Documentos de Trabalho

Working Paper Series

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NIPE WP 04/ 2017

NÚCLEO DE INVESTIGAÇÃO EM POLÍTICAS ECONÓMICAS

UNIVERSIDADE DO MINHO

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URL:
http://www.nipe.eeg.uminho.pt/

«This work was carried out within the funding with COMPETE reference nº POCI-01-0145-FEDER-006683 (UID/ECO/03182/2013), with the FCT/MEC’s (Fundação para a Ciência e a Tecnologia, I.P.) financial support through national funding and by the ERDF through the Operational Programme on "Competitiveness and Internationalization – COMPETE 2020 under the PT2020 Partnership Agreement»

Measuring political rivalry and estimating its effect on economic growth

Elena Sochirca* and Francisco José Veiga†

Abstract

In this paper we construct a composite indicator of political rivalry using factor analysis and then build a panel dataset of political rivalry levels for 125 countries during the 1984-2012 period. According to the factor analysis results, while specific institutional quality aspects are fundamental for defining the degree of political rivalry, political regime specific variables and natural resources rents do not appear significant. A preliminary analysis of the constructed indicator shows that political rivalry is clearly inversely related to the level of development, and that there are significant differences in political rivalry levels among countries, depending on their income and geographical location. The results of system-GMM estimations of the effect of political rivalry on economic growth clearly indicate a negative effect, which is equally maintained when other political and institutional variables are simultaneously considered, and when the model is tested on a number of restricted samples, thus confirming the robustness of the baseline results. Additionally, regression results for the restricted samples suggest that the negative effect of political rivalry on growth weakens as the development level increases.

Keywords: Political rivalry; Economic growth; Policital competition; Factor analysis

JEL codes:

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1 Introduction

Over the recent years, various researchers have emphasized the key role that political processes and institutions have in determining efficient policies and conditioning economic performance. A generally sustained argument is that political processes and institutional quality are important endogenous determinants of economic incentives and interactions, and should be thus regarded crucial in explaining differences in economic performance across countries (e.g., Sochirca et al. (2016a), Aisen and Veiga (2013), Acemoglu and Robinson (2012), Acemoglu (2006), Sayer (2000), Persson and Tabellini (1992)).

More recently, the idea that political competition is beneficial for economic growth, as higher degrees of such competition were traditionally associated to the implementation of growth-enhancing policies (see, for example, Besley et al. (2010), Wittman (1989)), has been questioned by some researchers. In fact, a different perspective on this topic suggests that political competition may sometimes be harmful for economic growth and development (Sochirca et al. (2016a), Acemoglu (2006), Acemoglu (2009), Acemoglu and Robinson (2006), Lizzeri and Persico (2005)). In particular, Acemoglu (2006), Acemoglu (2009) emphasizes the idea that the main objective of the political elite may not be to serve the society, but to keep the control of political power for as long as possible, using it for their own benefit. In this case, political competition would rather reduce the incentives of the political elite to implement growth-enhancing and welfare-promoting policies, motivating instead the implementation of distortionary policies aimed solely at impeding political rival groups from rising to power.

In related research, this negative form of political competition, political rivalry, is generally referred to as a key factor affecting economic performance by breaking the balance between political power and economic opportunities, generating political constraints and conditioning the choice and implementation of policies (*e.g.*, Dixit and Londregan (1995), Dixit et al. (2000), Acemoglu and Robinson (2006), Acemoglu (2006), Sochirca et al. (2016a)). For example, Rodrik (1999) suggests that disagreements between political groups may inflict extra costs on the economy, interpreted in terms of forgone investments and growth opportunities. Similarly, Dixit and Londregan (1995) and Acemoglu and Robinson (2006) suggest that contesting political power may induce economic costs due to its growth-retarding effects. In Acemoglu (2006) the political elite's preferences over inefficient policies, due to their pursuit of political power, compromise long-term investments and lead to poor aggregate economic performance. Sochirca et al. (2016a) specifically study the effects of political rivalry on a number of macroeconomic indicators (namely, education, economic growth and income inequality) finding that all are negatively affected by political rivalry. Thus, when the goals pursued by the political elite, instead of economic efficiency considerations,

determine the policy choice, a strong negative impact of political rivalry is implied, and the resulting relation between political institutions and economic outcomes is then characterised by lower efficiency and higher economic costs (as in e.g. Alesina and Rodrik (1992), Alesina and Perotti (1994), Dixit and Londregan (1995), Acemoglu and Robinson (2006), Acemoglu (2006), Sochirca et al. (2016a)). In sum, political rivalry may in fact distort policies and generate inefficient resource allocations, thus inducing growth-retarding effects.

In this paper, we aim at contributing to the ongoing debate on this topic. Our objective is to develop a composite political rivalry indicator and construct a panel dataset for the maximum number of countries and timespan available, that could be further used for a wide range of applications. We will also test one possible use of this indicator, by including it in classic growth regressions. To build the indicator, we employ specific data reduction techniques, such as *principal component analysis* and *factor analysis*, and, to estimate the impact of political rivalry on economic growth, we use the *system-GMM* estimator. In constructing the political rivalry indicator, we follow Acemoglu's view (Acemoglu (2006, 2009)) and regard political rivalry as the inter-party 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. We also follow the argument that the existence of political rivalry is independent of the political system, as it may arise in both democratic and non-democratic regimes (Acemoglu (2006, 2009)).[1] Data from *Cross National Time Series Data Archive* (*CNTS*, 2015), *Database of Political Institutions* (*DPI*, 2012), *Economic Freedom of the World* (*EFW*, 2013), *POLITY IV* (2014), *International Country Risk Guide* (*ICRG*, 2013) and *World Development Indicators* (*WDI*, 2016) are used for constructing the political rivalry indicator, and data from *Penn World Tables* (*PWT9.0*) are used for our growth regressions.

To our knowledge, previous empirical research on this subject is extremely scarce, as so far we can only refer an empirical study by Sochirca et al. (2016b), estimating the macroeconomic effects of political rivalry based on a composite indicator built for that purpose. The present study goes beyond the existing literature both in scope and technical approach. In particular, while the political rivalry indicator used by Sochirca et al. (2016b) was solely based on theoretical indications, we employ proper data reduction techniques to define the structure of the composite indicator, which is technically more rigourous. Additionally, we use a considerably larger time-span (around 30 years) and work with panel data, instead of cross-section data, which enables a more comprehensive and robust analysis. Finally, here we use the *system*-GMM estimator, which is more consistent and commonly used in growth regressions.

[1] However, depending on the political regime, we would expect political rivalry to vary in degrees of intensity and forms of manifestation.

Besides reinforcing the support for the hypothesis that political rivalry negatively affects economic performance, we obtain some important new results. First, this work's thorough technical approach regarding the construction of the political rivalry indicator, suggests that natural resources (included as a component of the political rivalry indicator in Sochirca et al. (2016b)) do not appear important for defining the political rivalry phenomenon. Second, while both papers generally conclude that political rivalry has a significant negative economic effect, the previous study found no empirical evidence of such an effect for the higher income countries. Contrarily, in the present work, the empirical results actually show that political rivalry has in fact a significant negative impact in the high-income countries as well. Finally, the creation of a panel dataset containing the political rivalry levels for 125 countries over the period 1984-2012, which could be further used for a large variety of applications, is a key contribution to the research community.

The structure of this paper is the following: Section 2 deals with the construction and preliminary analysis of the composite political rivalry indicator; Section 3 describes our empirical model and presents the results of our growth regressions and robustness analysis; conclusions are summarized in Section 4.

2 Political Rivalry Indicator

In this section we explain the construction of the composite political rivalry indicator, using two alternative data reduction tecniques. We aim at creating an accurate indicator reflecting the phenomenon of political rivalry and consequently a panel dataset containing the political rivalry levels for the maximum number of countries and time span available, which could be further used in a large variety of applications. In Subsection 2.1 we discuss in more detail the variables selected to describe the political rivalry phenomenon and in Subsections 2.2 and 2.3 we use *principal component analysis* and *factor analysis* to reduce the data, construct the political rivalry indicator and perform a preliminary analysis of its variation accross countries and over time.

2.1 Variables selection

Given the complex nature of the political rivalry phenomenon, it can not be proxied by only one variable. Moreover, selecting variables that would accurately reflect political rivalry is a rather intricate task, since, besides being a multidisciplinary concept, political rivalry is still a new and practically unexplored issue in economics.

Based on the theoretical considerations discussed above, in constructing the political rivalry indicator

we shall consider two building blocks - the political and economic dimensions - as jointly determining the degree of rivalry between the political elite and other social groups. In particular, data from the political dimension should reflect: how interested the elite is to remain in power and how various political groups interact and compete with each other; what is the degree of institutional independence from political pressures and of state appropriation by the interests of the political elite; if specific aspects of institutional quality help mitigating the possible adverse effects of political rivalry. On their turn, data from the economic dimension should reflect: the efficiency of creating an environment enabling private sector development; creation of adequate incentives for physical and human capital investments; economic costs of institutional inefficiency; and exclusive benefits, which may aggravate political rivalry.

In selecting the variables to be included in our statistical data reduction exercises, we take into consideration these two dimensions, with the concern to generally avoid variables with overlapping information. We started by inspecting a large number (over 30) of political, institutional and economic variables from a number of data sources. An initial pre-selection, based essentially on the theory and on data availability, led to a set of 11 variables to be potentially included in the empirical analysis.[2] We subsequently restricted the anaysis to seven variables, by excluding: some of the sub-components of one index variable; variables that were considered less relevant; one variable for which data were not available. The finally selected variables are the following: *legis03* from Cross National Time Series Data Archive (CNTS, 2015), *checks* from Database of Political Institutions (DPI, 2012), *legal sysitem & property rights* from Economic Freedom of the World (EFW, 2013), *polity2* and *durable* from POLITY IV (2014), *political risk* from International Country Risk Guide (ICRG, 2013) and *natural resources rents* from World Development Indicators (WDI, 2016). Table 1 below summarizes the variables names, sources and description, and specifies whether the variable is expected to increase or decrease the degree of political rivalry.

[2]Please see Appendix A for a detailed description of these initially selected 11 variables.

Table 1: **Variables description**

Variables and sources	**Variables description**	**Expected influence**
legis03 (CNTS)	Effectiveness of the legislature.	-
checks (DPI)	Checks and balances based on legislative and executive indices of electoral competitiveness.	-
political risk (ICRG)	Six (out of twelve) factors, termed political risk components, such as: government's ability to carry out its declared programs and its ability to stay in office; corruption within the political system as a threat to foreign investment and a distortion to the economic and financial environment; strength of the legal system and public observance of the law; degree of government responsiveness to its people; overall institutional strength and beaurocracy quality.	-
polity2 (POLITY IV)	General regime effects (ranging from democracy to autocracy) evaluated in terms of openness and competitiveness of executive recruitment, constraints on chief executive, and regulation and competitiveness of participation.	-
durable (POLITY IV)	Regime durability expressed in the number of years since the last regime change or the end of a transition period defined by the lack of stable political institutions.	-
legal system & property rights (EFW)	Nine sub-components reflecting the judicial independence and impartial courts, integrity of the legal system, legal enforcement of contracts, military interference in rule of law and politics, protection of property rights, regulatory restrictions, reliability of police, business costs of crime.	-
natural resources rents (WDI)	Sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents (expressed as a % of GDP).	+

In Table 1, the column "Variables and source" includes variables' names as they appear in the respective database and the abbreviated database name, while the column "Variables description" contains a brief description of each variable as given by the source.[3] Inspection of variables' descriptions shows that variables *legis03*, *checks*, *polity2*, *durable* and *political risk* reflect aspects of the political dimension of political rivalry, while the variable *natural resources rents* reflects aspects of the economic dimension; the variable *legal system & property rights*, on its turn, has elements of both dimensions. The last column -

[3]Note that two of our variables, *political risk* and *legal system & property rights*, are aggregate variables for which we do not present the composing elements here (please see the *ICRG* and *EFW* user guides, available online, for more details). We also note that we exclude some components (such as internal and external conflicts, religious and ethnic tensions and military in politics) from the *political risk* aggregate variable, as we consider them irrelevant for political rivalry. The final *political risk* aggregate value was proportionately recalculated applying the specific weights for the remaining components used in the construction of political rivalry indicator.

"Expected influence", specifies whether a variable is expected to have a decreasing or an increasing effect on political rivalry. Namely, recalling our previous discussion on the definition of political rivalry, countries with higher values for the first six variables and lower values for the last variable are expected to exhibit lower degrees of political rivalry.

Next, we will use data reduction techniques to assess the extent of each variable's contribution to the composite political rivalry indicator to be constructed.

2.2 Data reduction techniques

Two formal techniques are commonly employed in the construction of composite indicators: the *principal component analysis* and the *factor analysis*. Both are recognised statistical techniques used for data reduction and also for detecting an underlying structure in the data, which can be particularly relevant when approaching complex and directly unmeasurable phenomena (see, for example, Dancey and Reidy (2004), Vyas and Kumaranayake (2006), Aisen and Veiga (2013)). These techniques basically imply retaining a number of components or factors (represented by a series of uncorrelated linear combinations of the original variables), which: (i) are able to explain most of the variance contained in the data; (ii) can be adequately interpreted; (iii) can be analytically combined in a more accurate joint representation of the studied phenomenon. An important characteristic of the retained components / factors is that, because they are uncorrelated, they are able to capture distinct dimensions in the analysed data. However, each additional component or factor explains a consecutively smaller proportion of the variance contained in the original variables and thus the contribution of each newly retained factor is marginally decreasing. This implies that only the factors that explain the larger part of variance contained in the original data should be used for a meaningful description of the studied phenomenon (Tabachnick and Fidell (2001), Lattin et al. (2003)).

Before applying the *principal component analysis* and *factor analysis* techniques in our statistical exercises, we first perform a number of standard tests and diagnostic procedures to check if our data satisfies the general criteria required for a robust data reduction exercise. We start by inspecting the data adequability by checking the descriptive statistics, confirming the variables types, correlations and sample size, and by performing the tests (namely, Kaiser-Meyer-Olkin test and Bartlett's test of Sphericity) commonly used for evaluating if the data can be properly treated by data reduction techniques, all summarized in Tables 2 and 3.

Table 2: **Descriptive statistics**

Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
legis03	5,506	1.804577	0.9282844	0	3
checks	5,280	2.632765	1.717109	1	18
political risk	3,824	68.75266	18.98281	7.083333	110.7292
polity2	5,349	2.03066	7.132953	-10	10
durable	5,424	24.04388	29.60954	0	205
legal system & property rights	2,461	5.512328	1.772601	1.160997	9.62463
natural resources rents	5,602	9.687764	14.0198	0	92.01895

As Table 2 shows, all our variables are continuous or discrete and our initial dataset contains at least 2461 observations, which by far satisfies the commonly required cases-to-variables ratio of at least 5 times as many observations as variables, as well as the rule of "200+" cases (see, for example, Hair et al. (1998), Stevens (2002)). Also, the descriptive statistics indicate that our data have a high degree of variability across countries and over time, which is indeed a desirable characteristic for both *principal component* and *factor* analyses.

Inspection of the correlation matrix in Table 3 confirms that, while no cases of multicollinearity have been detected in our sample, there are a few cases of correlations around the minimum threshold for variables *checks*, *polity2* and *natural resources rents*.[4] However, given that the results of both Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin test for detecting multicollinearity suggest the adequability of carrying out a *principal component* or a *factor analysis* on our data (the hypothesis that the variables are uncorelated is rejected for 1% of significance and the KMO measure is 0.76), we opt to keep all variables in the first stage of our data reduction exercises (Kaiser (1974), Pallant (2007), Hair et al. (1998)).[5]

[4]Note that, for the variables to be considered suitable for factor analysis, the correlations should be at least 0.3 or greater, as searching for common factors would make no sense for weakely related variables; multicollinearity issues can arise for correlations above 0.9, which could increase the standard error of factor loadings, making them less reliable and more difficult to interpret (see e.g. Field (2005), Lattin et al. (2003)).

[5]At a later stage, we gradually exclude the variables with insufficient factor loadings, which are precisely those with initially lower correlations, i.e. variables *checks*, *polity2* and *natural resources rents* (see our discussion below on factor analyses results).

Table 3: **Variables' correlation matrix**

Variables correlations	*legal system & property rights*	*checks*	*polity2*	*political risk*	*legis03*	*durable*	*natural resources rents*
legal system & property rights	1.0000	-	-	-	-	-	-
checks	0.2282	1.0000	-	-	-	-	-
polity2	0.3096	0.6028	1.0000	-	-	-	-
political risk	0.8238	0.3148	0.4830	1.0000	-	-	-
legis03	0.5286	0.4801	0.7625	0.6033	1.0000	-	-
durable	0.5893	0.2029	0.2552	0.5817	0.4541	1.0000	-
natural resources rents	-0.2501	-0.2433	-0.4843	-0.3134	--0.4106	-0.1762	1.0000

Number of observations: 1, 847
Bartlett test of sphericity: Chi-square = 7041.342 Degrees of freedom = 21 p-value = 0.000 H0: variables are not intercorrelated
Kaiser-Meyer-Olkin Measure of Sampling Adequacy KMO = 0.763

Next, we explain our choice of the data reduction technique. Many authors indicate that for sufficiently large samples, as is our case, both *principal component analysis* and *factor analysis* yield similar results (see, for example, Hair et al. (1998)). There is, however, one important difference to be considered: while *principal component analysis* uses, by assumption, all variability contained in the data, *factor analysis* uses only the variability that is actually shared by all variables (Fabrigar et al. (1999), Dancey and Reidy (2004)). Thus, in order to determine which technique is more suitable in our case, we start by performing a *principal component factor analysis*, that will inform us if the retained principal components can, in fact, explain *all* variance in our original data. In analysing the obtained results, summarized in Table 4, we are specifically interested in the uniqueness values, which give us the percentage of variance for each variable that is not explained by the principal components retained.

Table 4: **Results of the principal component factor analysis**

Factors	**Eigenvalues**	**Cumulative variance explained**	**Variables**	**F1 loadings**	**F2 loadings**	**Uniqueness**
F1	3.67870	0.5255	*legal system & property rights*	0.7605	0.5097	0.1619
F2	1.28307	0.7088	*legis03*	0.8580	-0.1709	0.2346
F3	0.76744	0.8185	*political_risk*	0.8400	0.3581	0.1661
F4	0.48103	0.8872	*checks*	0.5897	-0.4889	0.4132
F5	0.44545	0.9508	*natural resources rents*	-0.5372	0.3596	0.5821
F6	0.20975	0.9808	*polity2*	0.7752	-0.4969	0.1521
F7	0.13456	1.0000	*durable*	0.6491	0.5005	0.3282

Factor analysis/correlation; Method: principal-component factors
Rotation: orthogonal varimax (Kaiser off)
Number of obs = 1847; Retained factors = 2
LR test: independent vs. saturated: chi2(21) = 7045.16; Prob>chi2 = 0.0000

The last column of Table 4 illustrates that uniqueness values for all variables are considerably greater than zero. This clearly indicates that there is substancial variability left in the data after the principal components have been retained, thus allowing us to conclude that the *principal component* technique is inappropriate for our data. Therefore, all further data reduction exercises for constructing a composite political rivalry indicator are performed using *factor analysis*.

We start by performing a first *factor analysis* (*FA1*), which includes all seven variables and whose results are presented in Table 5.

Table 5: **FA1 results and factor loadings**

Factors	**Eigenvalues**	**Cumulative variance explained**	**Variables**	**F1 loadings**	**Uniqueness**
F1	3.29989	0.8468	*legal system & property rights*	0.7465 (0.8660)	0.2703
F2	0.86615	1.0690	*legis03*	0.8288 (0.4678)	0.7176
F3	0.06349	1.0853	*political_risk*	0.8292 (0.8306)	0.5949
F4	0.00819	1.0874	*checks*	0.5153 (0.1442)	0.2222
F5	-0.06889	1.0697	*natural resources rents*	-0.4519 (-0.1904)	0.1931
F6	-0.09698	1.0448	*polity2*	0.7513 (0.2135)	0.5612
F7	-0.17477	1.0000	*durable*	0.5779 (0.6344)	0.2030

Factor analysis/correlation; Method: principal factors
Rotation: orthogonal varimax (Kaiser off)
Number of obs = 1847; Retained factors = 4
LR test: independent vs. saturated: chi2(21) = 7045.16; Prob>chi2 = 0.0000

Analysing the results of *FA1* in Table 5, we can see that, from the four retained common factors with positive eigenvalues, only the first one is relevant for our analysis.[6] Namely, only *factor1* has a positive eigenvalue greater than 1, explaining around 85% of the variance contained in the original data[7] and displaying several highly significant variable loadings, namely four variables with loadings above 0.7, of which two above 0.8.[8] We can also see that all variables loadings on the first common factor retained are consistent with the expected (positive or negative) impact of each variable on political rivalry, as specified in Table 1. In particular, recalling that our political rivalry indicator should be inversely read (i.e. the higher its value the lower the political rivalry level), the loadings signs indicate a positive influence of all variables except that of the *natural resources rents* variable. All this confirms that *factor1* satisfies the

[6]Note that, athough initially we did not impose any restrictions on the number of common factors to be retained, subsequently we will only use common factors satisfying the usually applied criteria, which may include: considering only factors with eigenvalues greater than 1, imposing a minimum level of variance explained by the common factors, excluding variables with loadings below a certain level and inspecting if the loadings signs are maintained on all relevant factors (see, for example, Dunteman (1989), Hatcher (1994), Johnson (1998) and Stevens (2002) for more details on guideline criteria for retaining factors).

[7]Note that here (as well as in *FA2*) the cumulative proportion of the total variance explained by the factors with positive eigenvalues exceeds 1 due to the (negative) contribution of the factors with negative eigenvalues.

[8]The literature usually refers a minimum of three significant variable loadings for each factor; the significance level can be determined by the rule of thumb based on sample size (as in e.g. Stevens (2002)), which, given the number of observations in our sample, is already verified.

usual criteria and thus can be further used in the construction of our composite political rivalry indicator.

We also inspect the values in the "uniqueness" column, which, as previously refered, inform us about the common factors' explanatory power for each variable. We can then see that the variable *natural resources rents* appears to be poorly explained by the common factors retained, exhibiting a uniqueness value of 0.72 (implying that the retained common factors explain less than 30% of the variable's variance), which is above the usually refered threshold of 0.6. This may be due to the fact that it is the only variable outside the political-institutional domain in this analysis and thus may not share with other variables significant common features to be captured by the common factors retained.[9] All other variables have uniqueness values below 0.6 and thus appear to be well explained by the common factors retained.

In order to decide if all variables should be in fact included in the composite political rivalry indicator, we perform the usual procedure of rotating the initial results, applying the standard varimax rotation. The goal of this procedure is to obtain a clear pattern of high loadings for some variables and low loadings for others for each of the common factors retained. Evaluating the relevance of each of the seven initial variables, we consider the usual loading threshold of 0.3 to confirm significance. Thus, inspection of *factor1* rotated loadings (given in parentheses in column "*Factor1 loadings*") in Table 4 shows that variables *checks*, *polity2* and *natural resources rents* do not reach the minimum loading level, which suggests dropping these variables from the construction of our composite political rivalry indicator.

We thus perform a second *factor analysis*, *FA2*, which excludes the variables *checks*, *polity2* and *natural resources rents,* and the results of which are summarized in Table 6 below.[10] The intuition behind the exclusion of these three variables is the following. On the one hand, Acemoglu (2009) does not, in fact, consider democracy (proxied by variable *polity2* in our analysis) as a guarantee of institutional quality, sustaining that political rivalry may arise in any kind of political regime. On the other hand, checks and balances mechanisms (and consequently, the variable *checks*, according to its definition in DPI, see Table 1) are directly related to the degree of democracy in a society. Finally, as natural resources do not represent institutional or political characteristics, the relation between *natural resources rents* and the other variables can be expectedly weaker. These considerations, together with the three variables' low loadings in *FA1*, may in fact make them less relevant for the construction of the political rivalry indicator.

[9] Recall that factor analysis considers only the variables' *commonly* shared variance in retaining common factors, which naturally alienates the *natural resources rents* variable.

[10] As in *FA1*, here we also previously exclude correlation and multicollinearity problems, and confirm that there are no outliers that might affect correlations and thus distort results.

Table 6: **FA2 results and factor loadings**

Factors	Eigenvalues	Cumulative variance explained	Variables	F1 loadings	Uniqueness
F1	2.38528	1.0901	*legal system & property rights*	0.8663	0.5746
F2	-0.01582	1.0828	*legis03*	0.6522	0.2495
F3	-0.04276	1.0633	*political_risk*	0.8920	0.5863
F4	-0.13847	1.0000	*durable*	0.6432	0.2043

Factor analysis/correlation; Method: principal factors
Rotation: orthogonal varimax (Kaiser off)
Number of obs = 1902; Retained factors = 1
LR test: independent vs. saturated: chi2(21) = 3959.04; Prob>chi2 = 0.0000

As it can be seen, the exclusion of the variables that exhibited insufficient loadings in *FA1* generally improved the significance of the variables included and the common factor retained in *FA2*, as all 4 variables now have loadings above 0.64; aditionally, all variables appear to be well explained by the retained factor, as all uniqueness values are below 0.6. We also note that, because *FA2* retained only one positive common factor (with an eigenvalue greater than 1 and explaining all variance contained in the original data),[11] initial results are equal to rotated results. Although the results of *FA2* are more consistent and robust in terms of the variables' significance and the retained factor's explanatory power, we will use the results of both factor analyses to build two political rivalry indicators, one reference indicator and a secondary one (see Tables 7 and 8 below) as explained in detail in the next subsection.

2.3 Construction and preliminary analysis of the Political Rivalry Indicator

In this subsection we explain the construction of two political rivalry indicators, PR and $PR1$, which we build using the results of the two factor analyses performed, and also conduct a preliminary analysis of the obtained indicators (summarized below)

Table 7: Political Rivalry Indicators

Political rivalry indicators	Factor analysis	Variables included
Reference indicator, PR	Based on results of *FA2*	*legal system & property rights*, *legis03*, *durable, political risk*
Secondary indicator, $PR1$	Based on results of *FA1*	*legal system & property rights*, *legis03*, *checks*, *polity2*, *durable*, *political risk*, *natural resources rents*

In constructing the indicators, we proceed in the following manner. Using the factor scoring coefficients as weights, we calculate the common factors for each country-year available observation as a weighted

[11] Here again, due to the negative contribution of the common factors with negative eigenvalues.

sum of variables considered in the analysis. The factor scoring coefficients are obtained by the regression method, as suggested by Thomson (1951); as we are using factor analysis, the weights are applied to the standardized versions of the variables. Given that both *FA1* and *FA2* each retained only one common factor, the composite political rivalry indicators are then simply equal to the calculated common factors.

We obtain two panel datasets, one for PR, with 125 countries, and another for $PR1$, with 126 countries, with annual values for the period between 1984-2012.[12] Table 8 below summarizes the discriptive statistics for both indicators.

Table 8: **Descriptive statistics for PR and $PR1$**

Political rivalry indicator	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
PR	1,902	-1.19e-09	0.9340121	-2.636263	2.315111
$PR1$	1,847	-4.33e-10	0.9550382	-2.520101	2.007803

As previously emphasized, the constructed indicators inversely reflect the political rivalry level, that is, the higher an indicator's value, the lower the political rivalry level. We also recall that, as factor analysis uses standardized versions of variables to calculate common factors, the obtained political rivalry indicators have a zero mean and a unit standard deviation.[13] The descriptive statistics in Table 8 show that there is considerable heterogeneity in the data, as the values of PR and $PR1$ range from -2.636263 (for Haiti) and -2.520101 (for Congo) to 2.315111 and 2.007803 (for USA), respectively.

In our subsequent preliminary analysis, we will focus on our reference indicator of political rivalry, PR.[14] In particular, given our data heterogeneity, we further explore the PR dataset by considering subgroups of countries with similar characteristics. To do so, we apply the World Bank classifications by region and income *per capita*, and desagregate the complete sample into four income and six geographic groups, as shown in Table 9:[15]

[12] Not included in this paper but available for research purposes upon request.

[13] Note that, deviations from mean 0 and standard error 1 in the reported results in Table 8 are due to numerical roundoff and to the factor model solution found by the estimation method used.

[14] The same analysis has been performed using our secondary political rivalry indicator, $PR1$, for which the results are very similar and therefore not reported here to save space.

[15] The complete list of countries belonging to each *income* and *geo* group is provided in Appendix B.

Table 9: **Income and Geo Groups**

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

In order to obtain the mean values of the reference political rivalry indicator for each group, we estimate two simple regressions of PR on four *income* and six *geo* dummy variables. Then, using the estimated coefficients from each regression, we perform Wald tests on the coefficients' equality to evaluate the significance of political rivalry differences between different *income* and *geo* groups. More specifically, we use two simple estimation models, as follows:

1) by income *per capita*:

$$PR_{i,t} = \alpha_1 income_{1,i} + \alpha_2 income_{2,i} + \alpha_3 income_{3,i} + \alpha_4 income_{4,i} + u_{i,t} \tag{1}$$

2) by geographic location:

$$PR_{i,t} = \beta_1 geo_{1,i} + \beta_2 geo_{2,i} + \beta_3 geo_{3,i} + \beta_4 geo_{4,i} + \beta_5 geo_{5,i} + \beta_6 geo_{6,i} + v_{i,t} \tag{2}$$

where: $PR_{i,t}$ is the value of the reference political rivalry indicator in country i in year t; $income_{j,i}$ 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 $k = 1, 2, ..., 6$, is a dummy variable assuming the value 1 if country i belongs to geo group k, and the value 0 otherwise; $u_{i,t}$ and $v_{i,t}$ are the usual error terms.

Table 10 below presents the estimation results of regressions 1 and 2. The results of the Wald equality tests on every pair of coefficients α and β are summarized in Tables 11 and 12, respectively.

Table 10: PR **regressions by *income* and *geo* groups**

Dummy variables in Regression (1)	**Coefficient estimates** $\hat{\alpha}$	**Dummy variables in Regression (2)**	**Coefficient estimates** $\hat{\beta}$
$income_1$	0.9315762*** (37.44)	geo_1	1.36374*** (51.93)
$income_2$	-0.293671*** (-13.02)	geo_2	0.1183062*** (4.28)
$income_3$	-0.6491896*** (-24.15)	geo_3	-0.1881549*** (-4.06)
$income_4$	-0.8524156*** (-27.41)	geo_4	-0.4665186*** (-14.53)
-	-	geo_5	-0.0775475* (-1.80)
-	-	geo_6	-0.6934052*** (-24.33)
R^2	*0.62*	R^2	*0.60*
N	*1902*	N	*1902*

Estimation method: Ordinary Least Squares;

The level of significance is denoted by *** and *, for 1% and 10% respectively;
t-statistics are reported in brackets.

Inspecting the coefficient estimates $\hat{\alpha}$ and $\hat{\beta}$ in Table 10 (representing the mean values of PR in each *income* and *geo* group, respectively), we can see that countries from the high-income and advanced economies groups exhibit, as expected, the highest mean values of PR. In other words, countries belonging to these two groups have the lowest average levels of political rivalry, compared to all other *income* or *geo* groups. On the contrary, countries from the low-income and Sub-Saharan Africa groups have the highest levels of political rivalry. Furthermore, the results of the Wald tests of coefficients' equality reported in Tables 11 and 12 show that all *income* groups have statistically different mean values of PR, for 1% of significance; the same is verified for the *geo* groups, with the exceptions of the pairs geo_3- geo_4, and geo_5- geo_6, for which the mean values of PR are not significantly different. This suggests that there may be an important link between political rivalry and the income *per capita* level, and that geographical distance can, in fact, imply significant differences in political and institutional organization.

Table 11: **Wald tests on coefficients' equality of Regression (1)**

Coefficients	α_1	α_2	α_3	α_4	
α_1	-	***(1331.34)	***(1862.63)	***(2006.11)	***
α_2	***(1331.34)	-	***(102.67)	***(211.52)	
α_3	***(1862.63)	***(102.67)	-	***(24.44)	
α_4	***(2006.11)	***(211.52)	***(24.44)	-	

*** denotes rejection of tested hypothesis $\alpha_i = \alpha_j$, $i \neq j$, for 1% of significance;
F-statistics are reported in brackets.

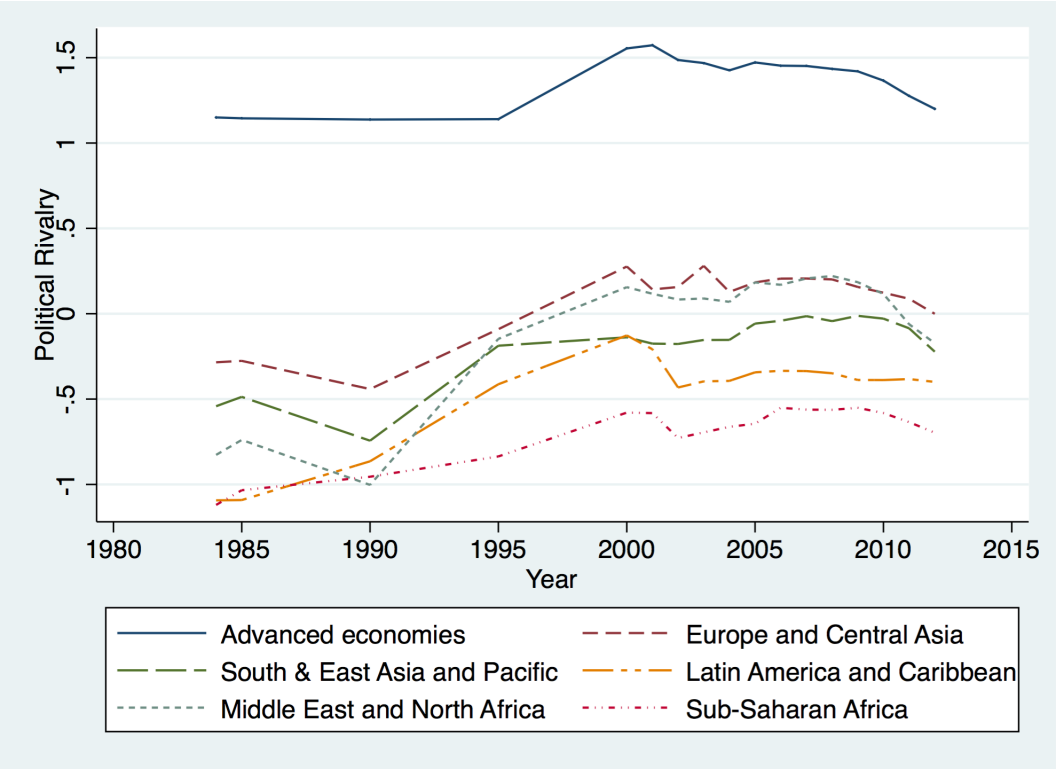
Table 12: **Wald tests on coefficients' equality of Regression (2)**

Coefficients	β_1	β_2	β_3	β_4	β_5	β_6
β_1	–	***(615.15)	***(963.97)	***(1681.68)	***(1771.79)	***(2969.46)
β_2	***(615.15)	-	***(74.35)	***(89.16)	***(288.27)	***(448.50)
β_3	***(963.97)	***(74.35)	-	(0.97)	***(53.47)	***(91.90)
β_4	***(1681.68)	***(89.16)	(0.97)	-	***(94.16)	***(175.33)
β_5	***(1771.79)	***(288.27)	***(53.47)	***(94.16)	-	(2.07)
β_6	***(2969.46)	***(448.50)	***(91.90)	***(175.33)	(2.07)	-

*** denotes rejection of tested hypothesis $\beta_i = \beta_j$, $i \neq j$, for 1% of significance;
F-statistics are reported in brackets.

Additionally, Figure 1 below represents the political rivalry dynamics across the world during the last thirty years. It can be seen that the overall general trend is positive, that is the political rivalry level tends to decrease across the world, which can be due to a general improvement of institutional quality in most countries. The highest increase in the PR indicator, corresponding to a decrease in the political rivalry level, clearly occured in the 1990's. However, a slight deterioration can be noted around 2008-2012, at the time of the recent international financial crisis. Figure 1 also clearly illustrates the differences in political rivalry levels among the six *geo* groups: there is a large gap between political rivalry in the advanced economies and in the rest of the world, of which the least developed countries (from the Sub-Saharan Africa group) exhibit the highest degree of political rivalry.

Figure 1: **Political rivalry across the world, 1984-2012**



Given that our data reduction exercises allowed us to create a panel dataset for a large number of countries and a relatively long time span, the constructed indicator(s) can be used in a variety of fields of applied research. In the next section of this paper we will test one possible application, by including PR (and also $PR1$) as an explanatory variable in a classic growth regression model.

3 Application: growth regression

In this section we test the applicability of the constructed composite political rivalry indicator by estimating the effect of political rivalry on economic growth using dynamic panel data models. We perform a baseline regression and several robustness tests to assess the relevance and robustness of the constructed indicator.

3.1 Data and model specification

Annual data on the explanatory variables (except PR) are collected from the *Penn World Tables* 9.0 and from the Barro-Lee educational dataset, covering the period between 1980-2014 and including 107

countries.[16] The estimations are performed using seven consecutive, non-overlapping 5-year periods from 1980 to 2014, namely: 1980-1984, 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2014.

Our empirical analysis is based on the panel data growth models commonly used in recent literature, in which the economic growth rate is represented as follows:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta \mathbf{X_{i,t}} + \gamma PR_{i,t} + u_i + v_t + \varepsilon_{i,t} \tag{3}$$

where $y_{i,t}$ denotes the log of real GDP *per capita* of country i at the end of period t, (its lag is included in the right hand-side to account for convergence), u_i and v_t denote the country- and time-specific effects respectively, and $\varepsilon_{i,t}$ is the usual error term. The variable $PR_{i,t}$ is our reference political rivalry indicator and the vector $\mathbf{X_{i,t}}$ includes current or lagged values of the remaining explanatory variables commonly considered in the growth literature, as follows:

- investment (% GDP);
- one period lagged years of secondary schooling, as a measure of human capital;
- population growth rate;
- trade openness (share of net exports in GDP).

Since here we consider a dynamic growth model for the level of $y_{i,t}$, we can rewrite (3), highlighting the presence of a lagged endogenous variable, as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \beta \mathbf{X_{i,t}} + \gamma PR_{i,t} + u_i + v_t + \varepsilon_{i,t} \tag{4}$$

in which $\alpha \neq 1$.

Traditional methods of panel estimation have been proven to be inadequate for estimating growth regressions with panel data, usually producing biased and inconsistent coefficients and unable to deal properly with endogeneity problems (see e.g. Bond et al. (2001), Voitchovsky (2005)). In order to remove the unobserved time-invariant effects, u_i, and to properly control for endogeneity and measurement error, we first-difference (4)(as in the *first-difference* GMM technique, developed by Arellano and Bond (1991)), which yields:

$$\triangle y_{i,t} = \alpha \triangle y_{i,t-1} + \beta \triangle \mathbf{X_{i,t}} + \gamma \triangle PR_{i,t} + \triangle v_t + \triangle \varepsilon_{i,t} \tag{5}$$

However, given that important information in the data may be lost in the process of differencing

[16] Which is below the initial 125 in the PR panel dataset, due to exclusion of observations with missing values.

the dynamic growth model, consistency and precision concerns have motivated the increasing use of the *system*-GMM estimation technique. It can be seen as an extended version of the *first-difference* GMM as it combines moment conditions for the equations in first-difference, (5), with additional moment conditions for the equations in levels, (4), having been referred to increase estimation efficiency (see Arellano and Bover (1995), Blundell and Bond (1998)). Many researchers sustain that in cases when explanatory variables are highly persistent over time and when their variation is mostly cross-sectional, as is the case of political rivalry, the *system*-GMM estimator yields more precise and less biased estimated coefficients and is more robust than the traditional estimators and the *first-difference* GMM (for details, see Blundell and Bond (1998), Blundell and Bond (2000), Bond et al. (2001) and Voitchovsky (2005)). Thus, following the common practice in the literature, we use the *system*-GMM estimator in our growth regressions.

3.2 Empirical results

The discussion of the empirical results is structured in two subsections: baseline regression and robustness analysis. In the baseline regression of our model we focus on the reference political rivalry indicator, PR, and we use consecutive, non-overlapping 5-year periods. The baseline regression results are reported in Table 13. Then, we perform several robustness tests by considering alternative period-lengths of 4 and 6 years,[17] including other political variables as additional regressors, and restricting our initial sample. The results of this robustness analysis are summarized in Tables 14 and 15.

Baseline regression results

The baseline regression estimates the effect of our reference political rivalry indicator, PR, on GDP *per capita* growth using the system-GMM method. These results are reported in column 1 of Table 13. Following common practice in growth regressions, we treat all the explanatory variables as endogenous in order to avoid potential problems of endogeneity that may be caused by reverse effects of growth. We also report the fixed effects estimation results, in column 2, which we use only for comparison reasons in order to rule out possible specification problems in the system-GMM.[18] Additionally, out of investigative curiosity, we perform the same analyses using the secondary political rivalry indicator, $PR1$, the results of which are shown in columns 3 (*system*-GMM estimations) and 4 (fixed effects estimations).

For all regressions reported in Table 13, the coefficients of the classical growth determinants have the

[17] Taking longer time intervals, up to 10 years, would have the drawback of generating a small number of periods and observations.

[18] As Aisen and Veiga (2013) refer, GMM models can be quite sensitive to the set of instruments and lag length chosen and, therefore, it may be useful to compare their results with the simple fixed effects results. This procedure allows ruling out possible *system*-GMM specification problems if the pattern of statistical significance of the coefficients yielded by the two estimators tends to be similar.

usual expected signs and are higly significant, at 1% and 5%. As expected, initial GDP *per capita* has a negative estimated effect on growth, thus accounting for conditional convergence. The estimated effect on growth is also negative for population growth and is positive for investment, secondary years of schooling and trade openess. As to our main research interest regarding the effect of political rivalry on growth, the baseline results show that there is a significant negative impact, at 5% ($p - value = 0.019$). Namely, and recalling that the constructed political rivalry indicator should be inversely read, the results reported in column 1 imply that a one point increase in the PR indicator results in an increase of around 1.19 percentage points in the annual GDP *per capita* growth. Taking into account the political rivalry time trends between 1990-2000 presented in Figure 1 above (see Section 2), a 0.4 point increase in the PR indicator attainable in 5 years on average, would allow the economy to grow 0.48 percentage points in the same period, which is not economically negligible. When $PR1$ is alternatively considered, the estimated negative effect on growth is not statistically significant. In fact, recalling that the secondary political rivalry indicator, $PR1$, also includes variables *polity2*, *durable* and *natural resouces rents*, which do not appear relevant for reflecting the political rivalry phenomenon (see our factor analysis in Section 2), its impact on economic growth could be expected less significant.

Table 13: **Baseline regressions**

	(1)	*(2)*	*(3)*	*(4)*
Explanatory variables	***System-GMM***	***Fixed Effects***	***System-GMM***	***Fixed Effects***
Initial GDP per capita (log)	-0.0262*** (-5.340)	-0.0794*** (-12.94)	-0.0248*** (-4.550)	-0.0778*** (-11.73)
Investment (% GDP)	0.220*** (3.908)	0.124*** (3.152)	0.243*** (4.489)	0.128*** (3.024)
Years of Secondary Schooling	0.0121*** (3.453)	0.0244*** (5.284)	0.0129*** (3.637)	0.0257*** (5.284)
Population growth	-0.616** (-2.504)	-0.759*** (-4.328)	-0.614** (-2.059)	-0.766*** (-4.036)
Trade openness	0.0273*** (2.626)	0.0216** (2.218)	0.0315*** (2.732)	0.0192** (2.032)
PR	0.0119** (2.346)	0.0278*** (5.012)	-	-
*PR*1	-	-	0.00634 (1.123)	0.0214*** (3.623)
Number of observations	*575*	*575*	*554*	*554*
Number of countries	*107*	*107*	*106*	*106*
Adjusted R-squared	-	*0.349*	-	*0.325*
Number of instruments	*95*	-	*95*	-
Hansen test (p-value)	*0.211*	-	*0.271*	-
AR1 test (p-value)	*5.60e-07*	-	*4.34e-06*	-
AR2 test (p-value)	*0.189*	-	*0.159*	-

Estimation methods: system-GMM for dynamic panel-data models and fixed effects; sample period: 1980–2012;
All explanatory variables were treated as endogenous; their three period lagged values were used as instruments in the first-difference equations and their once lagged first-differences were used in the levels equation;
*** and ** denotes rejection of null hypotheses for 1% and 5% of significance respectively; t-statistics are reported in brackets.

Robustness analysis

All the robustness tests results, reported in Tables 14 and 15, confirm the conclusions of the baseline regression regarding the effect of political rivalry on growth.[19]

First, we re-estimate the baseline regression using alternative period-lengths, of 4 and 6 years. The obtained results, reported in columns 1 and 2 of Table 14, confirm that political rivalry remains statistically significant, at 5%.

Second, we add two new political variables to our growth regression, namely regime changes and political competition (variables *change* and *polcomp* from POLITY IV database). The first variable

[19]We note that, in some robustness tests, small adjustments to the instrument matrix were necessary in order to avoid that the number of instruments exceeds the number of countries, as well as to ensure that the Hansen statistic confirms the validity of instruments used.

reflects pro-democratic or pro-autocratic authority changes in the political organization of a country; the second variable reflects the regulation and competitiveness of political participation and could be thus regarded as a "healthy" political competition. The results reported in column 3 of Table 14 confirm the robustness of the baseline regression, as political rivalry continues highly relevant for economic growth, at 1%. Regarding regime changes, its estimated effect on growth is negative and only weakly significant, at 10%, while political competition appears to have no significant effects on economic growth.

Third, we check if the baseline regression results are robust to sample restrictions, by excluding one group of countries at a time.[20] Regression results for the restricted samples based on the previously defined *geo* groups, summarized in Table 14, again confirm that our baseline estimations are robust to sample restrictions, as the negative effect of political rivalry on economic growth remains significant in practically all subsamples,[21] with the coefficients ranging from 0.0111 to 0.0348. Note that the strongest effect is estimated for the subsample that excludes the advanced economies, which may suggest that the magnitude of the political rivalry negative effect on growth weakens as the development level increases.

[20] Here, the countries are grouped applying the geographical location criteria as in our preliminary PR analysis in Section 2.

[21] The only exception is the subsample which excludes countries belonging to the Europe and Central Asia group, where the estimated negative effect of PR on economic growth is not statistically significant.

Table 14: **Robustness regressions**

	(1)	*(2)*	*(3)*
Explanatory variables	***4-year periods***	***6-year periods***	***5-year periods***
Initial GDP per capita (log)	-0.0366*** (-4.179)	-0.0271*** (-3.917)	-0.0368*** (-4.814)
Investment (% GDP)	0.264*** (3.310)	0.182*** (2.736)	0.221*** (2.844)
Years of Secondary Schooling	0.0132* (1.773)	0.00918** (2.055)	0.0151*** (2.797)
Population growth	-1.261*** (-3.405)	-1.267*** (-3.144)	-0.954*** (-3.229)
Trade oppeness	0.107** (2.497)	0.0334 (1.537)	0.0272*** (5.123)
PR	0.0150** (2.043)	0.0127** (2.110)	0.0305*** (3.505)
change	-	-	-0.000328* (-1.727)
polcomp	-	-	-0.00139 (-0.708)
Number of observations	*465*	*466*	*201*
Number of countries	*102*	*103*	*77*
Number of instruments	*84*	*74*	*71*
Hansen test (p-value)	*0.181*	*0.153*	*0.444*
AR1 test (p-value)	*0.00884*	*0.00745*	*0.0701*
AR2 test (p-value)	*0.749*	*0.694*	*0.197*

System-GMM estimations for dynamic panel-data models; sample period: 1980–2012;
All explanatory variables were treated as endogenous;

***, ** and * denotes rejection of null hypotheses for 1%, 5% and 10% of significance respectively;
t-statistics are reported in brackets.

Table 15: **Robustness regressions: restricted samples**

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Explanatory variables	*geo*1	*geo*2	*geo*3	*geo*4	*geo*5	*geo*6
Initial GDP per capita (log)	-0.0251***	-0.0270***	-0.0282***	-0.0265***	-0.0288***	-0.0324***
	(-4.468)	(-4.872)	(-5.762)	(-4.913)	(-5.525)	(-6.098)
Investment (% GDP)	0.137***	0.274***	0.211***	0.242***	0.197***	0.226***
	(2.088)	(4.202)	(2.675)	(3.159)	(3.900)	(4.792)
Secondary School	0.00826**	0.0121**	0.0118***	0.0114***	0.0139***	0.0149***
Enrollment	(2.007)	(2.316)	(2.859)	(3.085)	(4.748)	(5.078)
Population growth	-0.575**	-0.704**	-0.572**	-0.717**	-0.859**	-0.487*
	(-2.007)	(-2.204)	(-2.148)	(-2.477)	(-2.491)	(-1.896)
Trade oppeness	0.0236**	0.0336**	0.0253**	0.0646	0.0231***	0.0330***
	(2.432)	(2.480)	(2.560)	(1.500)	(3.237)	(2.689)
PR	0.0348***	0.00930	0.0191***	0.0147**	0.0111*	0.0137**
	(4.187)	(1.532)	(2.815)	(2.409)	(1.811)	(2.309)
Number of observations	*445*	*505*	*493*	*461*	*518*	*453*
Number of countries	*85*	*90*	*92*	*88*	*95*	*85*
Number of instruments	*72*	*72*	*72*	*72*	*72*	*72*
Hansen test (p-value)	*0.199*	*0.0993*	*0.112*	*0.155*	*0.108*	*0.139*
AR1 test (p-value)	*3.25e-05*	*2.05e-07*	*8.71e-06*	*3.17e-05*	*1.61e-05*	*4.04e-06*
AR2 test (p-value)	*0.116*	*0.195*	*0.171*	*0.315*	*0.243*	*0.474*

System-GMM estimations for dynamic panel-data models; sample period: 1980–2012;

All explanatory variables were treated as endogenous;

***, ** and * denote rejection of null hypotheses for 1% , 5% and 10% of significance respectively;
t-statistics are reported in brackets; the excluded *geo* group in each regression is indicated in the column title.

4 Conclusions

The main objective of this paper was to build a political rivalry indicator and consequently a panel dataset containing the political rivalry levels for the maximum number of countries and time span available, which could be further used in a large variety of applications. Then, one possible application was tested by

including the constructed political rivalry indicator as an explanatory variable in a dynamic panel data growth regression model, for which a baseline regression and several robustness tests were implemented.

Factor analysis was applied as a basis for variables inclusion in the construction of the political rivalry indicator. The results of factor analysis indicate that variables related to specific institutional quality aspects are fundamental for defining the degree of political rivalry: strength and effectiveness of the legal system, independence and impartiality of juditial system, protection of property rights, degree of government responsiveness and its ability to carry out declared programs, political distortions of the economic and financial environment, public observance of the law and overall institutional strength and beaurocracy quality. Contrarily, political regime specific variables and natural resources rents do not appear significant for determining a country's level of political rivalry, according to the *factor analysis* results. This data reduction exercise resulted in the construction of a reference political rivalry indicator, comprising four variables, and of a panel dataset with political rivalry levels for 125 countries between 1984-2012. A preliminary analysis of this panel dataset shows that there are significant differences in the political rivalry levels among countries depending on their income level and geographical location. These clearly indicate that political rivalry is inversely related to the development level.

Regarding the inclusion of the political rivalry indicator in a growth regression, our baseline results clearly indicate that political rivalry matters for economic growth, with a highly significant negative effect. This effect is maintained when other political and institutional variables are simultaneously included in the growth regression, and when the model is tested on a number of restricted samples, thus confirming the robustness of the baseline results. Additionally, regression results for the restricted samples suggest that the magnitude of the political rivalry negative effect on growth weakens as the development level increases. In sum, our overall results thus suggest that economic growth can not be fully sustained at higher levels without dealing with political rivalry issues.

The results and conclusions of this paper also present some interesting topics for future research. For example, further research on this subject could try to identify the factors, present in more developed countries, but absent in the less developed economies, which are able to weaken or absorb part of the political rivalry's negative effect on growth. Another issue for future research could be related to identifying the different channels of transmission through which political rivalry may affect economic growth, using structural, rather than reduced-form, growth regression models.

Acknowledgements: E. Sochirca acknowledges the financial support from Fundação para a Ciência e a Tecnologia (FCT), Portugal, through the post-doctoral grant SFRH/BPD/109307/2015.

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Appendix A

Table 16: **List of variables inititally considered for inclusion in the political rivalry indicator**

Variables and sources	***Variables description***
legis03 (CNTS)	Effectiveness of the legislature.
national government revenue and expenditure (CNTS)	Refers exclusively to central government and is reported without the "extraordinary" expenditures financed by direct foreign aids or loans.
checks (DPI)	Checks and balances based on legislative and executive indices of electoral competitiveness.
political risk (ICRG)	Index with twelve sub-components reflecting government's ability to carry out its declared programs and its ability to stay in office, corruption within the political system as a threat to foreign investment and a distortion to the economic and financial environment, strength of the legal system and public observance of the law, degree of government responsiveness to its people, overall institutional strength and beaurocracy quality, etc.
polity2 (POLITY IV)	General regime effects (ranging from democracy to autocracy) evaluated in terms of openness and competitiveness of executive recruitment, constraints on chief executive, and regulation and competitiveness of participation.
durable (POLITY IV)	Regime durability expressed in the number of years since the last regime change or the end of a transition period defined by the lack of stable political institutions.
legal system & property rights (EFW)	Index with nine sub-components measuring the judicial independence and impartial courts, integrity of the legal system, legal enforcement of contracts, military interference in rule of law and politics, protection of property rights, regulatory restrictions, reliability of police, business costs of crime.
regulation (EFW)	Index with three sub-components reflecting credit market, labour market and business regulations.
government enterprises and investment (EFW)	Rating constructed based on data (collected from a number of sources) on government investment as a share of total investment.
indicator of public investment efficiency (International Monetary Fund Staff Report, 2015)	Indicator reflecting the relationship between the public capital stock and indicators of quality and access to infrastructure assets.
natural resources rents (WDI)	Sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents (expressed as a % of GDP).

Appendix B

Table 17: **List of countries by geographical location**

Geo group	**List of countries**
geo_1	American Samoa, Andorra, Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Greenland, Iceland, Ireland, Italy, Lichtenstein, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Saudi Arabia, Spain, Sweden, Switzerland, United Kingdom, United States, Virgin Islands (U.S.).
geo_2	Afghanistan, Bangladesh, Bhutan, Brunei, Darussalam, Cambodia, China, Fiji, Guam, Hong Kong SAR, China, India, Indonesia, Japan, Kiribati, Korea, Dem. Rep. of Korea, Lao PDR, Macao SAR, China, Malaysia, Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nepal, Palau, Pakistan, Papua New Guinea, Philippines, Singapore, Samoa, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, Vietnam.
geo_3	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyz Republic, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan
geo_4	Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Bermuda, Belize, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venzuela.
geo_5	Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, United Arab Emirates, West Bank and Gaza, Yemen.
geo_6	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Democratic Rep. of Congo, Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagasccar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Table 18: **List of countries by income level**

Income group	**Countries**
$income_1$	Andorra, Aruba, Australia, Austria, Bahamas, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Croatia, Cyprus, Czech Republik, Denmark, Estonia, Finland, France, Germany, Greece, Greenland, Guam, Hong Kong SAR, China, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Kuwait, Liechtenstein, Luxembourg, Macao SAR, China, Malta, Netherlands, New Zealand, Norway, Oman, Poland, Portugal, Puerto Rico, Qatar, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, St. Kitts and Nevis, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States, Virgin Islands (U.S.).
$income_2$	Algeria, American Samoa, Angola, Antigua and Barbuda, Argentina, Azerbaijan, Belarus, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Grenada, Iran, Jamaica, Jordan, Kazakhstan, Latvia, Lebanon, Libya, Lithuania, Macedonia, Malaysia, Maldives, Mauritius, Mexico, Montenegro, Namibia, Palau, Panama, Peru, Romania, Russian Federation, Serbia, Seychelles, South Africa, St. Lucia, St. Vincent and Grenadines, Suriname, Thailand, Tunisia, Turkey, Turkmenistan, Tuvalu, Uruguay, Venezuela.
$income_3$	Albania, Armenia, Belize, Bhutan, Bolivia, Cameroon, Cape Verde, Republic of Congo, Côte d'Ivoir, Djibouti, Egypt, El Salvador, Fiji, Georgia, Gabon, Ghana, Guatemala, Guyana, Honduras, India, Indonesia, Iraq, Kiribati, Kosovo, Lao PDR, Lesotho, Marshall Islands, Micronesia, Moldova, Mongolia, Morocco, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Samoa, São Tomé and Principe, Senegal, Solomon Islands, South Sudan, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Timor-Leste, Tonga, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza,Yemen, Zambia.
$income_4$	Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Equatorial Guinea, Eritreia, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kenya, Kyrgyz Republic, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, North Korea, Rwanda, Sierra Leone, Somalia, Tajikistan, Tanzania, Togo, Uganda, Zimbabwe.

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