

# Economic performance, government size, and institutional quality

António Afonso · João Tovar Jalles

Published online: 12 March 2015  
© Springer Science+Business Media New York 2015

**Abstract** This paper studies the empirical link between government size, institutions and economic activity using a panel of 140 countries over 40 years. Our results, robust under different econometric techniques, show mostly a negative effect of government size on output, while institutional quality has generally a positive impact. Moreover, the detrimental effect of government size on economic activity is stronger the lower institutional quality, and the positive effect of institutional quality on output increases with smaller government sizes.

**Keywords** Production function · Institutions · Globalization · GMM · Pooled mean group · Common correlated effects

**JEL Classification** C10 · C23 · H11 · H30 · O40

---

We thank two anonymous referees for very useful comments. The opinions expressed herein are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

---

A. Afonso  
Department of Economics, UECE—Research Unit on Complexity and Economics,  
ISEG/UTL—Technical University of Lisbon, Lisbon, Portugal  
e-mail: aafonso@iseg.utl.pt

A. Afonso  
Directorate General Economics, European Central Bank, Kaiserstraße 29,  
60311 Frankfurt am Main, Germany

J. T. Jalles (✉)  
Center for Globalization and Governance, Nova School of Business and Economics,  
1099-032 Lisbon, Portugal  
e-mail: joaojalles@gmail.com

## 1 Introduction

Governments tend to absorb a sizeable share of society's resources and, therefore, they affect economic development and growth in many countries.<sup>1</sup> Throughout history high levels of economic development have been attained with government intervention. Where government did not exist, little wealth was accumulated. However, despite necessary, government intervention is not a sufficient condition for prosperity, if it leads to the monopolization of the allocation of resources and other important economic decisions, and societies did not succeed in attaining higher levels of income.<sup>2</sup>

Theoretically there can be a point for a positive effect of government spending on growth, essentially via a Keynesian view upon which the government impulse to aggregate demand plays an upward role. Usually, one would then call upon fiscal policy to expand in order to foster growth, *ceteris paribus*. On the other hand, the negative effect of government spending on growth can stem from the ideas of the fiscal theory of the price level, where after a contraction in government spending, the creation of expectations on consumers point to future lower taxes and an upward push in growth, also *ceteris paribus*.

In addition, economic progress is limited when government is zero percent of the economy (absence of rule of law, property rights, etc.), but also when it is closer to 100 percent (the law of diminishing returns operates in addition to, e.g., increased taxation required to finance the government's growing burden—which has adverse effects on human economic behaviour, namely on consumption decisions). This idea is related to the so-called “Armey Curve” (Armey and Armey 1995), who borrowed a graphical technique popularized by Arthur Laffer. Friedman (1997) suggested that the threshold at which government affects economic growth is between 15 and 50 % of the corresponding national income.

The existing literature assesses identification issues related with establishing the growth effects of different types of public spending and taxation (notably the empirical work spanning from Barro 1990 to Gemmill et al. 2011), and also presents mixed results as to the relationship between government size and economic development (Wahab 2011). On the debate between the positive versus negative effects of government growth, Grossman (1988) suggested that a non-linear model was preferred in explaining its impact on total economic output (see Wu et al. 2010 for a recent study conditioning on the level of economic development).

On the one hand, government activities may have positive effects due to beneficial externalities, the development of a legal, administrative and economic infrastructure and interventions to offset market failures (Ghali 1998; Colombier 2009<sup>3</sup>).

---

<sup>1</sup> According to the Wagner's Law the scope of the government usually increases with the level of income because government has to maintain its administrative and protective functions, its attempts to ensure the proper operation of market forces and provision of social and cultural (public) goods.

<sup>2</sup> Public choice explanations of government growth are discussed in Holcombe (2005).

<sup>3</sup> However, see Bergh and Ohrn (2011) for an empirical rebuttal.

On the other hand, the former may impact economic growth negatively due to government inefficiencies, crowding-out effects, excess burden of taxation, distortion of the incentives systems and interventions to free markets (Barro 1991; Bajo-Rubio 2000). Indeed, several studies report that the efficiency of government spending can increase, either by delivering the same amount of services with fewer resources or by using more efficiently existing spending levels (see Afonso et al. 2005; Angelopoulos et al. 2008). While the results vary, depending on the econometric model, the measurement of government size, the type of countries studied (rich vs. poor) and the time span considered, and a consensus is yet to be reached, the most recent studies typically find a negative correlation between government size and economic growth (Bergh and Henrekson 2010, 2011). *Ceteris paribus*, this is the underlying hypothesis in our study.<sup>4</sup> Moreover, Slemrod (1995) and Tanzi and Zee (1997) find a negative impact if the size of government exceeds a certain threshold. Controlling for other differences, European countries with government spending greater than 40 percent of GDP have had much lower growth rates during the last 15 years (Gill and Raiser 2012). The rationale behind this argument is that in countries with big governments the share of public expenditures designed to promote private sector productivity is typically smaller than in countries with small governments (Fölster and Henrekson 2001).

On the other hand,

Additional assessments are provided notably by Dar and Amirkhalkhali (2002) who report for OECD countries that Total Factor Productivity growth and productivity of capital are weaker in countries with larger governments. In the same vein, Afonso and Jalles (2013b), who report a negative effect of the debt ratio on growth, and that fiscal consolidation promotes growth, notably for OECD countries.

Our motivation also comes from Guseh (1997) who presents a model that differentiates the effects of government size on economic growth across political systems in developing countries. Growth in government size has negative effects on economic growth, but the negative effects are three times as great in non-democratic systems as in democratic systems. Understanding the link between government size, institutions and growth rests is important because, on the one hand, larger governments increase the potential for rent-seeking that adversely affects innovation. On the other hand, better institutions can mitigate rent-seeking activities and thereby induce the reverse effects on growth (see, e.g., Chaudhry and Garner 2007). Kirchgaessner (2001) provides a survey on the interactions between institutions and public finance.

Our paper includes several contributions: (1) we analyse a wide set of 140 countries composed of both advanced and emerging and low income countries, using a long time span running from 1970 to 2008, and employing different proxies for government size and institutional quality to increase robustness; (2) we build

---

<sup>4</sup> The Scandinavian welfare states have done reasonable well in terms of growth during the last ten to twenty years, not because, of, but rather despite, having big government sectors. In many areas, these countries offset the negative effect of large governments by applying market-friendly policies in other areas, such as trade openness and inflation control and growth enhancing structural reforms. These aspects go beyond the scope of this paper.

new measures of extreme-type political regimes which are then interacted with appropriate government size proxies in non-linear econometric specifications; (3) we make use of recent panel data techniques that allow for the possibility of heterogeneous dynamic adjustment around the long-run equilibrium relationship as well as heterogeneous unobserved parameters and cross-sectional dependence (e.g., Pooled Mean Group, Mean Group, Common Correlated Effects estimators, inter alia); and (4) we also deal with potentially relevant endogeneity issues.

Our results suggest the existence of a negative effect going from large governments to growth. Interestingly, government consumption is consistently detrimental to output growth irrespective of the country sample considered (OECD, Emerging and Low Income Countries). On the other hand, institutional quality has a significant positive impact on the level of real GDP per capita. Moreover, (1) the negative effect of government size on GDP per capita is stronger at lower levels of institutional quality, and (2) the positive effect of institutional quality on GDP per capita is stronger at smaller levels of government size. Furthermore, the stability of the coefficient estimates seems to have been relatively constant over time. Finally, our results prove themselves robust to several robustness analyzes.

The remainder of the paper is organised as follows. Sect. 2 presents the analytical framework. Sect. 3 presents the data. Sect. 4 elaborates on the econometric methodology and discusses our main results. Sect. 5 concludes.

## 2 Analytical framework

In this section we present a growth model that relates output and government size and it will provide the theoretical motivation for our empirical (panel) analysis in Sect. 3. Our model fits within a broader literature that expands a Barro (1991)-type model where government plays an active role.<sup>5</sup> We consider a typical economy with a constant elasticity of substitution utility function of the representative agent given by:

$$U = \int_0^{\infty} e^{-\gamma t} \frac{c_t^{1-\theta} - 1}{1-\theta} dt \quad (1)$$

where  $c$  is per capita consumption,  $\theta$  is the intertemporal substitution and  $\gamma$  is the (subjective) time discount rate or rate of time preference (a higher  $\gamma$  implies a smaller desirability of future consumption in terms of utility compared to utility obtained by current consumption. Population (which we assume identical to labour

<sup>5</sup> Peden and Bradley (1989) employ a theoretical model of output growth to derive an equation that controls for cyclical influences and distinguishes the effects of government growth on the economic base from the effects on the economic growth rate. Lee (1992) and Devarajan et al. (1996) expand Barro's model, allowing different kinds of government expenditures to have different impacts on growth. At a more disaggregated level, distinguishing between productive and non-productive spending, Glomm and Ravikumar (1997) and Kneller et al. (1999) are able to determine the optimal composition of different kinds of expenditure, based on their relative elasticities. Similarly, Chen (2006) investigates the optimal composition of public spending and its relationship to economic growth.

force,  $L$ ) grows at the constant rate  $n$ , that is,  $L_{it} = L_{i0}e^{nt}$ . Output in each country  $i$  at time  $t$  is determined by the following Cobb-Douglas production function:

$$Y_{it} = K_{it}^\alpha G_{it}^\beta (A_{it}L_{it})^{1-\alpha-\beta}, 0 < \alpha < 1, 0 < \beta < 1, 0 < \alpha + \beta < 1. \tag{2}$$

$Y$  is the final good, used for private consumption,  $G$  is public consumption expenditure, which proxies for government size, and  $K$  is investment in physical capital. We consider the case of no depreciation of capital. The output used to produce  $G$  equals  $qG$  (which one can think of as being equivalent to a crowding-out effect in private sector’s resources).  $A$  is the level of technology and grows at the exogenous constant rate  $\mu$ , that is, we have

$$A_{it} = A_{i0}e^{\mu t + I_{it}\rho_i} \tag{3}$$

with  $I_{it}$  being a vector of institutional quality, political regime and other related factors that may affect the level of technology and efficiency in country  $i$  at time  $t$ , and  $\rho_i$  is a vector of (unknown) coefficients related to these variables. In this framework, the state of labour-augmenting technology ( $A$ ) depends not only on exogenous technological improvements determined by  $\mu$ , but also on the level of institutional quality (such as the rule of law), the degree of democratic political foundations, etc. Institutions may be critical in facilitating technological breakthroughs, which may not occur without appropriate sound institutional environments. The presence of efficient and effective institutions ensures that labour can be used for productive purposes, instead of being wasted with red tape or rent seeking activities (North 1990; Nelson and Sampat 2001).

We begin by writing down the resource constraint for this economy in per worker terms, given by:

$$\dot{K}_t = Y_t - C_t - qG_t \Leftrightarrow \dot{k}_t = y_t - c_t - qg_t - nk_i \tag{4}$$

where  $\dot{K}_t$  is the time derivative of physical capital and small letters represent per worker terms (after scaling down by  $L$ ).

We now write the conditions that characterize the optimal path for the economy and determine the steady-state solution for private and public consumption and income per worker. The optimal path is the solution of:

$$\begin{aligned} \max_{c_t, g_t} \int_0^\infty e^{-\gamma t} \frac{c_t^{1-\theta} - 1}{1-\theta} dt \\ \text{s.t. : } \dot{k}_t = k_t^\alpha g_t^\beta A_t^{1-\alpha-\beta} - c_t - qg_t - nk_i. \end{aligned} \tag{5}$$

Solving the Hamiltonian’s corresponding first order conditions and after some manipulations yields:

$$\begin{aligned}
 k^* &= A \left( \frac{\alpha}{\theta\mu + \gamma + n} \right)^{\frac{1-\beta}{1-\alpha-\beta}} \left( \frac{\beta}{q} \right)^{\frac{1-\beta}{1-\alpha-\beta}} \\
 g^* &= A^{\frac{1-\alpha-\beta}{1-\beta}} \left( \frac{\beta}{q} \right)^{\frac{1-\beta}{1-\alpha-\beta}} k^{*\frac{\alpha}{1-\beta}} \quad (6) \\
 y^* &= k^{*\alpha} g^{*\beta} A^{1-\alpha-\beta} \\
 c^* &= y^* - (n + \mu)k^* - qg^*.
 \end{aligned}$$

A special case occurs when  $\alpha + \beta = 1$  and  $n = \mu = 0$  in which there is no transition dynamics and the economy is always in the balanced growth path.

We refrain from making full considerations on the model's solution, but one, in particular, is worth making<sup>6</sup>: an increase in  $q$  (which implicitly proxies the overall size of the public sector translating the fact that more resources are needed/required to finance  $G$ ) reduces both the optimal level of private consumption per worker (and physical capital per worker) and, more importantly, the optimal level of output per worker in this model economy.

Turning to econometric specification, in the steady state, output per effective worker ( $\hat{y}_{it} = Y_{it}/A_{it}L_{it}$ ) is constant while output per worker ( $y_{it} = Y_{it}/L_{it}$ ) grows at the exogenous rate  $\mu$ . In general, output in effective worker terms evolves as  $\hat{y}_{it} = (k_{it})^\alpha (g_{it})^\beta$  and in (raw) worker terms, output evolves according to  $y_{it} = A_{it}(k_{it})^\alpha (g_{it})^\beta$ . Taking logs on both sides we get  $\ln y_{it} = \ln A_{it} + \alpha \ln k_{it} + \beta \ln g_{it}$ , and using (3) and the fact that in (2) we have  $(A_{it}L_{it})^{1-\alpha-\beta}$  entering the utility function, we obtain,

$$\ln y_{it} = A_0 + (1 - \alpha - \beta)\mu_{it} + (1 - \alpha - \beta)\rho_{it} + \alpha \ln k_{it} + \beta \ln g_{it}. \quad (7)$$

Equation (7) describes the evolution of output per worker, as a function of a vector of institutional and political related variables, which may change over time, the size of the public sector or government, the level of physical capital and the exogenous growth rate of output. Given the production function relationship, (7) is valid both within and outside the steady-state and this is important, particularly, if one makes use of static panel data techniques for estimation purposes. Moreover, it is not dependent on assumptions on the behaviour of savings, hence offering a reasonable basis for estimation. Taking (7) as the baseline we will then augment it by splitting  $k_{it}$  into physical ( $k$ ) and human capital ( $h$ ),<sup>7</sup> and use both a linear and non-linear specification (in which interaction terms are included), as follows:

$$\ln y_{it} = b_0 + b_1 t_i + b_3 I_{it} + b_4 \ln k_{it} + b_5 \ln h_{it} + b_6 \ln g_{it} + \varepsilon_{it} \quad (8)$$

$$\ln y_{it} = b_{0i} + b_1 t_i + b_3 I_{it} + b_4 \ln k_{it} + b_5 \ln h_{it} + b_6 \ln g_{it} + b_7 (I_{it} g_{it}) + \eta_{it} \quad (9)$$

<sup>6</sup> In an alternative setting in which the government introduces a tax over total income (or production) to finance public consumption, the overall conclusion (with respect to the effect of government size) does not change.

<sup>7</sup> We thank an anonymous referee for raising the issue that one should include an education proxy.

where the  $b$ 's are (unknown) parameters to be estimated,  $I_{it}$  and  $g_{it}$  denote the proxies for institutional quality and government size, respectively, and  $\varepsilon_{it}$  and  $\eta_{it}$  are model specific error terms satisfying the usual assumptions of zero mean and constant variance. Equations (8) and (9) provide the basis for the empirical models to be estimated in Sect. 4.

Finally, the variation of causality between government size and growth detected in cross-section and time-series papers suggests that there are important differences in the way in which governments influence economic performance across countries. We argue that it may reflect institutional differences across countries and, while this is a plausible conjecture, there is as yet little direct evidence to confirm that institutions and political regimes make a difference to the way in which governments affect economic outcomes.

### 3 Data

The dataset consists of an unbalanced heterogeneous panel of 140 countries over the period 1970–2010 in 5-year non-overlapping averages (to overcome short-run business cycle fluctuations as is common practice in the empirical growth literature).<sup>8</sup> Countries are grouped into advanced (OECD), emerging market economies (EME) and low income countries (LIC) based on the World Bank classification. Annual data on real GDP per capita ( $y$ ) and gross fixed capital formation ( $inv$ ) are retrieved from the World Bank' World Development Indicators. We estimate the capital stock ( $K_y$ ) using the perpetual inventory method, that is,  $K_{y_t} = Inv_t + (1 - \delta)K_{y_{t-1}}$ , where  $Inv_t$  is the investment and  $\delta$  is the depreciation rate. Data on  $Inv_t$  comes from Summers and Heston's PWT 7.1 as real aggregate investment in PPP. We estimate the initial value of the capital stock ( $K_{y_0}$ ), in year 1950 as  $Inv_{1950}/(g + \delta)$  where  $g$  is the average compound growth rate between 1950 and 1960, and  $\delta$  is the depreciation rate (set to 7 % for all countries and years). In addition we use average years of schooling from Barro-Lee dataset as our proxy for human capital.

The proxies for government size (our  $G$ ) are government consumption ( $govcons\_gdp$ ), total government expenditures ( $totgovexp\_gdp$ ), total government revenues ( $totgovrev\_gdp$ ), and total government debt ( $govdebt\_gdp$ ) all expressed in percentage of GDP. They come from the IMF's International Financial Statistics (IFS).

For institutional-related variables (our  $I$ ) we rely on: (1) Freedom House's Political Rights, Civil Liberties, (2) the Polity 2 index, a democracy index and the regime durability (in years) from Marshall and Jaegger's Polity's 4 database, (3) an index of democratization due to Vanhanen (2005), (4) a governance index and its 6 sub-components<sup>9</sup> from Kaufmann et al. (2009) (World Bank Governance

<sup>8</sup> Summary statistics and correlation matrices are omitted for economy of space but they are available upon request.

<sup>9</sup> This is the result of averaging six variables: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

Indicators)<sup>10</sup>; (5) government fractionalization from the *Quality of Government Dataset*<sup>11</sup>; (6) the KOF indices of economic, political and social dimensions of globalization<sup>12</sup>; years in office, index of legislative competitiveness, index of executive competitiveness, checks and balances and dummy for legislative election held all from the *World Bank's Database on Political Institutions*.<sup>13</sup>

## 4 Methodology and results

### 4.1 Baseline results

Equations (8) and (9) can be estimated directly using panel data techniques, which allow for both cross-section and time-series variation in all variables.

Table 1 presents our first set of results for the fixed-effects specifications covering different proxies for institutional quality (eight in total). We use government consumption for our baseline, as the more obvious spending policy measure available to the fiscal authorities, and discuss its individual inclusion in our regression of interest as well as its interaction with a variable  $I_{it}$ .

We find a positive effect of the capital stock on the level of real GDP per capita throughout the different specifications regardless of the institutional variable employed. The positive role of human capital is also evident from these regressions in accordance to other studies. One also finds a statistically significant negative coefficient on the government size proxy in 10 out of 16 specifications. Its coefficient varies between  $-0.08$  and  $-0.11$ , meaning that an increase in government size by 10 % points, is associated with a 1.1–0.8 % lower annual growth per capita. This order of magnitude is consistent with previous literature. Institutional quality, generally speaking, has equally a consistent and statistically significant positive impact on economic activity, though its order of magnitude differs between the selected proxy under scrutiny.

When statistically significant the interaction term is negative, meaning that (1) the negative effect of government size on GDP per capita is stronger at lower levels of institutional quality, and (2) the positive effect of institutional quality on GDP per capita is stronger at smaller levels of government size. The interaction term means that the marginal effect of government size will differ at different levels of institutional quality. However, this result depends on the proxy used for  $I_{it}$ . Nevertheless, we obtain in most regressions considerably high R-squares. Moreover, when regional dummies are included, coefficients keep their statistical significance and sign (not shown).

We go on in further exploring the robustness of our results to other institutional proxies and the results are generally in line with ones already reported. In Table 2,

<sup>10</sup> The interested reader should refer to the original sources for the full definition of the variables used.

<sup>11</sup> <http://www.qog.pol.gu.se/data/datadownloads/qogstandarddata/>.

<sup>12</sup> <http://globalization.kof.ethz.ch/>.

<sup>13</sup> <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20649465~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>.



**Table 1** Baseline results, full sample: Fixed Effects estimation with interaction terms

Estimator	Fixed effects							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spec.	Institutional Proxy							
	Civil liberties		Political rights		Polity		Democracy Index	
Physical capital	0.601*** (0.145)	0.601*** (0.145)	0.610*** (0.144)	0.608*** (0.144)	0.768*** (0.150)	0.800*** (0.151)	0.670*** (0.150)	0.687*** (0.152)
Human capital	0.271*** (0.083)	0.267*** (0.083)	0.250*** (0.083)	0.246*** (0.083)	0.258*** (0.082)	0.246*** (0.083)	0.314*** (0.085)	0.308*** (0.086)
Public Consumption	-0.088*** (0.022)	-0.017 (0.056)	-0.085*** (0.022)	-0.034 (0.049)	-0.073*** (0.022)	-0.017 (0.040)	-0.086*** (0.022)	-0.054 (0.046)
Institutions	0.191* (0.101)	0.421** (0.194)	0.312*** (0.081)	0.465*** (0.156)	0.119*** (0.023)	0.181*** (0.043)	0.164*** (0.043)	0.220*** (0.083)
Interaction		-0.157 (0.113)		-0.110 (0.096)		-0.047* (0.027)		-0.043 (0.054)
Observations	940	940	940	940	922	922	865	865
R-squared	0.743	0.744	0.747	0.747	0.752	0.753	0.774	0.774
Number of countries	140	140	140	140	136	136	136	136
Estimator	Fixed effects							
Spec.	Institutional Proxy							
	Regime durability		Vanhanen democracy		Government fractionalization		Government fractionalization	
Physical capital	0.671*** (0.147)	0.569*** (0.143)	1.598*** (0.268)	1.556*** (0.270)	0.870*** (0.156)	0.869*** (0.156)	-0.580*** (0.159)	-0.496*** (0.162)
Human capital	0.335*** (0.080)	0.311*** (0.078)	0.225** (0.111)	0.226** (0.111)	0.266*** (0.083)	0.267*** (0.083)	0.640** (0.308)	0.717** (0.307)

Table 1 continued

Estimator	Fixed effects							
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Institutional Proxy	Regime durability		Vanhanen democracy	Government fractionalization	Governance			
Public Consumption	-0.075*** (0.021)	-0.046* (0.027)	0.010 (0.038)	0.057 (0.054)	-0.084*** (0.025)	-0.081*** (0.028)	-0.114*** (0.036)	-0.085** (0.038)
Institutions	0.654*** (0.079)	1.761*** (0.181)	0.369** (0.176)	-0.103 (0.424)	0.007 (0.045)	0.034 (0.110)	0.215*** (0.047)	0.085 (0.074)
Interaction		-0.677*** (0.101)		0.379 (0.310)		-0.018 (0.065)		-0.098** (0.043)
Observations	924	924	372	372	770	770	394	394
R-squared	0.765	0.778	0.778	0.779	0.740	0.740	0.789	0.793
Number of countries	136	136	65	65	133	133	138	138

The models are estimated by Fixed-Effects. The dependent variable is the logarithm of real GDP per capita. A constant term and time effects have been included but are not reported for reasons of parsimony. Robust heteroskedastic-consistent standard errors are reported in parenthesis below each coefficient estimate. \*, \*\*, \*\*\* denote significance at 10, 5 and 1 % levels

we observe a statistically significant negative coefficient for the government size proxy in 12 out of 16 specifications, and the coefficient's range compares broadly in magnitude with one reported before.

Moreover, if one uses also the World Bank's Governance (WBG) indicators, as a robustness check and despite the fact that these are only available from 1996 onwards, the conclusions still hold (see Table 3). Likewise, and complementing the aggregate full sample estimation we present a bar chart (Fig. 1) by country group (Advanced Economies, Emerging Market Economies and Low Income Countries) where we display only the statistically significant coefficients, for the respective WBG indices. Voice and accountability as well as rule of law are the two most important governance aspects to impact GDP per capita in OECD countries; in emerging market economies more importance is attributed to government effectiveness; in low income countries regulatory quality and rule of law stand out as the most important indicators.

In relation to the evolution over time of the relevance of both government size and institutional quality, Figs. 2 and 3 summarise respectively the relevant statistical estimate coefficients coming from the estimation of Eq. (8). Checking the time dimension constitutes an additional robustness check and we do not observe any switching signs over time; more importantly for most proxies estimates have been relatively stable throughout the period under consideration.

#### 4.2 Dynamic panel estimation: accounting for endogeneity

In the analysis of empirical production functions, the issue of variable endogeneity is generally of concern. That said, instead of estimating static equations, we now allow for dynamics to play an active role. A negative correlation between government size and economic activity does not imply causality. In fact, the most obvious reason (among many) to suspect reverse causality a problem is that welfare states social insurance schemes act as automatic stabilizers. We reformulate our regression equation(s) to include additionally the lagged real GDP per capita (the remainder of the variables is unchanged). We estimate by means of the Arellano-Bover system-GMM estimator which jointly estimates the equations in first differences, using as instruments lagged levels of the dependent and independent variables, and in levels, using as instruments the first differences of the regressors.<sup>14</sup> Intuitively, the system-GMM estimator does not rely exclusively on the first-differenced equations, but exploits also information contained in the original equations in levels. The results in Table 4 for a selected number of institutional quality proxies support the previous findings. Moreover, diagnostic statistics, in

<sup>14</sup> As far as information on the choice of lagged levels (differences) used as instruments in the differences (levels) equation, as work by Bowsher (2002) has indicated, when it comes to moment conditions (as thus to instruments) more is not always better. The GMM estimators are likely to suffer from "overfitting bias" once the number of instruments approaches (or exceeds) the number of countries (as a simple rule of thumb). In the present case, the choice of lags was directed by checking the validity of different sets of instruments.

**Table 2** Baseline results, full sample: Fixed Effects estimation with interaction terms

Estimator	Fixed effects							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spec.	Institutional Proxy							
	KOF social		KOF political		KOF economic		Years in office	
Physical capital	0.035 (0.153)	0.026 (0.154)	0.474*** (0.163)	0.502*** (0.159)	0.232 (0.167)	0.196 (0.170)	0.755*** (0.152)	0.749*** (0.151)
Human capital	0.210*** (0.074)	0.210*** (0.074)	0.283*** (0.080)	0.269*** (0.079)	0.179** (0.085)	0.186** (0.085)	0.233*** (0.081)	0.235*** (0.081)
Public Consumption	-0.021 (0.025)	0.009 (0.070)	-0.126*** (0.026)	-0.360*** (0.055)	-0.108*** (0.026)	-0.065 (0.048)	-0.074*** (0.022)	-0.037 (0.031)
Institutions	0.696*** (0.104)	0.797*** (0.238)	0.251** (0.124)	0.666*** (0.226)	0.033 (0.089)	0.145 (0.191)	0.007*** (0.001)	0.013*** (0.004)
Interaction		-0.062 (0.132)		-0.584*** (0.122)		0.111 (0.105)		-0.004* (0.002)
Observations	613	613	639	639	632	632	920	920
R-squared	0.772	0.772	0.727	0.739	0.723	0.724	0.751	0.752
Number of countries	137	137	137	137	137	137	137	137
Estimator	Fixed effects							
Spec.	Institutional Proxy							
	Legislative election		Legislative election		Executive competitiveness		Checks and balances	
Physical capital	0.807*** (0.152)	0.812*** (0.154)	0.807*** (0.154)	0.812*** (0.156)	0.805*** (0.153)	0.831*** (0.154)	0.747*** (0.151)	0.756*** (0.152)
Human capital	0.248*** (0.082)	0.248*** (0.082)	0.242*** (0.082)	0.241*** (0.083)	0.225*** (0.082)	0.216*** (0.083)	0.211** (0.083)	0.208** (0.083)

**Table 2** continued

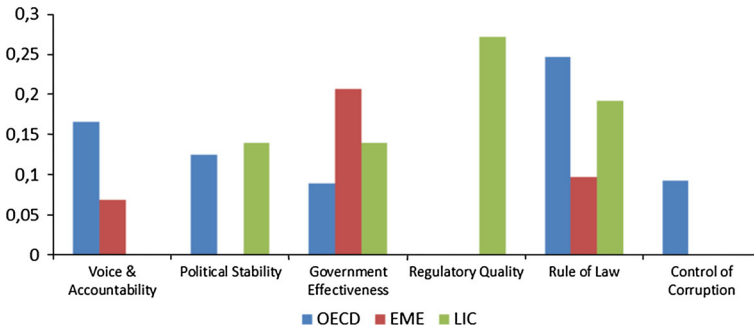
Estimator	Fixed effects							
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Institutional Proxy	Legislative election	Legislative election	Legislative competitiveness	Executive competitiveness	Checks and balances	Checks and balances	Checks and balances	Checks and balances
Public Consumption	-0.071*** (0.022)	-0.075*** (0.028)	-0.078*** (0.022)	-0.084* (0.044)	-0.079*** (0.022)	-0.124*** (0.042)	-0.078*** (0.022)	-0.092*** (0.030)
Institutions	0.098* (0.052)	0.064 (0.140)	0.137** (0.070)	0.156 (0.135)	0.226*** (0.072)	0.373*** (0.138)	0.120 (0.081)	0.230 (0.182)
Interaction		0.022 (0.083)		0.001 (0.008)		0.011 (0.009)		0.008 (0.012)
Observations	925	925	921	921	921	921	914	914
R-squared	0.746	0.746	0.746	0.746	0.748	0.749	0.741	0.742
Number of countries	137	137	137	137	137	137	137	137

The models are estimated by Fixed-Effects. The dependent variable is the logarithm of real GDP per capita. A constant term and time effects have been included but are not reported for reasons of parsimony. Robust heteroskedastic-consistent standard errors are reported in parenthesis below each coefficient estimate. \*, \*\*, \*\*\* denote significance at 10, 5 and 1 % levels

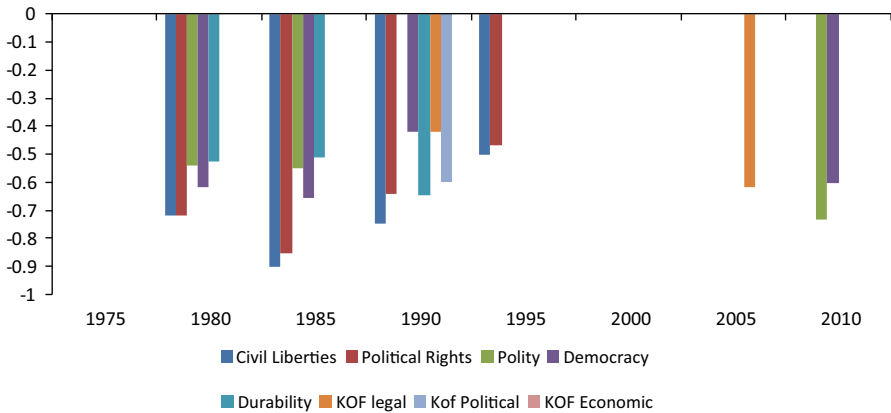
**Table 3** World Bank Governance Indicators, full sample: Fixed Effects estimation with interaction terms

Estimator	Fixed effects											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Spec.												
Institutional Proxy	Voice and accountability	Government effectiveness	Regulatory quality	Rule of law	Control of corruption							
Physical capital	0.397** (0.162)	0.196 (0.174)	0.553*** (0.156)	0.550*** (0.157)	0.478*** (0.159)	0.333** (0.163)	0.534*** (0.157)	0.487*** (0.163)	0.518*** (0.159)	0.440*** (0.161)	0.431*** (0.162)	0.279* (0.163)
Human capital	0.551* (0.321)	0.661** (0.319)	0.532* (0.306)	0.522* (0.307)	0.604* (0.314)	0.709** (0.310)	0.758** (0.310)	0.800** (0.312)	0.573* (0.312)	0.646** (0.311)	0.558* (0.320)	0.639** (0.313)
Public consumption	-0.129*** (0.037)	-0.081** (0.040)	-0.111*** (0.035)	-0.117*** (0.037)	-0.126*** (0.036)	-0.089** (0.037)	-0.121*** (0.035)	-0.108*** (0.037)	-0.126*** (0.036)	-0.095** (0.038)	-0.126*** (0.037)	-0.090** (0.037)
Institutions	0.017 (0.037)	0.184*** (0.068)	0.119*** (0.024)	0.137*** (0.045)	0.140*** (0.042)	0.050 (0.073)	0.167*** (0.035)	0.104 (0.068)	0.162*** (0.043)	0.033 (0.071)	0.043 (0.037)	0.158** (0.064)
Interaction		-0.125*** (0.043)		-0.016 (0.033)		-0.136*** (0.043)		0.043 (0.040)		-0.094** (0.041)		-0.141*** (0.038)
Observations	392	392	392	392	392	392	392	392	392	392	392	392
R-squared	0.771	0.779	0.791	0.792	0.781	0.789	0.790	0.791	0.783	0.788	0.772	0.784
Number of countries	137	137	137	137	137	137	137	137	137	137	137	137

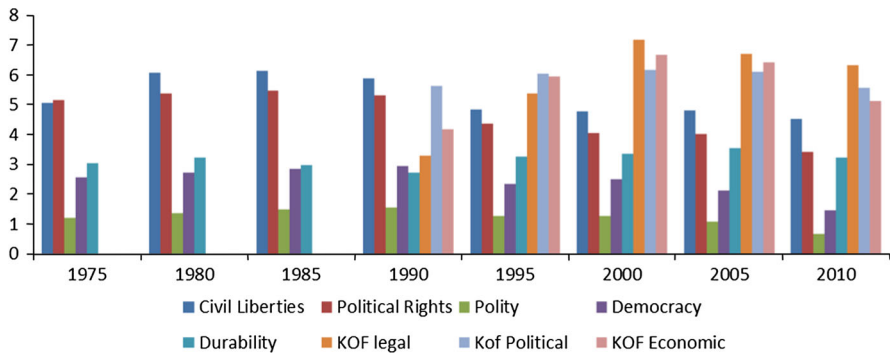
The models are estimated by Fixed-Effects. The dependent variable is the logarithm of real GDP per capita. A constant term and time effects have been included but are not reported for reasons of parsimony. Robust heteroskedastic-consistent standard errors are reported in parenthesis below each coefficient estimate. \*, \*\*, \*\*\* denote significance at 10, 5 and 1 % levels



**Fig. 1** Growth regressions' estimated coefficients using World Bank's Governance Indicators by country group (only statistically significant). *Note* author's computations



**Fig. 2** Estimated coefficients of government consumption in regressions using different institutional proxies, over time (only statistically significant). *Note* author's computations



**Fig. 3** Estimated coefficients of different institutional proxies, over time (only statistically significant). *Note* author's computations

**Table 4** Accounting for Endogeneity: System GMM estimation, full sample

Estimator	SYS-GMM										
Spec.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Institutional proxy	Civil liberties	Political rights	Polity	Democracy index	Regime durability	Vanhanen democracy	Government fractionalization	Governance	KOF social	KOF political	KOF economic
Physical capital	1.467*** (0.208)	1.448*** (0.207)	1.570*** (0.201)	1.539*** (0.192)	1.628*** (0.188)	1.620*** (0.149)	1.712*** (0.252)	1.461*** (0.218)	1.825*** (0.195)	1.736*** (0.235)	1.714*** (0.213)
Human capital	0.037 (0.082)	0.068 (0.080)	0.092 (0.076)	0.061 (0.070)	0.121* (0.072)	0.185* (0.096)	0.190** (0.088)	0.600* (0.370)	0.295*** (0.095)	0.178** (0.090)	0.313*** (0.109)
Public Consumption	-0.113*** (0.024)	-0.117*** (0.025)	-0.083*** (0.023)	-0.087*** (0.026)	-0.100*** (0.024)	-0.067*** (0.017)	-0.111*** (0.027)	-0.157*** (0.058)	-0.085*** (0.031)	-0.113*** (0.040)	-0.095*** (0.038)
Institutions	0.328*** (0.093)	0.181*** (0.068)	0.068*** (0.019)	0.083*** (0.033)	0.177*** (0.046)	0.197* (0.109)	0.003 (0.036)	0.100** (0.043)	0.115 (0.105)	0.131 (0.090)	0.551*** (0.114)
Observations	834	834	817	770	819	369	757	391	606	631	624
Number of countries	140	140	136	136	136	65	133	138	137	137	137
Hansen ( <i>p</i> -value)	0.809	0.790	0.738	0.856	0.752	0.751	0.719	0.133	0.247	0.204	0.329
AB AR(1) ( <i>p</i> -value)	0.001	0.000	0.001	0.009	0.001	0.131	0.015	0.003	0.001	0.020	0.001
AB AR(2) ( <i>p</i> -value)	0.239	0.227	0.181	0.504	0.173	0.003	0.239	0.362	0.146	0.442	0.063

The models are estimated by system GMM (SYS-GMM). The dependent variable is real GDP per capita growth. Robust heteroskedastic-consistent standard errors are reported in parenthesis below each coefficient estimate. The Hansen test evaluates the validity of the instrument set, i.e., tests for over-identifying restrictions. AR(1) and AR(2) are the Arellano-Bond autocorrelation tests of first and second order (the null is no autocorrelation), respectively. Also a constant term, lagged dependent variable and time effects have been included but are not reported for reasons of parsimony. \*, \*\*, \*\*\* denote significance at 10, 5 and 1 % levels



particular the validity of the instrument set used (assessed via the Hansen test), are well behaved.<sup>15</sup>

#### 4.3 Using new political system's measures

Following Rodrik and Wacziarg's (2005) approach we construct new (and more meaningful) democracy measures based on the variable *Polity*. The role of political systems and democracy in particular, on the government size-growth relationship is assessed by regressing three structural aspects of democracy (to be defined below) on 5-year averages of real GDP per capita growth rates.<sup>16</sup> Indeed, *polity* does not capture two important dimensions of political regimes—either their newness (following, for example, democratization or a return to authoritarian rule) or their more established (consolidated) nature.

Rodrik and Wacziarg (2005) define a major political regime change to have occurred when there is a shift of at least three points in a country's score on *polity* over three years or less. Using this criterion we define new democracies (ND = 1) in the initial year (and subsequent four years) in which a country's *Polity* score is positive and increases by at least three points and is sustained, ND = 0 otherwise. Established democracies (ED = 1) are those new democratic regimes that have been sustained following the 5 years of a new democracy (ND). In any subsequent year, if established democracies (ED) fail to sustain the status of ND, ED = 0. Using these criteria, they define sustained democratic transitions (SDT) as the sum of ND and ED. They use the same procedure, *mutatis mutandis*, to define new autocracies (NA), established autocracies (ES) and sustained autocratic transition (SAT).

This yields six distinct binary-type measures of the character of political regimes—ND, ED, NA, EA, SDT, and SAT—for most years during 1970–2010. Finally, Rodrik and Wacziarg (2005) define small regime changes (SM) as changes in *polity* from one year to the next that are less than three points.<sup>17</sup> There are several advantages from creating these new measures, which allow us to distinguish the impact of new and established electoral democracies and autocracies on economic development.<sup>18</sup>

Endogeneity<sup>19</sup> between right-hand side proxies of democracy and autocracy and a standard set of control variables is corrected for by taking a system-GMM (SYS-GMM) approach—as detailed above. As suggested in Mauro (1995), Hall and Jones (1999) and Acemoglu et al. (2001), the democracy measures are instrumented by:

<sup>15</sup> In the great majority of our system-GMM regressions the Hansen-J statistic is associated with p-values larger than 10 %. This statistic tests the null hypothesis of correct model specification and valid overidentifying restrictions, i.e., validity of instruments.

<sup>16</sup> An equation with real GDP per capita growth as the dependent variable is motivated by (standard) augmentation of Solow-Swan type models with a government size proxy and following Barro and Sala-i-Martin's (1992) approach.

<sup>17</sup> Thus SM = 1 for a small regime change and SM = 0 otherwise.

<sup>18</sup> An empirical application of these measures to explain the impact of extreme-type political regimes on economic performance can be found in Jalles (2010).

<sup>19</sup> And also the existence of possible measurement errors when accounting for democracy.

1. the durability (age in years) of the political regime type (*durable*) retrieved from Marshall and Jaegggers' database<sup>20</sup>
2. *latitude*: Hall and Jones (1999) launched the general idea that societies are more likely to pursue growth-promoting policies, the more strongly they have been exposed to Western European influence, for historical or geographical reasons. Two other possible instruments could be common and civil law, translating the type of legal origin of each country
3. ethnic fragmentation (*ethnic*): on a broad level, the role of ethnic fragmentation in explaining the (possible) growth effect of democracy can be derived from the literature on the economic consequences of ethnic conflict. It has been shown that the level of trust is low in an ethnically divided society (Alesina and La Ferrara 2000). Moreover, the lack of co-operative behaviour between diverse ethnic groups, leads to the tragedy of the commons as each group fights to divert common resources to non-productive activities (Mauro 1995)<sup>21</sup>

Table 5 reports the results with the four proxies for government size. We observe that government size appear mostly with statistically significant negative coefficients. When interacted with SDT it has a positive and statistically significant coefficient, meaning that in democratic countries the negative impact of government size is mitigated but remains mostly negative. The remaining proxies keep the statistically negative coefficient, but interaction terms lose economic and statistical relevance. For the OECD sample the individual effects of the different proxies of government size are similar but interaction terms are never statistically significant. Emerging market and low income countries report a statistically negative coefficient on public consumption, total government expenditure and debt-to-GDP ratio, with the latter having a lesser detrimental effect in democratic countries (see Fig. 4 for a graphical summary). All in all, government consumption is the proxy that is more consistently and more detrimental to output growth and the one that should be used for the remainder of the paper.

As suggested by Ram (1986) another possible specification is the use of the growth rate of the government size proxy. We also tested this specification to determine its impact on growth across different levels of institutional quality. All variables were retained except  $G_{it}$  that is now replaced by  $dG_{it}/G_{it}$  together with the corresponding interaction terms (results available upon request). Comparing with our previous results the coefficients of the linear term of government size proxies were positive and statistically significant in two out of five specifications. However, according to Conte and Darrat (1988) Ram's specification is suitable for testing short-term effects, while the specification used in this paper assesses the effects of government size on the underlying longer-run economic activity.

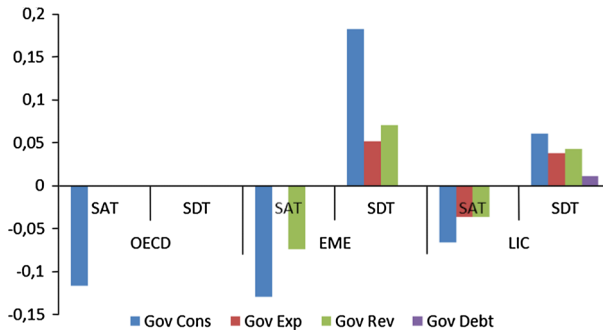
<sup>20</sup> The average age of the party system is also used in Przeworski et al. (2000).

<sup>21</sup> Other similarly possible instruments are the historical settler mortality or population density in 1500, as in Acemoglu and Robinson (2005), the share of population that speaks any major European language—*Eurfrac*—, inter alia. For the three instruments chosen the exclusion restriction is that durability, latitude and ethnic fragmentation do not have any impact on present economic growth other than their impact on democracy.

**Table 5** New political system's measures: system GMM estimation with interaction terms, full sample

Estimator	SYS-GMM							
Spec.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Government Proxy	Public consumption		Government expenditure		Government revenue		Public debt	
Physical capital	0.758*** (0.153)	0.767*** (0.153)	1.726*** (0.185)	1.722*** (0.184)	1.078*** (0.173)	1.091*** (0.173)	0.518*** (0.156)	0.525*** (0.155)
Human capital	0.260*** (0.085)	0.252*** (0.085)	0.272*** (0.088)	0.260*** (0.087)	0.274*** (0.082)	0.266*** (0.082)	0.077 (0.089)	0.055 (0.088)
Government proxy	-0.110*** (0.026)	-0.058** (0.023)	-0.090*** (0.017)	-0.063*** (0.015)	-0.037* (0.019)	-0.066*** (0.018)	-0.021*** (0.002)	-0.017*** (0.002)
G*SAT	-0.056*** (0.019)		-0.028** (0.011)		-0.034*** (0.012)		-0.006** (0.003)	
G*SDT		0.055*** (0.019)		0.031*** (0.011)		0.035*** (0.011)		0.011*** (0.003)
Observations	785	785	402	402	586	586	739	739
Number of countries	132	132	94	94	123	123	129	129
Hansen (p-value)	0.871	0.872	0.752	0.799	0.898	0.778	0.784	0.861
AB AR(1) ( <i>p-value</i> )	0.003	0.003	0.068	0.081	0.046	0.035	0.004	0.005
AB AR(2) ( <i>p-value</i> )	0.154	0.184	0.031	0.029	0.164	0.172	0.350	0.377

The models are estimated by system GMM (SYS-GMM). The dependent variable is real GDP per capita growth. “SDT” and “SAT” stand for sustained democratic transition and sustained autocratic transition—for more details refer to the main text. Robust heteroskedastic-consistent standard errors are reported in parenthesis below each coefficient estimate. The Hansen test evaluates the validity of the instrument set, i.e., tests for over-identifying restrictions. AR(1) and AR(2) are the Arellano-Bond autocorrelation tests of first and second order (the null is no autocorrelation), respectively. Also a constant term, lagged dependent variable and time effects have been included but are not reported for reasons of parsimony. \*, \*\*, \*\*\* denote significance at 10, 5 and 1 % levels



**Fig. 4** Estimated coefficients of the interaction terms of different government size proxies with new political system's measures, by country group. *Note* author's computations

#### 4.4 Robustness checks

One concern when working with time-series data is the possibility of spurious correlation between the variables of interest (Granger and Newbold 1974). This situation arises when series are not stationary, that is, they contain stochastic trends as it is largely the case with GDP and investment series. Results of first (Im et al. 2003) and second generation (Pesaran 2007) panel integration tests (not shown) suggest that we can accept most conservatively that non-stationarity cannot be ruled out in our dataset.

It seems that the time-series properties of the data play an important role: we suggest that the bias in our models is the result of nonstationary errors, which are introduced into the fixed-effects and GMM equations by the imposition of parameter homogeneity. Hence, careful modelling of short-run dynamics requires a slightly different econometric approach. We assume that (8), or (9), represents the equilibrium which holds in the long-run, but that the dependent variable may deviate from its path in the short-run (due, e.g., to shocks that may be persistent). There are often good reasons to expect the long-run equilibrium relationships between variables to be similar across groups of countries, due e.g., to budget constraints or common technologies (unobserved TFP) influencing them in a similar way. In line with discussions in the empirical growth literature we shall assume that the long-run relationship is composed of a country-specific level and a set of common factors with country-specific factor loadings.

The parameters of (8) and (9) can be obtained alternatively via recent panel data methods. We resort to the Mean Group (MG) estimator (Pesaran and Smith 1995) and the Pooled Mean Group (PMG) estimator, which involves both pooling and averaging (Pesaran et al. 1999). These estimators are appropriate for the analysis of dynamic panels with both large time and cross-section dimensions, and they have the advantage of accommodating both the long-run equilibrium and the possibly heterogeneous dynamic adjustment process.

A second step is to make use of the Common Correlated Effects Mean Group (CCEMG) estimator that accounts for the presence of unobserved common factors

whose presence factors is achieved by construction and the estimates are obtained as averages of the individual country-specific estimates (Pesaran 2006). A related and recently developed approach due to Eberhardt and Teal (2010) was termed Augmented Mean Group (AMG) estimator and it accounts for cross-sectional dependence by inclusion of a “common dynamic process”.

The panel analysis that follows is based on this unrestricted error correction ARDL( $p, q$ ) representation:

$$\Delta y_{it} = \phi_i y_{it-1} + \beta'_i x_{it-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{it-j} + \sum_{q=1}^{q-1} \gamma'_{ij} \Delta x_{it-j} + \mu_i + u_{it}, i = 1, 2, \dots, N; \tag{10}$$

$$t = 1, 2, \dots, T$$

where  $y_{it}$  is a scalar dependent variable,  $x_{it}$  is the  $k \times 1$  vector of regressors for group  $i$ ,  $\mu_i$  represents the fixed effects,  $\phi_i$  is a scalar coefficient on the lagged dependent variable.  $\beta'_i$ 's is the  $k \times 1$  vector of coefficients on explanatory variables,  $\lambda_{ij}$ 's are scalar coefficients on lagged first-differences of dependent variables, and  $\gamma'_{ij}$ 's are  $k \times 1$  coefficient vectors on first-differences of explanatory variables and their lagged values. We assume disturbances  $u_{it}$  to be independently distributed across  $i$  and  $t$ , with zero mean and constant variance. Assuming that  $\phi_i < 0$  for all  $i$ , there exists a long-run relationship between  $y_{it}$  and  $x_{it}$  defined as:

$$y_{it} = \theta'_i x_{it-1} + \eta_{it}, i = 1, 2, \dots, N; t = 1, 2, \dots, T \tag{11}$$

where  $\theta'_i = -\beta'_i / \phi_i$  is the  $k \times 1$  vector of the long-run coefficients, and  $\eta_{it}$ 's are stationary with possible non-zero means (including fixed effects). Equation (10) can be rewritten as:

$$\Delta y_{it} = \phi_i \eta_{it-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{it-j} + \sum_{q=1}^{q-1} \gamma'_{ij} \Delta x_{it-j} + \mu_i + u_{it}, i = 1, 2, \dots, N; \tag{12}$$

$$t = 1, 2, \dots, T$$

where  $\eta_{it-1}$  is the error correction term given by (5), hence  $\phi_i$  is the error correction coefficient measuring the speed of adjustment towards the long-run equilibrium.

Table 6 presents our first set of robustness results, and it includes for each sub-sample both the PMG and MG estimates using *Polity* as our chosen proxy for institutional quality which enters in linear form together with public consumption (Panel A) and well as in multiplicative form (Panel B).<sup>22</sup> For the PMG estimates, the OECD sub-group obtains a positive and statistically significant coefficient on institutions and statistically negative coefficients on government size when using the both the PMG and MG estimators. One should expect rich countries to get a negative correlation between government size and output if thought in terms of the

<sup>22</sup> This section relies on presenting results from increasingly sophisticated econometric techniques, rather than, for instance, allowing for a wider set of control variables to play a role, simply because our intention is to isolate the effects of our main variables of interest and adding more controls could contaminate those estimates.

**Table 6** Estimations allowing for heterogeneous technology parameters but homogeneous factor loadings (with and without interaction terms)

Estimator	PMG			MG		
	(1) OECD	(2) Emerging	(3) Low income	(4) OECD	(5) Emerging	(6) Low income
<b>Panel A</b>						
Physical capital	1.656*** (0.135)	1.246*** (0.196)	0.805* (0.434)	1.125*** (0.255)	0.956* (0.616)	0.727* (0.421)
Human capital	0.181* (0.105)	0.124* (0.072)	0.159* (0.096)	0.217* (0.131)	0.179* (0.081)	0.249*** (0.080)
Public consumption	-0.119** (0.059)	-0.249* (0.144)	0.157 (0.199)	-0.151*** (0.062)	-0.281 (0.227)	0.130 (0.213)
Polity	0.032** (0.010)	0.572* (0.352)	0.457* (0.261)	0.124* (0.081)	0.407** (0.204)	0.712 (0.611)
Error Correction	-0.76***	-0.64***	-0.71*	-0.86***	-0.68	-0.69
Hausman test for homogeneity ( <i>p</i> -value)	0.12	0.08	0.02			
<b>Panel B</b>						
With interaction term						
Physical capital	1.303*** (0.227)	1.001** (0.727)	0.903* (0.627)	1.001*** (0.371)	1.223* (0.905)	0.628* (0.402)
Human capital	0.174* (0.124)	0.120* (0.08)	0.141* (0.08)	0.139** (0.060)	0.201* (0.161)	0.214** (0.108)
Public consumption	-0.162*** (0.044)	-0.101* (0.074)	0.090 (0.081)	-0.210*** (0.078)	-0.091 (0.072)	0.101 (0.188)
Polity	0.660* (0.386)	0.058 (0.574)	0.660 (0.886)	0.997** (0.386)	0.108 (0.418)	0.181 (0.276)
Interaction	-0.926* (0.549)	0.248 (0.648)	0.926 (0.549)	-0.556 (0.781)	0.107 (0.801)	0.610 (0.594)
Error correction	-0.81***	-0.74**	-0.57*	-0.64***	-0.78*	-0.58
Hausman test for homogeneity ( <i>p</i> -value)	0.14	0.07	0.09			

The models are estimated by either PMG or MG estimators. The dependent variable is the logarithm of real GDP per capita. Hausman test for homogeneity: under the null hypothesis the difference in the estimated coefficients between the MG and PMG estimators, it is not significant and PMG is more efficient

\*, \*\*, \*\*\*\*\* Significance at 10, 5 and 1 % levels

Olson's (1982) mechanism: organized interest groups tend to evolve, and struggle to get advantages for themselves in the form of transfers or legislation, which have a side effect, delaying the regular functioning and growth of economy. The scope for interest group action is likely to be greater in countries with larger governments, where there is increased potential for profits from rent-seeking activities, leading to

a greater diversion of resources to unproductive ends (Buchanan 1980). Recently, Bergh and Karlsson (2010) also uncovered a detrimental output effect of larger governments in a panel of rich countries using the Bayesian Average over Classical Estimates approach. For both emerging and low income countries statistical significance of government size is weaker but the institutional proxy is still statistically significant for emerging countries and for low income countries.

The MG estimator provides consistent estimates of the mean of the long-run coefficients, though these will be inefficient if slope homogeneity holds. Under long-run slope homogeneity, the pooled estimators are consistent and efficient. The hypothesis of homogeneity is tested empirically in all specifications using a Hausman-type test applied to the difference between MG and PMG.<sup>23</sup> The  $p$  value of such a test is also present in Table 6, and only for the OECD the null is rejected, being the MG estimator more efficient, and the long-run slope homogeneity rejected.

An equivalent set of results with the interaction term between public consumption and our institutional proxy is presented in Panel B. It shows that in the case of the OECD the interaction term is negative and statistically significant. However, in the case of emerging and low income countries the interaction term is no longer statistically significant.

Finally, in Table 7 when ones allows for heterogeneous technology parameters and factor loadings, we still get negative and statistically significant coefficients on our government size proxy which is in line with Romero-Avila and Struch (2008) who found a negative a significant effect from government consumption (and transfers) on output. However, in the case of emerging and low income countries such effect is no longer as strong and sometimes even positive (even if not statistically significant).<sup>24</sup> We compare different econometric specifications for robustness and completeness. Still, for the OECD sample there are negative interaction terms: (1) the negative effect of public consumption on real GDP per capita is stronger at lower levels of institutional quality, and (2) the positive effect of institutional quality on real GDP per capita increases at smaller levels of public consumption.

## 5 Conclusion

We provide new evidence on whether “too much” government is good or bad for economic progress and macroeconomic performance, particularly when associated with differentiated levels of (underlying) institutional quality and alternative political regimes. We conduct an empirical panel exercise taking 140 countries from 1970 to 2010 and employing different proxies for government size and institutional

<sup>23</sup> Under the null hypothesis the difference in the estimated coefficients between the MG and the PMG estimators is not significant and the PMG is more efficient.

<sup>24</sup> In poor countries public sectors are typically small, and the relationship between government size and output can even be positive (because a state typically succeeds in collecting taxes when successful at providing the stability necessary for economic activity—sound institutions—to start growth)—see Besley and Persson (2009).

**Table 7** Estimations allowing for heterogeneous technology parameters and factor loadings (with and without interaction terms)

Sample <i>Spec.</i>	OECD		Emerging		Low income	
	CCEMG (1)	AMG (2)	CCEMG (3)	AMG (4)	CCEMG (5)	AMG (6)
Physical capital	0.256*** (0.019)	0.433*** (0.115)	0.959*** (0.278)	0.538*** (0.181)	0.447** (0.186)	0.655*** (0.062)
Human capital	0.210*** (0.071)	0.181** (0.909)	0.110* (0.082)	0.020 (0.017)	0.050* (0.027)	0.223 (0.155)
Public consumption	-0.204* (0.101)	-0.018* (0.011)	-0.222* (0.127)	-0.096 (0.109)	0.191 (0.221)	0.006 (0.105)
Polity	0.105* (0.068)	0.008 (0.007)	0.328* (0.161)	0.090* (0.064)	0.325* (0.211)	0.346** (0.138)
<i>With interaction term</i>						
Physical capital	0.300*** (0.125)	0.461*** (0.112)	0.919*** (0.273)	0.405* (0.223)	0.567** (0.292)	0.731* (0.402)
Human capital	0.233** (0.101)	0.197* (0.147)	0.076** (0.037)	0.038* (0.021)	0.144* (0.088)	0.239* (0.159)
Public consumption	-0.291** (0.134)	-0.146* (0.107)	-0.352* (0.192)	0.050 (0.451)	0.328 (0.248)	0.288 (0.216)
Polity	0.148* (0.091)	0.383 (0.477)	0.088** (0.039)	-0.676 (0.520)	0.139* (0.703)	0.632 (0.930)
Interaction	-0.159* (0.082)	-0.961 (0.827)	-0.061 (0.153)	0.544 (0.399)	0.253 (0.237)	-0.435 (0.089)

The models are estimated by CCEP or AMG estimators. The dependent variable is the logarithm of real GDP per capita

\*, \*\*, \*\*\* Significance at 10, 5 and 1 % levels

quality. Moreover, we make use of recent panel data techniques that allow for the possibility of heterogeneous dynamic adjustment around the long-run equilibrium relationship as well as heterogeneous unobserved parameters and cross-sectional dependence; we also deal with potentially relevant endogeneity issues.

Our findings can be summarized as follows: (1) generally speaking, our results seem to suggest that bigger governments tend to hamper economic activity and this finding is invariant to the selected government size proxy under scrutiny, country grouping analysed or estimation method employed; (2) institutional quality has a positive impact on the level of real GDP per capita, though results are dependent on the proxy considered; (3) the negative effect of government size on real GDP per capita is stronger at lower levels of institutional quality, and the positive effect of institutional quality on GDP per capita is stronger at smaller levels of government size.

A possible interpretation for our results rests on acknowledging that most countries may already be at the “slippery” side of the Armey curve, where spending is not productive enough and/or government financing is too distortionary. This study aims to contribute to the ongoing debate on the effect of government size on



economic activity, and it managed to provide robust additional evidence on the existence of a negative relationship between the two concepts. At least one caveat should be mentioned and this relates to the fact that we do not differentiate between different public spending items. This is difficult at the aggregation level considered and would go beyond the scope of this paper. Nevertheless, Afonso and Jalles (2013a) study the relationship of education, social security and health public spending and the economic business cycle in more detail. Moreover, looking closely at what governments actually do and, equally important, how they finance their production and provision of public goods and services can reveal that different activities have differentiated impact on growth. Finally, the determination of the “optimal level of government” and other issues related to public sector efficiency, though interesting questions per se, were beyond the scope of this paper and remain good candidates for future research.

**Acknowledgments** We are grateful to Julia Lendvai, Niklas Potrafke, to participants at the 14th Banca d’Italia Public Finance Workshop (Perugia), and at the 68th Annual Conference of the International Institute of Public Finance (Dresden), for useful comments on previous versions. We also thank two anonymous referees for useful suggestions that significantly improved the paper. The opinions expressed herein are those of the authors.

## References

- Acemoglu D, Robinson J (2005) *Economic origins of dictatorship and democracy*. Cambridge University Press, Cambridge
- Acemoglu D, Johnson S, Robinson JA (2001) The colonial origins of comparative development: an empirical investigation. *Am Econ Rev* 91(1369):1401
- Afonso A, Jalles JT (2013a) The cyclicity of education, health, and social security government spending. *Appl Econ Lett* 20(7):669–672
- Afonso A, Jalles JT (2013b) Growth and productivity: the role of government debt. *Int Rev Econ Financ* 25:384–407
- Afonso A, Schuknecht L, Tanzi V (2005) Public sector efficiency: an international comparison. *Public Choice* 123(3–4):321–347
- Alesina A, La Ferrara E (2000) The determinants of trust. NBER Working Papers 7621
- Angelopoulos K, Philippopoulos A, Tsionas E (2008) Does public sector efficiency matter? Revisiting the relation between fiscal size and economic growth in a world sample. *Public Choice* 137(1–2):245–278
- Armey D, Armey R (1995) *The freedom revolution: the new republican house majority leader tells why big governments failed, why freedom works and how we will rebuild America*. Regnery Publishing Inc, Washington
- Bajo-Rubio O (2000) A further generalization of the Solow growth model: the role of the public sector. *Econ Lett* 68:79–84
- Barro R (1990) Government spending in a simple model of endogenous growth. *J Polit Econ* 98(5):s103–s117
- Barro R (1991) Economic growth in a cross section of countries. *Quart J Econ* 106:407–443
- Barro R, Sala-i-Martin X (1992) Convergence. *J Polit Econ* 100:223–251
- Bergh A, Henrekson M (2010) Government size and implications for economic growth: two way traffic. American Enterprise Institute for Public Policy Research, Washington
- Bergh A, Henrekson M (2011) Government size and growth: a survey and interpretation of the evidence. *J Econ Surv* 25(5):872–897
- Bergh A, Karlsson M (2010) Government size and growth: accounting for economic freedom and globalization. *Public Choice* 142:195–213
- Bergh A, Ohn N (2011) Growth effects of fiscal policies: a critical appraisal of Colombier’s (2009) study. IFN Working Paper 858, Research Institute for Industrial Economics, Stockholm

- Besley T, Persson T (2009) The origins of state capacity: property rights, taxation, and policy. *Am Econ Rev* 99(4):1218–1244
- Bowsher CG (2002) On testing overidentifying restrictions in dynamic panel data models. CEPR Discussion Paper No. 3048, CEPR London
- Buchanan J (1980) Rent-seeking and profit-seeking. In: Buchanan JM, Tullock G (eds) *Towards a theory of the rent-seeking society*. TX, College Station
- Chaudhry A, Garner P (2007) Do governments suppress growth?: institutions, rent-seeking, and innovation blocking in a model of Schumpeterian growth. *Econ Politics* 19(1):35–52
- Chen B (2006) Economic growth with optimal public spending composition. *Oxf Econ Pap* 58:123–136
- Colombier C (2009) Growth effects of fiscal policies: an application of robust modified M-estimator. *Appl Econ* 41:899–912
- Conte MA, Darrat AF (1988) Economic growth and the expanding public sector: a reexamination. *Rev Econ Stat* 70(2):322–330
- Dar A, Amirkhalkhali S (2002) Government size, factor accumulation and economic growth: evidence from OECD countries. *J Policy Model* 24:679–692
- Eberhardt M, Teal F (2010) Productivity analysis in global manufacturing production. Oxford University, Discussion Paper Series #515, November 2010
- Fölster S, Henrekson M (2001) Growth effects of government expenditure and taxation in rich countries. *Eur Econ Rev* 45:1501–1520
- Friedman M (1997) If only the US were as free as Hong Kong. *Wall Str J* A14
- Gemmell N, Kneller R, Sanz I (2011) The timing and persistence of fiscal policy impacts on growth: evidence from OECD countries. *Econ J* 121(550):F33–F58
- Ghali KH (1998) Government size and economic growth: evidence from a multivariate cointegration analysis. *Appl Econ* 31:975–987
- Gill I, Raiser M (2012) Golden growth: Restoring the lustre of the European Economic Model. International Bank for Reconstruction and Development and the World Bank
- Glomm G, Ravikumar B (1997) Productive government expenditures and long-run growth. *J Econ Dyn Control* 21:183–204
- Granger CWJ, Newbold P (1974) Spurious regressions in econometrics. *J Econom* 2:111–120
- Grossman P (1988) Government and economic growth: a non-linear relationship. *Public Choice* 56(2):193–200
- Guseh JS (1997) Government size and economic growth in developing countries: a political-economy framework. *J Macroecon* 19:175–192
- Hall RE, Jones C (1999) Why do some countries produce so much more output per worker than others? *Quart J Econ* 114(83):116
- Holcombe R (2005) Government growth in the twenty-first century. *Public Choice* 124(1–2):95–114
- Im KS, Pesaran MH, Shin Y (2003) Testing for unit roots in heterogeneous panels. *Journal of Econometrics* 115:53–74
- IMF (2001) A manual on government finance statistics 2001. (GFSM 2001). <http://www.imf.org/external/pubs/ft/gfs/manual/gfs.htm> Washington DC: International Monetary Fund
- Jalles JT (2010) Does democracy foster or hinder growth? Extreme-type political regimes in a large panel. *Economics Bulletin* 30(2):1359–1372
- Kaufmann D, Kraay A, Mastruzzi M (2009) Governance matters VIII: aggregate and individual governance indicators for 1996–2008. World Bank Policy Research Paper No. 4978. <http://ssrn.com/abstract=1424591>
- Kirchgaessner G (2001) The effects of fiscal institutions on public finance: a survey of the empirical evidence. CESifo working paper No. 617, Germany
- Lee J (1992) Optimal size and composition of government spending. *J Jpn Int Econ* 6:423–439
- Mauro P (1995) Corruption and growth. *Quart J Econ* 110(681):712
- Nelson RR, Sampat BN (2001) Making sense of institutions as a factor shaping economic performance. *J Econ Behav Organ* 44(2001):31–54
- North D (1990) *Institutions, institutional change and economic performance*. Cambridge University Press, Cambridge
- Olson M (1982) *The rise and decline of nations: economic growth, stagflation, and social rigidities*. Yale University Press, New Haven
- Peden E, Bradley M (1989) Government size, productivity and economic growth: the post-war experience. *Public Choice* 61(3):229–245

- Pesaran MH (2006) Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica* 74(4):967–1012
- Pesaran MH (2007) A simple panel unit root test in the presence of cross section dependence. *J Appl Econom* 22(2):265–312
- Pesaran MH, Smith RP (1995) Estimating long-run relationship from dynamic heterogeneous panels. *J Econom* 68:79–113
- Pesaran MH, Shin Y, Smith RP (1999) Pooled mean group estimation of dynamic heterogeneous panels. *J Am Stat Assoc* 94:31–54
- Przeworski A, Alvarez M, Cheibub J, Limongi F (2000) *Democracy and development: political regimes and economic well-being in the World, 1950–1990*. Cambridge University Press, New York
- Ram R (1986) Government size and economic growth: a new framework and some evidence from cross-section and time series data. *Am Econ Rev* 76:191–203
- Rodrik D, Wacziarg R (2005) Do democratic transitions produce bad economic outcomes? *Am Econ Rev* 95(3):50–55
- Romero-Avila D, Struch R (2008) Public finances and long-term growth in Europe: evidence from a panel data analysis. *Eur J Polit Econ* 24(1):172–191
- Slemrod J (1995) What do cross-country studies teach about government involvement, prosperity, and economic growth? *Brook Pap Econ Act* 2:373–431
- Tanzi V, Zee H (1997) Fiscal policy and long-run growth. *IMF Staff Pap* 44:179–209
- Vanhanen T (2005) Measures of democracy 1810-2004 [computer file]. FSD1289, version 2.0 (2005-08-17). Tampere: Finnish Social Science Data Archive [distributor]
- Wahab M (2011) Asymmetric output effects of government spending: cross sectional and panel data evidence. *Int Rev Econ Financ* 8(1):574–590
- Wu SY, Tang J-H, Lin ES (2010) The impact of government expenditure on economic growth: how sensitive to the level of development. *J Policy Model* 32(6):804–817