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EERI Research Paper Series No 06/2014

ISSN: 2031-4892

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Electoral Systems and Economic Growth: What is the Importance of the Proportionality Degree?

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Abstract

Previous empirical studies analysing the effect of electoral systems on growth lack unanimous answers as they miss-specify mixed systems in the empirical setting, that is, they neglect to consider the proportionality degree of mixed electoral systems. This work supplies the missing answers by properly distinguishing the three types of electoral rules using a proportionality degree index, that is, the Gallagher index. We estimate a non-linear relationship between the Gallagher proportionality index and the per capita GDP growth using cross-country panel data. Our findings show that the proportionality degree is significant for growth; mixed systems (characterised by an intermediate level of proportionality), combining the different advantages of both proportional and plurality systems, solve the problem of the accountability-responsiveness and the political-government instability trade-offs. As a consequence, they reach relatively higher growth rates with respect to more "extreme" electoral rules.

Keywords: *Economic Growth, Electoral System, Proportionality index*

JEL Classification: C23, D72, H1

1. Introduction

A recent field of economic growth theory argues that the development of a society depends on its economic institutions (Acemoglu, Johnson and Robison, 2005). The debate deals with the political determinants of growth (Hall and Jones, 1999; Glaeser et al., 2004; Rodrik, Subramanian and Trebbi, 2004). Among such political determinants, electoral rules have attracted considerable interest due to the importance of their implications in terms of economic policy.

Most of the research that has focused on the effect that electoral systems (*proportional* and *majoritarian*) have on economic growth is in the field of comparative politics. There are two opposing views deriving from the characteristics of the two "extreme" systems. A proportional representation (PR) system is best for countries wanting a highly representative parliament that is a microcosm of the pluralism of opinions in society. Alternatively, a majoritarian system is best for countries where the winning party, with the most votes in an election, forms a stable single-party government. Those features are reflected in the effects of electoral systems on growth. On the one hand, majoritarian elections, allowing only the winner of elections to implement all of the policies, benefit from explicit accountability of incumbent politicians and it is easier for them to pass economic policies (Leduc et al., 1996; Powell, 2000); this leads to higher economic growth rates. On the other hand, PR stimulates economic growth better than majoritarian systems overall because there is no trade-off between governing effectiveness (accountability) and high quality democracy (responsiveness) (Lijphart, 1984; 1999). There is no robust empirical evidence in the literature that confirms either one or the other of these options. Nowadays, mixed systems combining PR and majoritarian elements are becoming one the most attractive electoral rules. This is because mixed systems allow countries to enjoy the benefits of minority representation (within the Parliament) and, at the same time, they produce less fractionalisation than PR (Kostadinova, 2002). More and more countries are abandoning their extreme electoral positions in favour of mixed ones. However, up till now, there have been no comprehensive studies on the effect of mixed systems on economic growth.

To analyse mixed systems in an empirical framework is not easy. Previous works on the effect of electoral systems on growth have used a dummy variable as a proxy for the electoral systems (Abelman and Pesevento, 2007); but this practice is misleading because some mixed systems have a larger proportional element than others, that is, they may be designed with different degrees of proportionality. Therefore, we believe that the failure in robustness of empirical studies regarding the link between electoral systems and growth depends on both the lack of mixed systems and their miss-specification. In order to consider mixed systems properly in an empirical setting, a

continuous measure of the degree of proportionality of an electoral rule is needed. We may hypothesise that mixed rules realise a concave representation-accountability trade-off such that they may maintain the independence of responsiveness (of PR) and of accountability (of majoritarian representation), leading to relatively high growth rates (Carey and Hix, 2011; Moser and Scheiner, 2004). In this light the present study aims to enrich the empirical literature by more accurately testing how electoral rules affect growth. More precisely, we use the Gallagher dis-proportionality index (often used for comparing proportionality across electoral systems) to specifically consider mixed electoral systems together with pure PR and majoritarian systems. Empirically we specify and test, with a panel of 91 countries over the time span 1979-2010, a non-linear relationship between the Gallagher index and the countries' rates of growth. We find that the relationship appears as a sign curve with the growth rate reaching its minimum and maximum value in correspondence with a high and an intermediate degree of proportionality respectively. This result supports the increasing "success" of mixed electoral systems because it shows that a mixed electoral representation (characterised by an intermediate level of proportionality) is better, in terms of economic growth, than more extreme electoral representations. The reason is that mixed systems may, to a large degree, possess the different advantages of both PR and plurality systems, without having the respective systems' drawbacks. Therefore, they mitigate the classical representation-accountability trade-off proposed by theoretical literature. Besides, we enrich the literature by offering a new explanation for our findings in terms of the trade-off between *government* and *political (in)stability*. On the one hand, less proportional rules, promoting effective government, enforce *government stability*; but, on the other hand, given their lack of representativeness, they lead to *political instability*. On the contrary, more proportional systems enforce political stability in spite of government instability. In this light, mixed systems that combine PR and majoritarian elements balance political and government stability, thus promoting relatively high growth rates.

The paper is organised as follows: in section 2 we summarise the theoretical and empirical literature on the effects of electoral systems on growth and develop the hypotheses that we are going to test; in section 3 we describe the econometric model and variables; in section 4 we show the results and finally the conclusions are presented in section 5.

2. The literature and the testing of the hypothesis

Constitutional rules may affect economic growth through their influence on governments' economic policies (Persson and Tabellini, 2003; Rodrik, 1996) and countries' economic institutions (e.g. North, 1990; Persson, 2005; Hall and Jones, 1999). Acemoglu, (2005) points out that "different policies will map into different outcomes". In this light, it becomes especially important

to analyse the implications of electoral systems on growth. However, there is no consensus on the specific types of electoral features that will improve growth. The debate among scholars about electoral systems advocates an inevitability of theoretical trade-offs between representation and accountability (Persson and Tabellini, 2003) that emerges from the features of the two systems. In majoritarian elections the winner is the candidate who gets the most votes in the district[1]; they guarantee the accountability for the party in government but do not guarantee the representation of political minorities in Parliament. PR, instead, in which voters vote for a list of candidates drawn up by political parties and the number of elected candidates of each list is proportional to the votes received, grants accurate representation of voter desires but it does not assure that a clear cut majority can be held accountable for decisions.

Political economic literature emphasises the importance of political accountability in achieving economic growth (e.g. Ferejohn, 1986; Benhabib and Przeworski, 2005). When accountability is high, voters can and do vote out of office poorly performing politicians (e.g. Powell and Whitten, 1993). This, in turn, induces politicians to exert extra effort and opt for better macroeconomic policies (Persson and Tabellini, 2004). In majoritarian systems, a single and cohesive party government with a majority of parliamentary seats is able to implement its manifesto policies without the need to engage in post-election negotiations with coalition partners. This means it is easier for them to pass their economic policies. Therefore, both the accountability and the cohesion of government stimulate growth. If parties or candidates expect to win by a landslide, the incentives to exert effort or forego rents are weaker under plurality rule. One of the main problems with majoritarian elections is the sudden and substantive policy-alterations (Lijphart, 1999); policy and reform reversals have negative economic effects, as they create instability and render private investments less productive (Rodrik, 1991).

Instead, politicians under PR systems may want to propose universal redistributive programs (such as spending on broad-based public education programs and healthcare) to large and geographically dispersed groups of voters[2] that boost growth through increasing human capital (Mankiw et al., 1992, Milesi-Ferreti et al., 2002; Scartascini and Crain, 2001). Nevertheless, PR systems can produce broad and fractious coalitions. If coalition governments are formed via bargains between parties after elections, as is often the norm in PR systems, voters do not know a priori how their

[1] There are two types of majoritarian systems: simple majority, or "First-past-the-post", and absolute majority. The former occurs when the candidate who obtains the largest number of votes is elected. The latter combines the effects of both rounds of voting in an absolute majority vote in a single round of voting. The electorate votes for a single candidate and in declining order indicate their preferences for the remaining candidates. If no-one gets the absolute majority in the first election, then the candidate who receives the smallest number of votes is eliminated, and the corresponding second choices are counted.

[2] Several studies indicate that PR increases the share of public spending going to universal programs, while plurality rule increases the share going to special interest groups (e.g. Persson and Tabellini, 2004; Milesi-Ferretti et al., 2002).

votes will determine which party or parties govern, and which policies will then be followed. Moreover, under proportional rule it is harder to agree on which policies to pass, thus slowing down the adoption of policies which stimulate growth. To sum up, there are elements that encourage or discourage growth in both the electoral rules.

The empirical literature on that topic shows contrasting and non-robust results. Lijphart (1999) firstly found a small, positive effect of PR on GDP rate of growth. Powell (2000) examined elections in 20 democracies over 25 years and confirmed the hypothesis that majoritarian systems have an easier time passing economic policies resulting in higher economic growth rates. More recently, Persson (2005) highlights the empirical evidence that PR has a positive effect on GDP per capita and total factor productivity, but the effects are not robust. Persson and Tabellini (2006) find that PR promotes per capita GDP through the improvement of property rights protection and trade liberalisation but those results are not significant when studying democratising countries. Persson and Tabellini (2003) find non robust evidence for the hypothesis that PR increases productivity growth.

The recent view in political science is that, rather than assuming the trade-off between representation and accountable government, there are new electoral systems, mixed-member systems, attempting to maximise both objectives. Mixed systems, combining PR and majoritarian elements, sacrifice pure proportionality for the specific purpose of increasing the accountability and are now one the most attractive electoral rules. This implies an increasing interest on the part of political and economic scientists in exploring the direct effect that mixed systems have on economic growth. Carey and Hix (2011) argue that semi-PR systems usually generate the beneficial outcomes of PR systems without significantly reducing the accountability benefit of plural-majoritarian systems, thus producing relatively high growth rates.

So far, there have not been any comprehensive empirical studies on the effects of mixed systems on economic growth. Abelman and Pesevento (2007) find that countries with mixed electoral representations have higher levels of economic growth compared to countries with totally majoritarian or totally proportional systems.[3] Kostadinova (2002) compares mixed systems in Eastern European Countries and finds that they allow countries to enjoy the benefits of minority representation without sizeable government fragmentation.

We believe that empirical literature lacks in robust answers because either it does not consider mixed systems at all or considers them inappropriately. That is, the common features of empirical analyses on this topic are to identify electoral systems with dummy variables, neglecting their

[3] This positive effect of mixed systems on economic growth is statistically significant when data include only countries that have implemented democratic *policies within the last thirty years.

proportionality degree. Mixed electoral systems may provide a larger proportional element than others, that is, they may be designed by legislators with different degrees of proportionality.[4] As an example, Italy, in the time span under consideration (1979-2010), experienced mixed systems with different proportionality degrees. Until 1993 Italian elections were purely proportional. The referendum of April 18, 1993 switched the electoral system into a mixed one with a low proportionality degree; for the Senate (upper chamber), 3/4 of the 315 seats were assigned using the majoritarian criterion and the remaining 1/4 used the proportional one; for the Chamber of Deputies (lower chamber), 630 seats were distributed in 26 electoral districts; in each district, 75% of the seats were assigned with the majoritarian system and the remaining 25% with the proportional one. Law no. 270, December 20th 2005, changed the Italian electoral system again; it became a mixed one with a high degree of proportionality: both in the Chamber of Deputies and in the Senate, the seats are assigned with PR criterion but the law offers a "majority premium" to the coalition that gets the most votes.

Ideally, one can locate the various possible mixed systems on a continuum from most to least proportional and formulate expectations about their effects on economic growth. Therefore, only a continuous measure of such a proportionality degree would allow one to consider them properly in an empirical setting.

The literary contribution of the present work is twofold. The first consists in testing how the proportionality degree of electoral systems affect growth. We specify a cubic model that describes the relationship between the proportionality degree of an electoral system and growth. The cubic expression is one of the most general non-linear specifications of an empirical model. The choice of a non-linear model allows us to test the hypothesis that mixed systems, characterised by intermediate levels of proportionality, provide a better environment for productive economic policies. The reason would be that mixed rules mitigate two trade-offs: the first one, between accountability and responsiveness, proposed by theoretical literature; the second one, between *government* and *political (in)stability*, which is the second contribution that the present work provides to the literature. On the one hand, less proportional electoral systems promote cohesive governments which are able to implement their policies without the need for partners, which is the source of government stability.[5] On the other hand, less proportional systems are more politically

[4] Also the proportionality degree of PR systems may vary, even if in a shorter range. Both theoretical (Gallagher 1992; Lijphart 1986; Loosemore and Hanby 1971) and empirical (Gallagher 1991; Blondel 1969) literature propose to rank PR formulas according to their proportionality degree. The most widely accepted ranking is Lijphart's (1986), which considers the Hare and Droop largest remainder (LR) *method to be the most proportional, followed by the Sainte-Lagu¨e highest-average (HA) method, followed by Imperiali LR, d'Hondt HA, and Imperiali HA.

[5] Government stability means that governments have a long lifespan.

unstable[6] than more proportional ones. The source of this kind of instability lies in the lack of representativeness (of the minorities within the Parliament or the Committee) of the government to any change in popular opinion during its term in office.[7] The mixed variant, placing side by side the best features of less proportional practice (government stability) and the more proportional practice (political stability), sustains growth more than the two extreme electoral rules.

3. The econometric model and the variables

The neoclassical growth model can be written as (Caselli et al., 1996)

$$lnY_{i,t} - lnY_{i,t-1} = \beta lnY_{i,t-1} + \delta X_{i,t} + \alpha_i + \mu_t + \varepsilon_{i,t} \qquad (1)$$

where $Y_{i,t}$ is per-capita GDP in country i in period t, $X_{i,t}$ is a row vector of determinants of economic growth, α_i is a country specific effect, μ_t is a time-specific effect,[8] and $\varepsilon_{i,t}$ is an error term. Baltagi (2001) mentions that there are two main problems when considering the dynamic panel data regression of eq. (1). First, the lagged dependent variable as a regressor leads to autocorrelation. Second, $\ln Y_{i,t}$ is a function of α_i, hence $\ln Y_{i,t-1}$ would also be a function of α_i. Thus, $\ln Y_{i,t-1}$ which is a right-hand side regressor would be correlated with the error term. This tends to yield biased and inconsistent OLS estimators even if the $\varepsilon_{i,t}$ are not serially correlated. In order to solve this problem, Arellano and Bond (1991) proposed their "difference GMM estimator". Nonetheless, Blundell and Bond (1998) conclude that when the lagged dependent variable and the explanatory variables are persistent over time, lagged values of these variables are weak instruments for the regression equation in differences, which affect the asymptotic and small-sample performance of the difference. To face this issue, Arellano and Bover (1995) and Blundell and Bond (1998) propose the use of the "system GMM estimator", which is based on asymptotic and small sample properties, to diminish any potential biases in the finite samples estimator.

The use of the system GMM estimator in empirical growth research is strongly recommended by Bond et al. (2001). As Islam (1995) pointed out, estimating equation (1) is equivalent to estimating the following

$$lnY_{i,t} = (1+\beta) lnY_{i,t-1} + \delta X_{i,t} + \alpha_i + \mu_t + \varepsilon_{i,t} \qquad (2)$$

[6] Political instability means that successive majorities which govern are an expression of different political ideologies.

[7] Drazen (2000) provides two reasons why political instability may affect economic outcomes. Firstly, political instability creates uncertainty with respect to future institutions and policymakers which, in turn, alters the behaviour of private agents and firms with respect to the capital accumulation. In addition, it changes the incentives of policymakers who either try to increase their term in office and/or benefit from the position they have while they are in office. Secondly, political instability can have a direct effect on productivity because it disrupts market functioning and economic relations.

[8] The inclusion of time specific effect is important in the growth models because the means of the log output series typically increases over time.

Many panel data empirical growth models are based on the hypothesis of *conditional convergence*, namely that countries converge to their own steady-state, the level of which is a function of some variables. The coefficient β in eq. (1) and (2) measures the conditional convergence, that is, if $\beta<0$ there is conditional convergence.

In order to measure how the change in the proportionality degree of an electoral system affects economic growth we used the Gallagher (dis)proportionality (of the electoral outcome) index, proposed by Gallagher (1991). The Gallagher index (or least squares index) is a proper representation index of political parties within a Parliament;[9] because of the link between the kind of electoral system and the kind of political parties representation, it may be considered as a very good proxy for the measure of proportionality of an electoral system. Indeed, theoretical literature states (see Persson and Tabellini, 2000) that the electoral system that guarantees a greater representation of political parties is a more proportional one while the less representative one is less proportional. Blais (1988) confirmed that it is possible to classify electoral systems according to their electoral outcomes; moreover, empirical studies have shown that a majoritarian system produces a higher level of disproportionality than a proportional representation system (Lijphart, 1994; Anckar, 2002), whereas a mixed-electoral system produces an intermediate level (Powell and Vanberg, 2000; Anckar, 2002). The Gallagher index (thereafter *GI*) is constructed as

$$GI = \sqrt{\frac{1}{2}\sum_i (v_i - s_i)^2}$$

where v_i and s_i are respectively the share of votes and of seats of a single political party (i=1,...., n political parties) at elections in each country within the considered time span. The index can take values from 0 to 100 with 0 indicating perfect proportionality between seats and votes and 100 meaning that the only seat at stake goes to the winner. Clearly the bounds of the *GI* (0 and 100) are only theoretical values. The *GI* among the investigated countries ranges from 0.26 to 33.25. Countries that experienced plurality, PR and mixed systems fall in this range, as table A.1 in Appendix A shows. In the time span 1979-2011, some countries maintained the same electoral system, while other countries changed it (as in the case of Italy, in the previous section). The majority of countries have had democratic elections since the '80s; only two countries started having democratic elections from the year 2000 (Albania, Croatia).[10] In table 1 below, we provide the descriptive statistics of *GI* according to the three electoral rules.

[9] This continuous measure of proportionality of the electoral system is inspired by Duverger's Laws: "The majoritarian single ballot system tends to party dualism; the double ballot majority system and the proportional system tend to a multipartitism". Those Laws state a multiplying effect of proportional representation.

[10] It is clear that before the first year of a democratic election, *GI* shows missing values.

Table 1: *GI* statistics according to electoral systems, 1980-2011

PR				MIXED				PLURALITY			
Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
4.6	4.4	0.26	29.4	7.8	4.9	0.91	30.2	14.4	7.5	1.3	33.25

It can be noticed that the mean of *GI* under the heading PR is lower than that under MIXED that, in its turn, is lower than that under PLURALITY; it confirms that *GI* is a good proxy for electoral systems. A further proof is given by the analysis of Italy; we find that the mean of *GI* for Italy is 2.6 between 1980-1993 (when the electoral system was proportional), 8.44 between 1994-2005 (when the electoral system became less proportional) and 5.02 between 2006-2011 (when the electoral system switched back to a more proportional one). Sometimes, for the same value of *GI*, electoral systems overlap. This happens because the *GI* is a proper representation index.

The literature surveying empirical growth models suggests a long list of variables claimed as statistically significant determinants of growth. The typical empirical study limits attention to a small number of variables of particular interest. Following the most accredited empirical studies on growth[11] the following list presents the control variables used in our empirical growth model:[12]

- Private investment/GDP (thereafter *I*); it is a proxy for the saving rate. We expect a positive relation with economic growth. An issue of causal relationship between private investments and growth may emerge: private investments are high because of a high rate of growth. In order to take this problem into account, we consider *I* as endogenous.
- Population growth rate (thereafter ΔPop). As the Solow growth model predicts, we expect a negative sign for this variable.
- A measure of the human capital (thereafter *HC*). It is a composite measure of the investment in education and health. Of course larger investments in human capital increase economic activity. Its effect on GDP growth is expected to be positive.
- General government consumption expenditure/GDP (thereafter *G*); it controls for public budget management. The impact of government consumption spending on economic growth is not predictable.[13] Some expenses may have a positive effect (such as on education and health) and others a negative effect.

[11] See Grossman (1972), Barro and Sala-i-Martin (1995).
[12] Table A.2 in Appendix A provides a detailed description of variables.
[13] Barro (1991) finds that growth is inversely related to the share of government consumption in GDP. Levine and Zervos (1993) measure the role of government in economic activity by using the ratio of government consumption to GDP and also find a negative, insignificant relationship between government consumption to GDP and growth. Clearly, where the composition of government expenditure on health and education (measured as a share of GDP) is considered, the above conclusion must be revised because the relationship between government spending and growth of per capita income (Gallup et al. 1998) has a positive sign.

- Level of export/GDP (thereafter *Exp*); it controls for the level of openness of a country. We expect a positive sign.
- The Polity IV index (thereafter *Polity*); it controls for the level of democracy of a country.
- The latitude (thereafter *Latitude*), ethnicity (thereafter *Ethnic*) and religion (thereafter *Religion*) of a country. Alesina et al. (2003) consider them as robust determinants of growth.[14]

Table 2 below shows the descriptive statistics of all variables.

Table 2: Statistics

Variable	Mean		Std. Dev.	Min	Max	Observations
GI	7.45	overall	6.39	0.26	33.25	N = 2005
		between	5.22			n = 91
		within	3.66			T = 22
ΔPop	0.013	overall	0.75	-0.78	3.92	N = 2900
		between	0.02			n = 91
		within	0.07			T = 31
I	0.22	overall	0.08	0.007	1.05	N = 2783
		between	0.06			n = 88
		within	0.06			T = 31
G	0.19	overall	0.09	0.04	1.55	N = 2783
		between	0.06			n = 88
		Within	0.06			T = 32
HC	2.48	overall	0.55	1	3.6	N = 2649
		between	0.52			n = 83
		within	0.19			T = 32
Exp	0.26	overall	0.29	2.93	6.85	N = 2783
		between	0.22			n = 88
		within	0.18			T = 32
Polity	3.26	overall	14.58	-88	10	N = 2727
		between	8.78			n = 87
		within	11.56			T = 32
Latitude	23.18	overall	27.43	-36.9	63.9	N = 3003
		between	27.24			n = 91
		within	2.61			T = 33
Ethnic	0.39	overall	0.24	0.002	0.93	N = 3003
		between	0.24			n = 91
		Within	0			T = 33
Religion	0.41	overall	0.23	0	0.86	N = 2937
		between	0.23			n = 89
		within	0			T = 33

As said in the previous paragraph, in order to test our hypothesis about the effect of the proportionality degree of an electoral system on growth, we specify and estimate a cubic function as follows:

$$lnY_{i,t} = (1+\beta)lnY_{i,t-1} + \gamma_1 GI_{i,t} + \gamma_2 GI_{i,t}^2 + \gamma_3 GI_{i,t}^3 + \delta X_{i,t} + \alpha_i + \mu_t + \varepsilon_{i,t} \qquad (3)$$

Estimation of equation (3) shows a short-run analysis of growth, that is, we consider the short run effect of the *GI* on economic performance. But many panel data studies in economic growth fields (i.e., Islam, 1995) have averaged data over non-overlapping three/four/five-year periods. This is

[14] Table A.3 shows the correlation between regressors.

because variation in growth rates at annual frequencies may give very misleading answers about the long term growth process. In a second set of estimations we take into account the long run effects of the *GI* (and other variables) on economic performance, averaging observations over eleven non-overlapping 3-year intervals from 1979 to 2010.[15]

4. Results

We estimate the dynamic panel data growth model as in equation (3) using the Arellano-Bover (1995)/Blundell-Bond (1998) system GMM panel data techniques. The empirical analysis has been conducted on a panel of 91 countries[16] over 32 years (from 1979 to 2010).

Table 3 shows the estimation results when the dependent variable is the annual rate of growth (as $lnY_{i,t} - lnY_{i,t-1}$) of country *i* at time *t*. In order to control for heteroskedasticity, every estimated equation has robust standard errors. The third-to-last row of table 3 displays the number of instruments; the second-to-last row shows the Chi^2 (and the p-value in parenthesis) of the Hansen test whose null hypothesis is that over-identification restrictions are valid, that is, under the null, all the instruments are exogenous; we do not reject the null and the model is correctly specified.[17] The last row of table 3 displays the p-value of the Arellano-Bond test for second-order autocorrelation in the first differenced residuals: in all the specifications there is no autocorrelation of residuals. We follow the standard practice of counting a country as democratic according to its score of Polity IV index, that is, we restrict the sample to countries with a score of Polity IV greater than +3 in the year of election (Gleditsch and Hegre, 1997).

First of all, in every specification in table 3, the coefficient of the lagged dependent variable is negative and highly significant. Noting that it is calculated as $\hat{\beta} - 1$ (where $\hat{\beta}$ is the estimated coefficient of $lnY_{i,t-1}$), and given that it is between -1 and 0, it means that countries converge to their own steady state.

Table 3: Estimations. Dependent variable: annual rate of growth

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
lnY(-1)	-0.13***	-0.13***	-0.14***	-0.14***	-0.14***	-0.14***	-0.14***	-0.13***
	(22)	(19)	(16)	(20)	(20)	(20)	(18)	(23)

[15] We choose a 3-year period instead of a 4/5-year period in order to have more data time point for each country.

[16] Countries are: Albania; Angola; Argentina; Australia; Austria; Bahamas; Bangladesh; Belgium; Bolivia; Botswana; Brazil; Bulgaria; Canada; Chile; Colombia; Costa Rica; Croatia; Cyprus; Czech Republic; Denmark; Dominican Republic; Ecuador; Egypt; El Salvador; Finland; France; Germany; Greece; Guatemala; Guinea-Bissau; Guyana; Honduras; Hungary; Iceland; India; Indonesia; Iraq; Ireland; Israel; Italy; Jamaica; Japan; Latvia; Liberia; Lithuania; Luxembourg; Malaysia; Malta; Mexico; Moldova; Mongolia; Montenegro; Morocco; Mozambique; Namibia; Netherlands; New Zealand; Nicaragua; Niger; Norway; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Portugal; Romania; Russia; Senegal; Serbia; Slovakia; Slovenia; South Africa; South Korea; Spain; Sri Lanka; Suriname; Sweden; Switzerland; Taiwan; Thailand; Togo; Trinidad & Tobago; Turkey; Ukraine; United Kingdom; United States; Uruguay; Venezuela; Zambia.

[17] We also compute, but we do not show, the difference-in-Hansen test in order to test the joint validity of the full instrument set; we do not reject the null, therefore the full set of instruments is jointly valid.

GI	-0.02**	-0.022**	-0.024**	-0.017**	-0.017**	-0.016**	-0.018**	-0.014**
	(-2.4)	(-2.3)	(-2.1)	(-2)	(-2)	(-2.04)	(-2.07)	(-2.07)
GI^2	0.002**	0.002**	0.002**	0.0014**	0.0014**	0.0014**	0.0016**	0.0012**
	(2.26)	(2.2)	(2)	(2)	(2)	(2.06)	(2.1)	(2.1)
GI^3	-0.00004**	-0.00004**	-0.00004**	-0.00004**	-0.00003**	-0.00003**	-0.00004**	-0.00003**
	(-2.26)	(-2.2)	(-2.1)	(-2.05)	(-2.06)	(-2.15)	(-2.2)	(-2.2)
I	0.73***	0.73***	0.75***	0.68***	0.68***	0.64***	0.65***	0.61***
	(5)	(5)	(4.6)	(4.3)	(4.3)	(4.1)	(4.1)	(4)
I(-1)	0.01	0.03	-0.01	-0.06	-0.06	-0.07	-0.06	-0.14
	(0.06)	(0.16)	(-0.06)	(-0.3)	(-0.3)	(-0.4)	(-0.3)	(-0.9)
HC	0.75*	0.18**	0.20**	0.20***	0.18***	0.18***	0.19***	0.15***
	(1.66)	(2.43)	(2.3)	(2.7)	(2.6)	(2.6)	(2.6)	(2.6)
HC(-1)	-0.57							
	(-1.4)							
G	-0.30***	-0.36**	-0.4**	-0.6***	-0.6***	-0.6***	-0.62***	-0.52***
	(-3.3)	(-2.24)	(-2.1)	(-2.7)	(-2.7)	(-2.7)	(-2.6)	(-2.7)
G(-1)	-0.06							
	(-0.64)							
ΔPop	-1.72	-1.76	-1.81	-1.82	-1.80	-0.3	-0.47	-0.05
	(-1.6)	(-1.56)	(-1.41)	(-1.48)	(-1.48)	(-0.3)	(-0.4)	(-0.05)
Polity			0.003	0.003	0.003	0.003	0.003	0.002
			(1.3)	(1.4)	(1.4)	(1.4)	(1.4)	(1.4)
Exp				0.13**	0.15**	0.14**	0.14**	0.11**
				(2.24)	(2.4)	(2.4)	(2.4)	(2.3)
Exp(-1)				0.02				
				(1.4)				
Latitude						0.001**	0.001*	0.001*
						(2.06)	(1.91)	(1.7)
Religion							-0.01	0.03
							(-0.3)	(0.7)
Ethnic								-0.16**
								(-2.2)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
N. obs.	1707	1707	1603	1603	1603	1603	1594	1594
N. instrum.	44	42	43	45	44	45	46	47
Chi^2 (p-value) Hansen test	1.06	1.03	1.85	1.72	1.7	1.8	1.83	1.85
	(0.5)	(0.5)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)
p-value 2nd order autocorrelation	0.2	0.22	0.43	0.7	0.6	0.6	0.6	0.5

Notes. All regressions contain calendar year dummies (results not reported); the time span is 1979-2010. The dependent variable is $[\ln Y_{i,t} - \ln Y_{i,t-1}]$. The variable *I* is treated as endogenous. Standardised normal *z*-test values are in parentheses. Standardised normal z-test values are in parentheses; robust standard errors. We restrict the sample to countries with a score of Polity IV greater than 3. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Column (a) shows the estimation result with matrix *X* containing only the standard determinants of growth, such as private investments, population growth rate, public consumption spending and human capital. They are inserted contemporaneously and one year lagged because such variables are expected to exercise their effects on the GDP rate of growth, even one year later. The estimation shows that the lagged coefficients are not significant; therefore, in order to find a better specification of the model, we estimate equation (3) without the lags of *HC* and *G*. Column (b) shows that all the contemporaneous coefficients become significant; in the following estimations we confirm the specification as in (b) and we add, one by one, all the other control variables listed above, as a robustness check of the results.

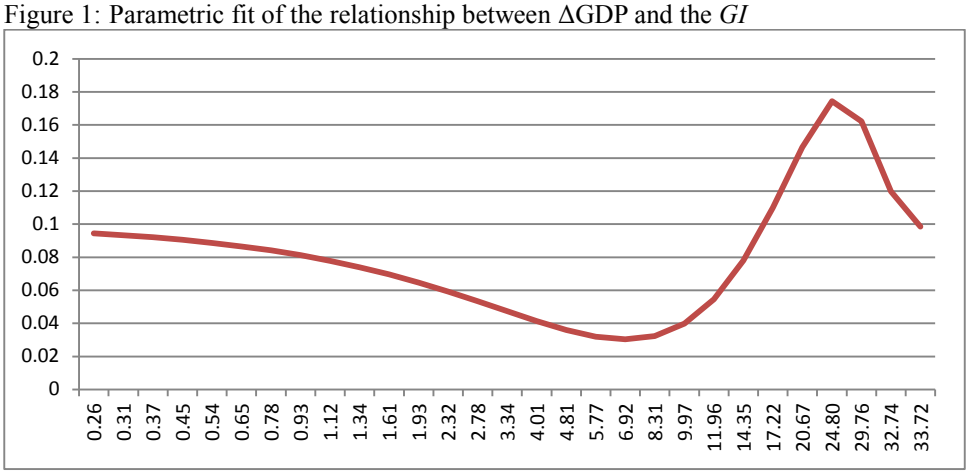
In every specification in table 3 the coefficients of *GI*, GI^2 and GI^3 are highly significant and their signs alternate, the first one (*GI*) being negative.

In order to graph the effect of the *GI* index on growth, by using the estimated coefficients in column (b), we use the following equation:

$$\Delta GDP = -0.022GI + 0.002GI^2 - 0.00004GI^3 \qquad (4)$$

Given that ideally one can locate the various possible mixed systems on a continuum from the most to the least proportional, in figure 1 below we have constructed, on the horizontal axis, a scale of disproportionality index values starting with the minimum value (among countries) and increasing it by 1.1 up to the maximum value; then we have calculated the per capita rate of growth according to equation (4) using the estimated coefficients of *GI*, GI^2, GI^3.

Figure 1: Parametric fit of the relationship between ΔGDP and the *GI*



From the graph above, it emerges that the relationship between the proportionality degree of the electoral system and growth has a minimum and maximum value. The value of *GI* which maximises growth rate is about 26, while the value of *GI* which minimises growth rate is about 7. This shape of the proportionality degree-growth relationship confirms our hypothesis that the proportionality degree is significant in explaining how electoral systems affect growth. In figure 1, moving from the extreme left of the horizontal axis towards the right, up to the minimum value of the growth rate, it is reasonable to believe that the electoral rule, within that range, remains proportional, with a decreasing proportionality degree. The PR degree of proportionality may vary according to factors such as the precise formula used to allocate seats, the number of seats in each constituency or in the elected body as a whole and the level of any minimum threshold for elections (see footnote 4). In this portion of the *GI*, cutting down the proportionality degree of the electoral rule within PR systems without adding any majoritarian elements, implies the reduction of the PR benefits without the counterbalance of plurality benefits. This is the reason why the growth rate decreases in figure 1. When the *GI* goes above 7, it is also reasonable to believe that the corresponding electoral system has become mixed. Figure 1 suggests that, as the proportionality

degree of mixed systems decreases, the growth rate rises to its maximum value; then it drops when the proportionality degree of the electoral system becomes very low. We will explain this shape of the relationship curve between the proportionality degree and growth rate according to the two trade-offs that mixed systems mitigates. The first one is the trade-off between accountability and representation: mixed systems, putting together the best features of majoritarian practice (accountability) and the proportional method (representation), stimulate growth rate. Moreover, we offer another new interesting interpretation of the curve shown in figure 1 in the light of the trade-off between *government* and *political (in)stability*: mixed systems reduce both government and political instability enhancing growth. In more detail, in the increasing portion of the growth rate in figure 1 (which corresponds to the interval of *GI* [7-26]), a small reduction in the proportionality degree of mixed rule implies that the marginal substitution between political stability in favour of government stability is beneficial for growth. While considering mixed electoral rules with an always lower proportionality degree (*GI*>26), the same marginal substitution leads to a growth decrease: this happens because political stability almost disappears. Finally, it is interesting to underline that, as figure 1 shows, we can find a value for *GI* which maximises the growth rate. This result means that, for governors, a "best" proportionality degree for a mixed system can be reached; and it is just that one which balances accountability and representation, such as political and government stability, in order to maintain their independence and reinforce them each other.

This result remains robust with the introduction of all the control variables that we have listed above, as shown in table 3. The private investment (the variable *I*) is a proxy for the capital accumulation process. As already mentioned, $I_{i,t}$ is treated as endogenous. The contemporaneous coefficient is always positive and significant, as expected, while the lagged coefficient is always insignificant. The contemporaneous coefficient is about 0.7 meaning that if private investment increases by 1% the growth rate rises by 0.7%.

The effect of *HC* on countries' growth is positive and significant everywhere. *HC* is a proxy for human capital: countries with a more developed labour force, rather than less-skilled workers, are more likely to increase their production from any given resource base, because they invest in education and public health care (Easterly and Rebello, 1993; Mankiw et al., 1992). Moreover, according to Romer (1990), countries with a quality developed labour force are able to generate new products or ideas that are the foundation for technological progress.

G is the level of public consumption spending/GDP. It is negative and highly significant everywhere in table 3, meaning that public consumption spending negatively affects growth. In general, the impact of public consumption on growth is negative because it is a non-productive expense that requires financing through taxation which is detrimental to growth. Its coefficient is,

on average over estimations, equal to 0.5 meaning that the growth rate increases by 5% as the *G* rises by 1%.

$\Delta Pop_{i,t}$ is negative but never significant. The negative sign is perfectly in line with the classical assumption of the Solow growth model: as the population grows, if all else is constant, the per capita rate of growth of the economy decreases.

From specifications (c) we control for the Polity IV index of democracy; *Polity* is never significant. In order to control for the degree of openness of a country we introduce the variable *Exp* from (d). It enters contemporaneously and one year lagged. The contemporaneous coefficient is positive and significant as expected but the lagged is not significant; therefore it is dropped in the following estimations. The magnitude of the coefficient means that an increase of 1% in the share of export/GDP implies an increase of 0.13 in the rate of growth.

La Porta et al. (1999) argues that legal origin, distance from the Equator and ethnolinguistic fractionalisation all explain the quality of government. Therefore, it is recommended to control for them in a growth model. *Latitude* is positive and always significant; the positive sign confirms the previous studies on the impact of the absolute latitude on growth (see Sala-i-Martin, 1997; Bloom and Sachs, 1998; Rodrik at al., 2004). While we expect that ethnic fractionalisation is associated with negative outcomes in terms of the quality of government, religion fractionalisation would have a positive correlation with measures of good governance. Our results confirm those predictions: *Ethnic* has a negative and significant sign while *Religion* is not significant.

An important issue here is to deal with the possibility of endogeneity of the Gallagher index. To the best of our knowledge, none of the theoretical and empirical literature analysing the link between electoral rules and growth deals with this problem: all consider electoral systems the first as a determinant of growth and not the reverse. We believe that if the electoral system was affected by growth, the problem of governors' choice, of one electoral rule rather than another would not arise. But, an endogeneity problem may arise when dealing with political institutions, that is, there may be some omitted factors that influence political systems and simultaneously influence economic growth. In order to deal with the possible endogeneity of *GI* we perform the *C* test (or the "difference in Hansen test") on the *GI* variable. If *GI* is exogenous, under the null the Hansen statistic tests the validity of a subset of orthogonality conditions. Under the alternative, a subset of the original set of instruments is endogenous, and the remainder are still exogenous. In GMM terms there is a smaller set of orthogonality conditions. Therefore, in order to perform the *C* test we have to estimate two models, one where *GI* is exogenous and another where the *GI* is endogenous. The estimation of the first model gives us a Hansen statistic (H1) and the estimation of the second model gives us another Hansen statistic (H2). We need to use the same set of exogenous instruments for

both estimations, meaning that we have to assume all the other orthogonality conditions hold, that is, all the other included and excluded instruments remain exogenous. H1 and H2 are both distributed as a Chi^2 with the dof of H2 smaller than the dof of H1. The endogeneity test on *GI* is simply a test of H1-H2. The test statistic H1-H2 is distributed as Chi^2 with dof equal to the number of regressors being tested for endogeneity (in our case, 1). If they are endogenous, then H1-H2 will be high because H1 is high but H2 is not. The result of the two estimations is given in table A.4 in the Appendix. The estimation in (b) is the same as in table 3; the estimation in (b') treats GI as endogenous. Now we compare the two Hansen tests: (H1-H2) is distributed as a Chi^2 with dof=1 and it is equal to 0.32. We do not reject the null at 1% therefore *GI* is exogenous.

As a further analysis of the robustness of our results, we perform another set of estimations where all the variables are averaged over 11 non-overlapping 3-year period from 1979 to 2010 in order to take into account their long run effect on growth, as said in the previous section. Results are shown in table A.5 in the Appendix. Now the dependent variable is $[\ln Y_{i,t} - \ln Y_{i,t-\tau}]$ where $Y_{i,t}$ is the three-year mean of the per capita GDP and $Y_{i,t-\tau}$ is the mean of the per capita GDP for the previous three years. The estimation technique is the Arellano-Bover (1995)/Blundell-Bond (1998) system GMM. The *GI*, GI^2 *and* GI^3 remain highly significant and their signs do not change. We can comment on the other control variables as in table 3 with the exception of *I* and *Exp*. Although they have a positive sign, they are not significant here; however *ΔPop* becomes significant.

5. Concluding remarks

This work investigates how the degree of proportionality of an electoral representation affects the rate of growth of per capita GDP. We chose a continuous measure of the electoral system degree of proportionality in order to properly consider mixed systems in an empirical setting - this has never been done before. Graphically it emerges that our results confirm the recent success of mixed rules. The explanation is twofold. Firstly, in mixed systems the beneficial accountability characteristics of plurality/majoritarian systems, (which may induce office-motivated politicians to enact growth-promoting policies), are put beside the beneficial representativeness characteristics of PR (which induce politicians to enact public policies that benefit broad rather than narrow interests). Secondly, a mixed method enhances both political and government stability stimulating a relatively high growth rate. To sum up, electoral representations with an intermediate degree of proportionality sacrifice a little representativeness in favour of greater governability. Our result suggests that a "best" representation degree can be reached using the Gallagher index as the measure. Further research will be needed in order to understand how legislators should design mixed systems that have such a proportionality degree.

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Appendix A

Table A.1: Distribution of countries according to their electoral system, 1979-2010

PR	Mixed	Plurality
Argentina, Austria, Belgium, Costa Rica, Denmark, Ecuador El Salvador (since 1998), Finland, Guinea-Bissau (Since 2007), Guyana, Iceland, Indonesia, Ireland, Israel, Italy (since 1980 to 1993), Luxembourg, Malta, Moldova (since 1994), Mongolia 2009, Mozambique (since 1995), Namibia (since 1989), Netherlands, Nicaragua (since 1987), Norway, Paraguay, Peru (since 1981), Poland (since 1990 to 2006), Portugal, Luxembourg, Malta, Moldova (since 1994), Mongolia 2009, Mozambique (since 1995), Namibia (since 1989), Netherlands, Nicaragua (since 1987), Norway, Paraguay, Peru (since 1981), Poland (since 1990 to 2006), Portugal, Romania (since 1991 to 2006), Slovakia (since 1993), Slovenia (since 1992), South Africa, Sri Lanka, Suriname (since 1988), Sweden, Turkey (since 1984), Ukraine (since 2007), Uruguay (since 1985).	Albania (since 1992), Australia, Bolivia (since 1983), Brazil, Croatia (since 1993), Czech Rep. (since 1991), Dom. Rep., El Salvador (since 1983 to 1997), Germany, Greece, Guatemala (since 1986), Honduras (since 1982), Hungary (since 1991), India, Italy (since 1994), Japan, Lithuania (since 1993), Mozambique (in 1994), New Zealand (since 1993), Philippines (since 1999), Poland (since 2007), Romania (since 2007), Senegal, South Korea, Spain, Suriname (1980), Switzerland, Taiwan (since 1992), Ukraine (since 1998 to 2003)	Bahamas, Bangladesh, Botswana, Canada, Chile (since 1990), France, Jamaica, Mongolia (since 1993 to 2008), New Zealand (since 1980 to 1992), P. N. Guinea, Philippines (since 1988 to 1997), Thailand, Trinidad-Tobago, Ukraine (since 1994 to 1997), UK, USA, Zambia (since 1992)

Source: Database of Political Institutions 2012. Mixed systems are those in which both PR and plurality elements coexist. Our Elaborations.

Table A.2: Variables description

lnY	Natural logarithm of gross domestic product at constant price 2000 US. Source: World Bank, 1980-2011.
GI	Gallagher Disproportionality index. Source: Gallagher Electoral Disproportionality Data, 1945-2011http://www.tcd.ie/Political_Science/staff/michael_gallagher/ElSystems/Docts/ElectionIndices.pdf.
Δpop	Population rate of growth. Source: World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects, 1980-2011.
I	Share of gross capital formation at current PPPs this category follow the definitions of the System of National Accounts (SNA). Source Penn World Table 8.0
HC	Index of human capital per person, based on years of schooling (Barro/Lee, 2012) and returns to education (Psacharopoulos, 1994). Source: Source Penn World Table
G	Share of government consumption at current PPPs this category follow the definitions of the System of National Accounts (SNA). Source Penn World Table 8.0
Exp	Share of merchandise exports at current PPPs this category follow the definitions of the System of National Accounts (SNA). Source Penn World Table 8.0
Polity	The Polity IV index is a combined polity score ranging from -10 (strongly autocratic) to +10 (strongly democratic), reached by subtracting the autocracy score from the democracy score. The democracy and autocracy indexes were originally constructed additively based on the following indicators: competitiveness of executive recruitment, openness of executive recruitment, constraints on chief executive, regulation of participation, and competitiveness of participation. Scholars have reduced the index to a dichotomous measure of democracy and autocracy.
Latitude	Degrees of latitude is the distance from the equator. Source: Robert E. Hall and Charles I. Jones, http://www.stanford.edu/~chadj/HallJones400.asc
Religion	The index of religious fractionalisation is based on data from the Encyclopaedia Britannica, 2001 Data source Source Key: eb=Encyclopaedia Brit, cia=CIA, sm=Scarrit and Mozaffar; lev=Levinson, wdm=World Directory of Minorities, census=national census data; upload from http://www.anderson.ucla.edu/faculty_pages/romain.wacziarg/downloads/ fractionalisation.xls
Ethnic	The variable ethnic fractionalisation combines the language variable above with other information about racial characteristics (normally skin colour). Groups were classified as different if they spoke a different language and/or had different physical characteristics. Data source Source Key: eb=Encyclopaedia Brit, cia=CIA, sm=Scarrit and Mozaffar; lev=Levinson, wdm=World Directory of Minorities, census=national census data; upload from http://www.anderson.ucla.edu/faculty_pages/romain.wacziarg/downloads /fractionalisation.xls

Table A.3: Correlations

	GI	***Δpop***	***I***	***G***	***HC***	***Exp***	***Polity***	***Latitude***	***Religion***	***Ethnic***
GI	1									
Δpop	0.05	1								
I	-0.14	-0.02	1							
G	0.07	-0.01	-0.27	1						
HC	-0.14	-0.12	0.28	0.05	1					
Exp	-0.19	-0.04	0.11	0.25	0.25	1				
Polity	-0.007	-0.02	0.1	-0.04	0.23	-0.01	1			
Latitude	-0.04	-0.06	0.13	0.2	0.3	0.2	0.08	1		
Religion	0.11	-0.02	0.03	-0.03	0.3	0.01	0.03	-0.15	1	
Ethnic	0.12	0.04	-0.29	0.005	-0.3	-0.14	-0.13	-0.4	0.19	1

Table A.4:
Estimations for the *C* test.

	(b)	(b')
lnY(-1)	-0.13***	-0.13***
	(19)	(12)
GI	-0.022**	-0.01
	(-2.3)	(-0.1)
GI^2	0.002**	0.001
	(2.2)	(0.1)
GI^3	-0.00004**	-0.00002
	(-2.2)	(-0.12)
I	0.73***	0.73***
	(5)	(5)
I(-1)	0.03	0.01
	(0.16)	(0.04)
HC	0.18**	0.18**
	(2.43)	(2.2)
G	-0.36**	-0.36**
	(-2.24)	(-2.25)
ΔPop	-1.76	-1.63
	(-1.56)	(-0.9)
Time dummies	yes	yes
N. instrum.	42	41
Chi^2 Hansen test (dof)	1.03	0.71
	(2)	(1)

Notes. All regressions contain calendar year dummies (results not reported); the time span is 1979-2010. The dependent variable is $[\ln Y_{i,t} - \ln Y_{i,t-1}]$. The variable *I* is treated as endogenous. Standardised normal *z*-test values are in parentheses. Standardised normal z-test values are in parentheses; robust standard errors. We restrict the sample to countries with a score of Polity IV greater than 3. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).

Table A.5: Estimations. Dependent variable: three-year mean of the per capita GDP rate of growth

	(i)	(l)	(m)	(n)	(o)	(p)
lnY(-1)	-0.21***	-0.14***	-0.2***	-0.21***	-0.21***	-0.22***
	(16)	(23)	(13)	(13)	(14)	(14)
GI	-0.36***	-0.02**	-0.02**	-0.02**	-0.02**	-0.02**
	(-2.59)	(-2.04)	(-1.97)	(-1.97)	(-2.1)	(-2.07)
GI²	0.002**	0.0014*	0.0018*	0.0018*	0.002*	0.002*
	(2.28)	(1.6)	(1.74)	(1.75)	(1.87)	(1.74)
GI³	-0.00004**	-0.00003	-0.00003	-0.00003*	-0.00004	-0.00004
	(-2.07)	(-1.4)	(-1.6)	(-1.65)	(-1.76)	(-1.61)
I	0.71**	0.5	0.47	0.44	0.46	0.45
	(2.35)	(1.5)	(0.98)	(0.9)	(1)	(1)
HC	0.23**	0.15**	0.19**	0.19**	0.2**	0.18**
	(2. 3)	(1.96)	(1.99)	(2.02)	(2.1)	(2.01)
G	-0.95***	-0.6**	-1.2*	-1.3**	-1.3**	-1.3**
	(-2.9)	(-2.1)	(-1.93)	(-2.04)	(-2.05)	(-2.1)
ΔPop	-0.1***	-0.07**	-0.1**	-0.1**	-0.1**	-0.1**
	(-3.04)	(-2.01)	(-2.2)	(-2.1)	(-2.24)	(-2.2)
Polity		0.003***				
		(2.7)				
Exp			0.22	0.22	0.2	0.2
			(1.5)	(1.56)	(1.5)	(1.5)
Latitude				0.001*	0.001**	0.001**
				(1.88)	(2.1)	(1.96)
Religion					0.003	0.06
					(0.04)	(0.7)
Ethnic						-0.16*
						(-1.7)
Time dummies	yes	yes	yes	yes	yes	yes
N. obs.	568	537	568	568	564	564
N. instrum.	27	28	28	29	30	31
Chi² (p-value) Hansen test	4.86	5.9	7.6	7.4	7.3	7.3
	(0.8)	(0.7)	(0.5)	(0.5)	(0.6)	(0.6)
p-value 2nd order autocorrelation	0.3	0.3	0.3	0.3	0.3	0.3

Notes. All regressions contain calendar year dummies (results not reported); the time span is 1979-2010. The dependent variable is $[\ln Y_{i,t} - \ln Y_{i,t-\tau}]$ where $Y_{i,t}$ is the three-year mean of the per capita GDP and $Y_{i,t-\tau}$ is the mean of the per capita GDP in the previous three year. The variable *I* is treated as endogenous. Standardised normal *z*-test values are in parentheses. Standardised normal z-test values are in parentheses; robust standard errors. Two-step estimations with Windmeijer (2005) correction. We restrict the sample to countries with a score of Polity IV greater than 3. Significant coefficients are indicated by * (10% level), ** (5% level) and *** (1% level).