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PUBLIC EDUCATION SPENDING AND ECONOMIC GROWTH: THE GOVERNANCE THRESHOLD EFFECT

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This paper aims to give reason to the mixed result between the public education spending and growth found largely by the empirical works and to confirm the nonlinear character of this relationship. Using cross countries data averaged during the period 1980-2013, and the structural threshold regression method STR (Kourtellos et al,. 2015) to investigate the heterogeneous effects of the public education spending on growth considering governance indicators as threshold variable, we obtain evidence that this expenditure contributes positively to the economic performance only if the country is above the threshold level and presents good governance otherwise the effect is negative.

Keywords: Education Expenditure, Governance, Economic Growth, Threshold Effects, Structural Threshold Regression STR
JEL Classification: I22, I25, P46, O43, H52

1. INTRODUCTION

It is largely proved that governments play crucial role in terms of resources allocation, social organization, regulation, enforcement of laws and political stability. In reality, they provide many services such as education, health and defense where the private sector finds difficult to offer them despite their considerable impact on the economic performance. So persuaded by the important role of governments in promoting growth, many economists are interested to their size dimension. Precisely, they analyze the linear relationship between the public spending- as a proxy of the public sector's size - and the economic growth (Kormendi, 1983; Ram, 1986; Kormendi and Meguire, 1986; Barro, 1991; Barro and Sala-i- Martin, 1992; Easterly and Rebelo, 1993; Devarajan, et al., 1996; Hulton, 1996; Pritchett, 1997; Aschauer, 2000a and b, etc.).

However, their results seem to be mixed where many among them reveal that expanding the government size enhances the economic performance in the sense that it advances the country's investment environment and leads thus to a crowding-in effect on the private investment (Rubinson, 1977; Kormendi, 1983; Ram, 1986; Kormendi and

Meguire, 1986, and Grossman, 1987 and 1988). While many others find negative correlation, explained essentially by the misallocation of the public resources that in general may lead to high tax burdens (Landau, 1983; Grier and Tullock, 1989; Barro, 1991 and Engen and Skinner, 1992), or no significant relationship (Kormendi and Meguire, 1985, and Hsieh and Lai, 1994).

Many authors have tried to give reasons to these controversial results. Some of them suggest the existence of a nonlinear relationship with the macroeconomic performance where the impact of government spending depends on the optimal size of government expenditure by determining a threshold value (Vedder and Gallaway, 1998[1] and Sheehey, 1993). Using the Hansen's threshold model for the case of Taiwan, Chen and Lee (2005)[2] confirm that all the three classifications of government expenditure as a ratio to GDP (total government expenditure, government investment spending, and government consumption expenditure) have threshold effects. At the same time and based on the model of Ram (1986), and Odawara (2010)[3] proves this nonlinear relationship by estimating a threshold model that relates three measures of public spending: government consumption, government investment and total expenditure as share to GDP, to the economic growth. However, others authors have argued that the impact of government expenditure depends on his composition such as public spending addressed to defense, health or schooling which constitutes the main interest of this paper (Njikamp and Poot, 2004).

Convinced that potential benefits are important if populations are highly educated[4], many countries especially those in development devote a large part of their budget into their education system. For this reason, many authors are particularly interested to the relationship between education financing and economic growth which is extensively investigated with theoretical and empirical models (Glomm and Ravikumar, 1992; Sylwester, 2000 and 2002; etc.).[5] Nevertheless, their results are mitigated where certain reveal a weak effect on the economic growth (Aschauer, 1989; Barro, 1990 and 1991; Levine and Renelt, 1992; Easterly and Rebelo, 1993; Devarajan et al. 1996; Mittnik and Neumann, 2001; Sylwester, 2000; De la Croix and Delavallade, 2009). Several explanations are advanced but Pritchett (1997) argue that the negative or the ambivalent effect is due to the inefficacy of the public education expenditure which is related to

[1] Vedder and Gallaway, 1998 determine the optimal total government expenditure size of the United States and the OECD countries during 1947-1997. Their empirical analysis is based on the study of Armey, 1995 which implements the Laffer curve to present the link between public spending and economic growth.

[2] They use the quarterly data of Taiwan from 1979 Q1 to 2003 Q3.

[3] The author uses quarterly data from 1970 Q1-2008 Q4 for the U.S., Australia, Canada, Japan, and the UK.

[4] Lucas (1988); Benhabib and Spigel (1994); Levine and Zervos (1993); Hanushek and Kimko (2000), etc.

[5] See Benos and Zotou (2014) for more details on the literature evocating the relationship between education ex-penditure and growth.

issues of governance in the broad sense of government efficacy. This idea was reviewed by many studies interested to the government's quality dimension especially to the role of governance in explaining the relationship between government size and growth (Acemoglu et al., 2008; Barro, 1999; Torsten and Tabellini, 2007 and Dzhumashev, 2014a and b). Their results prove that the development of the legal system and the improvement of the institutional quality can contribute to more efficient provision of public goods which in turn is associated with high economic growth (Rajkumar and Swaroop, 2008[6]; Baldacci, et al., 2008).

So the government quality may be nonlinear when elucidating the relationship between public educational expenditure and growth but few empirical studies has so far given little attention to institutions as a threshold factor (Tanzi and Schuknecht, 1995; Deverajan et al, 1996 and Baldacci et al., 2008). In fact, the majority of research links separately public spending on education with growth (Barro, 1990 and 1991; Easterly and Rebelo, 1993; Sylwester, 2000 etc.), and governance with growth (Coppier and Michetti, 2006; Dzhumashev, 2009) or in reality public education expenditure, governance and economic performance are interlinked in the sense that a good quality of governance can increase the efficiency of the public education investment (Pritchett, 1997) which can improve the economic performance. This idea constitutes the main objective of this work where we look to assess empirically their impact.

This paper differs from the previous studies in the sense that it is the first, in our knowledge, that analyzes at the same time the direct link between the public education spending and the economic performance, and the indirect link referring to the institutional quality. Particularly, we determine endogenously the threshold level of governance in order to explain the mitigated relationship between the public spending on education and the economic growth. In fact, many studies proved that public investment on education can enhance growth if the country present good governance while weak governance can be regressive to sustained growth (Rajkumar and Swaroop, 2008). So the purpose of the present study is to address the question of how government quality measured by governance indicators and government size measured by the public education investment affect the economic performance by determining a threshold level.

However, one difficulty with the recent works that evocate the nonlinear model-specifically studies relative to the impact of finance, public debt, foreign direct investment, government aid, institutional quality, etc.[7] on growth - is that they ignore the problem of the threshold variable endogeneity which means that the Hansen approach (Hansen, 1996 and 2000) yields to inconsistent estimated parameter for the

[6] Rajkumar and Swaroop, 2008 prove that the quality of bureaucracy and the level of corruption present significant explanatory power for health and education outcomes in the case of a pooled time series regression. They show that in developing countries the efficacy of the public investment in education and health increase largely if the quality of governance is good.

[7] There is strong evidence that these threshold variables (Governance, trade, public debt, etc.) are endogenous (Panizza and Presbitero, 2012; Frankel and Romer, 1999 and Acemoglu, et al., 2001).

specific-partial effects regime (Kourtellos et al., 2013). So what distinguishes this paper from previous studies is to deal with endogenous threshold variable as well as endogenous regressors in order to analyze the presence and to determine the governance threshold level endogenously using for the first time the structural threshold regression model (STR) developed by Kourtellos et al. (2015) and which is a generalization of the Hansen (1996, 1999 and 2000) and Caner and Hansen (2004) methods. This work is based on a cross sectional data for developed and developing countries where the variables are averaged over 1980-2013. The obtained results confirm the existence of a governance threshold level effect through it the public education spending presents a positive impact on the growth process when the government quality is high otherwise the relationship is negative.

The rest of the paper is structured as follows. Section 2 presents the methodology and the data adopted in this study. Section 3 develops the empirical results and Section 4 summarizes the conclusions.

2. METHODOLOGY AND DATA

We use a linear cross-country model to start our investigation of the effect of public education spending on economic growth. Drawing upon Barro (1991), Mankiw et al. (1992), Barro (1996a and b) etc. the growth equation is based on a neoclassical growth framework:

$$GROWTH_i = \alpha GEDU_i + \beta X_i + \varepsilon_i, \quad (1)$$

$GROWTH_i$ is the dependant variable measured by the growth rate in a country i, $GEDU_i$ is the country level of public educational expenditure in percentage of the GDP, X_i is a set of macro control variables such as initial income per capita, investment gross domestic product ratio, human capital, financial development, trade openness and ε_i is a noise term.

Recently, a certain number of works have occurred that the relationship between economic growth and public expenditure can be affected by many other factors such as governance (Pritchett, 1997; Rajkumar and Swaroop, 2008 and Baldacci, et al., 2008). This finding constitutes our main objective in this paper where precisely, we study whether the link between public spending on education and economic growth through the institutional factors is different in each sample grouped of countries in the basis of threshold level.

To analyze this indirect effect, we determine endogenously the threshold level by using the threshold models considered as a simple method that captures nonlinearities in cross section and time series models. This method is different from the traditional approach where this level is obtained exogenously. In fact, if the threshold level is assessed arbitrarily or is not the result of empirical models, it becomes impossible to

find his confidence interval and the econometric estimator obtained from the exogenous sample splitting may present serious inferential problems.

The regression of the threshold level is based on the following nonlinear model:

$$GROWTH_i = (\alpha_1 GEDU_i + \beta X_i) I(INSTITUTIONAL\ QUALITY \leq \gamma) + (\alpha_2 GEDU_i + \beta_2 X_i) I(INSTITUTIONAL\ QUALITY > \gamma) + \varepsilon_i, \quad (2)$$

The threshold level variable (q_i) is the INSTITUTIONAL QUALITY that divides the sample into regimes or groups and γ is the unknown threshold parameter. The public education expenditure's impact on growth is α_1 and α_2 respectively for countries with low and high institutional quality. The indicator function is $I(\cdot)$ which takes the value 1 if the argument is valid and 0 otherwise.

$I(q_i \leq \gamma) = 1$ if $q_i \leq \gamma$: Regime 1,

$I(q_i \leq \gamma) = 0$ if $q_i > \gamma$: Regime 2,

$I(q_i > \gamma) = 1 - I(q_i \leq \gamma)$,

where q_i is a non-constant variable.

To estimate these nonlinear models, Hansen (1996) presents two steps. The first consists to test the null hypothesis of linearity against the threshold model (Equation 2) H0: $\alpha_1 = \alpha_2$. The model is linear and the regression is reduced to equation 1 if the estimated coefficients are equal $\alpha_1 = \alpha_2$ and $\beta_1 = \beta_2$ otherwise the model is nonlinear. The second step is reserved to the regression of equation 2 and the estimation of γ by the minimization of the residual sum of squares.

This paper is novel compared to the previous studies that use the Hansen approach (TR) for cross-countries data (Hansen, 1996 and 2000). In fact, we refer to the Structural Threshold Regression model (STR) of Kourtellos et al. (2015) due to the endogeneity of the governance indicators that leads to biased estimated threshold levels. In reality, many plausible threshold variables are endogenous which can limit the usefulness of the model of Hansen (1996 and 2000). This new method of Kourtellos et al. (2015) is a generalization of the simple threshold regression model (TR) of Hansen (2000) and Caner and Hansen (2004)[8] that allows for the endogeneity of the threshold variable as well as the regressors, and the regime-specific heteroskedasticity[9]. However, for panel

[8] The model of Caner and Hansen (2004) (IVTR) considers the assumption of the exogeneity of the threshold variable and allows only for the endogeneity of the regressors.

[9] The estimation of the threshold parameter is based on a two-stage concentrated least squares method that considers mills ratio bias correction term in each regime. The model derives also the asymptotic distribution and proposes a method in order to construct confidence intervals. It provides inference for the slope parameters based on the generalized method of moments. The performance of the asymptotic

data, Hansen (1999) presents a threshold regression method for non-dynamic panels with individual fixed effects. González et al. (2005) and González et al. (2017)[10] generalize this approach and develop a panel smooth transition regression model for which the coefficients can change gradually from one regime to another. Nevertheless, these approaches are static and invalid for dynamic panel. For this reason, Seo and Shin (2016) have proposed recently a dynamic threshold panel data model to deal with the double endogeneity of the threshold variable and the regressors using two different estimation methods: first-differenced two step least squares and first differenced GMM.

Following Kourtellos et al. (2015), q_i is endogenous so the reduced form equation that determines which regime applies is given by:

$$q_i = \pi_q' Z_i + \vartheta_{q_i}. \tag{3}$$

Equation (3) is analogous to a selection equation that appears in the literature on limited dependent variable models (Heckman, 1979). The main difference is that while the limited dependent variable models that treat qi as latent and the sample split as observed, here the sample split value is treated as an unknown parameter that will be estimated.

So equation (1) is generalized to allow for two regimes:

$$GROWTH_i = \alpha GEDU_i + \beta X_i + \delta' X_i I(q_i \leq \gamma) + k\rho_i(\gamma) + \varepsilon_i, \tag{4}$$

where $E(\varepsilon_i - Z_i) = 0$.[11]

To test the effect of public education spending on economic growth conditional on the quality of institutions, we use a cross sectional balanced dataset averaged over the period 1980-2013[12] for a sample of 109 developed and developing countries.[13]

The dependant variable is the economic growth rate of the real GDP per capita (GROWTH) averaged over the period 1980-2013. The threshold variable corresponds to the governance indicators. As compared with the existing literature that focuses on specific features of institutional quality, we use a comprehensive set of 5 governance

approximations is investigated using a Monte Carlo simulation. For more details see Kourtellos et al. (2015).

[10] This paper is a revised and updated version of the Working Paper No. 604 (2005), Stockholm School of Economics.

[11] See Kourtellos et al. (2015) for more details about this method and the estimation program. This model becomes TR model when $k = 0$.

[12] We choose the period 1980-2013 because data are more available for several countries particularly for the public educational spending. For this analysis, the panel data approach cannot be used because the lack of data that can considerably limit the number of observations.

[13] See appendix for the list of countries. The number of countries (109 countries) is obtained after eliminating all the unobserved data because the method requires balanced datasets.

indicators obtained from the database of Kaufman, Kraay and Mastruzzi[14] (WGI) in order to capture the full extent of the interaction between institutions and education expenditure in generating economic performance.

These governance indicators are: political stability and absence of violence (POLISTAB) which measure the government stability; government effectiveness (GOV) evaluates the capability of a government to implement effective policies and to maintain credibility; regulatory quality (REGU) gives information about the ability of the government to formulate policies that encourage the private sector; rule of law (LAW) informs about the existence of a good legal system that defends property rights and enforces contracts; control of corruption (CORRUP) estimates the degree to which public power is diverted from private gain. The values of these indicators are between -2.5 and 2.5 where the high level indicates good governance.

The main independent variable in this model is the government expenditure on education as a ratio of the GDP[15] (GEDU) which measures the size dimension of the government. This variable largely used in the literature evaluates the effort of the government in terms of investment in the education sector (Barro, 1990 and 1991). The others independent variables[16] represent the traditional determinants of the economic growth introduced in the regression model as control variables as suggested by numerous studies of growth theories : the initial real GDP per capita (US$ 2000 constant prices) (GDP80) adopted to test the convergence hypothesis of Solow which implies that countries with low initial level of GDP per capita realize a high level of economic growth compared to countries that start with a high level of GDP per capita; the human capital (HK) measured by the average years of schooling which reflects the quantitative aspect of education[17]; the openness of the economy to the rest of the World (TRADE) which is the sum of export and import as a ratio of GDP. This variable is mainly considered by the literature as a fundamental determinant of the economic growth and as a common and powerful measure of the institutional framework of the economy[18]; the

[14] Data are obtained from the World Governance Indicators WGI 2014. The choice of this database is related to the literature where it is the most widely employed empirical sources of government quality and because it covers multiple areas of governance.

[15] We consider the average of this variable during the period 1980-2013.

[16] All these variables are in average during the period 1980-2013 except the initial GDP which is relative to 1980.

[17] In our analysis, we refer only to the quantitative aspect of the human capital by considering the most used indicator which is the average years of schooling but the literature presents a large debate about the quantitative and the qualitative aspect. Many authors confirm the considerable effect of the quality of education on growth (Lee and Lee, 1995; Hanushek and Kim, 1995; Bosworth and Collins, 2003 and Ciccone and Papaioannou, 2005, etc.).

[18] See Frankel and Romer (1999), Noguer and Siscart (2005), Feyrer (2009), and Squalli and Wilson (2011) for more details about this variable. See also Busse and Koniger (2012) for several measures of the openness trade.

physical capital investment (as percentage of GDP) (IY) and the ratio of the liquid liabilities (LL)[19] to the GDP employed as a proxy of the financial development of the economy. All these variables are obtained from the World Bank Development Indicators except the human capital (HK) from the Barro and Lee (2013) database and the liquid liabilities variable (LL) from the Financial Structure Database of the World Bank.

Tables 1 and 2 present the descriptive statistics and the correlation matrix of all the variables. The results imply that the public education spending (GEDU) is negatively related to the economic growth which is similar to the empirical finding of several works (Easterly and Rebelo, 1993 and Sylwester, 2000 and 2002) but controversial to the theoretical literature that rather find a positive link (Glomm and Ravikumar, 1992). However, the governance indicators (CORRUP, REGU, POLISTAB, LAW and GOV) are positively related to the economic performance but highly correlated between them for this reason they are introduced separately in the regression equation. The negative sign of the initial GDP (GDP80) confirms the convergence hypothesis of Solow. The Human capital (HK) has also a negative sign which supports the results of many empirical studies that prove the evidence of a weak relationship with the economic performance (Sala-i-Martin, 2002). The others determinants of growth (commercial openness TRADE, investment IY and financial development LL) reveal the positive sign largely advanced by the theoretical literature.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GROWTH	109	0.0140	0.0164	-0.0409	0.0835
GDP80	109	8489.512	12668.16	178.8503	81788.95
KH	109	6.7281	2.6846	1.1757	12.5114
GEDU	109	4.3863	1.6772	1.1094	11.7162
TRADE	109	80.8811	51.9683	21.166	356.3131
IY	109	21.4120	5.0629	9.9496	42.5093
LL	109	55.2068	42.0235	8.2314	276.5573
CORRUP	109	0.1348	1.0763	-1.4422	2.4315
REGU	109	0.1754	0.9613	-1.8269	1.9360
POLISTAB	109	-0.1137	0.9396	-2.2977	1.4699
LAW	109	0.0761	1.0374	-1.6892	1.9514
GOV	109	0.1706	1.0379	-1.6823	2.1461

[19] In this study, we are limited only to the liquid liabilities as a proxy of the financial development where the abundant literature refers to other banking sector development indicators such as private sector credit and the commercial bank assets.

Table 2. Correlations

	GROWTH	GDP80	KH	GEDU	TRADE	IY	LL	CORRUP	REGU	POLISTAB	LAW	GOV
GROWTH	1.000											
GDP80	-0.174	1.000										
KH	0.276	0.548	1.000									
GEDU	-0.007	0.087	0.301	1.000								
TRADE	0.126	0.157	0.223	0.145	1.000							
IY	0.477	0.117	0.316	0.229	0.318	1.000						
LL	0.337	0.409	0.506	0.073	0.484	0.336	1.000					
CORRUP	0.253	0.696	0.741	0.293	0.287	0.286	0.569	1.000				
REGU	0.318	0.647	0.770	0.166	0.302	0.288	0.591	0.937	1.000			
POLISTAB	0.185	0.600	0.630	0.293	0.353	0.286	0.484	0.824	0.807	1.000		
LAW	0.320	0.671	0.752	0.265	0.272	0.338	0.602	0.972	0.972	0.836	1.000	
GOV	0.338	0.684	0.788	0.260	0.279	0.354	0.614	0.967	0.962	0.804	0.972	1.000

Notes: GROWTH=the rate of economic growth; GDP80=initial GDP; KH=human capital; GEDU=public education expenditure (a percentage of GDP); TRADE=economic openness (a percentage of GDP); IY=investment (a percentage of GDP); LL=liquid liabilities (a percentage of GDP); CORRUP=corruption; REGU=regulatory quality; POLISTAB=political stability; LAW=rule of law and GOV=government effectiveness.

3. EMPIRICAL RESULTS

The objective of this paper is to analyze the relationship between the growth rate of the real GDP per capita and the spending on education by investigating the possibility of multiple growth regimes using a set of growth determinants as control variables and governance indicators as threshold variables.

Table 3 presents the results of the null hypothesis test of a linear model against the alternative of a threshold variable using the threshold sup test developed by Hansen, 2000. The statistical significance of the threshold is evaluated by the p-value which is obtained by the bootstrap method with 2000 replications and 15% trimming percentage. This p-value indicates that the test of no-threshold can be rejected and thus the sample can be split in two regimes: regime 1 for countries with governance indicators value below the threshold level and where the institutional quality is weak, and regime 2 for countries above this threshold level and where the quality of their institutions is high. We report also the threshold level and the corresponding 95% confidence interval.

Table 3. Threshold Estimate of the Institutional Quality (Governance Indicators)

	CORRUP	REGU	POLISTAB	LAW	GOV
LM test for no threshold	23.180	21.963	19.014	21.387	23.682
Bootstrap P-Value	0.001	0.000	0.013	0.001	0.000
Threshold estimates	0.341	0.557	0.266	0.505	0.131
95% confidence interval	[-0.528,0.521]	[0.247, 0.557]	[-0.218, 0.786]	[0.065, 0.564]	[0.116, 0.512]

Note: H0=no-threshold effect.

After proving the nonlinearity of the model, we estimate the threshold level in order to analyze how institutional quality affects the link between public education expenditure and growth. Tables 4, 5, 6, 7 and 8 present the regression results of the linear model and the nonlinear model using the STR method (Kourtellos et al., 2015) when the threshold variable is endogenous[20] and the TR method (Hansen, 2000) when we ignore this endogeneity.[21]

The linear model estimation using the OLS method reveals the non significance of the public education expenditure coefficient confirming thus the ambiguous results advanced by many studies cited above. The coefficient of the initial GDP is negative and significant which is in line with the Solow hypothesis of convergence. However and as mentioned by the theoretical literature, the human capital, the investment and the financial development procure a positive effect on the economic growth while the coefficient of the trade is statistically insignificant.

The results of the nonlinear model estimation using the STR method confirm the negative sign of the public education spending that becomes significant when institutions fall below the threshold level for all the governance indicators and in contrast, above this threshold level, it becomes positive and significant for rule of law (LAW) and regulatory quality (REGU). This finding replicates that the effect of public education spending on growth is positive only if institutions function properly. So, devoting an increasing amount of resources to education cannot promote growth if the country is characterized by bad governance. As confirmed by Mauro (1997) and Tanzi and Davoodi (1997), the lack of control for these investments can lead to their misappropriation or their misusing in order to satisfy private or personnel objective.

The nonlinearity of the model implies that the threshold level divides the sample on two regimes where countries above this level are in general developed or emerged[22] with high rate of growth (1.7 percent in average during the estimated period), high level

[20] The endogeneity of the institutional quality is controlled by considering the latitude as an instrument variable (La Porta, et al., 1999). The literature has also adopted other governance instruments such as the settler mortality but we do not used it because his data is limited which can reduce the number of observations in our sample.

[21] We use the TR method (Hansen, 2000) just in order to compare with the results of the STR method (Kourtellos et al., 2015) while the endogeneity of the threshold variable is confirmed by many theoretical studies.

[22] See appendix of the list of countries above the governance indicators threshold level.

of human capital (9 years in average), considerable part of GDP invested in education (around 4.7 percent in average), in addition to their high ratios of trade (97 percent of GDP in average), liquid liabilities (84 percent of GDP in average) and physical investment (22 percent of GDP in average). At the same time, these countries present good institutional quality[23] which offers a favorable environment that can stimulate their investment in education and generate positive impact on the economic performance.

However, countries below the threshold level[24] are generally in development with low growth rate (in average around 1 percent), low level of human capital (around 5 years in average) in addition to the large part of GDP devoted to education, which is close to the developed countries' part (around 4 percent in average), but with weak growth's determinants factors where trade represents in average around 70 percent of the GDP, 38 percent for the liquid liabilities and 20 percent for investment, and weak governance indicators[25]. In fact, the negative effect of the public educational expenditure on growth can be explained by the non immediate productivity of this spending (Sylwester, 2000 and 2002) but also by his inefficiency. Moreover, Blankenau et al. (2007) argue that a high investment in education is usually realized in the detriment of other investment (infrastructure, health, etc.) and at the same time it needs a high taxation which can oust the private investment and affect it negatively. Whereas, the result of this study implies that the effectiveness of this education investment depends on many others factors that can boost the growth such as the openness of the economy, the institutional quality, etc. (Krueger and Lindahl, 2001) where these developing countries are in general less performing which in contrary can slow down growth.

For all the models considering the STR and the TR methods, the estimated coefficient of the initial real GDP per capita (GDP80) is negative and statistically significant when institutions fall below and above the threshold level confirming thus the convergence hypothesis of Solow. The estimated coefficients of the human capital (HK), the investment in physical capital (IY) and the financial development (LL) are positive and statistically significant[26] for the two regimes which are in line with the theory. In fact, the human capital (HK) stimulates the economic growth (Lucas, 1988)

[23] According to our sample, these indicators are in average equal to 1.344; 1.260; 0.925; 1.341 and 1.187 respectively for corruption; regulatory quality; political stability; rule of law and government effectiveness.

[24] See appendix for the list of countries below the governance indicators threshold level.

[25] According to our sample, these indicators are in average around -0.594; -0.428; -0.647; -0.574 and -0.600 respectively for corruption; regulatory quality; political stability; rule of law and government effectiveness.

[26] The coefficients of the human capital (HK) are insignificant for countries of regime 2 relative to the threshold variables: regulatory quality (REGU) and government effectiveness (GOV) (Tables 5 and 8). The coefficients of the liquid liabilities (LL) are insignificant for countries of regime 2 relative to the threshold variables: control of corruption (CORRUP) and government effectiveness (GOV) (Tables 4 and 8).

regardless the governance level but his effect is more important when the institutional quality is good. The physical investment (IY) presents the same result in the sense that his return rises only for countries with high institutional quality. This finding supports the theoretical results that suggest a positive effect and a strong correlation between the physical capital investment and the economic performance independently of the level of development of each country (Barro, 1990; Sachs and Warner, 1995; Bosworth and Collins, 2003; Le and Suruga, 2005, etc.).

For the two regimes, the financial development (LL) has a positive effect on growth which is more remarkable for countries below the threshold level. This result joins the finding of De Gregorio and Guidotti (1995) and Huang and Lin (2009) where they prove that this positive effect is larger in low income countries than in high income countries.[27] Whereas, Rioja and Valev (2004) confirm that this relationship is positive and significant for the middle-income countries, weakly significant in high-income countries, but absent in low-income countries.[28]

The estimated coefficients of the trade openness are negative and statistically significant below the threshold level and become positive and significant above it.[29] The negative impact on growth occurs when institutions are weak but this effect becomes positive when the country present good governance. Several studies highlight the positive effect of trade openness on the economic performance (Krugman, 1979; Young, 1991 and Grossman and Helpman, 1991) through many channels as the economies of scale (Taylor, 1994 and Grossman and Helpman, 1991); the innovation, the knowledge, the import of ideas and the diffusion of information (Feder, 1982 and Grossman and Helpman, 1992), and the competition's improve in the domestic economy and hence the increase of productivity (Greenaway and Milner, 1993 and Aghion, et al., 1997). Recently, many economists suggest that the potential of trade to affect growth is contingent on various economic, social, political, institutional, and structural factors but only few of them who test the nonlinearity of this relationship (Bhagwati and Srinivasan, 2002; Rodrik and Rodríguez, 2001; Foster, 2008 and Dufrenot et al., 2009). Particularly, the positive effect of trade on growth depends mainly on complementary reforms such as educational investment, financial depth, inflation stabilization, public infrastructure, governance, labor market flexibility, etc. which can explain our empirical results where the developing countries find many difficulties to draw this beneficial effect (Chang et al., 2009).

[27] Their results are robust using several financial development measures.

[28] De Gregorio and Guidotti, 1995 explain this result by the fact that the financial development takes place outside the banking system, while his proxy focuses on banking sector development.

[29] The estimated coefficient of TRADE is insignificant only for the government effectiveness (GOV) of regime 2 of the TR estimation (Table 8).

Table 4. Threshold Estimates of Corruption (CORRUP)
(Dependant Variable: The Growth Rate of the GDP per Capita)

	Linear Model	Threshold Model TR estimation (LS)		Threshold Model STR estimation(LS)	
	OLS without threshold	Regime 1 CORRUP<0.341	Regime 2 CORRUP>0.341	Regime 1 CORRUP<0.1554	Regime 2 CORRUP>0.1554
GDP80	-0.724***	-0.740***	-1.369***	-0.689***	-1.332***
	(0.132)	(0.110)	(0.156)	(0.124)	(0.153)
KH	1.560***	1.182***	3.454**	0.785*	3.689***
	(0.447)	(0.405)	(0.859)	(0.476)	(0.804)
GEDU	-0.455	-0.901***	0.650*	-1.048***	0.263
	(0.427)	(0.385)	(0.335)	(0.411)	(0.354)
TRADE	-0.434	-0.722*	0.451**	-0.728*	0.451***
	(0.282)	(0.374)	(0.170)	(0.420)	(0.170)
IY	2.113***	1.965**	2.700***	1.912***	2.663***
	(0.613)	(0.611)	(0.745)	(0.614)	(0.752)
LL	1.126***	1.329***	0.403	1.272***	0.272
	(0.256)	(0.308)	(0.250)	(0.357)	(0.234)
R-sq	0.4813	0.5598	0.8130		
Heteroskedasticity test P-Value	0.0448	-	-	-	-
No.Observations	109	74	35	68	41

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity). All the variables are in average for the period 1980-2013. ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate.

Table 5. Threshold Estimates of Regulatory Quality (REGU)
(Dependant Variable: The Growth Rate of the GDP per Capita)

	Linear Model	Threshold Model TR estimation (LS)		Threshold Model STR estimation(LS)	
	OLS without threshold	Regime 1 REGU< 0.557	Regime 2 REGU> 0.557	Regime 1 REGU< 0.5030	Regime 2 REGU> 0.5030
GDP80	-0.724***	-0.649***	-1.372***	-0.703***	-1.325***
	(0.132)	(0.121)	(0.153)	(0.124)	(0.154)
KH	1.560***	1.145**	3.800***	0.577	2.360***
	(0.447)	(0.420)	(0.586)	(0.507)	(0.799)
GEDU	-0.455	-1.032**	0.590**	-1.040***	0.587*
	(0.427)	(0.402)	(0.322)	(0.401)	(0.337)
TRADE	-0.434	-0.760*	0.447**	-0.727*	0.535*
	(0.282)	(0.374)	(0.169)	(0.418)	(0.177)
IY	2.113***	1.895**	2.675***	1.902***	2.917***
	(0.613)	(0.615)	(0.762)	(0.605)	(0.769)
LL	1.126***	1.412***	0.405*	1.259***	0.331
	(0.256)	(0.305)	(0.252)	(0.351)	(0.221)
R-sq	0.4813	0.5657	0.8041		
Heteroskedasticity test P-Value	0.0369	-	-	-	-
No.Observations	109	72	37	70	39

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity). All the variables are in average for the period 1980-2013. ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate.

Table 6. Threshold Estimates of Political Stability (POLISTAB)
(Dependant Variable: The Growth Rate of the GDP per Capita)

	Linear Model	Threshold Model TR estimation (LS)		Threshold Model STR estimation(LS)	
	OLS without threshold	Regime 1 POLISTAB< 0.266	Regime 2 POLISTAB> 0.266	Regime 1 POLISTAB< 0.2663	Regime 2 POLISTAB> 0.2663
GDP80	-0.724***	-0.697***	-1.308***	-0.718***	-1.455***
	(0.132)	(0.108)	(0.143)	(0.110)	(0.146)
KH	1.560***	1.201**	3.187***	0.835*	2.978***
	(0.447)	(0.421)	(0.789)	(0.476)	(0.656)
GEDU	-0.455	-0.961**	1.003**	-0.991***	0.385
	(0.427)	(0.392)	(0.256)	(0.385)	(0.334)
TRADE	-0.434	-0.714*	0.491**	-0.701***	0.509***
	(0.282)	(0.408)	(0.158)	(0.375)	(0.165)
IY	2.113***	1.874**	3.187***	1.873***	2.747***
	(0.613)	(0.601)	(0.713)	(0.612)	(0.701)
LL	1.126***	1.429***	0.438*	1.324***	0.390*
	(0.256)	(0.319)	(0.254)	(0.324)	(0.220)
R-sq	0.4813	0.5592	0.8390		
Heteroskedasticity test P-Value	0.0410	-	-	-	-
No.Observations	109	73	36	72	37

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity). All the variables are in average for the period 1980-2013. ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate.

Table 7. Threshold Estimates of Rule of Law (LAW)
(Dependant Variable: The Growth Rate of the GDP per Capita)

	Linear Model	Threshold Model TR estimation (LS)		Threshold Model STR estimation(LS)	
	OLS without threshold	Regime 1 LAW < 0.505	Regime 2 LAW > 0.505	Regime 1 LAW< 0.5055	Regime 2 LAW>0.5055
GDP80	-0.724***	-0.696***	-1.353***	-0.705***	-1.424***
	(0.132)	(0.109)	(0.154)	(0.110)	(0.151)
KH	1.560***	1.154**	3.265***	0.919**	2.710***
	(0.447)	(0.405)	(0.828)	(0.439)	(0.730)
GEDU	-0.455	-0.973**	0.761**	-0.992***	0.592*
	(0.427)	(0.384)	(0.304)	(0.381)	(0.317)
TRADE	-0.434	-0.751*	0.450**	-0.709*	0.512***
	(0.282)	(0.384)	(0.167)	(0.384)	(0.167)
IY	2.113***	1.944**	2.669**	1.916***	2.709***
	(0.613)	(0.610)	(0.772)	(0.609)	(0.706)
LL	1.126***	1.400***	0.414*	1.346***	0.391*
	(0.256)	(0.319)	(0.247)	(0.332)	(0.220)
R-sq	0.4813	0.5686	0.8134	0.5598	0.8130
Heteroskedasticity test P-Value	0.0326	-	-	-	-
No.Observations	109	72	37	72	37

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity). All the variables are in average for the period 1980-2013. ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate.

Table 8. Threshold Estimates of Government Effectiveness (GOV)
(Dependant Variable: the Growth Rate of the GDP per Capita)

	Linear Model	Threshold Model TR estimation (LS)		Threshold Model STR estimation(LS)	
	OLS without threshold	Regime 1 GOV< 0.131	Regime 2 GOV> 0.131	Regime 1 GOV< 0.1312	Regime 2 GOV> 0.1312
GDP80	-0.724***	-0.808***	-1.237***	-0.820***	-1.349***
	(0.132)	(0.126)	(0.154)	(0.130)	(0.145)
KH	1.560***	1.244**	3.727***	0.634	3.084***
	(0.447)	(0.420)	(0.699)	(0.518)	(0.671)
GEDU	-0.455	-0.880*	0.223	-0.905**	0.052
	(0.427)	(0.440)	(0.393)	(0.434)	(0.378)
TRADE	-0.434	-0.910*	0.313	-0.884**	0.440**
	(0.282)	(0.434)	(0.197)	(0.430)	(0.190)
IY	2.113***	2.059**	2.719**	2.038***	2.722***
	(0.613)	(0.628)	(0.714)	(0.628)	(0.669)
LL	1.126***	1.155**	0.246	0.990***	0.211
	(0.256)	(0.328)	(0.253)	(0.362)	(0.219)
R-sq	0.4813	0.5736	0.7504	0.5598	0.8130
Heteroskedasticity test P-Value	0.0379	-	-	-	-
No.Observations	109	62	47	62	47

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity). All the variables are in average for the period 1980-2013. ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate.

4. CONCLUSION

This paper contributes to the important and also the contemporary debate on the relationship between public spending particularly on education and long run economic growth. The theoretical literature had largely confirmed their strong link (Glomm and Ravikumar, 1992, Benabou, 1995 and 1996, etc.). However, the results of the empirical works are mixed. In fact, the focus of the existing literature was on the linear relationship between them or it can be nonlinear. Recently many studies are interested to determine whether there exist nonlinear effects of finance, trade, public debt, foreign investment, institutional quality, etc. on growth (Khoury and Savvides, 2006; Drukker, et al., 2005; Falvey, et al., 2007; Azman-Saini, et al., 2010; Odawara, 2010, etc.) but studies related to public spending especially on education still absent. So once a rich set of alternative theories are developed in this context, there is little evidence for such nonlinearities which constitute our main interest in this study.

Our objective in this work was to determine how institutional quality can affect the impact of public education investment on the economic performance. We have tried to prove that the relationship between them is mitigated due to the quality of country's institutions. Particularly, we have looked to identify the critical level of governance such that over it, more public spending on schooling promotes growth. The findings of this

paper suggest that if the governance is weak more public spending on education leads to lower growth. However, the improvement of the quality of institutions enhances the economic performance. This result is confirmed using for the first time the STR method developed by Kourtellos et al. (2015) in order to deal with the endogeneity of the threshold variables but also when we use the method of Hansen (1996 and 2000) that ignores this endogeneity. So knowing the turning point of the relationship between education financing and growth is crucial for policy makers, who could focus on other growth-enhancing strategies especially on governance and proposes measures that strengthen it rather than just expanding schooling resources.

APPENDIX

A1. List of Countries

Albania Algeria Argentina Australia Austria Bahrain Bangladesh Barbados Belgium Belize Benin Bolivia Botswana Brazil Brunei Darussalam Bulgaria Burundi Cameroon Canada Central African Republic Chile China Colombia Congo, Dem, Rep, Congo, Rep, Costa Rica Cote d'Ivoire Cyprus Denmark Dominican Republic Ecuador Egypt, Arab Rep, El Salvador Fiji Finland France Gabon Gambia, The Germany Ghana Greece Guatemala Guyana Honduras Hong Kong SAR, China Iceland India Indonesia Iran, Islamic Rep, Iraq Ireland Israel Italy Jamaica Japan Jordan Kenya Korea, Rep, Lesotho Liberia Luxembourg Malawi Malaysia Mali Malta Mauritania Mauritius Mexico Moldova Morocco Mozambique Namibia Nepal Netherlands New Zealand Nicaragua Niger Norway Pakistan Panama Paraguay Peru Philippines Portugal Rwanda Saudi Arabia Senegal Sierra Leone Singapore South Africa Spain Sri Lanka Sudan Swaziland Sweden Switzerland Syrian Arab Republic Thailand Togo Trinidad and Tobago Tunisia Turkey United Arab Emirates United Kingdom United States Uruguay Venezuela, RB Zambia Zimbabwe

A2. List of Countries Above and Below the Corruption Threshold Level (CORRU)

List of countries below the corruption threshold level: Albania Algeria Argentina Bangladesh Belize Benin Bolivia Brazil Bulgaria Burundi Cameroon Central Republic African China Colombia Congo, Dem, Rep, Congo, Rep, Cote d'Ivoire Dominican Republic Ecuador Egypt, Arab Rep, El Salvador Fiji Gabon Gambia, Ghana Guatemala Guyana Honduras India Indonesia Iran, Islamic Rep, Iraq Jamaica Jordan Kenya Lesotho Liberia Malawi Mali Mauritania Mexico Moldova Morocco Mozambique Nepal Nicaragua Niger Pakistan Panama Paraguay Peru Philippines Rwanda Saudi Arabia Senegal Sierra Leone Sri Lanka Sudan Swaziland Syrian Arab Republic Thailand Togo Trinidad and Tobago Tunisia Turkey Venezuela, RB Zambia Zimbabwe.

List of countries above the corruption threshold level: Australia Austria Bahrain Barbados Belgium Botswana Brunei Canada Chile Costa Rica Cyprus Denmark Finland France Germany Greece Hong Kong SAR, China Iceland Ireland Israel Italy Japan Korea, Rep, Luxembourg Malaysia Malta Mauritius Namibia Netherlands New Zealand Norway Portugal Singapore South Africa Spain Sweden Switzerland United Arab Emirates United Kingdom United States Uruguay.

A3. List of Countries Above and Below the Regulatory Quality Threshold Level (REGU)

List of countries below the regulatory quality threshold level: Albania Algeria Argentina Bangladesh Belize Benin Bolivia Brazil Bulgaria Burundi Cameroon Central Republic African China Colombia Congo, Dem, Rep, Congo, Rep, Cote d'Ivoire Dominican Republic Ecuador Egypt, Arab Rep, El Salvador Fiji Gabon Gambia, Ghana Guatemala Guyana Honduras India Indonesia Iran, Islamic Rep, Iraq Jamaica Jordan Kenya Lesotho Liberia Malawi Mali Mauritania Mexico Moldova Morocco Mozambique Namibia Nepal Nicaragua Niger Pakistan Panama Paraguay Peru Philippines Rwanda Saudi Arabia Senegal Sierra Leone South Africa Sri Lanka Sudan Swaziland Syrian Arab Republic Thailand Togo Tunisia Turkey Venezuela, RB Zambia Zimbabwe.

List of countries above the regulatory quality threshold level: Australia Austria Bahrain Barbados Belgium Botswana Brunei Canada Chile Costa Rica Cyprus Denmark Finland France Germany Greece Hong Kong SAR, China Iceland Ireland Israel Italy Japan Korea, Rep, Luxembourg Malaysia Malta Mauritius Netherlands New Zealand Norway Portugal Singapore Spain Sweden Switzerland United Arab Emirates United Kingdom United States Uruguay.

A4. List of Countries Above and Below the Political Stability Threshold Level (POLI STAB)

List of countries below the political stability threshold level: Albania Algeria Argentina Bahrain Bangladesh Belize Bolivia Brazil Bulgaria Burundi Cameroon Central Republic African China Colombia Congo, Dem, Rep, Congo, Rep, Cote d'Ivoire Dominican Republic Ecuador Egypt, Arab Rep, El Salvador Fiji Gabon Gambia, Ghana Guatemala Guyana Honduras India Indonesia Iran, Islamic Rep, Iraq Israel Jamaica Jordan Kenya Lesotho Liberia Malawi Mali Mauritania Mexico Moldova Morocco Mozambique Namibia Nepal Nicaragua Niger Pakistan Panama Paraguay Peru Philippines Rwanda Saudi Arabia Senegal Sierra Leone South Africa Spain Sri Lanka Sudan Swaziland Syrian Arab Republic Thailand Togo Trinidad and Tobago Tunisia Turkey Venezuela, RB Zambia Zimbabwe.

List of countries above the political stability threshold level: Australia Austria Barbados Belgium Botswana Brunei Canada Chile Costa Rica Cyprus Denmark Finland

France Germany Greece Hong Kong SAR, China Iceland Ireland Israel Italy Japan Korea, Rep, Luxembourg Malaysia Malta Mauritius Netherlands New Zealand Norway Portugal Singapore Sweden Switzerland United Arab Emirates United Kingdom United States Uruguay.

A5. List of Countries Above and Below the Rule of Law Threshold Level (LAW)

List of countries below the Rule of Law threshold level: Albania Algeria Argentina Bahrain Bangladesh Belize Benin Bolivia Brazil Bulgaria Burundi Cameroon Central Republic African China Colombia Congo, Dem, Rep, Congo, Rep, Cote d'Ivoire Dominican Republic Ecuador Egypt, Arab Rep, El Salvador Fiji Gabon Gambia, Ghana Guatemala Guyana Honduras India Indonesia Iran, Islamic Rep, Iraq Jamaica Jordan Kenya Lesotho Liberia Malawi Mali Mauritania Mexico Moldova Morocco Mozambique Namibia Nepal Nicaragua Niger Pakistan Panama Paraguay Peru Philippines Rwanda Saudi Arabia Senegal Sierra Leone South Africa Sri Lanka Sudan Swaziland Syrian Arab Republic Thailand Togo Trinidad and Tobago Tunisia Turkey Venezuela, RB Zambia Zimbabwe.

List of countries above the rule of law threshold level: Australia Austria Barbados Belgium Botswana Brunei Canada Chile Costa Rica Cyprus Denmark Finland France Germany Greece Hong Kong SAR, China Iceland Ireland Israel Italy Japan Korea, Rep, Luxembourg Malaysia Malta Mauritius Netherlands New Zealand Norway Portugal Singapore Spain Sweden Switzerland United Arab Emirates United Kingdom United States Uruguay.

A6. List of Countries Above and Below the Government Effectiveness Threshold Level (GOV)

List of countries below the government effectiveness threshold level: Albania Algeria Argentina Bangladesh Belize Benin Bolivia Brazil Bulgaria Burundi Cameroon Central Republic African China Colombia Congo, Dem, Rep, Congo, Rep, Cote d'Ivoire Dominican Republic Ecuador Egypt, Arab Rep, El Salvador Fiji Gabon Gambia, Ghana Guatemala Guyana Honduras India Indonesia Iran, Islamic Rep, Iraq Jamaica Jordan Kenya Lesotho Liberia Malawi Mali Mauritania Moldova Morocco Mozambique Nepal Nicaragua Niger Pakistan Paraguay Peru Philippines Rwanda Saudi Arabia Senegal Sierra Leone Sri Lanka Sudan Swaziland Syrian Arab Republic Togo Venezuela, RB Zambia Zimbabwe.

List of countries above the government effectiveness threshold level: Australia Austria Bahrain Barbados Belgium Botswana Brunei Canada Chile Costa Rica Cyprus Denmark Finland France Germany Greece Hong Kong SAR, China Iceland Ireland Israel Italy Japan Korea, Rep, Luxembourg Malaysia Malta Mauritius Mexico Namibia Netherlands New Zealand Norway Panama Portugal Singapore South Africa Spain

Sweden Switzerland Thailand Trinidad and Tobago Tunisia Turkey United Arab Emirates United Kingdom United States Uruguay.

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