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The governance threshold effect on the relationship between public education financing and income inequality

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Abstract

In this study, we use a structural threshold regression methodology STR developed by Kourtellos et al,. 2015 in order to determine the heterogeneous effects of public education expenditure on the income inequality at different levels of institutional quality. Our main objective is to give reason to the mixed result between public spending on education and inequality largely obtained by the empirical analysis and to confirm the nonlinear character of this relationship. We obtain strong evidence that public education expenditure improves income distribution only if the country is above the threshold level of governance otherwise the effect is negative.

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1. Introduction

The relationship between inequality and economic development has attracted a great attention where many economists confirm its nonlinearity by proving that the income distribution is worsening at early development' stages (Kuznets, 1955; Deininger and Squire, 1996). In fact, sectors with high productivity absorb resources from those with low productivity[1], but when workers start to move to these sectors, the income becomes more equally distributed improving thus the economic development. However, contrary to these Kuznets predictions, many studies find that the income inequality is markedly pronounced in developed countries (Piketty and Saez, 2003 and OECD, 2008). This increase, which characterizes several countries since 1985, and specifically during the recent economic crisis, generates a new debate on its determinant factors, its impact on growth and haw to limit its effects (OECD 2011, IMF 2015, Ostry et al. 2014).

Human capital, particularly public education, is largely considered as one of the most important way that reduces the social disparity. For this reason many developing countries devote considerable amount of their budget to schooling (Toh, 1984, Schultz, 1963 and Glomm and Ravikumar, 1992). As a signal of ability and productivity in the job market, education determines also the pay's level and the occupational choice, and gives more opportunities especially to poor persons to improve their social status. Due to this last strong link, tertiary education has registered a higher demand during these past decades and which results on two effects: A composition effect due to the change of the educated workers' proportion in the labor force. As postulated by Kuznets, this change tends to augment initially the inequality, but according to the compression effect, the rise of the skilled workers' number in the labor market reduces their wage after a certain threshold level and their income inequality (Knight and Sabot, 1983).

In this context, certain studies are principally interested to the relationship between public education expenditure and income inequality. In reality, the allocation of the government' scarce resources depends on each service' priorities (defense, education, infrastructure, etc.) but it remains important to determine the positive and the negative outcomes of such allocation by answering this question: Are public education expenditures contributing to reduce income inequality? If so, government can devote more resources to schooling in order to absorb this inequality. However, given the results of these studies, it is less clear as to whether or not this policy is beneficial in terms of income distribution.

In general, the literature studying the effect of public goods' provision particularly public education spending on income inequality still rarely but also with inconsistent or contradictory results. Certain theoretical studies argue that more unequal or heterogeneous societies attribute less resource to education (Soares, 1998; de la Croix and Doepke, 2009 and Glomm, 2004), while others approve that higher inequality is associated with more redistribution through higher taxation (Meltzer and Richard, 1981; Persson and Tabellini, 1994 and Bénabou, 1997). However, Glomm and Ravikumar (2003) prove that the role of public spending on education and subsidies in reducing income inequality is not entirely clear. The government investment in education can increase the school access' opportunities for poor children but at the same time it can enlarge the income gap between rich and poor. In fact, the poor cannot benefit from the education expansion if their resources to attend school are not enough and particularly when they pay taxes that serve in part to increase the government educational fund (Sylwester, 2000 and 2002). Jiminez (1986) joins this result by confirming that more public education expenditure fails to benefit poor and then to reduce income inequality. Wong (2016) argues that corruption affects the distributive outcomes of public spending but not in the expected direction.

[1] For example, the agricultural secctor.

Corruption may concentrate funds in the hands of elites due to the abuse of power by the bureaucrats and politicians, which can increase inequality.

More specifically, other studies are interested to the allocation of public funds across educational levels and its income inequality's effect (Birdsall, 1997; Sylwester, 2003; Su, 2004; Hwang, 2005). In this context, Birdsall (1997) affirms that the distribution of public spending on education between persons is far from equal in the sense that primary education expenditure in developing countries, where income inequality is high, is less important compared to the tertiary education whose main beneficiaries are rich. So, the decision to increase resources for higher education is in general inequitable and at the expense of primary education, especially in developing countries with low quality schooling. Moreover, the unequal incidence is negatively correlated with the strength of the country's governance. This result is also confirmed by Hwang (2005) who suggest the positive link between the share of resources allocated to the tertiary education and the income inequality.

However, many other studies compare between different educational regimes particularly public and private education (Glomm and Ravikumar, 1992; Gradstein and Justman, 1997, Doepke and de la Croix, 2004, etc.). Their results confirm the redistributive character of the public education, which explains its strong preference for the poor, but also identifies the role of the governance quality as a determining factor in this comparison (Dabla-Norris and Gradstein, 2004).

This paper contributes to this typical debate by analyzing the relationship between public education spending and income inequality. The main objective is to better ascertain whether or not addressing more resource to education is an effective strategy to lower social disparity. However, it differs by the use of a non-linear relationship in explaining the literature' mixed results. In reality, many factors can affect this correlation such as the income level of the economy (Lindert, 1996) but also the governance quality (Birdsall, 1997; Dabla- Norris and Gradstein, 2004) that constitutes our main focus in this study.

The paper is novel in two ways: First, and as our knowledge, this problematic that studies at the same time the direct link between the public education expenditure and the income inequality, and the indirect link with the institutional quality is not evoked in previous works. Precisely, we calculate endogenously the governance's threshold level in order to explain the mixed empirical results of the direct relationship. Second, we use the structural threshold regression's method (STR) (Kourtellos et al., 2015), considered as a generalization of the methods of Hansen (1996; 1999 and 2000), and Caner and Hansen (2004), to account simultaneously for the threshold nonlinearity and to deal with the double endogeneity issue for the threshold variable and the regressors, and the regime specific heteroskedasticity[2]. In fact, the Hansen's method is used in several works studying the nonlinear effect of finance, public debt, foreign direct investment, trade, government aid, institutional quality, etc., on economic growth and income inequality. However, this methodology ignores the double endogeneity's problem of the threshold variable and the control variables which leads to an inconsistent estimated parameter for the regime specific-partial effects (Kourtellos et al., 1993)[3]. This work is based on a cross sectional data for developed and developing countries averaged over the period 1980-2013. The results prove the existence of a governance threshold level effect through it the public education spending improves the income distribution otherwise the effect is negative.

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[2] The estimation of the threshold parameter is realized on 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 approximations is investigated using a Monte Carlo simulation. See Kourtellos et al. (2015) for more details.

[3] For example and as discussed in the literature, the institutional quality and the financial development variables are high likely to be endogenous (La Porta et al. 1997; Djankova et al. 2007; Panizza et al., 2012; Frankel and Romer, 1999 and Acemoglu et al., 2001).

The rest of the paper is organized as follows. Section 2 describes the methodology and the data adopted in this study. Section 3 presents the main results and finally in section 4 we conclude.

2. Data and methods

The paper studies the non-linearity between public education spending and income inequality using a threshold regression model and a sample of cross-country balanced data averaged over the 1980-2013 period[4] for one hundred five countries[5]:

$$GINI_i = (\alpha_1 GEDU_i + \beta_1 X_i)\, I(INSTITUTIONAL\ QUALITY \leq \gamma) + (\alpha_2 GEDU_i + \beta_2 X_i)\, I(INSTITUTIONAL\ QUALITY \geq \gamma) + \varepsilon_i \quad (1)$$

GINI is the dependant variable which measures the income inequality. The main independent variable of the model is the public spending on education as a ratio of the GDP (GEDU) that evaluates the government effort in terms of investment in the education sector (Barro 1990, 1991).

INSTITUTIONAL QUALITY is the threshold variable that split the sample in two regimes or groups. We use a comprehensive set of five governance' indicators of the database of Kaufman, Kraay and Mastruzzi[6]: political stability and absence of violence (POLISTAB) which is a measure of the government's stability; government effectiveness (GOV) estimates the government's capability to execute effective policies and sustain credibility; regulatory quality (REGU) evaluates the government's ability to create policies that support private sector; the rule of law (RLAW) gives information about the legal system that defends property rights and enforces contracts; control of corruption (CORRUP) calculates the degree to which public power is diverted from private gain. These indicators present a value between -2.5 which means bad or weak governance and 2.5 for good governance.

The parameter γ is the unknown threshold level. This model allows the role of the public education spending to differ depending on whether governance is above or below a certain level of γ. $\alpha_1$and α_2 evaluate respectively the education expenditure's impact on the income distribution for countries with low and high regime. The model becomes linear if $\alpha_1 = \alpha_2$,. ε is the error term and the subscript *i* represents country.

X is a vector of control variables which are: the initial real income per capita (GDP80), the human capital measured by the average years of schooling (HK), the commercial openness (TRADE) obtained by the sum of export and import as a ratio of GDP, the physical capital investment as a percentage of GDP (IY) and the ratio of the liquid liabilities (LL) to the GDP used as a financial development's proxy of the country.

The choice of these control variables is related to the literature survey of numerous studies on income inequality. In fact, a high level of income measured by the initial GDP per capita tends to affect the social disparity (Agnello and Sousa 2012; Gimet and Lagoarde-Segot, 2011; Kustepeli, 2006; Mookerjee and Kalipioni, 2010). The human capital is also an important factor that explains the income inequality's magnitude (Huggett et al. 2010; Beck et al. 2007; Ang, 2007). The improvement of the institutional quality presents a positive effect on the income distribution (Chong and Gradstein, 2007; Dobson and Ramlogan-Dobson, 2010; Dincer and Gunalp, 2012). Moreover, the commercial openness of the economy and its financial development influence the social disparity (Krueger, 1983; Bhagwati and Srinivasan, 2002; Goldberg and Pavcnik, 2007; Hamori and Hashiguchi, 2012; Jalil and Feridun, 2011; Mookerjee and Kalipioni, 2010, etc.).

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[4] We choose the period 1980-2013for two reasons: first data are more available particularly for the public educational spending and second the analysis requires a long period. We cannot use the panel data approach because the data's lack limits considerably the number of observations.

[5] See annex for the countries' list.

[6] Data are obtained from the worldwide governance indicators WGI 2014.

The data of income inequality measured by the GINI index is from the World Income Inequality Database WIID 2015[7]. All the control variables are obtained from the World Bank Development Indicators except the human capital which is from the Barro and Lee (2013) database.

The methodology consists to test at a first step the null hypothesis of linearity H_0: $\alpha_1 = \alpha_2$ against the threshold model in Equation (1). This hypothesis implies that the threshold parameter γ is not identified which becomes a nonstandard inference problem[8] where the Wald test statistics (LM) do not carry its conventional chi-square limit (Hansen, 1996 and 2000). For the second step, the analysis considers the Structural Threshold Regression model (STR) developed recently by Kourtellos et al. (2015) for averaged cross-countries data[9] in order to take into account of the double endogeneity issue for the threshold and the control variables and of the threshold nonlinearity simultaneously. This method is used because according to the abundant literature the institutional quality as a threshold variable and others control variables such as the financial development are highly likely to be endogenous. So, in this context the Threshold Regression approach of Hansen (1996 and 2000), applied only when all the variables are exogenous, or the Instrumental Variable Threshold Regression method, suggested by Caner and Hansen (2004) when the control variable is endogenous, lead necessarily to a biased estimated coefficient of the threshold variable. To correct this problem of endogeneity, we adopt as instrument variables the latitude for the threshold variable (La Porta et al., 1999[10]) and the legal origins for the financial development (La Porta, et al., 1999[11]).

Table 1: The descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GINI	105	41.766	9.010	27.248	68.05
GDP80	105	7258.393	9988.728	178.850	42656.57
KH	105	6.719	2.733	1.175	12.511
GEDU	105	4.426	1.660	1.435	11.716
TRADE	105	79.395	52.005	21.166	356.313
LL	105	54.991	42.760	8.231	276.557
IY	105	21.397	5.154	9.949	42.509
CORRUP	105	0.125	1.093	-1.442	2.431
REGU	105	0.158	0.972	-1.826	1.936
POLISTAB	105	-0.131	0.943	-2.297	1.469
RLAW	105	0.062	1.054	1.689	1.951
GOV	105	0.157	1.052	-1.682	2.146

[7] WIID version 3 september 2015.

[8] Inferences are realized by calculating the Wald or the LM statistic for each value of γ and then basing inference on the supremum of the Wald or the LM across each value of γ.

[9] For panel data, Hansen (1999) and González et al. (2005) and González et al. (2017) present a threshold regression method for non-dynamic panel. 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).

[10] The literature evocates also other instruments of governance as the settler mortality but we do not used it because the statistics are limited which can reduce the number of observations in our sample.

[11] Laporta et al. (1999) suggests that in general legal origins can explain cross-countries differences in financial development.

Table 2: Correlations

	GINI	GDP80	KH	GEDU	TRADE	LL	IY	CORRUP	REGU	POLISTAB	RLAW	GOV
GINI	1.000											
GDP80	-0.533	1.000										
KH	-0.340	0.690	1.000									
GEDU	0.0397	0.271	0.314	1.000								
TRADE	0.0612	0.099	0.225	0.192	1.000							
LL	-0.412	0.502	0.505	0.087	0.485	1.000						
IY	-0.199	0.146	0.317	0.242	0.318	0.336	1.000					
CORRUP	-0.437	0.843	0.742	0.322	0.282	0.568	0.286	1.000				
REGU	-0.390	0.771	0.772	0.193	0.291	0.590	0.289	0.939	1.000			
POLISTAB	-0.264	0.671	0.634	0.331	0.351	0.485	0.292	0.827	0.808	1.000		
RLAW	-0.485	0.816	0.752	0.287	0.265	0.601	0.338	0.973	0.950	0.841	1.000	
GOV	-0.456	0.818	0.790	0.292	0.270	0.613	0.355	0.967	0.962	0.804	0.973	1.000

Notes: GINI = the Gini index; GDP80 = initial GDP per capita; 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; RLAW = rule of law and GOV= government effectiveness.

3. Empirical Results

This section presents the results of the linear and the STR model (Kourtellos et al., 2015) when only the threshold variables is endogenous (LS method) and when certain control variables are endogenous in addition to the threshold variables (GMM method) (Tables 4, 5, 6, 7 and 8).

The Sup Wald test analyzes the existence of a threshold effect against the null of global linearity for each threshold variables where the p-value determines their statistical significance calculated using the bootstrap method with 2000 replications and 15% trimming percentage (Table 3). The results imply that the test of no-threshold can be rejected and thus the sample can be split in two regimes according to the governance threshold level. The countries of the regime 1 have their governance indicators below the threshold level which means relatively a weak institutional quality and the countries of the regime 2 are above this threshold level with a high quality of their institutions.

Table 3: Threshold test

	CORRUP	**REGU**	**POLISTAB**	**RLAW**	**GOV**
LM test for no threshold	27.300	26.765	27.686	27.094	27.224
Bootstrap P-Value	0.000	0.000	0.000	0.000	0.000

Note: H_0 = no-threshold effect.

The objective of this study is to determine how institutional quality affects the relationship between public education expenditure and income inequality. For the linear model, the coefficient of the public educational spending is insignificant. However, the results of the nonlinear model (LS and GMM methods) prove that the impact of the educational resources on the income inequality can be affected by the political, the social and the institutional environment of the country (Habibi, 1992; Stasavage, 2005 and Delavallade, 2006). In fact, the public educational spending's coefficient becomes positive and significant when institutional quality falls below the threshold level which means that more expenditure on schooling raises the income disparity if the governance is weak. In reality, when the public resources is misallocated or ousted just a minority of people can largely profit of these public funds than other which can enlarge the gap between persons. Richer persons who are less credit constrained can spend more on rent seeking which let them to appropriate a large part of the public spending, and their ability to do so is related to the quality of institutions. So the weak governance leads to intensify the rent seeking over the public educational resources which can increase the income inequality (Birdsall, 1997, Dabla-Norris and Gradstein, 2004 and Wong, 2016). Moreover, the investment in educational infrastructure, as an avenue for corruption, becomes less efficient and leads to accentuate the social disparity.

It is remarkable that these countries below the governance threshold level (regime 1) are developing or emerged[12]. They present a low level of income (the initial GDP is about 1300$) but also a high social inequality (in average their Gini is around 43) and a low level of human capital (around 5 years) unless their financial effort to improve it and which can be explained in part by the weak quality of their institutions[13].

However, above the governance threshold level, the coefficient of the public educational spending becomes negative and significant[14] which means that more investment on education in countries where governance is good can improve the income distribution. This result joins the common view of many economists who argue that in general public education reduces income inequality (Glomm and Ravikumar, 1992). For our sample, these countries that exceed the threshold level[15] are developed and present good governance[16], high level of income (their initial GDP is more than 18437$ in average), high human capital (more than 9.5 years in average), and low level of inequality (their Gini is around 33 in average).

For the other control variables, the results prove that a high level of income tends to increase the social inequality regardless of whether it is below or above the threshold level of governance. This finding is on line with the literature for which the economic development is disposed to increase the income inequality (Kuznets, 1955). The estimated coefficient of the human capital is positive and significant only for countries above the threshold level[17] which means that the accumulation of knowledge can extend the social gap when institutions are good. In reality, the evidence shows that the human capital's increase and then the decrease of its inequality do not lead automatically to a reduction of the income disparity. Moreover, the literature does not advance a strong support that raising the human capital can decrease the income inequality (Ram, 1986). In fact, certain studies confirm this negative correlation (Becker and Chiswick, 1966, Ahluwalia, 1976, De Gregorio and Lee, 2002) while others sustain the opposite relationship and explain it by the educational returns. In general, the return of the tertiary education is higher than those of the primary or the secondary education. In this case, the income inequality increases if the return of an extra year of education at the primary level is less important than at the higher level (Colclough et. al., 2010).

The openness trade and the financial development are always considered as essential aspects of growth, development and inequality. For this reason, understanding their effect is important although the mixed results of several empirical works. The estimated coefficients of the commercial trade (TRADE) are positive above and below the threshold level which means that the openness of the economy does not profit to the poor and cannot advance the income distribution. This finding joins the result of Goldberg and Pavcnik (2007), who according to the existent literature's review, realize that the trade liberalization conducts to worse the income inequality. However, others authors confirm that this effect is insignificant (Jaumotte, et al. 2013) where other find that the commercial trade changes the methods of production which encourage the skilled workers' demand and perhaps the capital goods' imports. This situation

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[12] See Appendix for the countries' list.

[13] According to our sample, corruption; regulatory quality; political stability; rule of law and government effectiveness are respectively in average around -0.402; -0.154; -0.447; -0.465 and -0.385.

[14] The estimated coefficients of the variable GEDU is insignificant for the STR model using the LS method for Corruption (CORRUP) and Political Stability (POLISTAB), and for the Regulatory Quality (REGU) and Political stability (POLISTAB) when we consider the GMM method.

[15] See Appendix for the countries' list.

[16] According to our sample, corruption; regulatory quality; political stability; rule of law and government effectiveness are respectively in average equal to 1.813; 1.676; 1.133; 1.586 and 1.650.

[17] For Corruption (CORRUP), Regulatory Quality (REGU), Rule of Law (RLAW) and government effectiveness (GOV).

can increase the income inequality at the first time but after this it will eventually decrease it (Acemoglu, 2003; Goldberg and Pavcnik, 2007 and Helpman et al., 2010)[18].

The results imply that the income distribution seems to be more equal when the financial sector is developed independently of the institutional quality. The literature review proves that there is a growing interest to the relationship between financial development and income inequality where two points of view are advanced. The first is in line with our result and for which the income's gap between different persons is absorbed during the time because the financial development allows poor, who before were excluded, to gain access (Beck et al. 2007; Clarke et al. 2006; Hamori and Hashiguchi, 2012; Jalil and Feridun, 2011; Mookerjee and Kalipioni, 2010). The second argues that the financial development may benefit rich and exclude poor especially when the institutional quality is weak. In fact, rich are able to offer collateral and then to pay loans while poor find many difficulties to obtain them even when the financial sector is well developed, which can increase the income inequality (Rajan and Zingales, 2003). Recently, another category of studies is typically interested to the nonlinear relationship between financial development and income inequality by determining its driving factors (Rajan and Zingales, 2003; Chong and Gradstein, 2007, etc.).

The estimated coefficients of the investment in physical capital are positive and statistically significant only above the threshold effect of the political stability. In general, rich people present high capacity of saving that allows them to invest more than poor. As result, the proportion of the aggregate savings in the revenue may go up and the rich earn at the expense of the poor. More than that, when the country is stable this investment, realized by rich persons, becomes more important which can expand the income gap. For this scenario, the possibility of catching up is not always possible even for an advanced level of development where rich dominate the entrepreneurial class and poor keep the wage-earning class (Banerjee and Newman, 1993 and Piketty, 1997).

In order to study the robustness[19] of these finding, the equation (1) is estimated considering two sub-periods 1980-1999 and 2000-2013[20] and using the STR model (GMM method)[21]. The results prove that for these two intervals of time, the sign of the public education spending' coefficients (GEDU) is positive below the threshold level and negative above it[22]. This finding, which is similar to the total period (1980-2013), implies that the inequality does not decrease when the governance is weak and below a certain threshold level.

For the others control variables, the robustness study proves that the results of the total period 1980-2013 are also obtained considering the two sub-periods (1980-1999 and 2000-2013). In fact, the initial income tends to increase the inequality below and above the threshold level[23]. The estimated coefficients of the trade openness (TRADE) and the financial development (LL) maintain respectively their positive[24] and negative[25] signs independently of the institutional quality level. The coefficients of the human capital (HK) remain positive and statistically significant above the threshold level. However, the investment in physical capital (IY) joins in

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[18] See also Halter, Oechslin, and Zweimuller (2014).

[19] See annex for the robustness results (Tables 9, 10, 11, 12 and 13)

[20] This choice, that consist to divide the initial period (1980-2013) considering only two sub-periods (1980-1999 and 2000-2013), is explained first by the fact that inequality remains constant during a short period, so we can observe a certain change of the Gini index only during a long period and second because the governance data starts at 1997.

[21] We use only the GMM method of the STR model because it is more performed.

[22] These coefficients are significant below and above the threshold level at the same time only for the government effectiveness (GOV) and the political stability (POLISTAB).

[23] This result is obtained for the political stability (POLISTAB) and the regulatory quality (REGU) during the first interval time and for the rule of law (LAW) during the second interval.

[24] The political stability (POLISTAB) for the two periods and the regulatory quality (REGU) for the first period.

[25] The rule of law (LAW) and the government effectiveness (GOV) for the two periods.

part the result obtained for the total period. The estimated coefficients are positive above and below the threshold level, which imply that more investment can enlarge the income inequality[26].

Table 4: Threshold estimates of Corruption (CORRUP) (*Dependant variable: the Gini index*)

	Linear model	**Threshold Model STR Estimation (LS)**		**Threshold Model STR Estimation (GMM)**	
	OLS without threshold	**Regime 1 CORRUP≤1.1489**	**Regime 2 CORRUP>1.1489**	**Regime 1 CORRUP≤1.0885**	**Regime 2 CORRUP>1.0885**
GDP80	-0.042**	0.143***	0.080	0.145***	0.184**
	0.017	0.034	0.088	0.034	0.083
KH	0.082*	-0.055	0.390***	-0.036	0.464***
	0.045	0.050	0.151	0.047	0.140
GEDU	0.050	0.183***	-0.045	0.184***	-0.391**
	0.052	0.047	0.188	0.048	0.169
IY	-0.077	-0.104	0.078	-0.041	0.008
	0.070	0.089	0.157	0.088	0.162
TRADE	0.087**	0.057	0.067**	0.061	0.099***
	0.039	0.038	0.026	0.039	0.026
LL	-0.169***	-0.065	0.112	-0.129***	-0.140***
	0.034	0.048	0.071	0.040	0.052
R-sq	0.343				
Heteroskedasticity Test P-Value	0.235	-	-		
No Observations	105	82	23	80	25

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the period 1980-2013 except the initial GDP (GDP80).
***, ** 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 Gini index*)

	Linear model	**Threshold Model STR Estimation (LS)**		**Threshold Model STR Estimation (GMM)**	
	OLS without threshold	**Regime 1 REGU≤0.7937**	**Regime 2 REGU>0.7937**	**Regime 1 REGU≤1.4249**	**Regime 2 REGU>1.4249**
GDP80	-0.042**	0.194***	0.110	0.158***	0.114
	0.017	0.050	0.092	0.029	0.083
KH	0.082*	-0.036	0.281	-0.008	0.419***
	0.045	0.048	0.183	0.044	0.156
GEDU	0.050	0.101**	-0.434**	0.113**	-0.028
	0.052	0.050	0.176	0.046	0.168
IY	-0.077	-0.105	0.130	0.021	0.160
	0.070	0.092	0.129	0.082	0.184
TRADE	0.087**	0.094**	0.051*	0.064**	0.148***
	0.039	0.040	0.030	0.033	0.045
LL	-0.169***	0.022	0.064	-0.139***	0.090
	0.034	0.065	0.078	0.031	0.063
R-sq	0.343	-	-	-	-
Heteroskedasticity Test P-Value	0.235	-	-	-	-
No Observations	105	76	29	88	17

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the period 1980-2013 except the initial GDP (GDP80).

[26] This result is obtained for the regulatory quality (REGU), the political stability (POLISTAB) and the government effectiveness (GOV) during the first interval time.

***, ** 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 Gini index*)

	Linear model	**Threshold Model STR Estimation (LS)**		**Threshold Model STR Estimation (GMM)**	
	OLS without threshold	**Regime 1 POLISTAB≤0.6640**	**Regime 2 POLISTAB>0.6640**	**Regime 1 POLISTAB≤0.8752**	**Regime 2 POLISTAB>0.8752**
GDP80	-0.042**	0.160***	0.191**	0.135***	0.199**
	0.017	0.040	0.087	0.032	0.086
KH	0.082*	-0.059	-0.085	-0.035	-0.116
	0.045	0.053	0.233	0.049	0.226
GEDU	0.050	0.220***	0.128	0.203***	0.320
	0.052	0.050	0.115	0.049	0.213
IY	-0.077	-0.037	0.447***	-0.018	0.584***
	0.070	0.095	0.110	0.090	0.143
TRADE	0.087**	0.195***	0.285***	0.173***	0.331***
	0.039	0.042	0.062	0.039	0.062
LL	-0.169***	-0.080	0.010	-0.129***	-0.009
	0.034	0.050	0.056	0.041	0.091
R-sq	0.343	-	-	-	-
Heteroskedasticity Test P-Value	0.235	-	-	-	-
No Observations	105	80	25	84	21

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the period 1980-2013 except the initial GDP (GDP80).
***, ** 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 (RLAW)** (*Dependant variable: the Gini index*)

	Linear model	**Threshold Model STR Estimation (LS)**		**Threshold Model STR Estimation (GMM)**	
	OLS without threshold	**Regime 1 RLAW≤1.1175**	**Regime 2 RLAW>1.1175**	**Regime 1 RLAW≤0.9472**	**Regime 2 RLAW>0.9472**
GDP80	-0.042**	0.122***	0.171*	0.124***	0.173**
	0.017	0.031	0.096	0.032	0.079
KH	0.082*	-0.044	0.418***	-0.017	0.186
	0.045	0.048	0.144	0.045	0.208
GEDU	0.050	0.154***	-0.443**	0.155***	-0.532***
	0.052	0.047	0.228	0.048	0.168
IY	-0.077	-0.089	0.075	-0.019	0.142
	0.070	0.091	0.164	0.093	0.169
TRADE	0.087**	0.069*	0.050**	0.081**	0.055*
	0.039	0.039	0.024	0.039	0.033
LL	-0.169***	-0.037	0.034	-0.120***	-0.172***
	0.034	0.050	0.084	0.039	0.053
R-sq	0.343	-	-	-	-
Heteroskedasticity Test P-Value	0.235	-	-	-	-
No Observations	105	80	25	78	27

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the period 1980-2013 except the initial GDP (GDP80).
***, ** 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 Gini index*)

	Linear model	Threshold Model STR Estimation (LS)		Threshold Model STR Estimation (GMM)	
	OLS without threshold	**Regime 1 GOV≤1.0808**	**Regime 2 GOV>1.0808**	**Regime 1 GOV≤1.0683**	**Regime 2 GOV>1.0683**
GDP80	-0.042**	0.141***	0.064	0.150***	0.164*
	0.017	0.037	0.082	0.036	0.085
KH	0.082*	-0.035	0.568***	-0.013	0.637***
	0.045	0.049	0.138	0.044	0.145
GEDU	0.050	0.162***	-0.290*	0.158***	-0.459***
	0.052	0.049	0.169	0.048	0.162
IY	-0.077	-0.070	0.114	0.002	0.202
	0.070	0.092	0.141	0.096	0.154
TRADE	0.087**	0.047	0.022	0.065*	0.061***
	0.039	0.040	0.023	0.039	0.023
LL	-0.169***	-0.026	0.106	-0.114***	-0.163***
	0.034	0.056	0.077	0.038	0.052
R-sq	0.343	-	-	-	-
Heteroskedasticity Test P-Value	0.235	-	-	-	-
No Observations	105	79	26	78	27

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the period 1980-2013 except the initial GDP (GDP80).
***, ** 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 contemporary debate on the relationship between public spending particularly on education and income inequality. This link is largely confirmed by the theoretical literature but the empirical studies present mitigated results. Many explanations had been advanced but the principal one is associated to the nonlinear relationship while the majority is focused on the linear correlation. Recently, the development of new econometric methods that determine endogenously the threshold effect had generated several works that analyze the nonlinear effect of finance, trade, public debt, etc. on growth and income inequality but studies related to the public educational spending still absents. So, once the rich literature developed in this context, there is a little evidence for such nonlinearities, which has constituted our main objective in this study.

One major contribution of this paper is that the regression model is based on the threshold effect's concept, proposed by Kourtellos, et al. (2015), in order to capture rich dynamics in the relationship between public education financing and income distribution. Our main interest was to determine how the institutional quality affects the relationship between public educational investment and income disparity. We find that this link depends crucially on the quality of institutions in a country. Particularly, we identify the critical level of governance over it more public spending on schooling reduces social inequality. This result means that when governance is weak, a high level of investment in education will be used for private gain which leads to increase income inequality, while the improvement of the institutional quality turns out statistically significant in narrowing this disparity. This finding is confirmed using data for one hundred five countries covering in average the period 1980-2013 and for the first time the STR model, advanced by Kourtellos, et al. (2015), considering only the endogeneity of the threshold variable (LS method) and then the endogeneity of the threshold and the control variables at the same time (GMM method). It is also robust when the total period is divided in two sub-periods (1980-1999 and 2000-2013).

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Worldwide Governance Indicators 2014 update: aggregate indicators of governance 1996-2013.

Appendix
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

Lists of countries above the threshold level

- List of countries above the corruption threshold level: Australia Austria Belgium Canada Chile Cyprus Denmark France Finland Germany Hong Kong SAR, China Iceland Ireland Japan Luxembourg Netherlands New Zealand Norway Portugal Singapore Spain Sweden Switzerland United Kingdom United States.
- List of countries above the regulatory quality threshold level: Australia Austria Canada Chile Denmark Finland Germany Hong Kong SAR, China Ireland Luxembourg Netherlands New Zealand Norway Singapore Sweden Switzerland United Kingdom United States.
- List of countries above the political stability threshold level: Australia Austria Barbados Belgium Botswana Canada Denmark Finland Germany Hong Kong SAR, China Iceland Ireland Japan Luxembourg Netherlands New Zealand Norway Portugal Singapore Sweden Switzerland.
- List of countries above the rule of law threshold level: Australia Austria Barbados Belgium Canada Chile Cyprus Denmark Finland France Germany Hong Kong SAR, China Iceland Ireland Japan Luxembourg Malta Netherlands New Zealand Norway Portugal Singapore Spain Sweden Switzerland United Kingdom United States.
- List of countries above the government effectiveness threshold level: Australia Austria Barbados Belgium Canada Chile Cyprus Denmark Finland France Germany Hong Kong SAR, China Iceland Ireland Israel Japan Luxembourg Malta Netherlands New Zealand Norway Portugal Singapore Spain Sweden Switzerland United Kingdom United States.

Robustness study

Table 9: **Threshold estimates of Corruption (CORRUP)** (*Dependant variable: the Gini index*)

	Threshold Model STR Estimation (GMM) Period 1 (1980-1999)		**Threshold Model STR Estimation (GMM) Period 2 (2000-2013)**	
	Regime 1 **CORRUP≤0.7293**	**Regime 2** **CORRUP>0.7293**	**Regime 1** **CORRUP≤1.0937**	**Regime 2** **CORRUP>1.0937**
GDPinitial	0.069***	0.020	0.066***	0.022
	0.021	0.035	0.014	0.030
KH	-0.034	0.095**	-0.018	0.198**
	0.023	0.050	0.020	0.079
GEDU	0.077***	-0.028	0.062***	-0.004
	0.026	0.045	0.022	0.038
IY	0.055	0.122*	-0.011	-0.038
	0.034	0.066	0.030	0.050
TRADE	0.041**	0.017	0.002	0.045***
	0.016	0.012	0.016	0.008
LL	-0.049**	-0.024	-0.043***	-0.004
	0.023	0.019	0.014	0.014
No Observations	77	28	81	24

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the two periods 1980-1999 and 2000-2013 except the initial GDP (GDPinitial). ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate

Table 10: **Threshold estimates of Regulatory Quality (REGU)** (*Dependant variable: the Gini index*)

	Threshold Model STR Estimation (GMM) Period 1 (1980-1999)		**Threshold Model STR Estimation (GMM) Period 2 (2000-2013)**	
	Regime 1 **REGU≤1.2196**	**Regime 2** **REGU>1.2196**	**Regime 1** **REGU≤1.4041**	**Regime 2** **REGU>1.4041**
GDPinitial	0.095***	0.105**	0.065***	0.044
	0.023	0.051	0.012	0.029
KH	-0.014	0.223***	-0.006	0.218**
	0.022	0.053	0.018	0.100
GEDU	0.026	-0.170**	0.049**	-0.042
	0.027	0.091	0.020	0.055
IY	0. 093***	0.344***	-0.001	0.109
	0.035	0.078	0.030	0.075
TRADE	0.051***	0.056***	0.001	0.050***
	0.015	0.030	0.014	0.015
LL	-0.047***	-0.014	-0.043***	0.011
	0.018	0.043	0.012	0.022
No Observations	86	19	88	17

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the two periods 1980-1999 and 2000-2013 except the initial GDP (GDPinitial). ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate

Table 11: **Threshold estimates of political stability (POLISTAB)** (*Dependant variable: the Gini index*)

	Threshold Model STR Estimation (GMM) Period 1 (1980-1999)		Threshold Model STR Estimation (GMM) Period 2 (2000-2013)	
	Regime 1 **POLISTAB≤0.9512**	**Regime 2** **POLISTAB>0.9512**	**Regime 1** **POLISTAB≤0.6532**	**Regime 2** **POLISTAB>0.6532**
GDPinitial	0.045***	0.086**	0.067***	0.062
	0.016	0.037	0.020	0.045
KH	-0.035	-0.083	-0.032	0.196*
	0.024	0.073	0.026	0.101
GEDU	0.058**	0.102	0.074***	-0.147**
	0.025	0.085	0.027	0.060
IY	0.056*	0.335***	0.026	0.260***
	0.033	0.113	0.034	0.089
TRADE	0.074***	0.121***	0.055***	0.111***
	0.015	0.037	0.019	0.029
LL	-0.046**	-0.023	-0.038***	0.011
	0.023	0.023	0.014	0.025
No Observations	84	21	80	25

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the two periods 1980-1999 and 2000-2013 except the initial GDP (GDPinitial). ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate

Table 12: **Threshold estimates of Rule of Law (LAW)** (*Dependant variable: the Gini index*)

	Threshold Model STR Estimation (GMM) Period 1 (1980-1999)		Threshold Model STR Estimation (GMM) Period 2 (2000-2013)	
	Regime 1 **LAW≤0.85368**	**Regime 2** **LAW>0.85368**	**Regime 1** **LAW≤1.2043**	**Regime 2** **LAW>1.2043**
GDPinitial	0.052***	0.028	0.056***	0.076**
	0.018	0.033	0.012	0.038
KH	-0.026	0.083	-0.009	0.197*
	0.021	0.054	0.018	0.102
GEDU	0.058**	-0.038	0.055***	-0.091
	0.025	0.062	0.021	0.058
IY	0.046	0.146**	0.003	0.049
	0.038	0.068	0.030	0.093
TRADE	0.047***	0.003	0.003	0.040***
	0.016	0.012	0.015	0.011
LL	-0.040*	-0.041*	-0.040***	-0.047*
	0.022	0.023	0.014	0.024
No Observations	76	29	82	23

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the two periods 1980-1999 and 2000-2013 except the initial GDP (GDPinitial). ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate

Table 13: Threshold estimates of Government Effectiveness (GOV) (*Dependant variable: the Gini index*)

	Threshold Model STR Estimation (GMM) Period 1 (1980-1999)		**Threshold Model STR Estimation (GMM) Period 2 (2000-2013)**	
	Regime 1 GOV≤0.7859	**Regime 2 GOV>0.7859**	**Regime 1 GOV≤1.1049**	**Regime 2 GOV>1.1049**
GDPinitial	0.076***	0.040	0.066***	0.030
	0.023	0.038	0.015	0.031
KH	-0.030	0.101**	-0.001	0.236***
	0.022	0.047	0.018	0.077
GEDU	0.064***	-0.062	0.058***	-0.080**
	0.026	0.052	0.022	0.039
IY	0.072*	0.174***	0.013	0.003
	0.038	0.063	0.031	0.058
TRADE	0.036**	0.003	-0.001	0.034***
	0.017	0.011	0.016	0.008
LL	-0.045**	-0.036*	-0.045***	-0.027*
	0.023	0.021	0.014	0.015
No Observations	79	26	79	26

Notes: the standard errors are reported in parentheses (White corrected for heteroskedasticity).
All the variables are in average for the two periods 1980-1999 and 2000-2013 except the initial GDP (GDPinitial). ***, ** and * indicate respectively significance at 1%, 5% and 10%. All the variables are in Log except the institutional quality and the growth rate