%, whereas Gunalp and Dincer (2010), in a sample of 20 transition countries, reports a threshold of 17.3%. In different studies on individual countries, Chen and Lee (2005), Zhu et al. (2010) and Altunc and Aydın (2013) report a threshold estimation within the range of 11-25%.

Besides the estimation of the optimal level of government spending we determine its non-linear impact on economic growth when it is above and below that level. In other words, we assess empirically the validity of BARS curve. We find strong evidence of the existence of an inverted "U-shaped" relationship between government size and economic growth. In particular, under the full sample, when the government size of the average country is below the threshold a 1% increase in government spending, as a share of GDP, will enhance economic growth by 0.99%. However, if the average country is above the threshold estimation then a 1% increase in government size will

[2]Time dummies are used only in the full sample regression because in the subsamples examined the number of countries drops considerably and extra variables lead to disproportionate number of instruments, see e.g. Roodman (2009).

[3]We also estimated the linear effect of government size on growth as well as a quadratic model, but the results are not statistically significant and they are available upon request.

[4]The developed countries are those listed as high income countries and the rest of the countries are assumed to be developing, following the classification of the World Bank.

decrease growth by 0.65%. Therefore, the impact of government spending on growth is larger quantitatively when it is below the estimated threshold.

This is the first empirical study which uncovers a statistically significant relationship between government spending and economic growth for both above and below the optimal level of government spending.

The above result remains valid even if we split our sample to developed and developing countries with estimated thresholds equal to 17.96% and 19.12% respectively.[5] Gray et al. (2007) has shown that larger governments tend to allocate a bigger share of their spending on unproductive sources compared to smaller countries. As a result, taking into account that government spending is mostly financed via taxation, a lower threshold estimation should be optimal for the developed countries.

In our sample the average government spending for the developing countries is 14.83%, whereas for the developed countries it is 17.88%. This indicates that the majority of the developing countries are still on the upward slopping part of the BARS curve and they can benefit from an increase in their government spending. On the other hand, the government size of the average developed country is very close to their optimal level.

Furthermore, we find that for the developing countries the negative effect of a larger than optimal government size is more significant quantitatively than the positive effect from a government size below optimal. On the other hand, developed countries have stronger positive effects when government size increases when it is below optimal, compared to the negative effects when it is above the estimated threshold. As a result, there is an asymmetric impact of government size on economic growth in developed and developing countries around the estimated threshold.

Regarding the remaining variables we find that capital formation is positive and statistically significant for the full sample and the developed countries. The openness to trade is statistically significant only for the developing countries. Lagged growth is weakly significant for the full sample with a small positive coefficient. Finally, the coefficient of inflation is close to zero and insignificant; and population growth doesn't have any significant effect on growth either, as in the related literature.

[5] Note that we have also performed the same analysis for OECD countries and we found very similar results with those for developed countries.

Table 1: Results of non-linear dynamic threshold estimations

Sample	Full	Developing	Developed
Threshold	18.0387	19.1246	17.9647
	(28.2371)***	(50.66)***	(55.3826)***
Government size			
$\hat{\beta}_1$	0.9948	0.272	1.048
	(4.0155)***	(2.0211)**	(4.7456)***
$\hat{\beta}_2$	-0.6476	-0.715	-0.5975
	(-3.6051)***	(-4.0335)***	(-5.2383)***
Covariates			
Lagged Growth	0.1373	-0.0036	0.0661
	(1.8472)*	(-0.0321)	(1.498)
Capital Formation	0.1604	0.0211	0.2536
	(2.5523)**	(0.1757)	(6.4925)***
Inflation	0.0007	0.0002	0.0725
	(0.561)	(0.1343)	(0.9555)
Openness	0.0269	0.1035	0.0128
	(0.8882)	(4.688)***	(0.7566)
Population	0.1891	0.6356	-0.4027
	(0.2187)	(0.854)	(-0.644)
Quarter effects	Yes	No	No
Observations	774	258	516
N	129	43	86

4 Conclusions

We assessed the non-linear relationship between government size and economic growth under a large panel dataset using a dynamic panel threshold model which allows for non-linear threshold effect with endogenous independent and threshold variables.

The empirical results verified the theoretical BARS curve. We found that the optimal level of government size that maximises economic growth is 18.04% for the full sample; 19.12% for developing and 17.96% for developed countries.

We were able to show that the inverted "U-shaped" non-linear relationship between government spending and economic growth is statistically significant around the optimal level, the upward and downward slopping part of the curve. We concluded that the results remained valid and robust under a split of our sample to developed and developing countries. Finally, we found that the effect of government spending on economic growth is asymmetric to developed and developing countries when it is above and below the optimal level.

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