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Effects of political rivalry on public educational investments and income inequality: evidence from empirical data

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Abstract

In this paper we intend to empirically examine how different political institutions may define the long-term economic development, determined by educational investments and income inequality. With this objective, we assess the impact of political rivalry on four selected macroeconomic variables: public investments in education, individual learning choice, GDP *per capita* and income inequality, motivated by previous theoretical results. We first construct a composite political rivalry indicator and examine how it varies across different groups of countries. Then, using cross-sectional data, we perform a series of regressions for examining political rivalry effects on the selected variables. Our empirical findings indicate that in lower income countries there is indeed a significant negative impact of political rivalry, which increases with the decrease in the development level. The same is not confirmed for higher-income countries, which may suggest that the relationship between political rivalry and the examined variables may, in fact, be weaker in these countries, or that relevant mechanisms may differ with the level of development.

Keywords: economic development, human capital accumulation, inequality, institutions, political rivalry, public education.

JEL classification: H21, H40, H52, E24, I24, O43, P0

1 Introduction

Uncovering the mechanisms of how political institutions may affect and determine economic performance is one of the most challenging research questions in modern economics. Related research on political institutions emphasizes their central role in defining economic policies and the resulting outcomes. Studies focusing on political and economic interactions argue that policies cannot be

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viewed as exogenous and, as important determinants of economic incentives, should be regarded crucial in explaining differences in economic performance across countries (*e.g.* Persson and Tabellini, 1992; Acemoglu and Robinson, 2001; Sayer, 2000; Acemoglu, 2006).

In this paper we intend to empirically examine how different political institutions may define the long-term economic development, determined by educational investments and income inequality. With this objective, we will assess the impact of political rivalry on several fundamental macroeconomic indicators, selected based on the main conclusions of the theoretical endogenous growth model with new political economy elements, developed in Sochirca *et al.* (2012). Following Acemoglu (2006, 2009), we will specifically regard political rivalry as the inter-party political competition for power of both economic and political nature, aimed at keeping the political elite in the office and in control for as long as possible (as in, *e.g.*, Dixit and Londregan, 1995; Dixit *et al.*, 2000; Acemoglu and Robinson, 2001; Scruggs, 2001; Acemoglu, 2006).[1]

Our present work relates to the increasing literature on the new political economy of growth, combining economic analysis with new political economy elements and refering to political rivalry as a key factor affecting economic performance (see, for example, Dixit et al., 2000; Scruggs, 2001; Acemoglu, 2006). The effects of political rivalry are generally associated with breaking the balance between political power and economic opportunities, thus negatively affecting the relation between political institutions and economic outcomes. For example, Rodrik (1999) argues that disagreements between political groups may inflict the extra cost on the economy. Similarly, Acemoglu and Robinson (2001) and Dixit and Londregan (1995) suggest that contesting political power may induce economic costs due to its growth-retarding effects. Inconsistencies between economic and political powers will cause the goals pursued by the elite and the political rivalry thus generated, instead of economic efficiency considerations, to determine social and economic policy choice. Success or failure of implemented economic policies then depends on how prevailing institutions manage political rivalry.

Given that the key variables of the model in Sochirca *et al.* (2012), which we intend to empirically analyse in this study, reflect specific macroeconomic policies and indicators, political rivalry can be expected to influence them. In particular, the model developed in Sochirca *et al.* (2012)

[1] As such, political rivalry may arise in both democratic and non-democratic regimes and thus its existence is independent of the political system, varying only in degrees of intensity and forms of manifestation.

suggested that non-distortionary redistribution *via* public education equalizes income levels and increases human capital accumulation in the economy, which has a growth promoting effect. On the other hand, it also illustrated that the efficiency of such redistribution policy is distorted by political rivalry, with resulting negative effects on economic outcomes. Motivated by these theoretical results, in this work we will empirically examine the impact of political rivalry on four selected economic variables: public investments in education, individual learning choice, GDP *per capita* and income inequality.

In choosing these specific variables for our empirical analysis we also relate to some studies on the relationship between human capital accumulation, inequality and economic growth. For example, as emphasized by Perotti (1996) and Saint Paul and Verdier (1996), higher inequality is indeed associated with a lower level of human capital accumulation, and lower human capital accumulation is associated with lower levels of economic growth. More recently, the cross-country analysis of Easterly (2007) reafirmed that human capital accumulation and economic development are adversely affected by inequality, which is a barrier to schooling and economic growth. A study by Galor and Moav (2004) indicated a change in the qualitative impact of inequality on the process of development, resulting from the replacement of physical capital accumulation by human capital accumulation as the prime engine of economic growth. Their results suggested that, in later stages of development, a more equal distribution of income stimulates investment in human capital and promotes economic growth. An inverse relationship between these variables is modelled in Chatterjee and Turnovsky (2010), who consider public investments in education both as the growth engine and an important determinant of inequality.

To our knowledge, there are no previous empirical data on political rivalry as defined in our research. Therefore, we first construct a composite political rivalry indicator, comprising the elements of institutional quality and exclusive pecuniary benefits, which we consider crucial for determining the degree of rivalry between the political elite and other social groups. For this purpose, we use data from the Worldbank Governance Indicators on government effectiveness, regulatory quality and control of political power for private gains, together with data on rents from natural resources. In this way, we compute the political rivalry level for each country and examine how it varies across different groups of countries. The construction and preliminary analysis of this composite political rivalry indicator is one of the key outcomes of our empirical study. This analysis revealed a high level of political rivalry heterogeneity by income and geographical location, indicating that higher-

income countries have much lower levels of political rivalry, mainly due to their high institutional quality. On the contrary, exclusive resources rents appear to be responsible for increasing the level of political rivalry in countries more abundant in natural resources.

Using cross-sectional data for a large set of countries, we then perform a series of regressions in order to assess the impact of political rivalry on the above referred economic variables. Our empirical findings indicate that in lower income countries there is indeed a significant negative political rivalry impact, which increases with the decrease in the development level. Such results, however, are not confirmed for higher-income countries, which may suggest that the relationship between political rivalry and the selected economic variables may, in fact, be weaker in these countries, or that the relevant mechanisms may differ with the level of development.

The structure of this paper is the following. In Section 2 we construct and analyse the composite political rivalry indicator. Section 3 describes our data sets and the models' specifications. In Section 4 we present and discuss the main empirical findings, as well as the robustness analysis results. Concluding remarks are presented in Section 5. Detailed information on our sample countries and included variables is provided in the Appendix.

2 Political rivalry indicator

2.1 Definition and construction of the political rivalry indicator

As previously mentioned, relevant theoretical research generally associates political rivalry with disagreements between political groups, generating political constraints and conditioning the choice and implementation of policies (Acemoglu and Robinson, 2001; Acemoglu and Johnson, 2005). When goals pursued by the political elite, instead of economic efficiency considerations, determine the policy choice, a strong negative impact of political rivalry is implied. The resulting relation between political institutions and economic outcomes is then characterised by lower efficiency and higher economic costs (Alesina and Rodrik, 1992; Alesina and Perotti, 1994; Dixit and Londregan, 1995, Acemoglu and Robinson, 2001; Acemoglu, 2006). As such, political rivalry becomes a key distorting factor in the economy. Moreover, related theoretical research refers that political rivalry is aggravated when there are extra interests to consider, such as exclusive revenues accessible only to the political group in power - the elite, guaranteeing that the elite's utility is higher than the

utility of any other social group (Acemoglu, 2009). To our knowledge, data on political rivalry (as defined above) do not exist. Therefore, the referred theoretical considerations represent the starting point for defining and constructing a measure of political rivalry for this empirical study.

In particular, the *composite political rivalry indicator*, PR, includes two elements: institutional quality, IQ, which basically defines the level of political rivalry in a country; and exclusive pecuniary benefits, EPB, which can additionally aggravate this level. The institutional quality element reflects the balance between political power and economic opportunities; exclusive pecuniary benefits are the exclusive elite revenues from natural resources. Based on these criteria, we select the existing empirical data as follows.

First, in order to obtain a measure of institutional quality we make use of the Worldbank Governance Indicators, which are aggregate indicators of six broad dimensions of governance, as presented in Table 1 below:

Table 1: **Worldbank Governance Indicators**

Indicator	**Description**
1. *Voice and Accountability*	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
2. *Political Stability and Absence of Violence*	Reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.
3. *Government Effectiveness*	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
4. *Regulatory Quality*	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
5. *Rule of Law*	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
6. *Control of Corruption*	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

Source: www.govindicators.org , accessed in November, 2012.

These indicators are constructed in the framework of the Worldwide Governance Indicators project and are compiled in a data set summarizing the views of a large number of worldwide

enterprises, citizens and expert assessments on the quality of governance. Gathered from over 30 underlying data sources, the six aggregate indicators are based on a number of survey institutes, think tanks, non-governmental organizations, international organizations, and private sector firms.[2] The Worldwide Governance Indicators published in 2012 are available for 211 countries for the years 1996-2011, all estimates' values ranging from approximately -2.5 (weak) to $+2.5$ (strong) governance performance.[3]

For the construction of the first component of our composite political rivalry indicator, IQ, we restrict our attention to indicators 3, 4 and 6 from Table 1, that is, *Governance Effectiveness*, *Regulatory Quality* and *Control of Corruption*. Based on the Worldbank's specification, we consider that these three indicators capture the key ideas of political rivalry in line with the theoretical definition adopted in our empirical study. More specifically, given that our empirical study considers public policies on educational investments and human capital accumulation to be crucial for economic development through their relation to income inequality, it is very important to account for the ability to formulate, implement and commit to sound public policies. This is captured by indicators 3 and 4. On its turn, indicator 6 captures institutional quality in what regards the degree of government independence from political pressures, exercise of public power for private gain and control of the state by elites and private interests. The IQ component of our composite political rivalry indicator is then computed as a simple average of the three selected Worldbank governance indicators. It is important to note that, given the Worldbank's specification, the IQ component of our composite political rivalry indicator is inversely related to our definition of political rivalry, in the sense that values closer to $+2.5$ (*i.e.* stronger governance efficiency) imply lower political rivalry, while values closer to -2.5 (*i.e.* weaker governance efficiency) imply higher political rivalry. As noted above, IQ is the principal element defining the degree of political rivalry.

Second, in order to proxy the effect of exclusive pecuniary benefits, EPB, on political rivalry, we focus on natural resources rents, represented by the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest received by the public as the owner of natural resources, or the government on behalf of the public, given as a percentage of GDP.[4] From this perspective,

[2]Details on the underlying data sources, the aggregation method, and the interpretation of the indicators can be found in the WGI methodology paper: Kaufmann *et al.* (2010), "The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues". *World Bank Policy Research Working Paper No. 5430* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130

[3]The Worldwide Governance Indicators update incorporates revisions to data for previous years, and so the data release in the year 2012 supersedes data from all previous releases. Full interactive access to the aggregate indicators and the underlying source data is available at www.govindicators.org.

[4]Empirical data on the components of natural resources rents where collected from the World Bank online database.

the higher are the exclusive natural resources rents received by the political group in power, the more valuable it becomes continuing to control political power. Consequently, political rivalry will increase. EPB are therefore included in the composite political rivalry indicator with a negative sign, that is, decreasing overall governance performance and, correspondingly, increasing political rivalry. Given that the units of measure of natural resources rents are different from the units of measure of IQ, we normalize EPB to the interval $[-2.5, 0]$, with -2.5 corresponding to 100%.

In sum, the composite political rivalry indicator, PR, is obtained by simply adding the two above specified elements, IQ and EPB. Note that, although no specific weights were attributed to either IQ or EPB, the former is naturally dominant, given that the latter actually never take values very distant from zero.[5] In this way, political rivalry in a country is primarily determined by the state of its institutional quality, and may be additionally intensified by the exclusive pecuniary benefits generated from its resources.[6] We also note that, due to lack of data on natural resources and R&D rents for some countries, our final PR data set includes a total of 202 countries.

2.2 Preliminary analysis of the political rivalry indicator

Before proceeding to the main regressions of our study, it is important to analyse the values we obtain for the composite political rivalry indicator in the PR data sample (*i.e.* for 202 countries).

To start with, and considering the complete PR data set, the mean value of the composite political rivalry indicator is -0.2155. This, however, gives a rather incomplete characterization of the data because of specific characteristics of our data set. In fact, by simply considering the PR sample range, which goes from -2.65 (for Eritreia) to $+2.13$ (for Denmark), we can infer that there is a high degree of heterogeneity in the data. This is further confirmed by the high values of variance, standard deviation and coefficient of variation, given by $\sigma^2 = 1.1078$, $\sigma = 1.0525$ and $C.V. = -488.31$ respectively. These statistical measures illustrate that the dispersion around the mean is very high, as the standard deviation is almost 4.9 times greater than the absolute value of the mean. Based on this result and in order to handle the uncovered data heterogeneity, we

[5] Since natural resources rents are initially given as a percentage of GDP, their values are far from 100% and consequently, EPB generally takes values closer to zero. For example, in countries where natural resources are a main source of revenue, these values are around 40%-50% on average, corresponding to $EPB \approx -1$. In the remaining countries, these values are much lower, with EPB close to zero.

[6] Given that EPB is always negative, PR may drop below -2.5 in countries where IQ is very low.

want to explore how the political rivalry indicator differs across groups of countries with similar characteristics.

Thus, we divide the countries from our sample into separate groups, using two distinct criteria: *(i)* income *per capita* and *(ii)* geographic location, by region. This choice is motivated by two main factors: income inequality being one of our key research objectives, and the fact that geographical proximity generally reflects cultural, economic, social and political similarities in the institutional organization of countries. Our initial sample is then disaggregated into four income and seven geographic region (geo) sub-samples:

Income groups		**Geo groups**	
$income_1$	high-income	geo_1	Western Europe, USA, Canada and Oceania
$income_2$	upper-middle	geo_2	East Asia and Pacific
$income_3$	lower-middle	geo_3	Europe and Central Asia
$income_4$	low-income	geo_4	Latin America and Caribbean
		geo_5	Middle East and North Africa
		geo_6	South Asia
		geo_7	Africa

For this disaggregation we follow the group categories and composition used by the Worldbank, and we associate each country of our complete sample to a specific income or geo group. The complete list of countries by income and geo groups is provided in the Appendix.

Next, for each of the above referred groups, we compute the mean values of PR and test for the significance of differences between them. A straightforward way to perform this analysis is to estimate two simple regressions (one for each analytical category) of PR on several dummy variables, as follows:

1) Income per capita:

$$PR_i = \alpha_1 Inc_{1,i} + \alpha_2 Inc_{2,i} + \alpha_3 Inc_{3,i} + \alpha_4 Inc_{4,i} + u_i \tag{1}$$

2) Geographic region:

$$PR_i = \beta_1 Geo_{1,i} + \beta_2 Geo_{2,i} + \beta_3 Geo_{3,i} + \beta_4 Geo_{4,i} + \beta_5 Geo_{5,i} + \beta_6 Geo_{6,i} + \beta_7 Geo_{7,i} + v_i \tag{2}$$

where: PR_i is the value of the composite political rivalry indicator in country i;
$Inc_{j,i}$ for $j = 1, 2, 3, 4$, is a dummy variable assuming the value 1 if country i belongs to income group j, and the value 0 otherwise;
$Geo_{k,i}$ for $k = 1, 2, ..., 7$, is a dummy variable assuming the value 1 if country i belongs to geo group k, and the value 0 otherwise;
u_i and v_i are the usual error terms.

Regressions (1) and (2) are the main regressions for the analysis of the composite political rivalry indicator. The OLS (Ordinary Least Squares) estimation results are presented in column [1] of Tables 2 and 3. Additionally, we also perform two auxiliary regressions for each analytical category, where the dependent variables are the two elements of PR, that is, institutional quality, IQ, and exclusive pecuniary benefits, EPB. These additional regressions will allow us to perform a more in-depth analysis of the composite political rivalry indicator. The results for these auxiliary regressions are presented in columns [2] and [3] of Tables 2 and 3.

Table 2: PR **regressions by income**

Moderator variables	**Coefficient estimates,** $\hat{\alpha}$		
	Dependent variables:		
	(1) PR_i	(2) IQ_i	(3) EPB_i
Inc_1	0.9540^{***}	1.1346^{***}	-0.1806^{***}
	(8.6101)	(15.8345)	(-3.3396)
Inc_2	-0.3617^{***}	-0.0933	-0.2685^{***}
	(-3.1208)	(-1.2440)	(-4.7469)
Inc_3	-0.8352^{***}	-0.5933^{***}	-0.2419^{***}
	(-7.2728)	(-7.9891)	(-4.3169)
Inc_4	-1.1119^{***}	-0.9513^{***}	-0.1606^{**}
	(-8.0150)	(-10.6046)	(-2.3718)
R^2	*0.48*	*0.68*	*0.01*
N	*202*	*202*	*202*

Notes: the level of significance is denoted by ***, ** and *, for 1%, 5% and 10% respectively; $t-$ *statistics* are reported in brackets.

Table 3: PR **regressions by geographical location**

Moderator variables	**Coefficient estimates,** $\hat{\beta}$		
	Dependent variables:		
	(1)	(2)	(3)
	PR_i	IQ_i	EPB_i
Geo_1	1.2332***	1.3082***(14.0076)	−0.0749
	(9.8590)		(−1.2909)
Geo_2	−0.6211***	−0.4907***	−0.1305
	(−3.5902)	(−3.7986)	(−1.6251)
Geo_3	−0.4446***	−0.1799	−0.2647***
	(−2.9348)	(−1.5903)	(−3.7653)
Geo_4	−0.1930	−0.0736	−0.1195*
	(−1.2526)	(−0.6394)	(−1.6704)
Geo_5	−0.8869***	−0.2514*	−0.6354***
	(−4.6592)	(−1.7693)	(−7.1928)
Geo_6	−0.7434***	−0.6523***	−0.0911
	(−2.6877)	(−3.1590)	(−0.7094)
Geo_7	−0.9912***	−0.7181***	−0.2731***
	(−8.2766)	(−8.0313)	(−4.9136)
R^2	*0.51*	*0.60*	*0.15*
N	*202*	*202*	*202*

Notes: see Table 2

Note that, the coefficient estimates, $\hat{\alpha}$ and $\hat{\beta}$, represent the mean values of PR by income and geo groups respectively. For example, from Table 2, we can see that the mean value of PR in the high-income countries, *i.e.* for group $income_1$, is 0.9540, which is substantially higher than the mean values of PR in all the other groups, where it is negative. This implies that in high-income countries political rivalry is considerably lower than in other countries, which is mainly explained by their comparatively higher institutional quality, again with a positive mean value of 1.1346.

The same result is verified for regression (2). Group geo_1, comprising the developed countries, exhibits a higher mean value of PR (*i.e.* a lower average degree of political rivalry) also mainly due to its high institutional quality level. Additionally, in this regression we can identify two other sets of countries: one, comprising groups geo_2, geo_3, geo_5, geo_6 and geo_7, in which the mean value of PR is negative and significantly different from zero, and another, comprising group geo_4, in which the mean value of PR is negative, but not significantly different from zero. In fact, in group geo_4 neither the value of institutional quality nor the value of exclusive pecuniary benefits are statistically different from zero. On its turn, the high significance level of PR in groups geo_3 and geo_5 is due to exclusive pecuniary benefits instead of institutional quality, and the opposite is verified for group geo_6 (as can be seen in the results reported in columns [2] and [3] of Table 3). In

fact, groups geo_3 and geo_5 include countries from Eastern Europe, Central Asia, Middle East and North Africa, characterized by high levels of natural resources endowments, contrarily to groups geo_4 and geo_6, which include countries from Latin America and Caribbean, and South Asia.

In order to objectively assess the significance of the differences of political rivalry between various income and geo groups, we perform Wald tests on coefficients' equality of regressions (1) and (2). The results we obtain generally confirm the ideas advanced in the previous paragraph. Namely, in regression (1), only for groups $income_1$ and $income_2$ the mean value of political rivalry indicator is statistically different from the mean value of the other groups. The same is verified for groups geo_1, geo_4 and geo_7 in regression (2). Table 4 below summarizes the results of the Wald equality tests on every pair of coefficients α, and Table 5 on every pair of coefficients β.

Table 4: **Wald tests on coefficients' equality of Regression (1)**

Coefficients	α_1	α_2	α_3	α_4
α_1	–	***(67.3293)	***(125.7134)	***(135.3953)
α_2	***(67.3293)	-	***(8.4188)	***(17.2193)
α_3	***(125.7134)	***(8.4188)	-	(2.3614)
α_4	***(135.3953)	***(17.2193)	(2.3614)	-

Notes: *** denotes rejection of tested hypothesis $\alpha_i = \alpha_j$, $i \neq j$, for 1% of significance; statistic χ^2 reported in brackets

Table 5: **Wald tests on coefficients' equality of Regression (2)**

Coefficients	β_1	β_2	β_3	β_4	β_5	β_6	β_7
β_1	–	***(75.4444)	***(72.9378)	***(51.6450)	***(86.6385)	***(42.4013)	***(164.9966)
β_2	***(75.4444)	-	(0.5895)	*(3.4154)	(1.0673)	(0.1404)	*(3.0932)
β_3	***(72.9378)	(0.5895)	-	(1.3557)	*(3.3056)	(0.8977)	***(8.0129)
β_4	***(51.6450)	*(3.4154)	(1.3557)	-	***(8.0283)	*(3.0220)	***(16.7310)
β_5	***(86.6385)	(1.0673)	*(3.3056)	***(8.0283)	-	(0.1827)	(0.2152)
β_6	***(42.4013)	(0.1404)	(0.8977)	*(3.0220)	(0.1827)	-	(0.6763)
β_7	***(164.9966)	*(3.0932)	***(8.0129)	***(16.7310)	(0.2152)	(0.6763)	-

Notes: *** and * denote rejection of tested hypothesis $\beta_i = \beta_j$, $i \neq j$, for 1% and 10% of significance respectively; statistic χ^2 reported in brackets.

Given this preliminary analysis, we can proceed to the main objective of our paper, that is, to assessing the PR effect on selected economic variables. To do so, first, in Section 3, we specify the regressions to be estimated and describe the data set used, and then, in Section 4, we present and discuss the obtained estimation results.

3 Model specification and data set

In this section, we specify all the regressions to be estimated for each of the economic variables we want to study, and describe the data sets used. As previously mentioned, we intend to test the main theoretical conclusions in Sochirca *et al.* (2012), regarding the impact of political rivalry on four selected variables: public investments in education, individual learning choice, GDP *per capita* and inequality.

3.1 Model specification

In order to assess the PR effect on selected economic variables, we begin by estimating standard linear regressions of the form:

$$Y_i = \gamma_0 + \sum_{m=1}^{M} \gamma_m X_{m,i} + \delta PR_i + e_i \tag{3}$$

where: subscript i denotes again the country included in the sample; Y is the dependent variable; X_m is the m^{th} variable from the M explanatory variables most often referred by the literature as important determinants of Y; PR_i is the composite political rivalry indicator; and e is the usual error term.

We are primarily interested in the estimation of parameter δ, which captures the effects of political rivalry. In order to assess these effects, we will perform four baseline regressions as defined in 3, one for each economic variable of interest, included as the dependent variable. According to the specifications defined below, we first examine the effects of political rivalry on public investments in education and individual learning choice, and, then, on GDP *per capita* and inequality.

Public investment in education

In the first regression, denoted by (3)-e, the dependent variable is public investments in education, E, which is proxied by the pupil-teacher ratio in secondary education, so as to reflect both quantitative and qualitative characteristics of such investments (similarly to Barro, 1991; Hanushek, 1997; Bernal *et al.*, 2012). Thus, higher and more efficient public investments in education correspond to lower values of E. As explanatory variables, besides PR, we include tax revenues, T, income inequality, $GINI$, human capital accumulation, HCA, population density, POP, and a

dummy for democracy, DEM (taking the value 1 if the country is a democracy, and 0 otherwise). We select these particular variables both based on the theoretical model developed in Sochirca *et al.* (2012) and following Sylwester (2000), who also refers them as important determinants of public investments in education.

Accounting for our measure of E, the direction of the explanatory variables' effects should be read inversely to their coefficients' signs. In particular, we expect negative coefficients for variables T and DEM, since a higher level of income tax revenues increases public investments in education, while in democracies a more equal distribution of political power favours allocating more resources to public goods in general and public education in particular.

On the contrary, the effects of the variables $GINI$ and POP on public investments in education are expected to be negative (that is, their coefficients are positive). For $GINI$ it is explained by the fact that, in highly unequal societies, there is a more pressing need to deviate public expenditures for urgent social policies directed to alleviating inequality. On its turn, a naturally increased pupil-teacher ratio when there is high population concentration, as well as the fixed costs savings resulting from agglomeration effects, may explain the positive coefficient sign for POP.

As for HCA, given our framework of endogenous economic growth, its effect on E can be ambiguous. On the one hand, for obvious reasons, lower human capital endowment motivates higher investments in education. On the other hand, a higher level of human capital can also motivate continuous investments in order to ensure that human capital keeps high in the future.

Regarding the impact of PR, based on the conclusions suggested by Sochirca *et al.* (2012), we expect that higher political rivalry reduces public investments in education, due to its overall distortionary effects. Recalling that a higher value of PR stands for a lower degree of political rivalry, the implied sign will be negative.

In sum, regression (3)-e is expected to yield the following relations:

$$E_i = f\left(T_i(-),\, GINI_i(+),\, HCA_i(?),\, DEM_i(-),\, POP_i(+),\, PR_i(-)\right)$$

Individual learning choice

Individual learning choice, $LEARN$, is the dependent variable in the second regression, denoted by (3)-*learn*. The variable $LEARN$ reflects the individual choice between education and working and is naturally proxied by the school enrollment rate in secondary education. As before, explanatory variables are selected based on the endogenously derived expression for the individual learning choice in Sochirca *et al.* (2012), as well as following some empirical findings on the subject (for

example, Nachmias, 1975; Munk, 2011). In particular, in addition to PR, we include public investments in education, E, human capital accumulation, HCA, the *log* of GDP *per capita*, $log(GDP)$,[7] schooling grades, $GRAD$, and again a dummy for democracy, DEM.

Regarding the effect of these variables on individual learning choice, we expect the following: lower educational investments and efficiency (that is, a higher E) provide less motivations for studying; more value is usually attributed to education in countries with higher human capital, GDP *per capita* and more democratic regimes; finally, individuals with less success in school are generally more prone to give up education prematurely.

As regards PR, lower political rivalry creates better economic and social conditions, improves the efficiency of the educational system and promotes aggregate human capital accumulation, thus encouraging individual learning choice. In sum, from regression (3)-*learn*, we expect the following coefficients' signs:

$$LEARN_i = f\left(E_i(-),\, HCA_i(+),\, log(GDP)_i(+),\, DEM_i(+),\, GRAD_i(+),\, PR_i(+)\right)$$

GDP *per capita*

We evaluate the impact of political rivalry on the level of GDP *per capita* in regression (3)-*gdp*. As in the previous regression, using the *log* of GDP *per capita* allows for a more adequate interpretation of the coefficients.[8] As explanatory variables, apart from PR, we select some of the regressors specified in the seminal paper of Barro (1991), testing the determinants of economic growth in a cross-section of countries, chosen following the specific context of the theoretical model in Sochirca *et al.* (2012). These are: public investments in education, E, human capital accumulation, HCA, high-technology exports *per capita*, H_TECH,[9] and the usual dummy for democracy, DEM.

For well-recognized reasons, all the above variables, except PR, are expected to have a positive effect on the level of GDP *per capita*. On its turn, the predicted effect of political rivalry on GDP *per capita* is negative, due to its discouraging impact on aggregate production (as suggested by Sochirca *et al.* (2012)). Regression (3)-*gdp* is then expected to yield the following coefficients'

[7] We opt for using the *log* of GDP *per capita* because it allows for a more adequate interpretation of its coefficient, as it is more appropriate to consider the relative (rather than unit) variation in GDP *per capita*.

[8] That is, taking into account the nature of the explained variable we analyse the relative (rather than unit) variation in GDP *per capita*, resulting from unit variations in the explanatory variables.

[9] Given that high-technology exports *per capita* require substantial amounts of investment in physical capital, this variable proxies the real domestic capital investments considered in Barro (1991) and reflected in Sochirca *et al.* (2012) in physical capital used in production, additionally capturing the efficiency and the aggregate production impact of such investments.

signs:

$$log(GDP)_i = f\,(E_i(-),\, HCA_i(+),\, H\_TECH_i(+),\, DEM_i(+),\, PR_i(+))$$

Inequality

In this final regression, (3)-*gini*, we assess the impact of political rivalry on income inequality, measured by the Gini Index. Here, along with PR, we consider five explanatory variables (following the empirical study by Odedokun and Round (2004) on the determinants of income inequality): social benefits, S_BEN, public investments in education, E, the *log* of GDP *per capita*, $log(GDP)$, openness to foreign trade, $TRADE$, and sectoral labour allocation, $SECTOR$.

While the evidence regarding the effects of GDP *per capita* and openness to foreign trade on income inequality is ambiguous (see, for example, Kuznets, 1955; Bourguignon and Morrisson, 1998; and Barro, 2000), the same does not apply to the other explanatory variables. Social benefits, including government subsidies and transfers, are an instrument largely applied in the common practice of many countries for reducing inequality. Similarly, public investments in education and human capital accumulation serve as social mobility promoters, enabling income convergence and overcoming inequality. Contrarily, sectoral labour allocation, here measured by the share of agricultural sector in the total labour force, is often associated with increasing income inequality, as it accentuates economic dualism in income distribution (see, for example, Bourguignon and Morrisson, 1998; and Odedokun and Round, 2004).

Political rivalry is expected to increase income inequality due to its negative effects on all economic mechanisms that ensure equity and promote social mobility (see Sochirca *et al.* (2012)). Consequently, in regression (3)-*gini*, we expect to obtain:

$$GINI_i = f\,(S\_BEN_i(-),\, E_i(+),\, log(GDP)_i(?),\, TRADE_i(?),\, SECTOR_i(+),\, PR_i(-))$$

Furthermore, in order to assess the impact of political rivalry by different geo and income groups, for each of the four baseline regressions specified above, *i.e.* (3)-*e*, (3)-*learn*, (3)-*gdp* and (3)-*gini*, we perform the following two supplementary regressions:

$$Y_i = \gamma_0 + \sum_{m=1}^{M} \gamma_m X_{m,i} + \delta PR_i + \sum_j \theta_j PR_i \cdot Inc_{j,i} + e_i \tag{4}$$

$$Y_i = \gamma_0 + \sum_{m=1}^{M} \gamma_m X_{m,i} + \delta PR_i + \sum_k \phi_k PR_i \cdot Geo_{k,i} + e_i \tag{5}$$

where $\sum_j$ and $\sum_k$ include, respectively, the income and geo groups j and k, for which PR has a statistically significant effect on Y. The identification of the income and geo groups belonging to $\sum_j$ and $\sum_k$ will be explained in detail in Section 4 (see Tables 6 and 7).

These two supplementary regressions will be subsequently denoted by: (4)-e and (5)-e, (4)-*learn* and (5)-*learn*, (4)-*gdp* and (5)-*gdp*, and (4)-*gini* and (5)-*gini* respectively. In sum, for each dependent variable E, $LEARN$, $log(GDP)$ and $GINI$, we will perform a series of three regressions: (3), (4) and (5).

3.2 Data sets

Each three-regression series specified in Section 3.1 is estimated using a different sample of countries. In particular, given the data availability for some of the considered variables, 89, 52, 68 and 103 countries are included in the regressions for E, $LEARN$, $log(GDP)$ and $GINI$ respectively. The four samples comprise a 15 year period from 1996 to 2011, conditioned by the Worldbank Governance Indicators available only starting from year 1996 (which we use to construct the composite political rivalry indicator, PR, in Section 2).

The employed data structure is a cross-section, as we use only one observation for each variable-country pair, corresponding to the average of available years for one variable in one country between 1996-2011. Our rule for including a country in any of the four samples was finding data for at least three years between 1996-2011 for all variables included in the respective three-regression series. The four samples include relatively balanced data for all income and geo groups, as specified in Section 2. The choice of a cross-section structure is motivated by three main reasons: first, the existence of a limited 15 year time-period for the key variable in our research, PR; second, missing data for some countries / variables for the time period 1996-2011; and third, the nature of the variables employed and of the socio-economic processes examined, which produce effects in a medium-long term. Moreover, a cross-section analysis allows us to compare differences between countries resulting from their specific characteristics, which is in fact our main objective.

All data have been collected from the World Bank online database. A detailed description of

the variables used in all regressions and the complete list of countries included in each sample is provided in the Appendix.

4 Empirical findings and robustness analysis

In this section, we present the empirical findings of all the regressions defined in Section 3.1, estimated by OLS. We also conduct diagnostic testings and a robustness analysis, the results of which are discussed at the end of the section.

4.1 Empirical findings

Before presenting and discussing our main estimation results, we must identify the income and geo groups to be included in the estimation of regressions (4) and (5). As previously mentioned in Section 3.1, these are the groups for which the effect of PR on the dependent variables is statistically significant.[10] They are identified by regressing each of our four dependent variables on PR multiplied, in turn, by all Inc or Geo dummies. The results of this selection procedure are presented in the following tables:

Table 6: **Results of regressions for selecting the income groups**

Dependent variables: E_i, $LEARN_i$, $log(GDP_i)$ **and** $GINI_i$				
Explanatory variables	***Coefficient estimates (by regression)***			
	E_i	$LEARN_i$	$log(GDP_i)$	$GINI_i$
constant	14.8493***	81.6432***	9.1684***	38.0870***
	(18.4448)	(26.4753)	(65.9648)	(38.2950)
$PR_i \cdot Inc_1$	0.3069	−6.4805	0.0699	−1.8719
	(0.2701)	(−0.8757)	(0.3394)	(−1.0806)
$PR_i \cdot Inc_2$	−2.0379	1.0154	0.7698***	−5.2578***
	(−1.4557)	(0.2061)	(2.8964)	(−3.1296)
$PR_i \cdot Inc_3$	−3.2049*	12.9533***	1.3699***	−3.1504*
	(−2.0223)	(2.8656)	(4.5501)	(−1.8917)
$PR_i \cdot Inc_4$	−16.5381***	59.9001***	5.4541***	−1.0816
	(−3.6238)	(3.5637)	(5.2333)	(−0.4204)
N	89	53	68	106
R^2	0.18	0.32	0.44	0.12
$F-statistic$	4.5692***	5.5210***	12.4911***	3.4587**

Notes: see Table 2

[10] Note that, given the heterogeneity of the composite political rivalry indicator detected in the preliminary analysis in Section 2, the PR effects may not be the same across different income and /or geo groups of countries.

Table 7: **Results of regressions for selecting the geo groups**

Dependent variables: E_i, $LEARN_i$, $log(GDP_i)$ **and** $GINI_i$				
Explanatory variables	***Coefficient estimates (by regression)***			
	E_i	$LEARN_i$	$log(GDP_i)$	$GINI_i$
constant	13.8280***	83.7009***	9.2329***	37.5496***
	(19.7718)	(21.7357)	(64.0977)	(41.1192)
$PR_i \cdot Geo_1$	0.3019	−17.8621	0.0360	−1.3599
	(0.2196)	(−0.9647)	(0.1457)	(−0.6318)
$PR_i \cdot Geo_2$	−2.8991*	6.2763	0.6886**	−1.9434
	(−2.0296)	(0.7808)	(2.5335)	(−1.0402)
$PR_i \cdot Geo_3$	1.3607	−6.7516	1.5228	−0.7643
	(0.9725)	(−0.7674)	(1.6461)	(−0.3876)
$PR_i \cdot Geo_4$	−6.0177***	10.0751	1.0066***	−10.0821***
	(−3.4947)	(1.6443)	(3.7334)	(−5.0343)
$PR_i \cdot Geo_5$	−1.0880	8.4095	0.9728*	1.9174
	(−0.6931)	(1.3084)	(1.6801)	(0.5602)
$PR_i \cdot Geo_6$	-	−8.4228	-	4.9945
		(−0.4222)		(1.2613)
$PR_i \cdot Geo_7$	−12.3015***	13.2701	4.9044***	−5.8607***
	(−5.2826)	(1.3951)	(5.3048)	(−3.1556)
N	87	54	67	106
R^2	0.34	0.15	0.44	0.27
$F-statistic$	6.9021***	1.1111	7.7312***	5.1656***

Notes: see Table 2; the explanatory variable ($PR \cdot Geo_6$) was excluded from regressions reported in columns [1] and [3] due to data constraints.

In the next regressions we will consider the income and geo groups for which the PR effects are statistically significant at 5%, as reported in Tables 6 and 7.

Tables 8-11 below report the estimation results of the regressions defined in Section 3.1. In particular, a separate table is constructed for each of the three-regression series of the dependent variables E, $LEARN$, $log(GDP)$ and $GINI$ and all four are presented below in the same order as follows: column [1] shows the results for the baseline regressions (3), and columns [2] and [3] for regressions (4) and (5) (by the above selected income and geo groups) respectively.[11]

[11] Recall that, taking into account the definition of variables E and PR, the direction of their effects should be read inversely to their coefficients' signs presented in the tables.

4.1.1 Results of regressions for public investments in education, E

As it can be seen from the results reported in column [1] of Table 8, with the exception of PR, all coefficients' estimates have the expected sign. Regarding HCA, the estimation results suggest that its positive effect on public investments in education predominates over its negative effect (the estimated coefficient sign is negative), thus eliminating the above referred ambiguity. That is, higher levels of human capital continue motivating further investments in education. As for PR, its coefficient is not statistically different from zero ($\hat{\delta} = 0.6710$, with a *p-value* of 0.4535). This can result from the heterogeneity detected in the composite political rivalry indicator, which implies possible distinct PR effects by different income and geo groups.[12]

In order to capture these possible effects by income groups, we perform regression (4)-e, the results of which are presented in column [2]. We can see that political rivalry has a statistically significant negative effect on public investments in education in countries from group $income_4$, as the coefficient associated to $(PR \cdot Inc_4)$ is negative and clearly statistically different from zero $\hat{\theta}_4 = -14.3967$, with a *p-value* of 0.0011. These results suggest that only in low-income countries, political rivalry considerations are relevant for influencing public policy on education. Given our definition of PR, the intuition behind this result is straightforward. Recall that in our context political rivalry may arise, for example, in the form of exercising public power for private gain, "capture" of the state by elites and private interests, and the resulting lack of quality of public policy formulation and implementation. Consequently, in poor countries the functioning of social policies (including public investments in education), being typically in early development stages, is more vulnerable to such episodes of political rivalry. Although we would expect a similar mechanism for higher-income countries, albeit on a smaller scale, it is not confirmed by our estimation results. This suggests that the relationship between political rivalry and public investments in education may in fact be weaker in higher-income countries, or that the mechanisms linking the two variables may be more complex than those considered in our study.

Column [3] reports the estimation results of regression (5)-e, accounting for possible distinct political rivalry effects by geo groups. The statistically significant negative effect of political rivalry on public investments in education in countries from group geo_7 is captured by $\hat{\phi}_7 = -9.4404$, with

[12] Note that, although having the expected coefficient signs, the variables T and POP are not statistically significant. Similarly to PR, their disaggregation by income and geo groups indicates that there are statistically significant effects on E for some of these groups. However, we do not explore this further given that avaliating their specific impact on E is not the objective of this study.

a *p-value* of 0.0016. Given that countries from group geo_7 have levels of development similar to those of countries included in group $income_4$, the intuition behind this result is similar to that presented in the previous paragraph. As for the effect of political rivalry in countries from group geo_4, it is not statistically significant: $\hat{\phi}_4 = -2.5483$ with a *p-value* of 0.3256. This occurs because including the variable $(PR \cdot Geo_4)$, which captures the political rivalry effect in highly unequal Latin American countries, together with the variable $GINI$ lowers the level of significance of both, due to the high correlation between them (correlation coefficient of -0.62). In fact, removing the variable $GINI$ from the regression, almost doubles the magnitude of the effect of $(PR \cdot Geo_4)$ and decreases its *p-value* to 0.0346.[13] Thus, the results of regression (5)-e suggest that political rivalry has a significant effect on public investments in education not only in countries with high poverty levels, but also in countries with high levels of inequality.

Table 8: Results of regressions (3)-e, (4)-e and (5)-e

Dependent variable: E_i			
Explanatory variables	***Coefficient estimates***		
	Regression (3)	**Regression (4)**	**Regression (5)**
constant	14.0949*** (3.4912)	12.4336*** (3.2447)	17.4982*** (2.6651)
T_i	−0.1014 (−1.0048)	−0.0916 (−0.9641)	−0.1396 (−1.4284)
$GINI_i$	0.2233*** (2.7399)	0.2473*** (3.2104)	0.1110 (1.0927)
HCA_i	−0.1561** (−2.4803)	−0.1252** (−2.0894)	−0.1217** (−1.9828)
POP_i	0.0002 (0.3177)	0.0002 (0.3104)	0.0004 (0.5215)
DEM_i	−3.0629* (−1.8390)	−3.1392** (−2.0020)	−2.8055* (−1.7609)
PR_i	0.2294 (0.2451)	0.6710 (0.7533)	0.6800 (0.7534)
$PR_i \cdot Geo_4$	-	-	−2.5483 (−0.9891)
$PR_i \cdot Geo_7$	-	-	−9.4404*** (−3.2743)
$PR_i \cdot Inc_4$	-	−14.3967*** (−3.3956)	-

[13] We will further refer to this result in our robustness analysis in Section 4.2.

N	89	89	89
R^2	0.26	0.35	0.35
$F-statistic$	4.7461***	6.2376***	5.2790***
$White\ (\chi^2)$	20.9092	32.5245	39.5225
$Breusch-Godfrey\ LM\ (\chi^2)$	2.5506	4.9781*	3.2662
$Ramsey\ RESET\ (F)$	0.8052	3.2680*	3.3780*

Notes: see Table 2.

4.1.2 Results of regressions for individual learning choice, $LEARN$

Results of regression (3)-*learn*, reported in column [1] of Table 9, indicate that, with the exception of PR, all coefficients' estimates have the expected sign and all, except $GRAD$ and PR, are statistically different from zero. As regards PR, similarly to the previous case, its effect on $LEARN$ is not important for the entire sample due to its heterogeneity; as for the variable $GRAD$, it is not statistically significant because of its relatively high correlation with another explanatory variable, E (correlation coefficient of-0.43). However, when considered individually, each of them is statistically significant for explaining $LEARN$ (for a 1% level of significance), and thus both are kept in the regression.

Furthermore, before proceeding to regression (4)-*learn* to account for the effect of PR by specific income groups identified in Table 6,[14] it is worth noting that political rivalry generates two distinct effects on the variable $LEARN$. On the one hand, there is a negative effect, captured by the coefficients associated to PR, caused by an unfavourable political environment. Such environment can discourage individual learning incentives due to misfunctions in the specific areas comprised by the composite political rivalry indicator (see Section 2). In our subsequent analysis we use the term "direct" to designate this kind of influence, to which we refer as the *direct effect*. On the other hand, as it was shown in regression (3)-e, political rivalry negatively affects public investments in education, which also reduces motivation and possibilities for studying. Thus, there is another negative effect of political rivalry on individual learning choice *via* the variable E, which we designate by *indirect effect* and which is captured by the increase in the magnitude of the coefficients associated to political rivalry, once E is excluded from the regression.[15]

[14] Note that we only consider disaggregation by income groups, given that the differences in the effects of political rivalry on individual learning choice by geo groups are not statistically significant.

[15] Consequently, it should be emphasized that, rigorously speaking, the coefficient used here to assess the direct effect captures the impact of all potentially existent mechanisms (other than E) through which political rivalry may affect individual learning choice.

More specifically, regarding the direct effect, we can see that the coefficients associated to $PR \cdot Inc_3$ and $PR \cdot Inc_4$ are positive and clearly statistically different from zero: $\hat{\theta}_3 = 9.6855$ and $\hat{\theta}_4 = 24.5303$, with *p-values* of 0.0055 and 0.0001 respectively (see column [2] of Table 9). These results again suggest that only in lower-income countries political rivalry considerations influence the individual learning choice.

As for the indirect effect, it is obtained by computing the difference between the direct and the total effects of PR on $LEARN$.[16] To do so, we compare the coefficients associated to political rivalry in groups $income_3$ and $income_4$ in regression **(4)**-*learn* (which give its direct effect) to its coefficients after excluding E (which give the total effect of political rivalry). This comparison reveals that the indirect estimated negative effect of political rivalry on individual learning choice represents on average approximately 25% of the overall estimated effect, keeping the other explanatory variables constant.[17] This implies that, for lower-income countries, public investments in education, negatively affected by political rivalry, will necessarily generate a lower beneficial influence on individual learning choice (note that the coefficient associated to E is negative and statistically different from zero at 1%). In other words, to the extent that E includes elements considered crucial for determining the individual learning choice,[18] the negative political rivalry impact on public investments in education will necessarily amplify the total negative political rivalry impact on individual learning choice.

Here, we note again that in higher-income countries political rivalry does not appear to affect individual learning choice. This is likely to occur because in these countries larger possibilities for private contributions (enabled by a higher income level *per capita*) turn social policies less crucial for determining individual learning choice, or because other potential mechanisms that may be relevant for higher-income countries are not captured in this regression.

[16] The total effect is thus given by the sum of the direct and indirect effects of PR on $LEARN$.

[17] This value is obtained by computing the simple average of the increase in the coefficients $\hat{\theta}_3$ and $\hat{\theta}_4$.

[18] Such as infrastructure, educational material provision, teaching quality and individual support, and equality of access and opportunity, see Sochirca *et al.* (2012).

Table 9: **Results of regressions (3)-*learn*, (4)-*learn* and (5)-*learn***

Dependent variable: $LEARN_i$		
Explanatory variables	***Coefficient estimates***	
	***Regression* (3)**	***Regression* (4)**
constant	21.3126 (0.5363)	18.8642 (0.4539)
E_i	-0.8549^{***} (-3.7127)	-0.7671^{***} (-2.6119)
HCA_i	0.3361^{**} (2.3269)	0.2818^{**} (2.1497)
$log(GDP_i)$	3.9901^{**} (2.4189)	3.5505^{***} (3.0392)
$GRAD_i$	0.3176 (0.8818)	0.3685 (1.0231)
DEM_i	10.8625^{***} (3.4872)	11.1135^{***} (3.8139)
PR_i	1.7133 (0.5870)	-3.1254 (-1.2610)
$PR_i \cdot Inc_3$	-	9.6855^{***} (2.9260)
$PR_i \cdot Inc_4$	-	24.5303^{***} (4.1725)
N	52	52
R^2	0.65	0.72
$F-statistic$	14.0721^{***}	13.7185^{***}
$White\ (\chi^2)$	30.2220	33.8163
$Breusch-Godfrey\ LM\ (\chi^2)$	7.2757^{**}	10.0385^{***}
$Ramsey\ RESET\ (F)$	1.9716	0.1784

Notes: see Table 2; $t-statistics$, calculated from autocorrelation consistent standard errors, using the Newey-West procedure, are reported in brackets.

4.1.3 Results of regressions for GDP *per capita*, $log(GDP)$

Table 10 below presents the results of the three-regression series for $log(GDP)$. As in the previous cases, all coefficients' estimates in regression (3)-*gdp*, reported in column [1], have the expected sign and, except PR, are statistically significant. It is worth noting that the strongest effect comes from our dummy for democracy, DEM, followed by public investments in education, E, and human capital accumulation, HCA (all for 1% level of significance). As regards political rivalry, similarly to the previous series of regressions for $LEARN$, we distinguish between two types of effects. On the one hand, there is the so-called direct effect of PR on $log(GDP)$, generated,

among other possible causes, by its discouraging impact on aggregate production. On the other hand, there is the so-called indirect effect *via* E, due to lower investments in education. Additionally, in the three-regression series for $log(GDP)$, there is another channel of transmission of political rivalry indirect effects, as follows. As we have seen above, public investments in education affect individual learning incentives and both are negatively influenced by political rivalry. Because both are crucial determinants for human capital accumulation, included in the regressions for $log(GDP)$, we should assess the indirect effect of political rivalry also *via* HCA.

Regarding the direct effect, accounting for the political rivalry effects by income and geo groups again yields interesting results. In particular, as reported in columns [2] and [3], we can see that the coefficients associated to $(PR{\cdot}Inc_3)$, $(PR{\cdot}Inc_4)$ and $(PR{\cdot}Geo_7)$ are positive and clearly statistically different from zero: $\hat{\theta}_3 = 0.7947$, $\hat{\theta}_4 = 2.7383$ and $\hat{\phi}_7 = 2.1432$, with *p-values* of 0.0083, 0.0038 and 0.0138 respectively. Although groups $income_2$, geo_2 and geo_4 were also reported significant in Tables 6 and 7, their effects are not statistically significant in regressions (4)-*gdp* and (5)-*gdp*.[19] Thus, given that groups in which the PR effect on $log(GDP)$ is statistically significant include lower-middle and low-income countries, we again confirm that, in lower income countries, political rivalry considerations may have serious implications for economic growth and development. For example, restricting our attention to the income groups, the results of regression (4)-*gdp* imply that a unit difference in PR between two countries belonging to group $income_3$ ($income_4$), *e.g.* $PR = -0.5$ and $PR = +0.5$, translates into a difference in the GDP *per capita* of approximately 80% (274%), keeping the other explanatory variables constant. And because a unit variation in PR reflects very different political environments (recall that the composite political rivalry indicator ranges between -2.5 and $+2.5$), small differences in its values imply considerable GDP *per capita* asymmetries between countries. Clearly, such influence should not be disregarded.

As for the indirect effect, using the same procedure as for the series of regressions for $LEARN$, we compute it for disaggregation by income and geo groups separately. In particular, after excluding E and HCA from regressions (4)-*gdp* and (5)-*gdp*, the coefficients associated to $(PR \cdot Inc_2)$, $(PR \cdot Inc_3)$ and $(PR \cdot Inc_4)$ increase on average by approximately 29%, while those associated to $(PR \cdot Geo_2)$, $(PR \cdot Geo_4)$ and $(PR \cdot Geo_7)$ indicate an average increase of around 36%. Again, as in the

[19] This occurs because, accurately speaking, while the PR, $(PR \cdot income_j)$ and $(PR \cdot geo_k)$ coefficients of the three-regression series for $log(GDP)$ give only the direct political rivalry effect on the dependent variable, initial disaggregation of the PR effect on $log(GDP)$ reported in (4.1) and (4.1), comprises both direct and indirect effects. Thus, once controling for other explanatory variables, whose coefficients may capture possible indirect effects of PR, it is not surprising that the statistical significance of PR for some groups is reduced.

series of regressions for $LEARN$, the total PR effect on $log(GDP)$ is amplified and its indirect effect, transmitted *via* E and HCA, accounts for around one third of the total, this being particularly relevant for lower income countries.

Table 10: **Results of regressions (3)-*gdp*, (4)-*gdp* and(5)-*gdp***

Dependent variable: $log(GDP_i)$			
Explanatory variables	***Coefficient estimates***		
	Regression (3)	**Regression (4)**	**Regression (5)**
constant	7.8535***	7.9746***	7.8179***
	(17.2449)	(18.8718)	(17.5639)
E_i	−0.0655***	−0.0444***	−0.0475***
	(−3.8808)	(−2.6598)	(−2.6718)
HCA_i	0.0329***	0.0274***	0.0267**
	(3.1572)	(2.7233)	(2.4847)
H_TECH_i	0.0003**	0.0003**	0.0003**
	(2.1792)	(2.6301)	(2.4697)
DEM_i	1.2912***	1.0358***	1.2304***
	(4.6429)	(3.7666)	(4.4605)
PR_i	0.1854	−0.0226	0.0282
	(1.4849)	(−0.1444)	(0.1604)
$PR_i \cdot Geo_2$	-	-	0.2493
			(0.8545)
$PR_i \cdot Geo_4$	-	-	0.4385
			(1.5366)
$PR_i \cdot Geo_7$	-	-	2.1432**
			(2.5394)
$PR_i \cdot Inc_2$	-	0.3285	-
		(1.1934)	
$PR_i \cdot Inc_3$	-	0.7947***	-
		(2.7323)	
$PR_i \cdot Inc_4$	-	2.7383***	-
		(3.0194)	
N	68	68	68
R^2	0.65	0.72	0.70
$F-statistic$	19.1500***	16.4957***	14.4543***
$White\ (\chi^2)$	23.6091	31.0300	37.2332
$Breusch-Godfrey\ LM\ (\chi^2)$	3.1523	0.5735	4.3509
$Ramsey\ RESET\ (F)$	2.8592	0.2465	0.6827

Notes: see Table 2.

4.1.4 Results of regressions for inequality, $GINI$

Results of our last three-regression series for $GINI$, are reported in Table 11. As reported in column [1], expected signs are verified for the estimated coefficients of the variables S_BEN,

E and PR, and are not verified for the variable $SECTOR$, for which the estimated coefficient yields negative. This inverse relationship between sectoral labour allocation and income inequality is likely to occur because there are less sources for inequality in countries where the share of the agricultural sector in the total labour force is larger. All variables, except $TRADE$ and $log(GDP)$, have statistically significant effects on income inequality. As regards political rivalry, we find that, contrarily to the previous regressions, its direct effect on inequality is statistically significant (for 5% significance level) even without disaggregation by geo and income groups. We will refer to this result in more detail in our analysis below. As for its indirect effect, as before, we evaluate it *via* public investments in education channel.[20]

Starting with the direct effect of PR on $GINI$, we can see that, as referred above, it is statistically significant even considering the entire sample: $\hat{\delta} = -1.8219$ with a *p-value* of 0.0394. However, we emphasize that this significance is explained not by the fact that PR is statistically significant in all income and geo groups, but rather because its effect is very strong in the groups where it is indeed significant. In particular, as reported in columns [2] and [3], we have: $\hat{\theta}_2 = -4.2256$, $\hat{\phi}_4 = -8.8306$ and $\hat{\phi}_7 = -3.4516$ with *p-values* of 0.0130, 0.0000 and 0.0725 respectively. Note that, the negative political rivalry effect is particularly strong in Latin American countries comprised in group geo_4 (and included in group $income_2$): a unit increase in PR represents a decrease in $GINI$ of approximately 8.8 percentage points, keeping other explanatory variables constant. Thus, there is a significant negative political rivalry effect on income inequality, which is especially strong in those countries where inequality levels are considerably higher compared to other regions.

Next, we assess the effect of PR on $GINI$ *via* E, which attenuates income inequality by promoting social mobility and enabling income convergence. Based on results in columns [2] and [3], we calculate the indirect negative estimated effect of political rivalry on income inequality, which amounts to, on average, around 10% and 5% of the total effect for the included geo and income groups respectively. Note that, although this indirect effect is somewhat weaker than that obtained in the previous regressions, this may not translate the real magnitude of the political rivalry impact *via* E for the following reasons. First, the indirect effect is likely to be dampened by the very strong direct effect of political rivalry on income inequality (when political rivalry either deteriorates general conditions or impedes their improvement through inefficient economic and social policies

[20] Although, as we have seen in the previous regression, GDP *per capita* is affected by political rivalry and thus may in general be one of the possible channels of transmission of its indirect effects, it is not statistically significant for explaining income inequality. Therefore, it is irrelevant to consider it in the calculation of the indirect effects of political rivalry on income inequality.

pursued by the political elite). Second, it is likely to represent only a partial indirect effect of E, since the latter could not be completely removed due to its implicit presence (through human capital accumulation) in other explanatory variables ($log(GDP)$ and $SECTOR$ in particular).[21] Thus, the values of the political rivalry indirect effects, suggested by the results of this regression, may not thoroughly illustrate their true magnitude and, in line with previous regressions, educational investments and human capital accumulation are likely to be important propagation channels of political rivalry effects to key economic indicators.

Table 11: **Results of regressions (3)-*gini*, (4)-*gini* and(5)-*gini***

Dependent variable: $GINI_i$			
Explanatory variables	***Coefficient estimates***		
	Regression (3)	**Regression (4)**	**Regression (5)**
$constant$	49.2127^{***}	47.0653^{***}	44.3523^{***}
	(4.8502)	(4.7499)	(4.7304)
S_BEN_i	-0.2287^{***}	-0.2408^{***}	-0.2094^{***}
	(-4.8635)	(-5.2351)	(-4.8339)
E_i	0.3548^{**}	0.3382^{**}	0.3034^{**}
	(2.5308)	(2.4767)	(2.2731)
$log(GDP)_i$	-0.2471	-0.0386	-0.0559
	(-2.12443)	(-0.0391)	(-0.0604)
$TRADE_i$	-0.0127	-0.0116	0.0115
	(-0.8926)	(-0.8417)	(0.1123)
$SECTOR_i$	-0.1401^{**}	-0.1048	-0.0816
	(-2.1419)	(-1.6096)	(-1.3228)
PR_i	-1.8219^{**}	-0.4359	0.2646
	(-2.1419)	(-0.4316)	(0.2859)
$PR_i \cdot Geo_4$	-	-	-8.8306^{***}
			(-4.4992)
$PR_i \cdot Geo_7$	-	-	-3.4516^{*}
			(-1.8167)
$PR_i \cdot Inc_2$	-	-4.2256^{**}	-
		(-2.5317)	
N	103	103	103
R^2	0.39	0.43	0.50
$F-statistic$	10.2305^{***}	10.1788^{***}	11.8088^{***}
$White\ (\chi^2)$	38.9357^{*}	40.8406	47.1053
$Breusch-Godfrey\ LM\ (\chi^2)$	1.4948	3.5513	2.2554
$Ramsey\ RESET\ (F)$	2.1041	0.6328	0.5173

Notes: see Table 2.

[21] Note that the correlation coefficients between E and $log(GDP)$ and $SECTOR$ are of -0.42 and 0.56 respectively.

4.2 Diagnostic testing and robustness analysis

In this section, we present and discuss the results of several diagnostic tests and robustness analysis performed for all the regressions in Section 4.1. We perform the usual tests for heteroscedasticity ($White$), serial correlation ($Breusch-Godfrey\ LM$) and generic model specification ($Ramsey\ RESET$), the results for which are reported in the Tables 8-11 for each regression respectively.[22] As regards the model specification and heteroscedasticity, no problems have been detected in any of the regressions; serial correlation has been detected in regressions (3)-*learn* and 4-*learn*.[23] Consequently, in columns [1] and [2] of Table 9, the $t-statistics$ were calculated from autocorrelation consistent standard errors, using the $Newey-West$ procedure.

In order to check for possible multicollinearity, we apply the common procedure of running auxiliary regressions (for regressions (3)-e, (3)-*learn*, (3)-*gdp* and (3)-*gini*), in which each of the explanatory variables (from the respective (3)) is regressed on all other explanatory variables. We do this in order to examine the degree of independence of each variable's effect in their original regressions. The R^2 values from the auxiliary regressions are then used to calculate each variable's tolerance level, given by $1-R^2$. A small tolerance value indicates that the variable under consideration is almost a perfect linear combination of other explanatory variables, and that it should not be included in the original regression. Following Allison (1999), we consider a tolerance level of 0.40 as the lowest bound, below which the degree of multicollinearity is considered to be excessive. This analysis revealed tolerance level below 0.40 (namely, 0.21) only for regression (3)-*gini*, when estimating $log(GDP)$ on the other explanatory variables.[24] Based on this result, we remove $log(GDP)$ from regressions (3)-*gini*, (4)-*gini* and (5)-*gini* and we confirm that the change in the estimation results is very slight, that is, all coefficients' estimates remain almost identical and the variables' significance is the same. This is due to the fact that variable $log(GDP)$ is not significant for explaining $GINI$, as we have seen above. Thus, all previously drawn conclusions as to the effects of other explanatory variables on $GINI$ continue to verify.

Next, we check the robustness of our main results by examining how the coefficient estimates of our variables of interest, PR, ($PR{\cdot}Inc_j$) and ($PR{\cdot}Geo_k$), behave when the regressions' specifications

[22] Following standard procedures, cross-terms where included in the $White$ test, the $Breusch-Godfrey\ LM$ test was conducted with two lags, and the $Ramsey\ RESET$ included one fitted term.

[23] All tests were conducted for a 5% level of significance.

[24] Besides this procedure, we also check for other signs of multicollinearity, such as: correlation coefficients above 0.9 between explanatory variables; very high standard errors and low t-statistics; unexpected changes in coefficient magnitudes or signs; and non-significant coefficients despite a high R^2. These are clearly not present in our regressions.

are modified by removing explanatory variables. If the estimates do not change significantly (that is, take the opposite sign, show dramatic variations in magnitude and/or statistical significance), this indicates that the coefficients are robust and can be interpreted as reliable causal effects of political rivalry on the selected economic variables. In particular, we perform the robustness analysis by removing, alternately, one explanatory variable from each regression and checking for the changes in the coefficient estimates of our variables of interest. As regards the three-regression series for E, the only significant change occurs when we remove variable $GINI$ from the regression (5)-e, which considerably increases the significance of variable $(PR \cdot Geo_4)$ (*p-value* decreases from 0.0983 to 0.0022). This is explained by the high correlation between $GINI$ and $(PR \cdot Geo_4)$ due to the reasons already mentioned in our analysis in Section 4.1. The estimated effect of political rivalry on GDP *per capita* is also robust, as slight changes occur only when removing variables E and DEM. This result for E is not new, as the same operation has already been performed in our previous analysis of the indirect effects of political rivalry on GDP *per capita* (see Section 4.1). As for DEM, dropping it from regressions (3)-*gdp* and (4)-*gdp* increased the significance of the variables PR and $(PR \cdot Inc_2)$ for a 10% and 5% level of significance respectively, which suggests that political rivalry may influence GDP *per capita* also through its relation with a country's specific form of government. As regards the remaining regressions for E and $log(GDP)$, as well as all the regressions for $LEARN$ and $GINI$, the coefficients' estimates of PR, $(PR \cdot Inc_j)$ and $(PR \cdot Geo_k)$ are robust to structural changes, as no significant variations in these estimates have been detected when dropping variables. In this way, the robustness analysis results further validate and support the key conclusions of this paper.

5 Concluding remarks

In this paper we intended to empirically test the main theoretical conclusions of Sochirca *et al.* (2012) regarding the impact of political rivalry on selected economic variables. In particular, based on empirical data for a large number of countries, we analysed how political rivalry may influence educational investments, individual learning choice, GDP *per capita* and income inequality. Given that, to our knowledge, there are no previous empirical data on political rivalry, we have first constructed a composite political rivalry indicator, comprising the elements of institutional quality and exclusive pecuniary benefits from natural resources, which we consider crucial for determining

the degree of rivalry between the political elite and other social groups. A preliminary analysis of this new political rivalry indicator revealed a high level of heterogeneity by income and geographical location. In particular, we find that higher-income countries have much lower levels of political rivalry, mainly due to their high institutional quality. On the contrary, exclusive natural resources rents are responsible for increasing the level of political rivalry in countries from Eastern Europe, Central Asia, Middle East and North Africa.

Regarding the main findings of this paper, our empirical analysis clearly suggests that, for certain income and geo groups, political rivalry has indeed a negative effect on the considered economic variables. In particular, as regards public investments in education and individual learning choice, political rivalry effects are significant in lower income countries, and, among these, their magnitude increases with the decrease in the development level. Regarding GDP *per capita*, our results suggest that even small differences in the degree of political rivalry imply considerable asymmetries in *per capita* income. This is particularly relevant for low income countries. As for the impact of political rivalry on income inequality, our findings indicate that it is globally significant even before sample disaggregation by income and geographical location. However, this is explained not by a statistically significant effect of political rivalry for all groups of countries, but rather by the fact that its impact is very strong in the groups where it is indeed significant. Again, this effect is particularly strong in countries with higher inequality levels. The results of our robustness analysis further support these conclusions, given that structural changes cause no significant variations in the coefficients' estimates for political rivalry.

The analysis performed also reveals the presence of the so-called indirect effects of political rivalry, particularly strong when transmitted *via* public investments in education, accounting for about one third of the total effect. Although we would expect similar mechanisms to work in higher-income countries as well, albeit on a smaller scale, this is not confirmed by the data. It may occur because the relationship between political rivalry and the selected economic variables may in fact be weaker in higher-income countries; also, the mechanisms that link the two variables and are relevant for higher-income countries may be more complex than those considered in our study. Thus, processes explaining the relationship between political rivalry and the selected economic variables for different income levels, as well as other mechanisms of transmission, should be further explored in future research.

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Appendix

Table 12: **List of countries by income level, including the political rivalry values**

$income_1$	PR	$income_2$	PR	$income_3$	PR	$income_4$	PR
Andorra	1.37	Algeria	-1.40	Albania	-0.49	Afghanistan	-1.71
Aruba	1.17	American Samoa	0.39	Armenia	-0.27	Bangladesh	-1.01
Australia	1.67	Angola	-2.57	Belize	-0.23	Benin	-0.55
Austria	1.77	Antigua and Barbuda	0.75	Bhutan	-0.18	Burkina Faso	-0.47
Bahamas, The	1.16	Argentina	-0.47	Bolivia	-0.93	Burundi	-1.56
Bahrain	-0.12	Azerbaijan	-2.02	Cameroon	-1.12	Cambodia	-0.87
Barbados	1.23	Belarus	-1.10	Cape Verde	0.12	Central African Republic	-1.37
Belgium	1.46	Bosnia and Herzegovina	-0.54	Congo, Rep.	-1.70	Chad	-1.81
Bermuda	1.26	Botswana	0.62	Côte d'Ivoir	-1.02	Comoros	-1.44
Brunei Darussalam	-0.44	Brazil	-0.06	Djibouti	-0.77	Congo, Dem. Rep.	-1.64
Canada	1.72	Bulgaria	0.06	Egypt, Arab Rep.	-0.85	Equatorial Guinea	-1.49
Cayman Islands	1.32	Chile	1.37	El Salvador	-0.50	Eritreia	-2.65
Croatia	0.19	China	-0.55	Fiji	-0.59	Ethiopia	-0.86
Cyprus	1.24	Colombia	-0.17	Georgia	-1.46	Gambia, The	-0.53
Czech Republik	0.78	Costa Rica	0.43	Gabon	-0.61	Guinea	-0.98
Denmark	2.13	Cuba	-0.56	Ghana	-0.12	Guinea-Bissau	-1.17
Estonia	0.99	Dominica	0.55	Guatemala	-0.46	Haiti	-1.47
Finland	2.09	Dominican Republic	-0.46	Guyana	-0.70	Kenya	-0.60
France	1.32	Ecuador	-0.84	Honduras	-0.80	Korea, Dem. Rep.	-1.96
Germany	1.60	Grenada	0.40	India	-0.29	Kyrgyz Republic	-0.66
Greece	0.60	Iran, Islamic Rep.	-0.96	Indonesia	-0.51	Liberia	-1.32
Greenland	1.03	Jamaica	0.00	Iraq	-1.77	Madagascar	-0.39
Guam	0.50	Jordan	0.13	Kiribati	-1.28	Malawi	-0.58
Hong Kong SAR, China	1.74	Kazakhstan	-0.66	Kosovo	-0.36	Mali	-0.91
Hungary	0.76	Latvia	0.40	Lao PDR	-2.19	Mauritania	-0.43
Iceland	1.80	Lebanon	-0.58	Lesotho	-0.35	Mozambique	-0.49
Ireland	0.72	Libya	-1.21	Marshall Islands	-0.97	Myanmar	-1.88
Israel	-0.93	Lithuania	-0.55	Micronesia, Fed. Sts.	-0.62	Nepal	-0.71
Italy	0.60	Macedonia, FYR	-0.25	Moldova	-0.51	Niger	-1.66
Japan	1.15	Malaysia	0.56	Mongolia	-0.68	Rwanda	-0.50
Korea, Rep.	0.70	Maldives	-0.13	Morocco	-0.15	Sierra Leone	-1.09
Kuwait	0.31	Mauritius	0.01	Nicaragua	-0.68	Somalia	-2.18
Liechtenstein	1.12	Mexico	0.09	Nigeria	-1.01	Tajikistan	-1.23

Luxembourg	1.84	Montenegro	-0.49	Pakistan	-0.70	Tanzania	-0.58
Macao SAR, China	0.78	Namibia	0.22	Papua New Guinea	-0.84	Togo	-1.00
Malta	1.03	Palau	-0.64	Paraguay	-1.02	Uganda	-0.60
Netherlands	1.91	Panama	-0.85	Philippines	-0.26	Zimbabwe	-1.46
New Zealand	1.90	Peru	-0.11	Samoa	0.02		
Norway	0.70	Romania	-0.17	São Tomé and Principe	-0.67		
Oman	0.31	Russian Federation	-0.60	Senegal	-0.26		
Poland	0.57	Serbia	-0.60	Solomon Islands	-1.04		
Portugal	1.09	Seychelles	-0.04	South Sudan	-1.73		
Puerto Rico	-0.16	South Africa	0.49	Sri Lanka	-0.18		
Qatar	0.47	St. Lucia	0.58	Sudan	-1.62		
Saudi Arabia	-0.17	St. Vincent and the Grenadines	0.52	Swaziland	-0.57		
Singapore	2.09	Suriname	-0.45	Syrian Arab Republic	-1.53		
Slovak Republic	0.66	Thailand	0.08	Timor-Leste	-1.13		
Slovenia	0.65	Tunisia	0.12	Tonga	-1.61		
Spain	1.23	Turkey	0.02	Ukraine	-0.83		
St. Kitts and Nevis	0.50	Turkmenistan	-1.57	Uzbekistan	-2.63		
Sweden	1.91	Tuvalu	-0.38	Vanuatu	-0.40		
Switzerland	1.91	Uruguay	0.63	Vietnam	-0.78		
Trinidad and Tobago	0.16	Venezuela, RB	-1.74	West Bank and Gaza	-0.88		
United Arab Emirates	0.22			Yemen, Rep.	-1.58		
United Kingdom	1.76			Zambia	-0.96		
United States	1.54						
Virgin Islands (U.S.)	0.91						

Source: own elaboration, based on Worldbank classification by income

Table 13: **List of countries by geographical location**

geo_1	geo_2	geo_3	geo_4	geo_5	geo_6	geo_7
American Samoa	Brunei Darussalam	Albania	Antigua and Barbuda	Algeria	Afghanistan	Angola
Andorra	Cambodia	Armenia	Argentina	Bahrain	Bangladesh	Benin
Australia	China	Azerbaijan	Aruba	Djibouti	Bhutan	Botswana
Austria	Fiji	Belarus	Bahamas, The	Egypt, Arab Rep.	India	Burkina Faso
Belgium	Guam	Bosnia and Herzegovina	Barbados	Iran, Islamic Rep.	Maldives	Burundi
Canada	Hong Kong SAR, China	Bulgaria	Bermuda	Iraq	Nepal	Cameroon
Cyprus	Indonesia	Croatia	Belize	Israel	Pakistan	Cape Verde
Denmark	Japan	Czech Republic	Bolivia	Jordan	Sri Lanka	Central African Republic
Finland	Kiribati	Estonia	Brazil	Kuwait		Chad
France	Korea	Georgia	Cayman Islands	Lebanon		Comoros
Germany	Korea, Dem. Rep.	Hungary	Chile	Libya		Congo, Dem. Rep.
Greece	Lao PDR	Kazakhstan	Colombia	Morocco		Congo, Rep.
Greenland	Macao SAR, China	Kosovo	Costa Rica	Oman		Côte d'Ivoire
Iceland	Malaysia	Kyrgyz Republic	Dominica	Qatar		Equatorial Guinea
Ireland	Marshall Islands	Latvia	Dominican Republic	Saudi Arabia		Eritrea
Italy	Micronesia, Fed. Sts.	Lithuania	Ecuador	Syrian Arab Republic		Ethiopia
Lichtenstein	Mongolia	Macedonia, FYR	El Salvador	Tunisia		Gabon
Luxembourg	Myanmar	Moldova	Grenada	United Arab Emirates		Gambia, The
Malta	Palau	Montenegro	Guatemala	West Bank and Gaza		Ghana
Netherlands	Papua New Guinea	Poland	Guyana	Yemen, Rep.		Guinea
New Zealand	Philippines	Romania	Haiti			Guinea-Bissau
Norway	Singapore	Russian Federation	Honduras			Kenya
Portugal	Samoa	Serbia	Jamaica			Lesotho
Saudi Arabia	Solomon Islands	Slovak Republic	Mexico			Liberia
Spain	Thailand	Slovenia	Nicaragua			Madagasccar
Sweden	Timor-Leste	Tajikistan	Panama			Malawi
Switzerland	Tonga	Turkey	Paraguay			Mali
United Kingdom	Tuvalu	Turkmenistan	Peru			Mauritania

United States	Vanuatu	Ukraine	Puerto Rico			Mauritius
Virgin Islands (U.S.)	Vietnam	Uzbekistan	St. Kitts and Nevis			Mozambique
			St. Lucia			Namibia
			St. Vincent and the Grenadines			Niger
			Suriname			Nigeria
			Trinidad and Tobago			Rwanda
			Uruguay			São Tomé and Principe
			Venzuela, RB			Senegal
						Seychelles
						Sierra Leone
						Somalia
						South Africa
						South Sudan
						Sudan
						Swaziland
						Tanzania
						Togo
						Uganda
						Zambia
						Zimbabwe

Source: own elaboration, based on Worldbank classification by geographical location

Table 14: **Variables description**

Variable	***Designation***	***Description***
DEM	dummy for democracy	Voice and accountability indicator (Worldbank Governance Indicators): reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
E	public investments in education	Pupil-teacher ratio (secondary): number of pupils enrolled in secondary school divided by the number of secondary school teachers.
EPB	exclusive pecuniary benefits	Total natural resources rents (% of GDP): the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.
$GINI$	income inequality	Gini index: the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution (a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality).
$GRAD$	grades	Progression to secondary school (% of total) divided by progression through secondary (% of total enrollment): Progression to secondary - number of new entrants to the first grade of secondary education (general programmes only) in a given year, expressed as a percentage of the number of pupils enrolled in the final grade of primary education in the previous year; Progression through secondary - 100% minus the percentage of repeaters in secondary (all grades), *i.e.* the number of students enrolled in the same grade as in the previous year, as a percentage of all students enrolled in secondary school.
HCA	human capital accumulation	Ratio of labour force with tertiary education (% of total) to the sum of labour force with secondary and labour force with primary education (% of total). Labor force with tertiary / secondary / primary education is the proportion of labor force that has a tertiary / secondary / primary education, as a percentage of the total labor force.
H_TECH	high-technology exports *per capita*	High-technology exports (% of manufactured exports) divided by the number of population. High-technology exports: products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.
IQ	institutional quality	Simple average of three Worldbank Governance Indicators: Governance effectiveness - reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Regulatory quality - reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Control of corruption - reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

$LEARN$	individual learning choice	School enrollment, secondary (% gross): total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age (can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition).
$log(GDP)$	log of GDP *per capita*	GDP *per capita* (constant 2000 US$): gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.
POP	population density	Population density: population density is midyear population (all residents regardless of legal status or citizenship, except for refugees not permanently settled in the country of asylum) divided by land area in square kilometers (a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones).
PR	political rivalry	Sum of PR and EPB.
S_BEN	social benefits	Subsidies and other transfers (% of expense): subsidies, grants, and other social benefits including social security, social assistance benefits, and employer social benefits in cash and in kind.
$SECTOR$	sectoral labour allocation	Employment in agriculture (% of total employment), including hunting, forestry, and fishing.
T	tax revenues	Tax revenue (% of GDP): compulsory transfers, except fines, penalties, and most social security contributions, to the central government for public purposes.
$TRADE$	openness to international trade	Sum of exports and imports (% of GDP).

Source: own elaboration, based on Worldbank data description