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Too much public expenditures, less economic growth?

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Abstract

This paper studies the existence, for West Africa Economic and Monetary Union (WAEMU)'s countries, of a public expenditures threshold above which its effect on economic growth is negative. We estimate also the effect on growth from the control variables that are standard in growth model. Therefore, we use panel data over the period 1985-2012. Relying upon the estimation of Panel Smooth Transition Regression (PSTR) model inspired from González et al. (2005), our main findings are the following. (i) The estimated threshold for the public expenditures is 15.41%. (ii) Before the threshold, public expenditure has no significant effect on economic growth. (iii) On the other side of the threshold, a fiscal policy expansion may be detrimental for growth.

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1. Introduction

Since the 2000s, Sub Saharan African (SSA) countries record positive growth rate. According to Devarajan and Fengler (2013), the gross domestic product (GDP) has grown by 5% on average. Countries in Franc Zone (FZ)[1], among SSA countries, are those which record higher economic growth.[2]. But, these performances are not sustainable since they are partly driven by primary commodities. They are therefore highly dependent on global economic conditions[3]. Also the performances are not enough to reduce poverty and precisely are below the 7% of growth required to achieve the Millennium Development Goals (MDGs). What drives economic growth? Easterly and Rebelo (1993) assert that fiscal policy is likely to be an important growth determinant. In the case of FZ's countries, fiscal policy is the unique instrument of policy regulation since monetary policy is independently handled by monetary authorities.

Even though fiscal policy is a classic theme in macroeconomic, there is still no consensus about the size and even the sign of its effects on growth (Giavazzi et *al.*, 2000; Bajo-Rubio et *al.*, 2004). According to Neoclassical growth models of Solow (1956) and Swan (1956), fiscal policy has no effect on the long-run growth rate. Neoclassical models consign the role of fiscal policy to one of determining the level of output. With endogenous growth models, fiscal policy has a key role in the growth process. Since the pioneering contributions of Barro (1990), Romer (1990) and Lucas (1988), several papers have extended the analysis demonstrating various conditions under which fiscal variables can affect long-run growth. Lucas (1988) argues that public investment in education increases the level of human capital and this can be seen as a main source of long-run economic growth. Moreover, Barro (1990) mentions the importance of government expenditures in public infrastructure for economic growth. Romer (1990) stresses the relevance of research and development expenditures as determinant of growth. Since these pioneering contributions, several papers provide mechanisms by which fiscal variables can affect long-run growth and there is still an ongoing debate (See for example Carrère and de Melo 2012).

Many fiscal variables are used to investigate the fiscal policy-growth nexus. The focus of this paper is on public expenditures as determinant of growth following Keynesian view. Regarding public expenditures, a great number of researchers study its effects on economic growth. Keynes (1936) figures out the relevance of public expenditures to mitigate the disequilibrium faced by economy. The Keynesian perspective emphasizes the multiplier effects associated with the increase in public expenditures. Whilst, the classical paradigm focuses on the *crowding-out effect* due among others to debt financing of the public deficit. It's generally agreed that government consumption hampers economic growth since the higher taxes needed to finance the consumption expenditure reduce the incentive to invest. Government investment such as provision of infrastructure services is known to foster long-run growth. A better distinction is given by Devarajan et *al.* (1996) who have divided public expenditures into productive and unproductive expenditures. Productive public expenditures are growth-enhancing while non-productive are not. Therefore, the link between public expenditures and growth can either be positive or negative. This leads to the following question: *does too much public expenditures lead to less economic growth?* That is, at what level of public expenditures does the relation between public expenditures and growth become negative? By answering this question, we emphasize the existence of non linear relationship between public expenditures and growth.

Several studies have suggested the possibility that fiscal policy may have non-linear effects. The study of Giavazzi et *al.* (2000) aims at searching the circumstances in which the response of national saving to fiscal policy may be non-linear. For this purpose, they use a set of OECD countries and a sample of developing countries for empirical evidence. They conclude that the non-linearity of the response by the private sector is stronger during fiscal contractions. In the sample of developing countries, the situation in which national saving is non-linear appear both when there are fiscal contractions and fiscal expansions. The study of Giavazzi et *al.*

[1] Franc Zone is a monetary area. This area includes: Cameroon, Gabon, Equatorial Guinea, Central Africa Republic, Chad, Republic of Congo, Ivory- Coast, Benin, Burkina Faso, Mali, Senegal, Niger, Bissau- Guinea and Togo.

[2] Three of the five SSA counties which have achieved double digits positive growth rate since 2000 are from FZ.

[3] The impact of 2008's global economic crisis is an illustration. In Equatorial Guinea for example, the growth rate falls from 11.29% in 2008 to -5.44% in 2009.

(2000) has two deficiencies. Firstly, they use dummies to characterize different regimes. Secondly, the use of dummies forced the authors to impose exogenous values for the thresholds. By using a Panel Smooth Transition Regression (PSTR), Minea and Vilieu (2009a) respond to these critics. Based on theoretical and empirical models, Minea and Vilieu (2009a) investigate the nonlinearity effects of public deficit on public investment depending on public debt ratio. They find that around a public debt ratio of 120%, the sign of the relation changes. A similar study has been conducted by Tanimoune et *al.* (2005) in WAEMU's countries and they found out that, to a debt ratio of 83%, the state has a Keynesian influence on economic activity. In another study, Minea and Vilieu (2009b) assess theoretically the importance of the financial system in the explanation of the non linear relation between fiscal policy, monetary policy and growth.

The above-mentioned studies do not precisely estimate the threshold level of public expenditures which is the main fiscal variable following Keynesian's view. However, to the best of our knowledge, non-linearity in the public expenditures-growth relationship has never been investigated in FZ context. One contribution of this article is to fill this gap by focusing on WAEMU's countries. Also, determine the threshold endogenously by using an appropriate econometric technique is an added value. The purpose of the paper is to estimate the threshold level of public expenditures below which public expenditures may have a positive impact on economic growth or above which public expenditures may be detrimental to economic growth. For this purpose, we will use a PSTR model inspired from González et *al.* (2005).

The organization of this article is as follows. Section 2 focuses on methodology and data description. Empirical results are contained in section 3 while concluding remarks are presented in section 4.

2. Methodology and data

This section describes the PSTR model and the data being used to assess the non-linearity of the relationship between public expenditures and economic growth.

2.1. Panel smooth transition regression model

The PSTR model is suitable for the purpose of this study. Villavicencio and Mignon (2011) highlight several interesting features. First, the coefficient can take different values, depending on the "regimes". Second, since the transition from one regime to another is smooth, the coefficients are allowed to change gradually. Finally, individuals are allowed to change between groups over time according to changes in the "threshold variable".

2.1.1. The theoretical model

The PSTR model, developed by González et *al.* (2005), is the extension of the Panel Threshold regression (PTR) model of Hansen (1999). The simplified form of the theoretical PSTR model is given by the relation (1).

$$y_{it} = u_i + \beta_0' x_{it} + \beta_1' x_{it} g(q_{it}, \gamma, c) + \varepsilon_{it} \quad \text{“(1)”}$$

where $i = 1,....,N$ denotes the number of countries in the panel and $t = 1,....,T$ determines the time dimension of the panel. y_{it} is the dependent variable. u_i represents the vector of fixed effects countries and $g(q_{it}, \gamma, c)$ is the transition function which depends on the transition variable (q_{it}), the threshold parameter (c) and the smoothness parameter (γ). $x_{it} = (x_{it}^1,....,x_{it}^k)$ is k-dimensional vector of time-varying exogenous variables and ε_{it} is the residual term. β_0 and β_1 indicate respectively the vector of parameters of the linear and non-linear model. The indicator function of the PSTR model is the transition function $g(q_{it}, \gamma, c)$ which is continuous and derivable and is normalized to be bounded between 0 and 1. This function allows the system to move progressively from one regime to other regimes. In order to postulate the functional form of the transition function, González et *al.* (2005), Granger and Teräsvirta (1993), Teräsvirta (1994), Jansen and Teräsvirta (1996) suggest to use the following logistic form (*equation 2*):

$$g(q_{it},\gamma,c)=\left[1+\exp\left(-\gamma\prod_{j=1}^{m}(q_{it}-c_j)\right)\right]^{-1} \quad \text{“(2)”}$$

With $\gamma>0$, $c_1<...<c_m$ where $c=(c_1...c_m)$ is an m-dimensional vector of threshold parameters. The slope of the parameter γ describes the smoothness of the transition from one regime to another. As $\gamma\to\infty$, the transition function approaches an indicator function that takes the value of 1 if $q_{it}>c_j$. If $\gamma\to 0$, the transition function becomes a linear panel regression model with fixed effects. By taking into account the transition function described in (2), equation 1 becomes:

$$y_{it}=u_i+\beta_0^{'}x_{it}+\sum_{j=1}^{m}\beta_j^{'}x_{it}g_j(q_{it}^{j},\gamma_j,c_j)+\varepsilon_{it} \quad \text{“(3)”}$$

2.1.2. Empirical specification

The dependent variable is economic growth which is captured by growth rate of real GDP. The main independent variable is public expenditures. It is measured by the ratio of public expenditures on real GDP. Non-fiscal and fiscal variables are taken as control variables. The choice of control variables is crucial since the introduction of particular control variable can wipe out the bivariate relationship between indicators of fiscal policy and growth (Easterly and Rebelo, 1993). Levine and Renelt (1992) retain a few control variables in their study. In a more general study, Sala-i-Martin (1997) has identified sixty variables to be significant in at least one growth regression. In this study, five control variables are included in the model: initial level of real GDP, private investment, taxes, external public debt and population.

The initial level of real GDP is used to control the conditional convergence in the spirit of the Neoclassical growth theory (Barro and Sala-i-Martin, 1995). It's also used as instrument variable to correct for endogeneity (Vinayagathasan, 2013). The initial level of real GDP is the one period lagged value of real GDP in log. Private investment permits to analyze the effect of private sector on growth. Private investment is captured by private gross fixed capital formation as ratio of GDP. The theory predicts that private initiative generally boosts economy growth and the expected sign is therefore positive. According to Neoclassical growth model, population can influence growth which is modeled as a growth rate. The influence of other fiscal variables is also important when estimating the effects of public expenditure on growth. Therefore, we control for the effect of taxes and debt. Taxes are measured by the ratio of government's resources taxes on real GDP. From the existing literature, we expect either an increasing relation between taxes and economic growth (Mendoza et *al.*, 1997) or a negative relationship (Milesi-Feretti and Roubini, 1998). Concerning external public debt, the theoretical literature suggests that it has a non linear relationship with growth (see for example Greenidge et *al.*, 2012; Reinhart and Rogoff, 2010) even though a recent study by Egert (2015) indicates that this non-linearity is not very robust. This variable is obtained by dividing the stock of external public debt to real GDP.

2.2. Data

We use, for the period 1985-2012, a balanced panel of seven countries of the WAEMU[4]. The data are obtained from the World Development Indicators (2014) and WAEMU's database on annual frequency. Before the econometric analysis, it is useful to look at the integration properties of the variables. For this purpose, we have conducted two unit root tests namely: Im, Pesaran and Shin (IPS) test (2003) and Levin, Lin and Chu test (LLC) (2002). Table 1 gives the result of unit root tests. From table 1, three variables (public expenditures, private investment and population) are stationary at the conventional level of significance. The other variables are not in level and become stationary after first differencing; therefore they enter as first differences in the empirical model. Moreover, the two tests give sometimes conflict conclusion; we retain the conclusion derived

[4] Bissau- Guinea is excluded in the sample because of its adhesion to the union in 1997.

from the IPS test. The reason is that the IPS test is more powerful than the LLC test since it combines information from time series and cross section dimension.

Table 1: Unit Root Tests

Variables	LLC Test		IPS Test		Conclusion
	Level	Difference	Level	Difference	
Public expenditures	0.82143 [0.2057]		2.06369** [0.0195]		I (0)
Gross domestic product	3.56886 [0.9998]	0.48390 [0.3142]	6.57123 [1.0000]	4.49599*** [0.0000]	I (1)
Private investment	0.85784 [0.1955]		1.68212** [0.0463]		I (0)
Taxes	0.38669 [0.6505]	-5.0057 *** [0.0000]	2.6463 [0.9959]	5.05137 *** [0.0000]	I (1)
External public debt	1.8030 [0.4789]	3.13797*** [0.0009]	2.57739 [0.9950]	-5.9321*** [0.0000]	I (1)
Population	7.15265*** [0.0000]		8.03631*** [0.0000]		I (0)

Note: The values in brackets are probabilities. Significance level: (***) 1%; (**) 5%.

3. Empirical results

We begin by testing the null hypothesis of linearity using three tests with the public expenditures as the relevant transition variable. In other words, we test if there exists a different GDP growth effect of public expenditures, when facing high and low levels of public expenditures. The results are reported in table 2. The null hypothesis that the model is linear is rejected for the Wald Test, Fisher Test and Likelihood Ratio Test. This result evidences that public expenditures impact the GDP growth differently, depending on the level of the ratio of public expenditures on GDP. Table 3 presents the test for no remaining non-linearity after assuming a two-regime model. The null hypothesis of the test is that there is one transition function versus there is at least two transition functions. The results indicate that the null hypothesis cannot be rejected, indicating that one threshold properly captures the non- linearity in the model. This implies that in the WAEMU region, there is only one threshold level of public expenditures which separates the low public expenditures regime and high public expenditures regime. We thus carry on the estimation of our non-linear growth model using the PSTR specification. Tables 4 and 5 highlight the model parameters estimated.

Let us start with a general comment relating to the control variables (see table 5 in appendix). First, the initial income coefficient is positive meaning that the convergence within WAEMU's countries is not established: holding constant other growth determinants, countries with lower GDP do not grow faster. Secondly, private investment has the right sign, as predicted by the Solow and endogenous growth models: its positive sign reflects the increasing relationship between capital accumulation and growth. Thirdly, the coefficients associated with taxes and external public debts are positive. This result is found in the literature especially when the level of the two variables is below an optimum point. But, after the public expenditure threshold, taxes influence negatively economic growth. This result is also consistent with the literature. Finally, the population growth coefficient is negative.

Regarding now our main variable of interest, the growth effect of public expenditures appears non-linear. The threshold level of public expenditures is 15.41% which is statistically significant at 1% level. Since the estimation procedure model consists of eliminating the individual effects u_i by removing country-specific means and applying non linear least squares to the transformed model[5], we have the same threshold for all the countries in the sample. Before the threshold, public expenditure has no effect on economic growth since the relation is not significant. The rationale of this result is that in SSA countries, governments do not generally

[5] For more details about the estimation, see González et *al.* (2005).

focus on more productive spending which are known to foster growth significantly. For instance, in FZ's countries, public capital expenditures represent only 7.173% of GDP (Mondjeli, 2013). Above the threshold, table 4 indicates that public expenditures influence negatively and significantly economic growth in WAEMU's countries. If WAEMU's countries increase their public expenditures by one percent, the growth rate will decrease by about 0.277 point. The result of the relation between public expenditures and growth gives some insights to the existing literature by trying to reconcile theoretical controversies and divergent empirical findings. On the theoretical aspect, the study enables to move from "*no State*" for Classical Paradigm and "*Too much State*" for Keynesian Paradigm to an "*optimal size of State*" in the line of New Keynesian School. This "*optimal size of State*" would guarantee a minimum of public services, public infrastructures and public investment which are necessary to enhance the effect of private initiative. On the empirical ground, public expenditures can influence positively or negatively economic growth depending not only on their nature as have been demonstrated by several studies (Devarajan et *al.*, 1996; Bloom et *al.*, 2001; Gupta et *al.*, 2005). But, as we have shown, changes in the sign of the relation can also depend on the level of public expenditures.

Table 2 : Linearity Test

Tests	**Statistic**	**Pvalue**
Wald Test (LM_W)	9.270**	0.049
Fisher Test (LM_F)	1.514*	0.076
LRT Tests (LRT)	9.497***	0.000

Note: H_0: Linear Model. H_1: PSTR model with at least one threshold. Significances Level: (***) 1% ; (**) 5%; (*) 10%.

Table 3: Test of Number of Regimes

Tests	**Statistic**	**Pvalue**
Wald Test (LM_W)	3.680	0.720
Fisher Test (LM_F)	0.545	0.773
LRT Tests (LRT)	3.717	0.715

Note: H_0: PSTR with one transition function. H_1: PSTR with at least two transition functions.

Table 4: Public Estimated coefficient of public expenditure

Variables	**(1)**		**(2)**		**(3)**
	Coef.	**t-Stat**	**Coef.**	**t-Stat**	
Public expenditures	0.061	0.505	-0.338**	-1.667	
Public expenditures threshold					15.41
γ					18.92
Number of observations					189

Note: The dependent variable is the growth rate of real GDP. Column 3 gives the value of the public expenditures threshold. In column 1, we have the value of the estimated coefficient before the threshold. Column 2 gives the value of estimated coefficient above the threshold. Significance level: (**) 5%.

4. Conclusion

Relying upon the estimation of smooth transition model for panel data, this article investigates the growth effect of public expenditures in the context of FZ especially in WAEMU's countries within the period 1985-2012. We estimate not only the threshold above which public expenditures is harmful for growth, but also the effect on growth from the control variables: initial level of income, private investment, taxes, external public debt and population growth. Before the estimation of PSTR model, we have run two preliminary tests. The test for non-linearity provides evidence that the relationship between public expenditures and growth is non-linear. According to the test used to estimate the number of regimes, we notice that there is only one threshold level of public expenditures which separates low public expenditures regime and high public expenditures regime. Results indicate that the estimated threshold for the public expenditures is 15.41% which is significant at the conventional levels. Before the threshold, public expenditure has no significant effect on economic growth. On the other side of the threshold, a fiscal policy expansion may be detrimental for growth. We also found that

private investment and external debt stimulate economic growth. In addition, we found evidence that taxes has a positive and a negative influence on growth before and after the threshold respectively.

This study is not without its limits. First, the exclusion of some relevant control variables in the growth equation may have led to specification bias. This is the case of variable that captures institutions. As it's well known, quality of institution is a key factor that explains bad economic performances especially in developing countries. But because of data limitations, we have not been able to introduce this variable in the specification. Second, some control variables may be endogenous and therefore our estimated coefficient may be biased. One solution to overcome this problem would have been to estimate a GMM models. But it's not technically feasible because of the sample size and the length of the study period. Third, since each economy is specific, optimum public expenditures may be country-specific. But the model used eliminates at the first step fixed effects and thus implying a unique threshold for all the countries.

Appendix

Table 5: Estimated coefficients of control variables

	(1)		(2)	
Variables	**Coef.**	**t-Stat**	**Coef.**	**t-Stat**
Initial income	2.872	0.768	1.181***	2.334
Private investment	0.218**	1.904	0.265	1.474
Taxes	0.885**	1.561	-2.620***	-4.685
External public debt	0.028**	1.628	0.049***	2.080
Population	-0.028	- 0.041	-2.673*	-1.565

Note: The dependent variable is the growth rate of real GDP. In column 1, we have the value of estimated parameters of control variables before the threshold. Column 2 gives the values of estimated parameters of control variables above the threshold. Significance level: (***) 1%; (**) 5%; (*) 10%.

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