Education spending, economic development, and the size of government

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Abstract

We examine the association between economic development and two measures of public spending on education: the "national effort" (public spending on education as a proportion of GDP) and "budget share" (public spending on education as a proportion of total government spending). Using panel data for a large sample of countries from 1989 to 2015, we compare mean levels of national effort and budget share measures for economically and politically distinct groups of countries. We find that economically more developed (richer) countries are characterised by a higher national effort and a lower budget share than less economically developed countries. This implies that richer countries, on average, have larger public sectors than poorer countries, consistent with Wagner's law and Baumol's "cost disease" hypothesis.

Keywords: education spending, Wagner's law, Baumol's cost disease, economic development, democracy

1 INTRODUCTION

Public spending accounts for the lion's share of the financing of education in most countries; indeed, the "massification" of education is made possible through public provision. Two headline measures of public education spending, namely the "national effort" (total public spending on education as a proportion of GDP) and the "budget share" (total public spending on education as a proportion of total government spending), are commonly used to compare the financing of public education across countries. Whether or not richer (developed) countries spend more on public education than do poorer (developing) countries, regardless of which of the two ratio measures is used, is a matter for empirical inquiry. In this paper, we therefore aim to test whether, on average, richer (developed) economies have larger public education sectors than poorer (developing) economies, in *both* national effort and budget share terms. As well as providing a global comparative view of education spending patterns, this offers a novel perspective on the implications for the size of the public sector (total government spending as a percentage of GDP) as income per capita increases.

The idea that the size of the public sector is positively related to the level of economic development is not new. Wagner's "law of increasing state activity", for instance, points to an apparent empirical regularity whereby an increasing share of overall government expenditure in the national economy is associated with rising income per capita. Wagner (1892; 1958) attributed expansion of the public sector to continued cultural and economic progress, which has associated social, welfare, regulatory and infrastructural requirements that necessitate a growing role for government spending in the economy (Kuckuck, 2014).

Baumol's "cost disease" hypothesis (Baumol, 1967; Baumol and Bowen, 1966) also predicts a growing public sector as a proportion of the economy. This is attributed to higher labour intensity and lower productivity growth in the public sector (for

example, in education and medical care) than in the private sector. Technological advancement, innovation and substitution of capital for labour lead to increases in wages in the private sector, which are mirrored as cost increases in the public sector. Under this explanation, public sector expansion is largely cost-driven.

The aim of this paper is to examine whether there exist differences in the mean levels of the national effort or budget share measures of education spending for economically (and politically) distinct groups of countries. By exploring the patterns of public education spending, we provide, as a by-product, insights into differences in the size of government for richer versus poorer countries. If the national effort and budget share measures are both larger for richer than for poorer countries, differences in the size of government are indeterminate in the absence of additional information. However, if richer countries have a larger national effort, but a smaller budget share than poorer countries, then this necessarily implies that richer countries, on average, have larger public sectors than poorer countries.

Several hypotheses can be formulated from the relevant empirical literature. The ability of publicly provided education to reach all parts of society (the massification of education), makes education a useful conduit through which social, cultural and economic progress (for example, human capital development) can be advanced. Public financing of education is, therefore, expected to expand along with overall public spending as part of governments' efforts to promote economic growth and development, especially if education is viewed as a merit good and a productive component of public spending.

To measure economic development, income per capita has been widely used as an explanatory variable in studies of education spending (Shin, 2020; Afonso and Alves, 2017; Cockx and Francken, 2016; Garritzmann and Seng, 2016; Dragomirescu-Gaina, 2015). The intuition is that richer, more developed, countries have greater resources with which to fund various social programmes, such as education (Brown and Hunter, 2004). The evidence suggests a positive relationship between the national effort measure and economic development (Shin, 2020; Cockx and Francken, 2016; Akanbi and Schoeman, 2010; Huber, Mustillo and Stephens, 2008; Busemeyer, 2007; Stasavage, 2005; Baqir, 2002; Ram, 1995; Tilak, 1989).

Evidence concerning the budget share is more limited. The few studies employing this measure mostly report a positive association between budget share and economic development (Fosu, 2010; Stasavage, 2005; Baqir, 2002), although the relationship is not always significant, and the studies by Fosu and Stasavage are concerned only with African countries. Angelov (2019) provides an example of a more recent study that employs a budget share measure of education spending to compare European Union countries' education spending but does not investigate the relationship between education spending and economic development. However, it is reasonable to suppose that, as countries grow and develop, the size and complexity of their respective public sectors (the variety of public goods to be financed by

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government) will grow, so education could end up constituting a reducing share of the total budget allocation, *ceteris paribus*. A negative association between the budget share and the level of development would be likely if education is a "necessity" with respect to total government spending.

The type of political regime is also relevant in an analysis of education spending. Regardless of the outcome measure (national effort or budget share), democratic countries are expected to spend more on education, *ceteris paribus*. It is well documented in the political economy literature that democracy is positively associated with the public provision of basic services, such as education (Baum and Lake, 2003; Lake and Baum, 2001), although there are different views about the exact mechanisms underpinning this association (Harding and Stasavage, 2014). On the one hand, spending more on socially productive public goods, such as education, provides a politically popular way for governments to demonstrate accountability and broaden their voter pool. Brown and Hunter (2004), for example, make this point with respect to spending on primary education in Latin America. On the other hand, evidence also exists for democratic developing countries (e.g., Brazil) that poorer electorates prefer government to allocate spending to areas other than education (Bursztyn, 2016); hence, a negative association between democracy and education spending is possible. However, overall, many empirical studies find evidence that public education spending is higher in democracies (Murshed et al., 2022; Shin, 2020; Garritzmann and Seng, 2016; Avelino, Brown and Hunter, 2005; Stasavage, 2005; Baqir, 2002). Consequently, in our analysis of public education spending, we categorise countries by political regime (democratic versus non-democratic) as well as by levels of income, while controlling for other social and economic factors.

The rest of this paper proceeds as follows. In section 2, we describe the data and outline the empirical method to be applied. In section 3, we report the empirical results, including checks for robustness. The main findings are discussed in section 4, and section 5 concludes.

2 DATA AND EMPIRICAL METHODS

We use annual panel data from 1989 to 2015 for up to 193 countries, although the number of available observations depends on the variables being considered. Table 1 presents details of the data collected. Two different continuous outcome measures for public education spending are examined, namely the national effort (total public spending on education as a proportion of GDP, *pse/gdp*) and budget share (total public spending on education as a proportion of total government spending, *pse/gov*). Three key categorical explanatory measures are used because our aim is to compare education spending for economically and politically distinct *groupings* of countries. The level of economic development (*ypc2015*) is represented by a set of dummy variables, categorising countries into five groups adapted from the World Bank's Country and Lending Groups as at 2015. These are based on gross national income (GNI) per capita in US dollars using the World Bank's Atlas

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method, which smooths exchange rate fluctuations and provides a comparable cross-country measure for grouping countries by income per capita. The sample contains representation across the full range of income levels. The richest group consists of the 21 wealthiest, long-standing Organisation for Economic Co-operation and Development (OECD) "core" countries; these constitute the same set of countries examined by Busemeyer (2007). The other four groups are high-income (mostly non-OECD), upper-middle-income, lower-middle-income, and low-income countries. Appendix table A1 gives a list of countries included in each group.

Table 1

Data definitions and sources

Variable name	Description of the variable	Source
	Dependent variables	
pse/gdp	Public spending on education, total (% of GDP)	World Bank EdStats
pse/gov	Public spending on education, total (% of total government spending)	World Bank EdStats
	Explanatory variables	
ypc2015	GNI per capita country grouping in 2015, 21 OECD countries	World Bank (Atlas Method)
region	Richer (versus poorer) country regions	Authors' compilation
poldemoc	Political democracy classification: yes; no	Freedom House
	Control variables	
pop024	Population aged 0-24 (% of total population)	World Bank EdStats
urban	Urban population (% of total population)	World Bank WDI
trade	Exports plus imports of goods and services (% of GDP)	World Bank WDI
hci	Human capital index	Penn World Table 9.0
pop65	Population aged 65 and above (% of total population)	World Bank WDI
military	Military expenditure (% of GDP)	World Bank WDI
fiscbal	Fiscal balance (% of GDP)	World Bank DPG
debt	General government gross debt (IMF, % of GDP)	World Bank TCdata360
	Other variables	
gdppc	GDP per capita, PPP (constant 2011 international $)	World Bank WDI
gini	Gini index (World Bank Estimate)	World Bank WDI

Notes: EdStats refers to the World Bank's Education Statistics database (World Bank, 2017a). TCdata360 refers to the World Bank's TCdata360 database (World Bank, 2017b). WDI refers to the World Bank's World Development Indicators database (World Bank, 2017c). DPG refers to the World Bank's Development Prospects Group: A Cross-Country Database of Fiscal Space (World Bank, 2017d). The pop024 variable is the sum of pop014 and pop1524 variables from the World Bank EdStats database. Freedom House refers to the Freedom in the World survey data (Freedom House, 2016). See Feenstra, Inklaar and Timmer (2015) for the Penn World Table 9.0.

An alternative classification of countries by development status is based on a binary richer-country/poorer-country split, defined in terms of regional country groupings (*region*). Appendix table A2 provides a list of countries included in each group. A binary perspective on education spending patterns can be explored by using a pair of regional dummy variables representing rich versus poor countries.

A classification of countries depending on whether they are democratic or non-democratic (*poldemoc*) is used to represent different political regime types. A classification of countries by regime type (democratic versus non-democratic) is not listed because this can vary over time. For each of the key categorical explanatory measures, sample selection bias is mitigated because the economic groupings of countries are invariant over the study period, and the political regime type (democratic versus non-democratic) typically varies only very slowly over time in most countries.

Several potentially important control variables are included in the analyses. The size of the school-going population up to age 24 (*pop024*) captures the positive demographic effect of the proportion of young people on education spending (Busemeyer, 2007, 2008; Brown and Hunter, 2004; Castles, 1989). The urbanisation ratio (*urban*) captures the positive effect of a greater concentration of the total population in urban areas on a government's propensity to act in favour of fundamental social needs, such as education (Akanbi and Schoeman, 2010; Huber, Mustillo and Stephens, 2008; Avelino, Brown and Hunter, 2005; Baqir, 2002; Schultz, 1988). Total international trade (*trade*) is often included in empirical analyses of education spending (Ozkok, 2017; Busemeyer, 2009; Huber, Mustillo and Stephens, 2008; Iversen and Stephens, 2008; Kaufman and Segura-Ubiergo, 2001). This allows for two possible effects: a positive compensation effect, in which government "compensates" society for the adverse effects of globalisation through greater social and welfare spending, and a negative efficiency effect, in which government sees increased globalisation as a mechanism to promote competitiveness, reducing the need for social and welfare spending.[1] Which trade effect dominates is an empirical question.

A number of other control variables are used for robustness checking. The size of the population aged 65 and above (*pop65*) represents a demographic cohort that competes for education spending in the form of transfer payments to the elderly population (Shin, 2020; Busemeyer, 2008; Iversen and Stephens, 2008; Avelino, Brown and Hunter, 2005; Brown and Hunter, 1999). Military spending (*military*) is also expected to compete for education's share of public resources, especially in countries with a large military presence (Shin, 2020; Baqir, 2002). The fiscal balance (*fiscbal*) and gross public debt stock (*debt*) are both expected to have implications for how much of the public purse is allocated to education (Busemeyer, 2009;

[1] More detailed explanations of the compensation and efficiency hypotheses are provided by Walter (2010), Adserà and Boix (2002), Garrett (1998a, 1998b, 2001), Rodrik (1998), Katzenstein (1985), Ruggie (1982) and Cameron (1978).

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Huber, Mustillo and Stephens, 2008; Tilak, 1989, 1990). Human capital development, as measured by the Penn World Table (Feenstra, Inklaar and Timmer, 2015) human capital index (*hci*), is not typically used in this empirical literature, but is included to control for the current-period stock of human capital as a proxy for the quality of education in a country.

Pooled descriptive statistics for each variable are reported in appendix table A3. Data availability is a pervasive problem in the literature on education spending. The two measures of education spending are available for fewer countries (N) and a smaller average number of time-series observations than are any of the explanatory variables: the sample is roughly half as large in most cases.

The approach we adopt – one-way or two-way ANOVA and ANCOVA, with the focus being a two-way factorial analysis of covariance – aims for a descriptive characterisation of *average* differences between broad groupings of countries, rather than implying specific causal linkages. The method is a variant of fixed effects estimation, but instead of estimating country fixed effects, more highly aggregated group effects are estimated. An advantage of this method is that it is possible to estimate mean differences in the groups of interest while controlling for other relevant variables. The regression equations include interactions of political and economic dummy variables, allowing for different intercepts in each political-economic group. However, no other interaction terms are included, and the parameters for the controls are assumed to be constant across all countries. Allowing for heterogeneous group parameters would mean having to interact all the group dummies with the control variables, leading to a proliferation of explanatory variables and excessive multicollinearity.

The models in equations (1) and (2) represent the empirical specifications to be tested. Separate single-equation models are estimated for national effort and budget share. In the model in equation (1), we include interaction terms between categorical variables for five economic groups and two political groups (democratic, non-democratic), yielding 10 categories. In the model in equation (2), we include interaction terms between categorical variables for two regional groups (richer, poorer) and the two political groups, yielding four categories.

$$Y_{it} = \sum_{j=1}^{5}\sum_{m=0}^{1} \alpha_{jm}(E_{jit} \times P_{mit}) + \sum_{n=1}^{N} \beta_n X_{nit} + \varepsilon_{it} \tag{1}$$

$$Y_{it} = \sum_{r=0}^{1}\sum_{m=0}^{1} \alpha_{rm}(R_{rit} \times P_{mit}) + \sum_{n=1}^{N} \beta_n X_{nit} + \varepsilon_{it} \tag{2}$$

Here, Y is either the national effort or budget share measure of total education spending; E_j (j = 1, …, 5) constitutes a set of five (1/0) dummy variables, one for each of the five GNI per capita country groups; P_m (m = 0, 1) is a set of two (1/0) dummy variables, one for each of the political groupings, i.e., democratic, (m = 1)

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or non-democratic ($m = 0$); R_r ($r = 0, 1$) is a set of two (1/0) dummy variables, one for each of the two regional country groups (poorer or richer); X_n ($n = 1, \ldots, N$) is a set of continuous control variables comprising a minimum of three or a maximum of eight controls; and ε is a generic random error term. Subscripts i and t denote observations for country i and time t, respectively, and a_{jm}, a_{rm} and β_n are parameters.

In order to focus on *differences* in national effort and budget share across groups, we reparameterise equations (1) and (2). We include an intercept term and, if there are k distinct economic/political categories, k-1 dummies are included, to avoid perfect multicollinearity. The base category is then represented by the intercept. For equation (1), the base category is the group of 21 OECD countries that are democratic. For equation (2), the base category is richer countries (or, more accurately, regions comprising the richest countries of the world) that are democratic. In the reparameterised model, the coefficients on the interactions between the dummy variables represent mean differences in the education spending measure for the relevant composite economic/political category relative to the base category. So, for example, for comparisons of different economic groups with a common political categorisation, a series of positive (negative) mean differences indicates that poorer countries have, on average, higher (lower) levels of the education spending measure relative to the relevant base category.

The least-squares dummy-variable (LSDV) estimator with heteroskedasticity-robust standard errors is used to obtain the baseline set of results. We undertake several types of robustness check. First, we report quantile (median) regression and robust regression estimates of the parameters to check for sensitivity to outlier observations.[2] Second, we examine a number of different estimators of the standard errors for the LSDV results.[3] These include one-way (country or year) and two-way (country and year) clustering, Newey-West heteroskedasticity and autocorrelation consistent (HAC) standard errors (Newey and West, 1987, 1994), and Driscoll and Kraay's (1998) standard errors, which are robust to heteroskedastic, autocorrelated and cross-sectionally dependent errors. Third, we examine the effects of including time dummies to control for year effects and adding additional control variables (*hci*, *pop65*, *military*, *fiscbal*, *debt*). Fourth, we examine the effects of using a continuous measure of GDP per capita (*gdppc*) as a way to check whether the substantive pattern of results is noticeably different from using our preferred GNI per capita categorisation of countries. Finally, we explore the implications of including a Gini index of income inequality (*gini*) and *hci* lagged by one period, and examining different quantiles (0.2, 0.25, 0.4, 0.5, 0.6, 0.75, 0.8) for the quantile estimator; with all these additional specifications we incorporate the main controls (*pop024*, *urban*, and *trade*).[4]

[2] Robust estimation uses the "rreg" routine in Stata. An initial screening based on Cook's distance is used to remove gross outliers. Starting values are then calculated, and Huber iterations performed, followed by biweight iterations, to determine the down-weighting of any outliers; see Hamilton (1991) for further details.
[3] Baum, Nichols and Schaffer (2010) and Cameron and Miller (2015) provide a practical discussion of cluster-robust inference. All estimates are obtained using Stata; one-way clustering of standard errors is performed using "cluster(country)" or "cluster(year)". Two-way clustering is performed with the user-written program "vce2way" (Yoo, 2017).
[4] We are grateful to a reviewer for suggesting these additional robustness checks.

3 RESULTS

Table 2 reports the main empirical estimates for the national effort and budget share, for the model with 10 economic/political categories; the corresponding results for the model with four categories are reported in table 3. In the tables of results, the coefficient estimates are labelled "*j*#*m*" ($j = 1, \ldots, 5$; $m = 0, 1$) for equation (1) and "*r*#*m*" ($r = 0, 1$; $m = 0, 1$) for equation (2). "BASE" represents the intercept estimate. Each estimation method (LSDV, quantile, and robust) is applied to a model with no controls (A), and with three controls (B). Note that there are no non-democratic OECD or richer countries, so there are no results for these combinations.

The most important finding from table 2 (equation (1)), and table 3 (equation (2)) is a reversal in the pattern of mean differences for the levels of the national effort compared to the budget share. Interaction of the economic and political dummies (table 2), or regional and political dummies (table 3), reveals a pattern of significant *negative* mean differences (compared to the base category) for the national effort but *positive* mean differences for the budget share. These patterns are similar regardless of whether no controls or three controls are used. When we control for political categorisation, richer (poorer) countries tend to spend more, on average, in national effort (budget share) terms, although the association is not always monotonic.

Whether a country has a democratic political system is associated with its education spending patterns, with significant mean differences within the same economic or regional group. For example, regardless of the spending measure (national effort or budget share), when we control for economic or regional group, democratic countries tend to spend more on average than their non-democratic counterparts. Table 4 reports a summary of the results from a series of pairwise Wald tests, conducted on the robust regression estimates obtained from tables 2 and 3, for the null hypothesis of parameter equality (i.e., no difference in the mean levels of education spending for countries with democratic versus non-democratic systems, within the same economic or regional group). For example, we can test whether the mean level of education spending in low-income democratic countries differs significantly from that of low-income countries that are not democratic. Because the intercept term is the common base category for all economic/political groups, we can ignore that and focus on the differences in the relevant coefficient estimates. We are conducting multiple hypothesis tests, which inflates the overall "familywise" Type I error rate, so we apply a Bonferroni correction to the level of significance used for each individual test by dividing the familywise error rate (set at 0.05) by the number of tests (for example, 0.05/4 tests = 0.0125). Even with such a correction, most pairwise comparisons still reveal statistically significant differences.

Table 2
Mean differences in the national effort and budget share by income group and regime type

Dependent variable	**pse/gdp**						**pse/gov**					
Estimation method	**LSDV**		**Quantile**		**Robust**		**LSDV**		**Quantile**		**Robust**	
	(A)	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**
1#0. Low income, not democratic	-1.551*** (0.254)	-1.635*** (0.359)	-1.787*** (0.133)	-1.885*** (0.260)	-1.979*** (0.130)	-2.013*** (0.207)	3.633*** (0.436)	-0.012 (0.726)	3.948*** (0.608)	-0.162 (0.696)	3.387*** (0.392)	-0.210 (0.614)
1#1. Low income, democratic	-1.684*** (0.123)	-1.756*** (0.257)	-1.757*** (0.127)	-1.877*** (0.257)	-1.724*** (0.153)	-1.759*** (0.216)	4.796*** (0.381)	1.339* (0.686)	5.135*** (0.366)	1.290** (0.581)	4.821*** (0.467)	1.467** (0.643)
2#0. Lower middle income, not democratic	-1.152*** (0.130)	-1.412*** (0.220)	-1.170*** (0.209)	-1.578*** (0.259)	-1.362*** (0.116)	-1.611*** (0.171)	4.304*** (0.368)	1.081* (0.600)	4.231*** (0.595)	0.614 (0.531)	4.196*** (0.353)	0.850* (0.511)
2#1. Lower middle income, democratic	-0.454*** (0.158)	-0.663*** (0.199)	-0.739** (0.318)	-1.126*** (0.287)	-0.979*** (0.117)	-1.123*** (0.159)	4.852*** (0.369)	2.421*** (0.446)	4.137*** (0.470)	1.661*** (0.419)	4.224*** (0.348)	1.830*** (0.468)
3#0. Upper middle income, not democratic	-1.090*** (0.155)	-1.389*** (0.230)	-1.357*** (0.166)	-1.669*** (0.177)	-1.432*** (0.129)	-1.764*** (0.146)	2.520*** (0.455)	-0.022 (0.503)	2.058*** (0.748)	-0.131 (0.371)	2.317*** (0.405)	-0.128 (0.450)
3#1. Upper middle income, democratic	-0.819*** (0.097)	-1.097*** (0.132)	-0.797*** (0.106)	-1.131*** (0.156)	-0.935*** (0.106)	-1.133*** (0.127)	3.643*** (0.279)	1.708*** (0.354)	3.556*** (0.331)	1.205*** (0.179)	3.411*** (0.318)	1.347*** (0.374)
4#0. High income (non-OECD), not democratic	-1.123*** (0.183)	-1.987*** (0.217)	-1.478*** (0.152)	-1.933*** (0.195)	-1.329*** (0.171)	-2.047*** (0.189)	0.987** (0.499)	-2.057*** (0.566)	0.034 (0.751)	-3.107*** (0.356)	0.683 (0.502)	-2.852*** (0.543)
4#1. High income (non-OECD), democratic	-0.814*** (0.091)	-0.768*** (0.101)	-0.644*** (0.123)	-0.654*** (0.130)	-0.777*** (0.106)	-0.721*** (0.111)	0.568** (0.249)	-0.038 (0.254)	0.923*** (0.308)	0.308 (0.342)	0.471 (0.333)	-0.099 (0.338)

Dependent variable	pse/gdp						pse/gov					
Estimation method	**LSDV**		**Quantile**		**Robust**		**LSDV**		**Quantile**		**Robust**	
	(A)	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**
5#0. High income (OECD), not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5#1. High income (OECD), democratic BASE	5.352*** (0.055)	3.668*** (0.312)	5.226*** (0.056)	3.107*** (0.334)	5.325*** (0.073)	3.449*** (0.260)	12.245*** (0.122)	4.332*** (0.831)	11.973*** (0.166)	0.885 (0.643)	12.217*** (0.214)	2.576*** (0.768)
pop024		0.016*** (0.006)		0.022*** (0.006)		0.018*** (0.004)		0.146*** (0.015)		0.191*** (0.010)		0.164*** (0.013)
urban		0.009*** (0.002)		0.011*** (0.003)		0.011*** (0.002)		0.029*** (0.007)		0.046*** (0.006)		0.040*** (0.006)
trade		0.008*** (0.001)		0.008*** (0.001)		0.007*** (0.001)		0.017*** (0.003)		0.022*** (0.003)		0.021*** (0.002)
R-squared	0.060	0.100	0.074	0.107	0.123	0.190	0.141	0.198	0.092	0.146	0.136	0.226
F-value	35.86***	34.89***	n/a	n/a	43.22***	48.51***	64.55***	56.40***	n/a	n/a	42.96***	54.58***
Countries	183	169	183	169	183	169	175	165	175	165	175	165
Years	27	26	27	26	27	26	27	26	27	26	27	26
Observations	2468	2288	2468	2288	2468	2288	2194	2069	2194	2069	2194	2069

Notes: BASE group is high-income (OECD) and democratic countries. A pseudo R-squared is reported for the quantile regression. Not applicable (n/a) means there are no applicable countries for these groups. Standard errors are given in parentheses. Huber/White heteroskedasticity-robust standard errors are reported for the LSDV and quantile estimators.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 3

Mean differences in the national effort and budget share by country region and regime type

Dependent variable	pse/gdp						pse/gov					
Estimation method	**LSDV**		**Quantile**		**Robust**		**LSDV**		**Quantile**		**Robust**	
	(A)	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**
0#0. Poorer country regions, not democratic	-1.298*** (0.147)	-2.031*** (0.216)	-1.633*** (0.117)	-1.756*** (0.234)	-1.681*** (0.104)	-1.760*** (0.199)	3.880*** (0.305)	1.492** (0.612)	4.046*** (0.499)	0.726 (0.764)	3.757*** (0.303)	1.108* (0.597)
0#1. Poorer country regions, democratic	-0.804*** (0.104)	-1.412*** (0.166)	-1.163*** (0.121)	-1.235*** (0.180)	-1.110*** (0.098)	-1.178*** (0.166)	5.077*** (0.233)	3.321*** (0.458)	4.833*** (0.287)	2.284*** (0.496)	4.923*** (0.283)	2.945*** (0.491)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	5.169*** (0.069)	2.095*** (0.375)	5.114*** (0.062)	2.047*** (0.404)	5.213*** (0.074)	2.520*** (0.348)	11.944*** (0.127)	5.333*** (1.193)	11.849*** (0.160)	2.093** (0.960)	11.943*** (0.212)	3.705*** (1.036)
pop024		0.034*** (0.007)		0.025*** (0.007)		0.019*** (0.006)		0.104*** (0.021)		0.163*** (0.019)		0.127*** (0.019)
urban		0.016*** (0.003)		0.022*** (0.003)		0.020*** (0.002)		0.029*** (0.008)		0.044*** (0.008)		0.037*** (0.007)
trade		0.013*** (0.002)		0.011*** (0.002)		0.011*** (0.001)		0.018*** (0.004)		0.017*** (0.004)		0.021*** (0.003)

Dependent variable	pse/gdp						pse/gov					
Estimation method	**LSDV**		**Quantile**		**Robust**		**LSDV**		**Quantile**		**Robust**	
	(A)	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**
R-squared	0.057	0.167	0.090	0.170	0.154	0.313	0.195	0.222	0.140	0.171	0.189	0.247
F-value	52.61***	63.60***	n/a	n/a	135.10***	125.25***	270.00***	113.21***	n/a	n/a	158.19***	84.82***
Countries	102	97	102	97	102	97	99	96	99	96	99	96
Years	27	26	27	26	27	26	27	26	27	26	27	26
Observations	1486	1382	1486	1382	1486	1382	1360	1299	1360	1299	1360	1299

Notes: BASE group is richer country regions that are democratic. See the notes for table 2. Standard errors are given in parentheses.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 4

Wald tests for parameter equality of the factor-variable interactions

Wald tests for parameter equality in table 2						
	Robust estimator					
	(A)			**(B)**		
Dependent variable: *pse/gdp*	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.0125)	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.0125)
Test parameter 1#0 = 1#1	$F(1, 2459) = 2.19$ $p = 0.1388$	No	No	$F\ (1, 2276) = 2.33$ $p = 0.1273$	No	No
Test parameter 2#0 = 2#1	$F(1, 2459) = 8.90$ $p = 0.0029$	Yes	Yes	$F(1, 2276) = 14.79$ $p = 0.0001$	Yes	Yes
Test parameter 3#0 = 3#1	$F(1, 2459) = 14.38$ $p = 0.0002$	Yes	Yes	$F(1, 2276) = 24.17$ $p = 0.0000$	Yes	Yes
Test parameter 4#0 = 4#1	$F(1, 2459) = 10.20$ $p = 0.0014$	Yes	Yes	$F(1, 2276) = 51.44$ $p = 0.0000$	Yes	Yes
	Robust estimator					
	(A)			**(B)**		
Dependent variable: *pse/gov*	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.0125)	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.0125)
Test parameter 1#0 = 1#1	$F(1, 2185) = 7.33$ $p = 0.0068$	Yes	Yes	$F(1, 2057) = 11.37$ $p = 0.0008$	Yes	Yes
Test parameter 2#0 = 2#1	$F(1, 2185) = 0.00$ $p = 0.9438$	No	No	$F(1, 2057) = 6.75$ $p = 0.0094$	Yes	Yes
Test parameter 3#0 = 3#1	$F(1, 2185) = 6.88$ $p = 0.0088$	Yes	Yes	$F(1, 2057) = 13.88$ $p = 0.0002$	Yes	Yes
Test parameter 4#0 = 4#1	$F(1, 2185) = 0.16$ $p = 0.6852$	No	No	$F(1, 2057) = 25.58$ $p = 0.0000$	Yes	Yes

Wald tests for parameter equality in table 3

	Robust estimator					
	(A)			(B)		
Dependent variable: *pse/gdp*	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.05)	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.05)
Test parameter 0#0 = 0#1	$F(1, 1483) = 33.66$ $p = 0.0000$	Yes	Yes	$F(1, 1376) = 35.80$ $p = 0.0000$	Yes	Yes
	Robust estimator					
	(A)			(B)		
Dependent variable: *pse/gov*	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.05)	Wald statistic	Uncorrected significance (α = 0.05)	Corrected significance (α = 0.05)
Test parameter 0#0 = 0#1	$F(1, 1357) = 16.59$ $p = 0.0000$	Yes	Yes	$F(1, 1293) = 37.70$ $p = 0.0000$	Yes	Yes

Notes: The "#" naming convention accords with that in the respective table of results. Using interaction models with applicable controls, "Yes" means the relevant interaction parameters are statistically significantly different ("No" means not significantly different) from one another for the respective pairwise comparison at the conventional (uncorrected) 5% level of significance or Bonferroni (corrected) level of significance. (A) refers to the model with no controls (unconditional mean differences) and (B) refers to the model with controls (conditional mean differences). Because there is only one pairwise test of parameter equality performed on the estimates from table 3, α (= 0.05) is the same for both the uncorrected and corrected critical level of significance.

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Estimated coefficients on the control variables have the expected signs. Both the youth population and urbanisation variables have positive coefficients. The coefficient on the trade variable is positive in most cases, which supports the compensation hypothesis.

The empirical patterns are generally robust to the use of two alternative estimation methods (quantile and robust, reported in tables 2 and 3) and to the use of alternative standard errors for the LSDV estimation (reported in appendix tables A4-A7). The largest standard errors are those clustered by country (as opposed to by year or by country and year). This is not surprising, because there are many countries for which very few observations are available for the dependent variable, and this makes it more difficult to estimate coefficients precisely when clustering by country.

Robustness checks considering differences in model specification (including year dummies and employing more than three controls) are reported in appendix tables A8 and A9 (using LSDV estimation), and tables A10 and A11 (using robust estimation); for these, only the more parsimonious regional and political specification (in equation (2)) is used, because a richer versus poorer interpretation is the key focus of our study. We make three observations about these additional robustness results. Firstly, including year dummies leaves the substantive patterns of mean differences unchanged; signs of the estimated coefficients are unaffected in all cases, although there are some changes in marginal levels of statistical significance for some of the budget share results. Secondly, if a robust estimator is used to deal with outliers, the empirical patterns are exhibited more clearly regardless of the specification used. Thirdly, the signs of the coefficients on the various additional controls (*hci*, *pop65*, *military*, *fiscbal* and *debt*) are as expected in most cases. Introducing an additional control each time entails an increasingly more complex specification that either does not confound or only partially confounds the empirical patterns.[5] The most comprehensive specification (using eight controls) provides additional support for the empirical patterns in the baseline results. Overall, the observed empirical patterns of negative (positive) mean differences for the national effort (budget share), compared to the base category, are robust to the use of different estimators for the coefficients and standard errors, and to plausible changes to the specification.

Several additional robustness checks use the robust estimator (or, where applicable, the quantile estimator), including the main controls (*pop024*, *urban*, and *trade*) in all cases. These results are reported in appendix tables A12 and A13. Firstly, to check that the general patterns for both measures of education spending are maintained when using a continuous measure of income per capita, the robust estimator is used with GDP per capita (*gdppc*) and political democracy (*poldemoc*) as explanatory

[5] Partial confounding refers to the case where only poorer countries that are not democratic are shown to have significantly different means from the base group (richer and democratic countries), and with the expected sign. No confounding refers to the case where either poorer country groups (irrespective of the state of democracy) or poorer and democratic countries are shown to have significantly different means from the base group, and with the expected sign.

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variables. This also checks whether using GDP per capita (instead of our preferred World Bank Atlas method of GNI per capita country groupings) reveals anything noticeably different about the data patterns. The results are reported in column I of tables A12 and A13. These specifications are consistent with the empirical patterns observed in the main results, with a significant positive coefficient on GDP per capita for national effort and a significant negative coefficient for budget share.[6]

Secondly, the effect of including a measure of income inequality (*gini*) (column II of tables A12 and A13) is explored because within-country disparities in income are likely to influence education attainments and, hence, the political motives behind the funding of education. However, poor data coverage plagues the use of a Gini measure (or any other measure) of income inequality, limiting the extent to which meaningful inferences can be made. Nonetheless, the general patterns are maintained, albeit with some inconclusive effects; the latter is not surprising given the considerably reduced number of observations available when introducing a Gini measure. The Gini coefficient itself is not statistically significant in the national effort regression but has a statistically significant positive sign for the budget share measure.

Thirdly, we control for the effect on current education spending of the lagged level of education by including the human capital index (*hci*) variable lagged one period. Results are reported in column III in tables A12 and A13. For the most part, the general patterns noted previously are maintained.

Fourthly, in addition to the benchmark median or 0.5 quantile regression (estimates at the 50th percentile for the sample), estimates are also produced for other quantiles (20th, 25th, 40th, 60th, 75th, and 80th percentiles). Results are reported in columns IV to X in tables A12 and A13. Overall, the general patterns of predominantly positive (negative) association between the level of economic development and national effort (budget share) in education spending are maintained.

4 DISCUSSION

From the perspective of the 2 × 2 categorisation in equation (2), richer (developed) countries tend to make a greater national effort with respect to education (they spend more on average on education as a share of GDP). In contrast, they tend to have lower budget shares (they spend less on average on education as a share of total government spending) relative to poorer (less-developed) countries.

In terms of national effort, richer country governments do not necessarily value education more highly than poorer country governments, but they have greater capacity to generate income from taxes. They can raise more income from taxes

[6] Alternative specifications were also fitted using GDP per capita and its squared and cubed values, along with the political democracy variable and main controls. In all cases considered, the main results are supported, i.e., the coefficient on the linear GDP per capita term maintains the same sign, is not too dissimilar in size, and remains statistically significant. Note that, in the main results, non-linearities are allowed for by estimating piecewise linear effects, i.e., average effects for different income groupings of countries.

because they have larger formal private-sector economies. They are therefore less fiscally constrained and can spend more on areas such as education. The inability of poorer-country governments to extract revenue from a relatively small tax base constrains not only the growth of these countries' public sectors – a point noted by Holcombe (2005), albeit in more general terms – but also their national effort with respect to education. Poorer countries tend to have greater informal-sector, cash-based economic activity relative to the size of the formal private-sector economy (Schneider and Enste, 2000), which makes it more difficult for governments in such countries to extract the tax revenue necessary to finance public education.

From a budget share perspective, poorer countries tend to spend more on education as a share of total government spending because they generally have smaller public sectors, which means education tends to comprise a larger share of the total public sector budget. However, richer countries are more likely to have large, complex public sectors with a greater variety of fiscal components to be financed from tax revenue. For example, a larger role of the state in providing various kinds of welfare support in richer countries could lead to other forms of public spending, such as education, being assigned a lower priority. An implication of this reasoning is that publicly provided education, as a whole, might take on the characteristics of a necessity with respect to public-sector spending in richer countries. Consequently, from a fiscal varieties perspective, education's share of the total "fiscal pie" tends to be smaller in richer countries with larger public sectors and a greater variety of fiscal components to be paid for from the public purse, explaining why the budget share allocation to education spending is lower (higher) in richer (poorer) countries. There is also a political dimension to this explanation. The priorities for education spending differ among poorer countries with contrasting levels (or states) of democracy. Political pressures compel governments in poorer, democratic countries to spend more on areas such as education, and when poorer democratic countries grow, they can more easily generate income from taxes to satisfy political pressures to spend more on education.

For comparable levels of economic development, democratic governments tend to spend more on education. On the other hand, our empirical results for the robust estimator with controls (table 3 and table A11) show that poorer, non-democratic countries have low budget shares that are not necessarily much different from those of richer (democratic) countries. This suggests that the former not only have smaller public sectors, but also have lower allocations to education from the public purse. This might partly explain why such countries remain poor and less developed.

The observation that richer (developed) countries, on average, tend to spend more on education as a share of GDP and less on education as a share of total government spending than poorer (less-developed) countries, implies that richer countries on average have larger public sectors (total government spending as a share of GDP) than poorer countries. This follows from the identity $(E/Y)/(E/G) \equiv G/Y$, where E is public education spending; Y is GDP and G is total government spending.

If the national effort, E/Y, and budget share, E/G, are both larger for richer than for poorer countries, then differences in the size of government, G/Y, between richer and poorer countries will depend on the relative size of the increases. However, if, as our results suggest, richer countries have a *larger* national effort, but *smaller* budget share than poorer countries, then the identity necessarily implies that richer countries have *larger* public sectors than poorer countries.

Table 5

Three inequality propositions

Description	Richer countries		Poorer countries
Proposition 1 (national effort)	$\left(\frac{E}{Y}\right)_R$	>	$\left(\frac{E}{Y}\right)_P$
Proposition 2 (budget share)	$\left(\frac{E}{G}\right)_R$	<	$\left(\frac{E}{G}\right)_P$
Proposition 3 (public sector)	$\left(\frac{G}{Y}\right)_R$	>	$\left(\frac{G}{Y}\right)_P$

Notes: E refers to public spending on education, Y to national income (GDP) and G to total public spending. Subscripts R and P refer to richer and poorer countries, respectively. If Propositions 1 and 2 hold true, then they imply Proposition 3.

Table 5 summarises the key empirical findings in this study in the form of three inequality propositions representing the characteristics of richer compared to poorer countries. To the best of our knowledge, such a characterisation of education spending (Propositions 1 and 2) and, by implication, the size of the public sector (Proposition 3) has not been presented in this form before. Because the inequalities in Propositions 1 and 2, based on our empirical results, are *different* for national effort compared to budget share, they imply that richer (poorer) countries have larger (smaller) public sectors.[7] Proposition 3 logically follows as a consequence of Propositions 1 and 2; however, if empirical analysis of education spending had revealed the *same* direction of association for both measures, then Proposition 3 would not necessarily result. The same could be said for any other national effort or budget share measure of fiscal expenditure. Therefore, our analysis provides a novel way to characterise differences in the size of government at different levels of income.

[7] We note two points relating to these inequalities. First, it does not matter whether E, Y and G are measured in real or nominal terms, provided both the numerator and denominator of the relevant ratio are measured in the same nominal or real terms (using the same deflator). Second, the same estimated size of the public sector in any one country, as given by sources such as the IMF, cannot simply be obtained by taking the quotient of the national effort and budget share for that country because these education spending measures are estimates. The quotient will give only a rough approximation of the size of government, especially for countries that have less accurate education spending data.

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5 CONCLUSION

We examine whether there are mean differences in the levels of public spending on education for two widely used national-level measures (national effort and budget share) for different economic (or regional) and political groupings of countries. Controlling for the state of democracy, we find that richer (poorer) countries tend to spend, on average, a larger (smaller) share of GDP on education, but a smaller (larger) share of total government spending on education. Richer countries, on average, make a greater national educational effort, whereas poorer countries allocate a greater budget share to education. By implication, richer countries, on average, have larger public sectors than poorer countries. In addition, for comparable levels of income, democratic countries tend to spend more on education than is the case for their non-democratic counterparts.

The findings with respect to levels of income can be summarised in the form of three inequality propositions. Examination of education spending patterns with respect to the national effort and budget share measures provides indirect support for a positive association between the size of government and income, consistent with Wagner's law and Baumol's "cost disease" hypothesis. Peacock and Scott (2000) note that different components of government expenditure might grow at different rates. Therefore, from the perspective of public policy analysis, future research might focus on testing the inequality propositions identified in this study with respect to other components of the government's budget allocation (for example, the national effort and budget share of health, military, or welfare spending).

Disclosure statement

The authors have no potential conflict of interest to report.

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TABLE A1

List of countries and territories by GNI per capita group in 2015 (ypc2015)

Low income (31)	Lower middle income (52)	Upper middle income (56)	High income (mostly non-OECD) (57)	High income (OECD) (21)
Afghanistan	Armenia	Albania	Andorra	Australia
Benin	Bangladesh	Algeria	Antigua and Barbuda	Austria
Burkina Faso	Bhutan	American Samoa	Aruba	Belgium
Burundi	Bolivia	Angola	Bahamas, The	Canada
Central African Republic	Cabo Verde	Argentina	Bahrain	Denmark
Chad	Cambodia	Azerbaijan	Barbados	Finland
Comoros	Cameroon	Belarus	Bermuda	France
Congo, Dem. Rep.	Congo, Rep.	Belize	British Virgin Islands	Germany
Eritrea	Cote d'Ivoire	Bosnia and Herzegovina	Brunei Darussalam	Greece
Ethiopia	Djibouti	Botswana	Cayman Islands	Ireland
Gambia, The	Egypt, Arab Rep.	Brazil	Channel Islands	Italy
Guinea	El Salvador	Bulgaria	Chile	Japan
Guinea-Bissau	Ghana	China	Croatia	Netherlands
Haiti	Guatemala	Colombia	Curacao	New Zealand
Korea, Dem. People's Rep.	Honduras	Costa Rica	Cyprus	Norway
Liberia	India	Cuba	Czech Republic	Portugal
Madagascar	Indonesia	Dominica	Estonia	Spain
Malawi	Kenya	Dominican Republic	Faroe Islands	Sweden
Mali	Kiribati	Ecuador	French Polynesia	Switzerland
Mozambique	Kosovo	Equatorial Guinea	Gibraltar	United Kingdom
Nepal	Kyrgyz Republic	Fiji	Greenland	United States
Niger	Lao PDR	Gabon	Guam	
Rwanda	Lesotho	Georgia	Hong Kong SAR, China	
Senegal	Mauritania	Grenada	Hungary	
Sierra Leone	Micronesia, Fed. Sts.	Guyana	Iceland	
Somalia	Moldova	Iran, Islamic Rep.	Isle of Man	
South Sudan	Mongolia	Iraq	Israel	
Tanzania	Morocco	Jamaica	Korea, Rep.	
Togo	Myanmar	Jordan	Kuwait	
Uganda	Nicaragua	Kazakhstan	Latvia	
Zimbabwe	Nigeria	Lebanon	Liechtenstein	
	Pakistan	Libya	Lithuania	
	Papua New Guinea	Macedonia, FYR	Luxembourg	
	Philippines	Malaysia	Macao SAR, China	
	Samoa	Maldives	Malta	
	Sao Tome and Principe	Marshall Islands	Monaco	
	Solomon Islands	Mauritius	Nauru	
	Sri Lanka	Mexico	New Caledonia	
	Sudan	Montenegro	Northern Mariana Islands	
	Swaziland	Namibia		
	Syrian Arab Republic	Palau		
		Panama		
		Paraguay		

Low income (31)	Lower middle income (52)	Upper middle income (56)	High income (mostly non-OECD) (57)	High income (OECD) (21)
	Tajikistan	Peru	Oman	
	Timor-Leste	Romania	Poland	
	Tonga	Russian Federation	Puerto Rico	
	Tunisia	Serbia	Qatar	
	Ukraine	South Africa	San Marino	
	Uzbekistan	St. Lucia	Saudi Arabia	
	Vanuatu	St. Vincent and the Grenadines	Seychelles	
	Vietnam	Suriname	Singapore	
	West Bank and Gaza	Thailand	Sint Maarten (Dutch part)	
	Yemen, Rep.	Turkey	Slovak Republic	
	Zambia	Turkmenistan	Slovenia	
		Tuvalu	St. Kitts and Nevis	
		Venezuela, RB	St. Martin (French part)	
			Trinidad and Tobago	
			Turks and Caicos Islands	
			United Arab Emirates	
			Uruguay	
			Virgin Islands (U.S.)	

Notes: Groups are adapted from the World Bank's Country and Lending Groups for the 2015 calendar year, based on GNI per capita calculated using the World Bank Atlas Method, except for the high-income (OECD) group, which includes the 21 countries comprising the "core" OECD countries that have been categorised as OECD for the entire study period, from 1989 to 2015 (i.e., excluding Chile, Czech Republic, Estonia, Hungary, Iceland, Israel, Korea, Latvia, Luxembourg, Mexico, Poland, Slovak Republic, Slovenia and Turkey, which are mostly included in the second high-income group). Numbers in parentheses show the total number of countries in each group. The historical classification is available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

Source: Adapted from the World Bank's historical classification.

TABLE A2

List of countries by two regional country groups (region)

Poorer country regions				
Central Africa (8)	**Central America (8)**	**East Africa (12)**	**South America (12)**	**South Asia (8)**
Cameroon	Belize	Burundi	Argentina	Afghanistan
Central African Republic	Costa Rica	Comoros	Bolivia	Bangladesh
Chad	El Salvador	Djibouti	Brazil	Bhutan
Congo, Dem. Rep.	Guatemala	Eritrea	**Chile**	India
Congo, Rep.	Honduras	Ethiopia	Colombia	Maldives
Equatorial Guinea	Mexico	Kenya	Ecuador	Nepal
Gabon	Nicaragua	Rwanda	Guyana	Pakistan
Sao Tome and Principe	Panama	Somalia	Paraguay	Sri Lanka
		South Sudan	Peru	
		Sudan	Suriname	
		Tanzania	**Uruguay**	
		Uganda	Venezuela, RB	
Southeast Asia (11)	**Southern Africa (13)**	**West Africa (16)**		
Brunei Darussalam	Angola	Benin		
Cambodia	Botswana	Burkina Faso		
Indonesia	Lesotho	Cabo Verde		
Lao PDR	Madagascar	Cote d'Ivoire		
Malaysia	Malawi	Gambia, The		
Myanmar	Mauritius	Ghana		
Philippines	Mozambique	Guinea		
Singapore	Namibia	Guinea-Bissau		
Thailand	**Seychelles**	Liberia		
Timor-Leste	South Africa	Mali		
Vietnam	Swaziland	Mauritania		
	Zambia	Niger		
	Zimbabwe	Nigeria		
		Senegal		
		Sierra Leone		
		Togo		
Richer country regions				
North America (3)	**Nordic Countries (5)**	**Western Europe (22)**		
Bermuda	Denmark	Andorra		
Canada	Finland	Austria		
United States	Iceland	Belgium		
	Norway	Channel Islands		
	Sweden	Faroe Islands		
		France		
		Germany		
		Gibraltar		
		Greece		
		Greenland		
		Ireland		
		Isle of Man		
		Italy		

Richer country regions				
North America (3)	**Nordic Countries (5)**	**Western Europe (22)**		
		Liechtenstein		
		Luxembourg		
		Monaco		
		Netherlands		
		Portugal		
		San Marino		
		Spain		
		Switzerland		
		United Kingdom		

Notes: The numbers in parentheses show the total number of countries in each sub-group of the respective country regions. For the poorer country regions, Equatorial Guinea, Chile, Uruguay, Brunei Darussalam, Singapore and Seychelles (the countries in bold) are excluded because they are classified as high-income (non-OECD) countries for most or all of the time period under investigation (from 1989 to 2015).

Source: Authors' compilation.

Table A3

Descriptive statistics

Variable name	Data coverage	*N*	Countries	Years	Mean	Std. dev.	Min.	Max.
pse/gdp	1989-2015	2551	193	13.2	4.505	2.007	0.781	44.334
pse/gov	1989-2015	2255	181	12.5	14.849	5.036	2.563	47.279
ypc2015	1989-2015	5859	217	27.0	n/a	n/a	n/a	n/a
region	1989-2015	3024	112	27.0	n/a	n/a	n/a	n/a
poldemoc	1989-2015	5105	193	26.5	n/a	n/a	n/a	n/a
pop024	1990-2015	4714	184	25.6	49.977	13.687	20.160	73.288
urban	1989-2015	5799	215	27.0	55.788	24.901	5.342	100.000
trade	1989-2015	4785	193	24.8	86.996	52.290	0.021	531.737
hci	1989-2014	3703	143	25.9	2.342	0.694	1.028	3.734
pop65	1989-2015	5234	195	26.8	7.073	4.814	0.697	26.342
military	1989-2015	3870	166	23.3	2.433	3.210	0	117.388
fiscbal	1990-2015	4184	191	21.9	-2.299	13.715	-505.442	122.188
debt	1989-2015	3796	186	20.4	57.015	49.714	0	789.833
gini	1989-2014	1188	155	7.7	39.875	9.871	16.23	65.76
gdppc	1990-2015	4803	195	24.6	15111	18507	247	137164

Notes: Years refers to the average number of years (time-series observations) for each country. Std. dev. refers to the overall standard deviation. Two changes were made to the original data for the pse/gdp variable. The zero observation for Turkey in 1998 was deleted (because there were no other 0% values in the dataset; nil or negligible appeared in the original UNESCO source data for this observation) and the observation for Tuvalu in 1997 (3730833.5%) was deleted as an obvious mistake; the extreme value for this observation also appeared in the original UNESCO source data. It was subsequently noted that this observation was deleted from the World Bank's Education Statistics (EdStats) data as of the update dated 21 May 2018. Descriptive results are not reported for ypc2015 (21 OECD countries), region and poldemoc because these are sets of binary variables used to characterise broad political and economic categories.

TABLE A4

Mean differences in the national effort by income group and regime type – alternative standard error estimates

Dependent variable: *pse/gdp*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
1#0. Low income, not democratic	-1.551*** (0.254)	-1.635*** (0.359)	-1.551*** (0.544)	-1.635* (0.911)	-1.551*** (0.265)	-1.635*** (0.394)	-1.551*** (0.549)	-1.635* (0.926)	-1.551*** (0.311)	-1.635*** (0.486)	-1.551*** (0.294)	-1.635*** (0.531)
1#1. Low income, democratic	-1.684*** (0.123)	-1.756*** (0.257)	-1.684*** (0.330)	-1.756** (0.774)	-1.684*** (0.129)	-1.756*** (0.255)	-1.684*** (0.332)	-1.756** (0.773)	-1.684*** (0.178)	-1.756*** (0.389)	-1.684*** (0.185)	-1.756*** (0.371)
2#0. Lower middle income, not democratic	-1.152*** (0.130)	-1.412*** (0.220)	-1.152*** (0.406)	-1.412** (0.688)	-1.152*** (0.108)	-1.412*** (0.197)	-1.152*** (0.399)	-1.412** (0.681)	-1.152*** (0.196)	-1.412*** (0.338)	-1.152*** (0.152)	-1.412*** (0.290)
2#1. Lower middle income, democratic	-0.454*** (0.158)	-0.663*** (0.199)	-0.454 (0.484)	-0.663 (0.627)	-0.454*** (0.108)	-0.663*** (0.131)	-0.454 (0.470)	-0.663 (0.609)	-0.454* (0.235)	-0.663** (0.305)	-0.454*** (0.162)	-0.663*** (0.169)
3#0. Upper middle income, not democratic	-1.090*** (0.155)	-1.389*** (0.230)	-1.090** (0.534)	-1.389* (0.801)	-1.090*** (0.131)	-1.389*** (0.140)	-1.090** (0.527)	-1.389* (0.780)	-1.090*** (0.244)	-1.389*** (0.369)	-1.090*** (0.195)	-1.389*** (0.193)
3#1. Upper middle income, democratic	-0.819*** (0.097)	-1.097*** (0.132)	-0.819*** (0.295)	-1.097** (0.423)	-0.819*** (0.085)	-1.097*** (0.119)	-0.819*** (0.292)	-1.097*** (0.419)	-0.819*** (0.141)	-1.097*** (0.203)	-0.819*** (0.092)	-1.097*** (0.159)
4#0. High income (non-OECD), not democratic	-1.123*** (0.183)	-1.987*** (0.217)	-1.123** (0.514)	-1.987*** (0.702)	-1.123*** (0.197)	-1.987*** (0.192)	-1.123** (0.519)	-1.987*** (0.695)	-1.123*** (0.249)	-1.987*** (0.332)	-1.123*** (0.273)	-1.987*** (0.259)
4#1. High income (non-OECD), democratic	-0.814*** (0.091)	-0.768*** (0.101)	-0.814** (0.338)	-0.768** (0.357)	-0.814*** (0.049)	-0.768*** (0.064)	-0.814** (0.329)	-0.768** (0.348)	-0.814*** (0.144)	-0.768*** (0.156)	-0.814*** (0.059)	-0.768*** (0.085)

Dependent variable: *pse/gdp*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
5#0. High income (OECD), not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5#1. High income (OECD), democratic BASE	5.352*** (0.055)	3.668*** (0.312)	5.352*** (0.225)	3.668*** (0.945)	5.352*** (0.058)	3.668*** (0.171)	5.352*** (0.226)	3.668*** (0.908)	5.352*** (0.089)	3.668*** (0.467)	5.352*** (0.083)	3.668*** (0.200)
pop024		0.016*** (0.006)		0.016 (0.018)		0.016*** (0.005)		0.016 (0.018)		0.016* (0.009)		0.016** (0.007)
urban		0.009*** (0.002)		0.009 (0.008)		0.009*** (0.001)		0.009 (0.007)		0.009** (0.004)		0.009*** (0.002)
trade		0.008*** (0.001)		0.008** (0.004)		0.008*** (0.001)		0.008** (0.003)		0.008*** (0.002)		0.008*** (0.001)
R-squared	0.060	0.100	0.060	0.100	0.060	0.100	0.060	0.100	0.060	0.100	0.060	0.100
F-value	35.86***	34.89***	3.78***	3.79***	78.63***	120.42***	n/a	n/a	15.83***	15.72***	60.00***	387.40***
Countries	183	169	183	169	183	169	183	169	183	169	183	169
Years	27	26	27	26	27	26	27	26	27	26	27	26
Observations	2468	2288	2468	2288	2468	2288	2468	2288	2468	2288	2468	2288

Notes: BASE group is high-income (OECD) and democratic countries. Three controls are used: youth population (pop024)*; urban population (urban) and trade (trade). A pseudo R-squared is reported for the quantile regression. Not applicable (n/a) means there are no applicable countries for these groups. The LSDV estimator using Huber/White heteroskedasticity-robust standard errors is reproduced from table 2 for ease of comparison. The various other standard error estimates for LSDV use one-way (country or year) and two-way (country and year) cluster-robust standard errors. The Newey-West and Driscoll-Kraay estimators use their own covariance matrix corrections to compute heteroskedasticity and autocorrelation consistent (HAC), and cross-sectional or spatial correlation consistent standard errors under different data-generating assumptions, respectively. The various standard errors are given in parentheses.*

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A5

Mean differences in the budget share by income group and regime type – alternative standard error estimates

Dependent variable: *pse/gov*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
1#0. Low income, not democratic	3.633*** (0.436)	-0.012 (0.726)	3.633*** (1.208)	-0.012 (2.003)	3.633*** (0.292)	-0.012 (0.682)	3.633*** (1.163)	-0.012 (1.988)	3.633*** (0.644)	-0.012 (1.069)	3.633*** (0.314)	-0.012 (0.984)
1#1. Low income, democratic	4.796*** (0.381)	1.339* (0.686)	4.796*** (0.832)	1.339 (1.748)	4.796*** (0.310)	1.339* (0.754)	4.796*** (0.802)	1.339 (1.776)	4.796*** (0.500)	1.339 (0.966)	4.796*** (0.451)	1.339 (1.092)
2#0. Lower middle income, not democratic	4.304*** (0.368)	1.081* (0.600)	4.304*** (1.148)	1.081 (1.791)	4.304*** (0.348)	1.081* (0.563)	4.304*** (1.142)	1.081 (1.779)	4.304*** (0.555)	1.081 (0.899)	4.304*** (0.468)	1.081 (0.803)
2#1. Lower middle income, democratic	4.852*** (0.369)	2.421*** (0.446)	4.852*** (1.009)	2.421* (1.236)	4.852*** (0.214)	2.421*** (0.390)	4.852*** (0.963)	2.421** (1.217)	4.852*** (0.548)	2.421*** (0.639)	4.852*** (0.219)	2.421*** (0.440)
3#0. Upper middle income, not democratic	2.520*** (0.455)	-0.022 (0.503)	2.520* (1.380)	-0.022 (1.502)	2.520*** (0.461)	-0.022 (0.378)	2.520* (1.382)	-0.022 (1.465)	2.520*** (0.663)	-0.022 (0.749)	2.520*** (0.668)	-0.022 (0.547)
3#1. Upper middle income, democratic	3.643*** (0.279)	1.708*** (0.354)	3.643*** (0.862)	1.708 (1.053)	3.643*** (0.230)	1.708*** (0.415)	3.643*** (0.847)	1.708 (1.076)	3.643*** (0.409)	1.708*** (0.524)	3.643*** (0.280)	1.708** (0.617)
4#0. High income (non-OECD), not democratic	0.987** (0.499)	-2.057*** (0.566)	0.987 (1.699)	-2.057 (1.648)	0.987** (0.378)	-2.057*** (0.407)	0.987 (1.668)	-2.057 (1.600)	0.987 (0.770)	-2.057** (0.830)	0.987* (0.516)	-2.057*** (0.339)

Dependent variable: *pse/gov*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
4#1. High income (non-OECD), democratic	0.568** (0.249)	-0.038 (0.254)	0.568 (0.834)	-0.038 (0.815)	0.568*** (0.188)	-0.038 (0.211)	0.568 (0.818)	-0.038 (0.803)	0.568 (0.372)	-0.038 (0.379)	0.568** (0.260)	-0.038 (0.284)
5#0. High income (OECD), not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5#1. High income (OECD), democratic BASE	12.245*** (0.122)	4.332*** (0.831)	12.245*** (0.500)	4.332** (2.156)	12.245*** (0.088)	4.332*** (0.602)	12.245*** (0.493)	4.332** (2.079)	12.245*** (0.196)	4.332*** (1.172)	12.245*** (0.128)	4.332*** (0.621)
pop024		0.146*** (0.015)		0.146*** (0.038)		0.146*** (0.013)		0.146*** (0.038)		0.146*** (0.021)		0.146*** (0.017)
urban		0.029*** (0.007)		0.029 (0.020)		0.029*** (0.006)		0.029 (0.020)		0.029*** (0.010)		0.029*** (0.009)
trade		0.017*** (0.003)		0.017*** (0.006)		0.017*** (0.003)		0.017*** (0.006)		0.017*** (0.004)		0.017*** (0.002)
R-squared	0.141	0.198	0.141	0.198	0.141	0.198	0.141	0.198	0.141	0.198	0.141	0.198
F-value	64.55***	56.40***	7.16***	8.08***	234.33***	201.25***	n/a	n/a	29.30***	26.94***	315.69***	476.80***
Countries	175	165	175	165	175	165	175	165	175	165	175	165
Years	27	26	27	26	27	26	27	26	27	26	27	26
Observations	2194	2069	2194	2069	2194	2069	2194	2069	2194	2069	2194	2069

Notes: BASE group is high-income (OECD) and democratic countries. The model uses three controls: youth population (pop024); urban population (urban) and trade (trade). See the notes for table A4. The various standard errors are given in parentheses.

*Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.*

Table A6

Mean differences in the national effort by country region and regime type – alternative standard error estimates

Dependent variable: *pse/gdp*	**LSDV**		**LSDV (One-way; Country)**		**LSDV (One-way; Year)**		**LSDV (Two-way)**		**Newey-West**		**Driscoll-Kraay**	
	(A)	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**	**(A)**	**(B)**
0#0. Poorer country regions, not democratic	-1.298*** (0.147)	-2.031*** (0.216)	-1.298*** (0.396)	-2.031*** (0.582)	-1.298*** (0.128)	-2.031*** (0.168)	-1.298*** (0.389)	-2.031*** (0.566)	-1.298*** (0.199)	-2.031*** (0.315)	-1.298*** (0.152)	-2.031*** (0.218)
0#1. Poorer country regions, democratic	-0.804*** (0.104)	-1.412*** (0.166)	-0.804** (0.343)	-1.412*** (0.467)	-0.804*** (0.081)	-1.412*** (0.135)	-0.804** (0.336)	-1.412*** (0.457)	-0.804*** (0.158)	-1.412*** (0.239)	-0.804*** (0.110)	-1.412*** (0.162)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	5.169*** (0.069)	2.095*** (0.375)	5.169*** (0.264)	2.095** (0.989)	5.169*** (0.052)	2.095*** (0.255)	5.169*** (0.260)	2.095** (0.950)	5.169*** (0.110)	2.095*** (0.534)	5.169*** (0.064)	2.095*** (0.319)
pop024		0.034*** (0.007)		0.034** (0.017)		0.034*** (0.005)		0.034** (0.016)		0.034*** (0.010)		0.034*** (0.005)
urban		0.016*** (0.003)		0.016** (0.008)		0.016*** (0.002)		0.016** (0.008)		0.016*** (0.004)		0.016*** (0.002)
trade		0.013*** (0.002)		0.013*** (0.004)		0.013*** (0.002)		0.013*** (0.004)		0.013*** (0.002)		0.013*** (0.002)

Dependent variable: *pse/gdp*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
R-squared	0.057	0.167	0.057	0.167	0.057	0.167	0.057	0.167	0.057	0.167	0.057	0.167
F-value	52.61***	63.60***	5.45***	6.80***	148.23***	109.08***	n/a	n/a	24.89***	31.33***	161.84***	103.56***
Countries	102	97	102	97	102	97	102	97	102	97	102	97
Years	27	26	27	26	27	26	27	26	27	26	27	26
Observations	1486	1382	1486	1382	1486	1382	1486	1382	1486	1382	1486	1382

Notes: BASE group is richer country regions that are democratic. The model uses three controls: youth population (pop024); urban population (urban) and trade (trade). See the notes for table A4. The various standard errors are given in parentheses.

*Significance levels are as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A7
Mean differences in the budget share by country region and regime type – alternative standard error estimates

Dependent variable: *pse/gov*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
0#0. Poorer country regions, not democratic	3.880*** (0.305)	1.492** (0.612)	3.880*** (0.909)	1.492 (1.609)	3.880*** (0.229)	1.492*** (0.360)	3.880*** (0.887)	1.492 (1.531)	3.880*** (0.452)	1.492* (0.892)	3.880*** (0.210)	1.492*** (0.466)
0#1. Poorer country regions, democratic	5.077*** (0.233)	3.321*** (0.458)	5.077*** (0.711)	3.321** (1.397)	5.077*** (0.141)	3.321*** (0.236)	5.077*** (0.686)	3.321** (1.341)	5.077*** (0.345)	3.321*** (0.684)	5.077*** (0.157)	3.321*** (0.301)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	11.944*** (0.127)	5.333*** (1.193)	11.944*** (0.506)	5.333 (3.265)	11.944*** (0.116)	5.333*** (0.952)	11.944*** (0.504)	5.333* (3.185)	11.944*** (0.203)	5.333*** (1.719)	11.944*** (0.176)	5.333*** (1.039)
pop024		0.104*** (0.021)		0.104* (0.059)		0.104*** (0.013)		0.104* (0.056)		0.104*** (0.030)		0.104*** (0.015)
urban		0.029*** (0.008)		0.029 (0.023)		0.029*** (0.008)		0.029 (0.023)		0.029** (0.012)		0.029*** (0.009)
trade		0.018*** (0.004)		0.018** (0.009)		0.018*** (0.004)		0.018** (0.009)		0.018*** (0.005)		0.018*** (0.004)

Dependent variable: *pse/gov*	LSDV		LSDV (One-way; Country)		LSDV (One-way; Year)		LSDV (Two-way)		Newey-West		Driscoll-Kraay	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
R-squared	0.195	0.222	0.195	0.222	0.195	0.222	0.195	0.222	0.195	0.222	0.195	0.222
F-value	270.00***	113.21***	25.86***	13.06***	723.40***	323.35***	n/a	n/a	118.36***	51.83***	611.34***	290.39***
Countries	99	96	99	96	99	96	99	96	99	96	99	96
Years	27	26	27	26	27	26	27	26	27	26	27	26
Observations	1360	1299	1360	1299	1360	1299	1360	1299	1360	1299	1360	1299

Notes: BASE group is richer country regions that are democratic. The model uses three controls: youth population (pop024); urban population (urban) and trade (trade). See the notes for table A4. The various standard errors are given in parentheses.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A8

A summary of changes to the model specification (national effort and LSDV estimator)

Dependent variable: *pse/gdp*	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
0#0. Poorer country regions, not democratic	-2.031*** (0.216)	-2.183*** (0.242)	-1.764*** (0.224)	-1.866*** (0.258)	-0.991*** (0.275)	-1.072*** (0.365)	-0.568* (0.296)	-0.692* (0.383)	-0.800*** (0.268)	-1.146*** (0.293)	-0.906*** (0.279)	-1.163*** (0.307)
0#1. Poorer country regions, democratic	-1.412*** (0.166)	-1.543*** (0.155)	-1.379*** (0.176)	-1.448*** (0.167)	-0.578** (0.237)	-0.631** (0.288)	-0.028 (0.258)	-0.102 (0.315)	-0.021 (0.257)	-0.277 (0.279)	-0.042 (0.265)	-0.241 (0.288)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	2.095*** (0.375)	1.504*** (0.518)	-1.863** (0.760)	-2.243*** (0.790)	-5.403*** (1.427)	-5.626*** (1.549)	-7.503*** (1.550)	-7.711*** (1.713)	-6.685*** (1.241)	-6.649*** (1.295)	-6.539*** (1.297)	-6.743*** (1.370)
R-squared	0.167	0.187	0.201	0.223	0.208	0.229	0.223	0.245	0.353	0.375	0.365	0.384
F-value	63.60***	15.33***	103.09***	23.20***	91.08***	22.81***	80.33***	21.89***	69.88***	21.30***	60.49***	19.72***
Countries	97	97	86	86	86	86	85	85	84	84	84	84
Years	26	26	25	25	25	25	25	25	25	25	25	25

Dependent variable: ***pse/gdp***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Covariates (controls)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of control variables	3	3	4	4	5	5	6	6	7	7	8	8
Are patterns confounded?	No	No	No	No	No	No	Partially	Partially	Partially	Partially	Partially	Partially
Observations	1382	1382	1256	1256	1256	1256	1174	1174	1101	1101	1030	1030

Notes: BASE group is richer country regions that are democratic. All models use a LSDV estimator and robust standard errors. I and II use homogeneous slopes and three controls (pop024, urban and trade). III and IV use homogeneous slopes and four controls (pop024, urban, trade and hci). V and VI use homogeneous slopes and five controls (pop024, urban, trade, hci and pop65). VII and VIII use homogeneous slopes and six controls (pop024, urban, trade, hci, pop65 and military). IX and X use homogeneous slopes and seven controls (pop024, urban, trade, hci, pop65, military and fiscbal). XI and XII use homogeneous slopes and eight controls (pop024, urban, trade, hci, pop65, military, fiscbal and debt). See table 1 for a description of each control variable used. Time (year) dummies are used in even-numbered specifications (II, IV, VI, VIII, X and XII). The estimates for the various controls and year fixed effects are excluded to save space. Huber-White heteroskedasticity-robust standard errors are given in parentheses.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A9

A summary of changes to the model specification (budget share and LSDV estimator)

Dependent variable: *pse/gov*	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
0#0. Poorer country regions, not democratic	1.492** (0.612)	0.985 (0.664)	1.296** (0.644)	0.737 (0.700)	1.358** (0.637)	0.499 (0.718)	2.207*** (0.661)	1.514** (0.755)	1.962*** (0.656)	1.269* (0.749)	1.803*** (0.667)	1.668** (0.756)
0#1. Poorer country regions, democratic	3.321*** (0.458)	2.799*** (0.499)	2.970*** (0.481)	2.451*** (0.530)	3.035*** (0.518)	2.204*** (0.596)	3.784*** (0.548)	3.186*** (0.628)	3.717*** (0.539)	3.162*** (0.621)	3.561*** (0.552)	3.391*** (0.630)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	5.333*** (1.193)	3.726*** (1.443)	-3.448** (1.686)	-4.803*** (1.810)	-3.737 (2.738)	-3.794 (2.805)	-4.396 (2.840)	-4.194 (2.923)	-1.745 (2.867)	-1.109 (2.948)	-1.285 (2.897)	-1.221 (2.955)
R-squared	0.222	0.237	0.296	0.311	0.296	0.311	0.331	0.343	0.347	0.360	0.415	0.423
F-value	113.21***	20.02***	110.62***	23.58***	100.86***	24.23***	91.63***	23.86***	92.91***	27.10***	96.81***	31.64***
Countries	96	96	85	85	85	85	84	84	84	84	84	84
Years	26	26	25	25	25	25	25	25	25	25	25	25

Dependent variable: ***pse/gov***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Covariates (controls)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of control variables	3	3	4	4	5	5	6	6	7	7	8	8
Are patterns confounded?	No	No	No	No	No	No	No	No	No	No	No	No
Observations	1299	1299	1175	1175	1175	1175	1099	1099	1091	1091	1024	1024

Notes: BASE group is richer country regions that are democratic. All models use a LSDV estimator and robust standard errors. See the notes for table A8. Huber-White heteroskedasticity-robust standard errors are given in parentheses.

*Significance levels are as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A10

A summary of changes to the model specification (national effort and robust estimator)

Dependent variable: ***pse/gdp***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
0#0. Poorer country regions, not democratic	-1.760*** (0.199)	-2.022*** (0.206)	-1.489*** (0.199)	-1.729*** (0.208)	-1.240*** (0.260)	-1.615*** (0.275)	-0.926*** (0.274)	-1.311*** (0.291)	-0.930*** (0.279)	-1.332*** (0.297)	-1.077*** (0.274)	-1.418*** (0.297)
0#1. Poorer country regions, democratic	-1.178*** (0.166)	-1.403*** (0.172)	-1.111*** (0.165)	-1.310*** (0.172)	-0.844*** (0.239)	-1.188*** (0.252)	-0.455* (0.253)	-0.785*** (0.267)	-0.424* (0.256)	-0.734*** (0.271)	-0.522** (0.250)	-0.797*** (0.268)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	2.520*** (0.348)	1.764*** (0.425)	0.251 (0.520)	-0.321 (0.566)	-1.013 (0.924)	-0.848 (0.951)	-2.635*** (0.965)	-2.416** (0.998)	-3.139*** (1.002)	-2.862*** (1.041)	-2.688*** (0.988)	-2.624** (1.053)
R-squared	0.313	0.335	0.331	0.351	0.333	0.351	0.338	0.357	0.340	0.363	0.373	0.392
F-value	125.25***	22.67***	103.17***	22.06***	88.81***	21.32***	74.25***	19.81***	62.34***	18.39***	60.71***	18.87***
Countries	97	97	86	86	86	86	85	85	84	84	84	84
Years	26	26	25	25	25	25	25	25	25	25	25	25

Dependent variable: ***pse/gdp***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Covariates (controls)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of control variables	3	3	4	4	5	5	6	6	7	7	8	8
Are the patterns confounded?	No	No	No	No	No	No	No	No	No	No	No	No
Observations	1382	1382	1256	1256	1256	1256	1174	1174	1101	1101	1030	1030

Notes: BASE group is richer country regions that are democratic. All models use a robust estimator. See the notes for table A8.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A11

A summary of changes to the model specification (budget share and robust estimator)

Dependent variable: ***pse/gov***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
0#0. Poorer country regions, not democratic	1.108* (0.597)	0.522 (0.626)	1.000* (0.588)	0.310 (0.617)	1.122 (0.761)	0.172 (0.806)	1.972** (0.771)	1.255 (0.829)	1.798** (0.751)	1.077 (0.804)	1.614** (0.702)	1.315* (0.767)
0#1. Poorer country regions, democratic	2.945*** (0.491)	2.335*** (0.517)	2.626*** (0.479)	1.919*** (0.503)	2.760*** (0.697)	1.777** (0.737)	3.292*** (0.709)	2.617*** (0.757)	3.268*** (0.690)	2.608*** (0.734)	3.037*** (0.642)	2.724*** (0.694)
1#0. Richer country regions, not democratic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1#1. Richer country regions, democratic BASE	3.705*** (1.036)	1.652 (1.400)	-4.570*** (1.533)	-6.683*** (1.748)	-5.296* (2.708)	-5.963** (2.810)	-5.074* (2.701)	-5.589** (2.838)	-2.121 (2.692)	-2.119 (2.821)	-1.306 (2.531)	-1.495 (2.719)
R-squared	0.247	0.264	0.328	0.348	0.328	0.347	0.373	0.386	0.402	0.421	0.483	0.492
F-value	84.82***	15.18***	94.92***	20.35***	81.47***	19.61***	81.11***	20.98***	80.84***	23.30***	94.69***	28.19***
Countries	96	96	85	85	85	85	84	84	84	84	84	84
Years	26	26	25	25	25	25	25	25	25	25	25	25

Dependent variable: ***pse/gov***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Covariates (controls)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of control variables	3	3	4	4	5	5	6	6	7	7	8	8
Are the patterns confounded?	No	No	No	No	No	No	No	No	No	No	No	No
Observations	1299	1299	1175	1175	1175	1175	1099	1099	1091	1091	1024	1024

Notes: BASE group is richer country regions that are democratic. All models use a robust estimator. See the notes for table A8.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A12

A summary of additional robustness checks (national effort with robust and quantile estimators)

Dependent variable: *pse/gdp*	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
1#0. Low income, not democratic		-0.664 (0.408)	-1.190*** (0.224)	-2.095*** (0.185)	-2.081*** (0.188)	-1.961*** (0.261)	-1.885*** (0.260)	-1.810*** (0.243)	-2.120*** (0.301)	-2.366*** (0.350)
1#1. Low income, democratic		-0.367 (0.434)	-1.244*** (0.228)	-1.622*** (0.184)	-1.608*** (0.202)	-1.846*** (0.195)	-1.877*** (0.257)	-1.851*** (0.252)	-2.070*** (0.324)	-2.220*** (0.312)
2#0. Lower middle income, not democratic		-0.784*** (0.275)	-1.426*** (0.178)	-2.093*** (0.168)	-2.050*** (0.155)	-1.845*** (0.206)	-1.578*** (0.259)	-1.210*** (0.237)	-1.128*** (0.274)	-1.259*** (0.267)
2#1. Lower middle income, democratic		-0.156 (0.227)	-1.150*** (0.161)	-1.644*** (0.143)	-1.628*** (0.133)	-1.491*** (0.211)	-1.126*** (0.287)	-0.530** (0.267)	-0.144 (0.289)	-0.193 (0.264)
3#0. Upper middle income, not democratic		-1.256*** (0.224)	-1.329*** (0.171)	-1.927*** (0.125)	-1.857*** (0.157)	-1.744*** (0.125)	-1.669*** (0.177)	-1.604*** (0.152)	-1.729*** (0.202)	-1.803*** (0.224)
3#1. Upper middle income, democratic		-0.910*** (0.185)	-0.983*** (0.128)	-1.192*** (0.110)	-1.182*** (0.105)	-1.205*** (0.105)	-1.131*** (0.156)	-1.017*** (0.127)	-1.175*** (0.141)	-1.344*** (0.178)
4#0. High income (non-OECD), not democratic		n/a	-1.619*** (0.205)	-2.149*** (0.258)	-1.974*** (0.323)	-2.025*** (0.135)	-1.933*** (0.195)	-2.164*** (0.222)	-1.911*** (0.424)	-1.959*** (0.377)
4#1. High income (non-OECD), democratic		-0.565*** (0.156)	-0.645*** (0.107)	-0.801*** (0.100)	-0.748*** (0.090)	-0.667*** (0.121)	-0.654*** (0.130)	-0.531*** (0.115)	-0.578*** (0.150)	-0.654*** (0.149)
5#0. High income (OECD), not democratic		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Dependent variable: ***pse/gdp***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
5#1. High income (OECD), democratic BASE		3.203*** (0.450)	1.755*** (0.417)	3.722*** (0.224)	3.603*** (0.223)	3.047*** (0.277)	3.107*** (0.334)	3.000*** (0.301)	2.708*** (0.381)	2.452*** (0.391)
Constant	2.963*** (0.287)									
gdppc	0.000009*** (0.000003)									
poldemoc	0.713*** (0.076)									
gini		-0.005 (0.008)								
hci (lagged one period)			0.499*** (0.091)							
R-squared	0.158	0.280	0.213	0.151	0.144	0.120	0.107	0.095	0.084	0.089
F-value	85.07***	26.72***	45.06***	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Countries	167	124	137	169	169	169	169	169	169	169
Years	26	25	26	26	26	26	26	26	26	26
Year fixed effects	No	No	No	No	No	No	No	No	No	No
Observations	2278	769	2010	2288	2288	2288	2288	2288	2288	2288

Notes: BASE group is high-income (OECD) and democratic countries. Models I, II, and III use a robust estimator. Models IV, V, VI, VII, VIII, IX, and X use a quantile estimator at the 20th, 25th, 40th, 50th, 60th, 75th, and 80th percentiles, respectively. The constant for Model I includes all countries, regardless of income group, ceteris paribus. All models use three controls: youth population (pop024); urban population (urban) and trade (trade). The estimates for the various controls are excluded to save space. A pseudo R-squared is reported for the quantile regression. Not applicable (n/a) means there are no applicable countries for these groups. The various standard errors are given in parentheses.

*Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table A13

A summary of additional robustness checks (budget share with robust and quantile estimators)

Dependent variable: *pse/gov*	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
1#0. Low income, not democratic		0.967 (1.063)	1.180* (0.656)	-0.341 (0.787)	-0.274 (0.700)	0.052 (0.972)	-0.162 (0.696)	-1.109* (0.673)	-0.854 (0.991)	-0.754 (1.007)
1#1. Low income, democratic		1.933* (1.137)	0.999 (0.666)	3.255*** (0.765)	2.717*** (0.539)	2.435*** (0.745)	1.290** (0.581)	-0.190 (0.475)	-0.770 (1.060)	-0.523 (1.045)
2#0. Lower middle income, not democratic		0.891 (0.729)	-0.048 (0.519)	0.215 (0.531)	0.286 (0.568)	0.918 (0.676)	0.614 (0.531)	0.335 (0.492)	0.879 (0.771)	0.581 (0.753)
2#1. Lower middle income, democratic		1.694*** (0.588)	1.710*** (0.465)	2.115*** (0.286)	1.905*** (0.120)	1.878*** (0.547)	1.661*** (0.419)	1.506*** (0.253)	1.885** (0.743)	1.730** (0.814)
3#0. Upper middle income, not democratic		0.323 (0.584)	1.569*** (0.506)	-2.129** (0.860)	-1.405* (0.802)	0.003 (0.638)	-0.131 (0.371)	-0.353 (0.509)	1.465** (0.717)	1.055 (0.755)
3#1. Upper middle income, democratic		0.237 (0.478)	1.188*** (0.370)	0.811*** (0.236)	0.831*** (0.263)	1.344*** (0.371)	1.205*** (0.179)	0.967*** (0.254)	1.514*** (0.553)	1.371** (0.592)
4#0. High income (non-OECD), not democratic		n/a	-1.415** (0.581)	-2.972*** (0.304)	-3.211*** (0.387)	-3.372*** (0.627)	-3.107*** (0.356)	-3.757*** (0.303)	-1.624 (1.293)	-1.034 (1.085)
4#1. High income (non-OECD), democratic		-0.117 (0.400)	-0.112 (0.320)	-0.914*** (0.218)	-0.685** (0.327)	0.065 (0.425)	0.308 (0.342)	0.413 (0.278)	0.821** (0.401)	0.326 (0.425)
5#0. High income (OECD), not democratic		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Dependent variable: ***pse/gov***	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
5#1. High income (OECD), democratic BASE		1.036 (1.164)	0.998 (1.225)	4.287*** (0.481)	3.603*** (0.664)	2.246** (0.907)	0.885 (0.643)	-0.810 (0.726)	1.296 (1.110)	3.350*** (1.064)
Constant	1.989** (0.841)									
gdppc	-0.000015** (0.000007)									
poldemoc	1.368*** (0.229)									
gini		0.098*** (0.021)								
hci (lagged one period)			0.404 (0.271)							
R-squared	0.205	0.295	0.279	0.081	0.093	0.121	0.146	0.166	0.189	0.193
F-value	105.86***	26.91***	58.31***	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Countries	164	124	134	165	165	165	165	165	165	165
Years	26	24	26	26	26	26	26	26	26	26
Year fixed effects	No	No	No	No	No	No	No	No	No	No
Observations	2060	718	1820	2069	2069	2069	2069	2069	2069	2069

Notes: BASE group is high-income (OECD) and democratic countries. Models I, II, and III use a robust estimator. Models IV, V, VI, VII, VIII, IX, and X use a quantile estimator at the 20th, 25th, 40th, 50th, 60th, 75th, and 80th percentiles, respectively. See the notes for table A12.

*Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.*