Vol. 47, No. 3 | pp. 285-406
September 2023 | Zagreb

ISSN: 2459-8860
https://doi.org/10.3326/pse.47.3

Institute of Public Finance

Public Sector Economics
3/2023

Public Sector Economics

3/2023

Vol. 47, No. 3 | pp. 285-406 | September 2023 | Zagreb

TABLE OF CONTENTS

Articles

Education spending, economic development, and the size of government

MARK MILLIN, Ph.D.*
DAVID FIELDING, Ph.D.*
P. DORIAN OWEN, Ph.D.*

Article**
JEL: H52, I22, I25
https://doi.org/10.3326/pse.47.3.1

* We thank two anonymous reviewers, and participants at the 59th Annual Conference of the New Zealand Association of Economists and at the University of Otago, Department of Economics, Brown Bag seminar for helpful comments and suggestions.
Mark Millin wishes to acknowledge financial support in the form of doctoral scholarship funding from the National Research Foundation (NRF) of South Africa and the University of Otago, and a publication bursary from the University of Otago.

** Received: September 29, 2022
Accepted: June 21, 2023

Mark MILLIN
Department of Economics, University of Auckland, Private Bag 92019, Auckland 1142, New Zealand
e-mail: mark.millin@auckland.ac.nz
ORCiD: 0000-0001-8481-5394

David FIELDING
Global Development Institute, University of Manchester, Manchester M13 9PL, United Kingdom, and Department of Economics, University of Otago, PO Box 56, Dunedin 9054, New Zealand
e-mail: david.fielding@manchester.ac.uk
ORCiD: 0000-0003-0506-4233

P. Dorian OWEN
Department of Economics, University of Otago, PO Box 56, Dunedin 9054, New Zealand
e-mail: dorian.owen@otago.ac.nz
ORCiD: 0000-0002-4966-0769

PUBLIC SECTOR ECONOMICS
47 (3) 285–333 (2023)

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

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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).

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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)

PUBLIC SECTOR ECONOMICS
47 (3) 285–333 (2023)

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.

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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.

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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.

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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.

REFERENCES

1. Adserà, A. and Boix, C., 2002. Trade, democracy, and the size of the public sector: The political underpinnings of openness. *International Organization*, 56(2), pp. 229-262. https://doi.org/10.1162/002081802320005478
2. Afonso, A. and Alves, J., 2017. Reconsidering Wagner's Law: Evidence from the functions of the government. *Applied Economics Letters*, 24(5), pp. 346-350. https://doi.org/10.1080/13504851.2016.1192267
3. Akanbi, O. A. and Schoeman, N. J., 2010. The determinants of public expenditure and expenditure on education in particular in a selection of African countries. *South African Journal of Economic and Management Sciences*, 13(1), pp. 50-61. https://doi.org/10.4102/sajems.v13i1.196
4. Angelov, A. G., 2019. Public expenditure on education in the EU member states: A cluster analysis. *Economic Archive*, 72(1), pp. 52-64.
5. Avelino, G., Brown, D. S. and Hunter, W., 2005. The effects of capital mobility, trade openness, and democracy on social spending in Latin America, 1980-1999. *American Journal of Political Science*, 49(3), pp. 625-641. https://doi.org/10.1111/j.1540-5907.2005.00146.x
6. Baqir, R., 2002. Social sector spending in a panel of countries. *IMF Working Paper*, No. 02/35. https://doi.org/10.5089/9781451845365.001
7. Baum, C. F., Nichols, A. and Schaffer, M. E., 2010. *Evaluating one-way and two-way cluster-robust covariance matrix estimates*. BOS'10 Stata Conference, July 2010.
8. Baum, M. A. and Lake, D. A., 2003. The political economy of growth: Democracy and human capital. *American Journal of Political Science*, 47(2), pp. 333-347. https://doi.org/10.1111/1540-5907.00023
9. Baumol, W. J. and Bowen, W. G., 1966. *Performing arts – The economic dilemma. A study of problems common to theater, opera, music and dance*. New York, NY: The Twentieth Century Fund.
10. Baumol, W. J., 1967. Macroeconomics of unbalanced growth: The anatomy of urban crisis. *American Economic Review*, 57(3), pp. 415-426.
11. Brown, D. S. and Hunter, W., 1999. Democracy and social spending in Latin America, 1980-92. *American Political Science Review*, 93(4), pp. 779-790. https://doi.org/10.2307/2586112
12. Brown, D. S. and Hunter, W., 2004. Democracy and human capital formation: Education spending in Latin America, 1980 to 1997. *Comparative Political Studies*, 37(7), pp. 842-864. https://doi.org/10.1177/0010414004266870
13. Bursztyn, L., 2016. Poverty and the political economy of public education spending: Evidence from Brazil. *Journal of the European Economic Association*, 14(5), pp. 1101-1128. https://doi.org/10.1111/jeea.12174
14. Busemeyer, M. R., 2007. Determinants of public education spending in 21 OECD democracies, 1980-2001. *Journal of European Public Policy*, 14(4), pp. 582-610. https://doi.org/10.1080/13501760701314417
15. Busemeyer, M. R., 2008. The impact of fiscal decentralisation on education and other types of spending. *Swiss Political Science Review*, 14(3), pp. 451-481. https://doi.org/10.1002/j.1662-6370.2008.tb00109.x

16. Busemeyer, M. R., 2009. Social democrats and the new partisan politics of public investment in education. *Journal of European Public Policy*, 16(1), pp. 107-126. https://doi.org/10.1080/13501760802453171
17. Cameron, A. C. and Miller, D. L., 2015. A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, 50(2), pp. 317-372. https://doi.org/10.3368/jhr.50.2.317
18. Cameron, D. R., 1978. The expansion of the public economy: A comparative analysis. *American Political Science Review*, 72(4), pp. 1243-1261. https://doi.org/10.2307/1954537
19. Castles, F. G., 1989. Explaining public education expenditure in OECD nations. *European Journal of Political Research*, 17(4), pp. 431-448. https://doi.org/10.1111/j.1475-6765.1989.tb00202.x
20. Cockx, L. and Francken, N., 2016. Natural resources: A curse on education spending? *Energy Policy*, 92, pp. 394-408. https://doi.org/10.1016/j.enpol.2016.02.027
21. Dragomirescu-Gaina, C., 2015. An empirical inquiry into the determinants of public education spending in Europe. *IZA Journal of European Labor Studies*, 4(25), pp. 1-24. https://doi.org/10.1186/s40174-015-0049-7
22. Driscoll, J. C. and Kraay, A. C., 1998. Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, 80(4), pp. 549-560. https://doi.org/10.1162/003465398557825
23. Feenstra, R. C., Inklaar, R. and Timmer, M. P., 2015. The next generation of the Penn World Table. *American Economic Review*, 105(10), pp. 3150-3182. https://doi.org/10.1257/aer.20130954
24. Fosu, A. K., 2010. The external debt-servicing constraint and public-expenditure composition in sub-Saharan Africa. *African Development Review*, 22(3), pp. 378-393. https://doi.org/10.1111/j.1467-8268.2010.00252.x
25. Freedom House, 2016. *Freedom in the world survey data*.
26. Garrett, G., 1998a. Global markets and national politics: Collision course or virtuous circle? *International Organization*, 52(4), pp. 787-824. https://doi.org/10.1162/002081898550752
27. Garrett, G., 1998b. *Partisan politics in the global economy*. New York, NY: Cambridge University Press.
28. Garrett, G., 2001. Globalization and government spending around the world. *Studies in Comparative International Development*, 35(4), pp. 3-29. https://doi.org/10.1007/BF02732706
29. Garritzmann, J. L. and Seng, K., 2016. Party politics and education spending: Challenging some common wisdom. *Journal of European Public Policy*, 23(4), pp. 510-530. https://doi.org/10.1080/13501763.2015.1048703
30. Hamilton, L. C., 1991. How robust is robust regression? *Stata Technical Bulletin*, 2, pp. 21-26.
31. Harding, R. and Stasavage, D., 2014. What democracy does (and doesn't do) for basic services: School fees, school inputs, and African elections. *Journal of Politics*, 76(1), pp. 229-245. https://doi.org/10.1017/S0022381613001254

32. Holcombe, R. G., 2005. Government growth in the twenty-first century. *Public Choice*, 124(1-2), pp. 95-114. https://doi.org/10.1007/s11127-005-4748-x
33. Huber, E., Mustillo, T. and Stephens, J. D., 2008. Politics and social spending in Latin America. *Journal of Politics*, 70(2), pp. 420-436. https://doi.org/10.1017/S0022381608080407
34. Iversen, T. and Stephens, J. D., 2008. Partisan politics, the welfare state, and three worlds of human capital formation. *Comparative Political Studies*, 41(4/5), pp. 600-637. https://doi.org/10.1177/0010414007313117
35. Katzenstein, P. J., 1985. *Small states in world markets*. Ithaca, NY: Cornell University Press.
36. Kaufman, R. R. and Segura-Ubiergo, A., 2001. Globalization, domestic politics, and social spending in Latin America: A time-series cross-section analysis, 1973-97. *World Politics*, 53(4), pp. 553-587. https://doi.org/10.1353/wp.2001.0016
37. Kuckuck, J., 2014. Testing Wagner's law at different stages of economic development. *FinanzArchiv/Public Finance Analysis*, 70(1), pp. 128-168. https://doi.org/10.1628/001522114X679183
38. Lake, D. A. and Baum, M. A., 2001. The invisible hand of democracy: Political control and the provision of public services. *Comparative Political Studies*, 34(6), pp. 587-621. https://doi.org/10.1177/0010414001034006001
39. Murshed, S. M. [et al.], 2022. Fiscal capacity, democratic institutions and social welfare outcomes in developing countries. *Defence and Peace Economics*, 33(3), pp. 280-305. https://doi.org/10.1080/10242694.2020.1817259
40. Newey, W. K. and West, K. D., 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3), pp. 703-708. https://www.jstor.org/stable/1913610
41. Newey, W. K. and West, K. D., 1994. Automatic lag selection in covariance matrix estimation. *Review of Economic Studies*, 61(4), pp. 631-653. https://doi.org/10.2307/2297912
42. Ozkok, Z., 2017. Financing education in Europe: The globalization perspective. *Economics & Politics*, 29(1), pp. 69-90. https://doi.org/10.1111/ecpo.12085
43. Peacock, A. and Scott, A., 2000. The curious attraction of Wagner's law. *Public Choice*, 102(1-2), pp. 1-17. https://doi.org/10.1023/A:1005032817804
44. Ram, R., 1995. Public educational expenditures in the United States: An analytical comparison with other industrialized countries. *Economics of Education Review*, 14(1), pp. 53-61. https://doi.org/10.1016/0272-7757(94)00029-6
45. Rodrik, D., 1998. Why do more open economies have bigger governments? *Journal of Political Economy*, 106(5), pp. 997-1032. https://doi.org/10.1086/250038
46. Ruggie, J. G., 1982. International regimes, transactions, and change: Embedded liberalism in the postwar economic order. *International Organization*, 36(2), pp. 379-415. https://doi.org/10.1017/S0020818300018993
47. Schneider, F. and Enste, D. H., 2000. Shadow economies: Size, causes, and consequences. *Journal of Economic Literature*, 38(1), pp. 77-114. https://doi.org/10.1257/jel.38.1.77

48. Schultz, T. P., 1988. Expansion of public school expenditures and enrollments: Intercountry evidence on the effects of income, prices, and population growth. *Economics of Education Review*, 7(2), pp. 167-183. https://doi.org/10.1016/0272-7757(88)90042-8
49. Shin, D., 2020. The military in politics and democracy: Its impact on government spending for education and health. *Social Science Quarterly*, 101(5), pp. 1810-1826. https://doi.org/10.1111/ssqu.12858
50. Stasavage, D., 2005. Democracy and education spending in Africa. *American Journal of Political Science*, 49(2), 343-358. https://doi.org/10.1111/j.0092-5853.2005.00127.x
51. Tilak, J. B. G., 1989. The recession and public investment in education in Latin America. *Journal of Interamerican Studies and World Affairs*, 31(1-2), pp. 125-146. https://doi.org/10.2307/165914
52. Tilak, J. B. G., 1990. External debt and public investment in education in Sub-Saharan Africa. *Journal of Education Finance*, 15(4), pp. 470-486. https://www.jstor.org/stable/40703837
53. Wagner, A., 1892. *Grundlegung der politischen ökonomie*. Leipzig: Winter.
54. Wagner, A., 1958. Three extracts on public finance. In: R. A. Musgrave and A. T. Peacock, eds., *Classics in the theory of public finance*. London: Palgrave Macmillan, pp. 1-15.
55. Walter, S., 2010. Globalization and the welfare state: Testing the microfoundations of the compensation hypothesis. *International Studies Quarterly*, 54(2), pp. 403-426. https://doi.org/10.1111/j.1468-2478.2010.00593.x
56. World Bank, 2017a. *Education statistics: Education expenditure*. Washington: The World Bank.
57. World Bank, 2017b. *TCdata360 database*. Washington: The World Bank.
58. World Bank, 2017c. *World development indicators*. Washington: The World Bank.
59. World Bank. 2017d. *World Bank development prospects group: A cross-country database of fiscal space*. Washington: The World Bank.
60. Yoo, H. I., 2017. *vce2way: A one-stop solution for robust inference with two-way clustering.*

PUBLIC SECTOR ECONOMICS
47 (3) 285-333 (2023)

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.*

Productivity and efficiency of central government departments: a mixed-effect model applied to Dutch data in the period 2012-2019

JOS L. T. BLANK, Dr.*
ALEX A. S. VAN HEEZIK, Dr.*
BAS BLANK, MSc*

Article**
JEL: H21, D24
https://doi.org/10.3326/pse.47.3.2

* We would like to thank prof. Vivian Valdmanis and two anonymous referees for their valuable comments on earlier versions of this paper.

** Received: September 21, 2022
Accepted: April 4, 2023

Jos L.T. BLANK
IPSE Studies Foundation and affiliated with TU Delft, Rotterdamseweg 183 C, 2629 HD Delft, The Netherlands
e-mail: j.blank@ipsestudies.nl
ORCiD: 0000-0002-0173-4239

Alex A.S. VAN HEEZIK
IPSE Studies Foundation, Rotterdamseweg 183 C, 2629 HD Delft, The Netherlands
e-mail: a.vanheezik@ipsestudies.nl
ORCiD: 0000-0003-1387-0307

Bas BLANK
IPSE Studies foundation and a PhD candidate at TU Delft, Rotterdamseweg 183 C, 2629 HD Delft, The Netherlands
e-mail: b.blank@ipsestudies.nl
ORCiD: 0000-0003-2278-1410

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

Abstract

Central government aims to stimulate the efficiency and technical change of public organizations. However, government primarily focuses on the institutions that deliver final public services, but not on the policy making institutions. This article analyses the productivity of central government departments (CGDs). From bureaucratic theory we hypothesize that productivity of these CGDs are low. In order to measure efficiency and technical change we estimate an average cost function based on data of Dutch individual CGDs during the period 2012-2019. The dataset consists of data on various services provided, resource usage and efficiency determinants. The cost function is estimated by a mixed-effect non-linear least squares method. The outcomes show that there are large efficiency differences among CGDs. It is also striking that technical change of the CGDs is non-existent over time, probably due to a lack of innovative behaviour, unwieldy bureaucracies and increasingly complex paperwork.

Keywords: central government, productivity, cost efficiency, efficiency determinants, technical change, cost function, scaling property, bureaucracy

1 INTRODUCTION

The public sector makes an important contribution to social welfare. Education, law enforcement and health care are important sectors for a well-functioning economy and contribute to a socially just society. Because these provisions are often financed by taxes and show a lack of market discipline, insight into the performance of these sectors is extremely important (Blank and Lovell, 2000; Blank and Valdmanis, 2019). Since many reforms such as privatization and contracting to outside agencies have taken place, motivated by the wish to enhance performance, analysis of the productivity, efficiency and effectiveness of public services is therefore a topic of great interest. Over the past 40 years there have been extensive developments in assessments of the public sector, due to the development of empirical methods measuring efficiency and productivity. Included among these developments are stochastic frontier analysis (SFA) and data envelopment analysis (DEA). These approaches have proved their value through applications in public services (Blank and Valdmanis, 2019; Fried, Lovell and Schmidt, 2008; Kumbhakar and Lovell, 2000; Kumbhakar, Parmeter and Zelenyuk, 2020).

The focus of productivity research generally is on organizations (or sectors) that are responsible for the provision of public services such as education (Haelermans and Blank, 2012; Haelermans, De Witte and Blank, 2012), health care (Hollingsworth, 2008), drinking water supply (Blank, Enserink and Van Heezik, 2019; Goede et al., 2016), road construction and maintenance (Lopez, Dollery and Byrnes, 2009), policing (Barton and Barton, 2011) and the immigration and naturalisation services (Niaounakis and van Heezik, 2019). To get an impression of the "mer à boire" of research in this field, see for instance www.ipsestudies.nl with reports and articles that contain thousands of references to international studies on this topic.

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

The strong focus on public service delivery is due to the relative simplicity of measuring the services or products provided by these organizations. In many cases, they produce final services that are fairly easy to capture in key figures. For example, the number of graduates, the number of hospital admissions or the amount of drinking water supplied are straightforward measures. However, there are also many public organizations that carry out activities that are more difficult to quantify. In particular, the outputs for policy making and public control defy a natural metric as such. At the decentralized level, these are mainly the policy departments of the municipalities and provinces. At the national level, they are the policy directorates of the ministries, which together form the so-called central government departments (CGDs). On behalf of the minister, they are responsible for the development of policy, laws and regulations and for directing the implementation thereof, including the organization of funding. The CGDs are also responsible for the evaluation of the policy pursued. In these endeavours it is difficult to measure how well these processes translate into the production of successful outcomes.

Hence, an important reason that research has not been carried out in this area is that measuring the output of this type of intermediary services causes many problems, such as the extensive number of services, the lack of documentation of the services and vagueness about its relevance. Another explanation is that the financial reports of these (intermediary) organizations are often not very transparent. This lack of transparency makes assessing the administrative costs of service provisions difficult. From a literature survey we were only able to find two references that could be related to this topic (Bikker and van der Linde, 2016; Hood and Dixon, 2015). Bikker and van der Linde (2016) focuses on the costs of policy making and control of municipalities. Hood and Dixon (2015) focuses on the cost performance of government services in the United Kingdom.

Aside from the fact that research in this area may fill a gap the relevance may also be substantial with reference to economic theory. Whereas other public services are mostly subjected to efficiency incentives resulting from tight funding, mandatory benchmarks, policy reviews or various types of inspection, central government departments are not. They may therefore suffer from perverse behaviour as described by Niskanen (1968), Weber (1922) and Bowen (1980). Although they take different perspectives, the central idea is that civil servants are driven by the ambition of expanding their budgets or at least exhausting the available budgets. In none of these cases do they lead to efficient usage of available resources or to innovative behaviour.

Our aim here is to fill the gap in assessing the productivity of CDGs. This research includes a survey of various data sources and correction of these data in order to carry out an analysis of the efficiency and productivity of the CGDs in the Netherlands during 2012-2019. We discuss the findings of this research in addressing three general questions:

1) What is the cost efficiency of CGDs?
2) What are the main determinants for the cost efficiency of CGDs?
3) What is the generic productivity trend of CGDs between 2012 and 2019?

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

In section 2, we will describe the research method employed. We describe the data collection and editing process in section 3. In section 4, the results of the analyses are presented. We present conclusions and recommendations in section 5.

2 METHOD

The total factor productivity (TFP) of a CGD is defined as the ratio between the value of production (Y) and the value of resources deployed (X) (Blank and Valdmanis, 2019; Niaounakis and Van Heezik, 2019):

$$Productivity = \frac{V_y(Y)}{V_x(X)} \tag{1}$$

With:
$V_y(Y)$ = production value of (vector of) services Y;
$V_x(X)$ = input value of (vector of) resources X.

When an institution provides more than one product and also has to use different means, the different products and resources used must be weighted. In the private sector, relative prices and wages to some fixed base can serve as weighting factors and the productivity is then equal to the production value divided by the input value. In a less formal way productivity can be defined as the ratio between revenues and costs, both controlled for general price and wage differentials. Because the public service generally lacks market-based prices for the services provided, weighting by prices is not possible. We therefore assume that the production value is equal to shadow costs involved at a given production level in a base year. In this case, we use the average costs that a department incurs to deliver a certain level of services. We weigh the different products with the estimated shadow prices that are assumed to reflect cost prices. From a social point of view, we can argue that citizens are willing to pay these prices, or else to reject them via the political process. Summarizing, productivity is measured as the ratio of shadow costs and actual costs. The shadow costs therefore serve as a benchmark. In that case, productivity equals one. Equation (1) can now be written as follows.

$$Productivity = \frac{C^{sh}(Y)}{C^{obs}(Y)} \tag{2}$$

Whereby:
$C^{sh}(Y)$ = shadow cost to produce Y;
$C^{obs}(Y)$ = actual (observed) cost to produce Y.

To control cost for general price differentials we need to apply price indices. For wage cost, we apply the index on contractual wage costs per hour (in public administration sector and public services). For material cost we apply the consumer price index (CPI).

We calculate shadow costs based on the results of a regression analysis. In doing so, we first make several additional assumptions. For example, the costs do not only

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

depend on the services provided, but also on year (representing technical change) and department. Due to technical change, the costs of the services provided in 2012 are different from the costs in 2019. We also consider the fact that services provided by one department may cost more or less than the same amount of services provided by another department due to differences in the complexity of the policy dossiers or the quality of the services provided. We indicate this as heterogeneity of the service or as a type of case mix. In addition, the model also contains a component that reflects the relative efficiency, which is measured as the difference in costs among CGDs, reflecting the characteristics of the business operations, such as the share of material costs, the staff structure or the employment conditions (i.e., cordial and/or cooperative). This approach has become more and more common in efficiency research and is based on the so-called scaling property. Instead of deriving cost efficiency measures in the first stage and consecutively regressing these cost efficiency measures on a set of determinants in a second stage, the effects of the determinants are derived directly in one stage only (Blank and Niaounakis, 2019; Wang and Schmidt, 2002). Relative efficiency and technical change together determine the development of productivity.

We can summarize the above in an equation in which the different components are incorporated. The cost function is given as:

$$\ln\left(c_{dt}\right) = a_0 + \sum\nolimits_m b_m \ln\left(y_{dtm}\right) + h \times time + het_d + eff_{dt} + err_{dt} \tag{3}$$

Where:

c_{dt} = actual costs department d at time t (adjusted for prices);
y_{dtm} = production of service m by department d at time t;
$time$ = trend, reflecting technical change;
het_d = percentage of deviating costs department d due to the heterogeneity of production;
eff_{dt} = percentage of additional costs due to inefficiency department d at time t;
err_{dt} = measurement error department d at time t.

Further:

$$eff_{dt} = \exp[-\sum\nolimits_k \theta_k \ln(z_{dtk})] \tag{4}$$

With:

z_{dtk} = characteristic k of department d at time t;
a_0, b_m, h, het_d and θ_k are the parameters of the model to be estimated. The parameter a_0 is the constant in the model, the parameters b_m are elasticities and represent the effect of a growth in production on the growth of costs and the parameter h shows the percentage annual growth/contraction of costs by generic productivity trends or formally as technical change. The parameters het_d show the percentage effect of the complexity of the services provided on the costs of a department. The parameter θ_k represents the proportion of determinant k in total inefficiency (Alvarez et al., 2006; Blank, 2020; Parmeter, 2018).

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

We also impose the condition on the model that a growth in production by a certain percentage leads to a proportional growth in costs (homogeneity requirement). So, a ten percent increase in the number of services provided automatically leads to a cost increase of ten percent. This homogeneity requirement implies that the b_ms must sum up to 1.

The above model can be estimated with a *mixed effects model* (Lindstrom and Bates, 1990). This approach combines two types of effects. Structural differences in the cost per unit of production among CGDs are "captured" by a *random effect* and interpreted by us as a measure of heterogeneity (or case mix). This effect is expressed in the term *het* in equation (3). In addition, *eff* in equation (4) consists of several determinants for efficiency, such as absenteeism by reason of illness or the degree of overhead. The effects of these determinants are also estimated. The joint effect of all determinants is called cost (in)efficiency.

Because case mix is not measured in a direct way, it cannot be ruled out that the case mix might also absorb some of the inefficiency. The actual efficiency differences could therefore be biased upward. In this case a CGD turns out to be structurally inefficient.

3 DATA

The activities of civil servants within the CGDs are diverse, ranging from drafting policy plans and legislative proposals as well as answering parliamentary questions to supervising policy implementation by agencies and public bodies and providing funding. Attempts have already been made to map all these activities, but at the level of directorates-general (Ministerie van Binnenlandse Zaken, 2009). These surveys consisted of an extensive inventory of directorates-general on activities pursued. More than 100 indicators were distinguished, which made using these indicators for analysis unmanageable. Moreover, these indicators are also not available over time. For this reason, we opted for a different route, where we can analyse productivity with fewer indicators. As multicollinearity may arise if too many indicators are included, therefore for the sake of parsimony, we select only the relevant factors affecting productivity. Hence, in this study, we use three indicators that provide insight into the "policy pressure" or workload of a CGD:

- Documents;
- Parliamentary questions;
- Program expenditures (at constant 2012 prices).

These three indicators represent the many related activities and together cover the activities of central government departmental production. A principal component analysis showed that six indicators cover more than 90% of the total variation in the more than 100 indicators (Blank et al., 2009). Here too, it will appear that the limited number of indicators explains a very large part of the variation in costs. The variable policy pressure is particularly visible in the number of documents and parliamentary questions. The documents variable concerns the number of

documents published by the ministry, excluding non-autonomous services and agencies, as stated on www.officielebekendmakingen.nl. This mainly concerns legal and regulatory documents, such as laws and legislative amendments. For the parliamentary questions indicator, we have mapped out the number of (written) answers to the questions asked by MPs (in writing) to the ministers of the various departments. The program expenditures are the total expenditures of the department minus the organization expenditures of the CGD and adjusted by CPI. These program expenditures include subsidies for the public bodies responsible for policy implementation and income transfers and therefore give an indication of the size of the policy areas managed by the relevant CGD.

To determine the use of resources from the CGDs, we used the actual organizational expenditures of the CGDs, provided in annual reports of the ministries. In these reports the organizational expenditures of the CGDs are broken down into personnel and material expenditures. For personnel expenditures, the annual reports make a distinction between expenditures for own staff, external hiring and other staff. Material expenditures are broken down by *shared service* organizations (SSOs), ICT and other material supplies, including expenditures on housing.

In addition to the data on production and use of resources, data have been collected on (possible) determinants of cost efficiency. This mainly concerns human resource management characteristics (HRM), such as absenteeism due to illness, working time factor and average age of employees. For an extensive list see the contents of table 1.

Note that CGDs form a rather homogeneous group of institutions that are more or less affected by the same contextual factors, which prevent estimates being biased by endogeneity.

To map personnel data, we used data provided via the Ministry of the Interior and Kingdom Relations which are based on the central salary administration. The data of eleven determinants were included in the dataset and are described in table 1.

The database used for the analysis consists of 88 observations (8 years in the time period 2012-2019 for 11 CGDs).

Table 1

Statistical description of CGDs data, 2012-2019 (N=88)

Variable	Average	Std. dev.	Min.	Max.
Means				
Total costs	240.38	134.81	28.92	553.78
Personnel costs	158.01	84.35	16.11	358.78
Cost of material	82.36	54.31	8.94	203.46
Production				
Documents	403.19	226.24	22.00	892.00
Parliamentary questions	307.16	226.86	5.00	954.00
Program expenditures	13,507.29	11,523.06	27.08	42,921.50
Efficiency determinants				
Share of women	48.77	9.53	22.41	62.03
Share of top positions	8.09	2.83	2.23	15.83
Share of women in top positions	31.37	10.79	8.67	50.75
Share of support staff	31.93	10.32	18.16	57.84
Absenteeism by reason of illness	4.02	0.78	1.89	5.56
Average age of employees	46.14	1.35	42.90	48.56
Entrance ratio	9.68	4.21	2.08	23.93
Exit ratio	9.92	2.51	5.30	17.04
Working time factor	94.82	1.05	92.61	96.83
Share of external staff	8.38	4.91	1.76	21.12
Cost share of material	33.16	6.66	18.84	56.00

We analyse the following central government departments:

1. General Affairs (GA),
2. Foreign Affairs (FA),
3. Interior Affairs (IA),
4. Economic and Agricultural Affairs (EA),
5. Treasury (TR),
6. Infrastructures (IS),
7. Education (ED),
8. Social Affairs (SA),
9. Justice and Safety (JS),
10. Health Care (HC),
11. Defence (Def).

It should be noted that at the end of the research period the Department of Economic and Agricultural Affairs was split into two separate departments (for political reasons). For that reason, we have aggregated the data of the separate departments into one fictional department for the years that they were still separated.

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

4 RESULTS

We estimated different specifications of the model and tested them against each other based on the Akaike information criterion (AIC). In the final model, due to the AIC the eleven determinants of efficiency could be reduced to five. Table 2 shows the cost function estimation results of the regression analyses. Based on the estimates, it is possible to calculate the marginal costs that provide evidence on the plausibility of the results. Recall, marginal costs represent the additional costs involved in the production of one additional unit of the product in question and are to a certain extent a reflection of cost prices. Since we are only using a limited number of services some omitted variables bias may occur. This may lead to estimated marginal costs of a specific service that also include costs of services that are correlated with this specific variable. Nevertheless, it still is a useful check on implausible values like negative or very large numbers. Table 3 presents the estimates of marginal costs in 2019.

Table 2
Cost function estimation results

Variables		Estimate	Std. dev.	Signif.
Documents	b_1	0.383	0.040	0.000
Parliamentary questions	b_2	0.168	0.030	0.000
Program expenditure	b_3	0.449	0.047	0.000
Constant	b_0	-0.741	0.136	0.000
Absenteeism by illness	θ_5	0.338	0.116	0.004
Entrance ratio	θ_7	-0.147	0.026	0.000
Working time factor	θ_9	6.943	2.571	0.007
Share of external staff	θ_{10}	0.112	0.029	0.000
Cost share of material	θ_{11}	0.458	0.059	0.000

The parameters of the production indicators (b_1-b_3) are significant. These parameters reflect the weights assigned to the various production indicators in order to calculate productivity. The parameters of the five ultimately remaining determinants of efficiency (θ_5, θ_7, θ_9, θ_{10}, and θ_{11}) are also all statistically significant at the 5% level.

Table 3
Marginal cost estimates

	Average	Std. dev.	Min.	Max.
Documents	26,930	11,827	11,048	44,773
Parliamentary questions	11,827	6,293	3,968	25,716
Program expenditure (million euros)	1,477	732	470	2,629

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

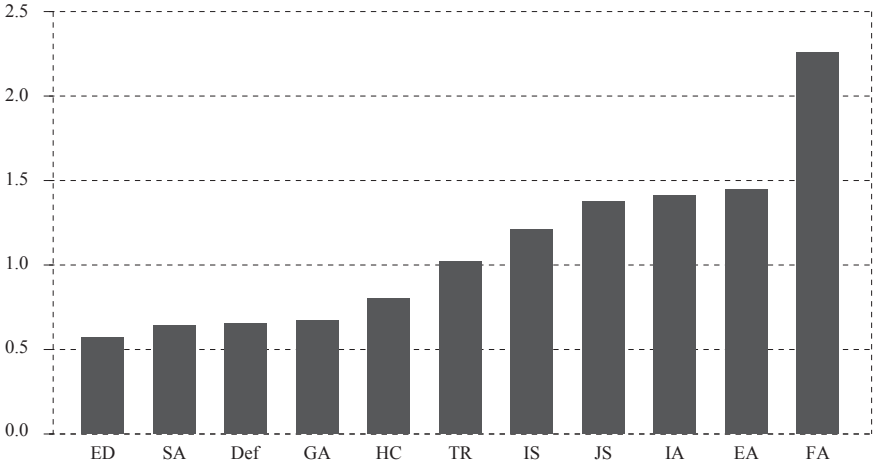
The parametric values of the production indicators have plausible values. They can be interpreted as average cost shares of the distinct services. For example, 38 percent of the resources deployed appear to be involved in the number of documents, 17 percent in the handling of parliamentary questions and 45 percent in the program expenditure. The estimated marginal costs (see table 3) amount to an average of 27,000 euros for a document, 12,000 euros for a parliamentary question and 1,500 euros per 1 million euros of program expenditure. Note the earlier remark on the omitted variable bias that may exists. The correlation between actual costs and the costs predicted by the model is equal to 99%.

The CGD GA, the Office of the Prime Minister, can be seen as an odd man out because of its small size and specific tasks. Such a peculiar observation could substantially affect the estimation results. We have therefore made the estimates again based on a data collection excluding GA. It shows that omitting GA has limited the effect of this on the estimation results.

As indicated in the model description, we also estimate an effect per CGD, which can be interpreted as case mix. Since we are dealing with panel data, we could estimate a so-called fixed effect for each CGD separately. This fixed effect, as the term suggests, is fixed over the whole period and can be regarded as a mixture of unobservable variables that is specific for that peculiar organisation. By applying the principle of the "benefit of the doubt" we assume that these variables are not under control of the CGD and include specific features of the services, such as the complexity or the political sensitivity of the dossiers. The case mix variable indicates how much more (or less) costs a CGD incurs due to a different workload in the activities performed. Figure 1 shows the results of the case mix. For each department, a number is shown about one. A number smaller than one implies that the case mix is lower than average, while a number greater than one implies that the case mix is higher than average. A value of 1.5 indicates that a specific CGD costs 50 percent more than in the average CGD. As has already been argued, it cannot be ruled out that this variable absorbs part of the inefficiency. The case mix may therefore be overestimated and the cost inefficiency underestimated.

Figure 1 shows that the CGDs of ED, SA, Def and GA have the lowest case mix. The cost per unit of product here is about 60 percent of the average case mix. The absolute leader in terms of case mix is the CGD of FA. The unit cost here is 120 percent higher than in the average CGD. The average case mix therefore differs considerably per CGD. However, as explained, there may be some overestimation here.

Figure 1
Case mix per CGD



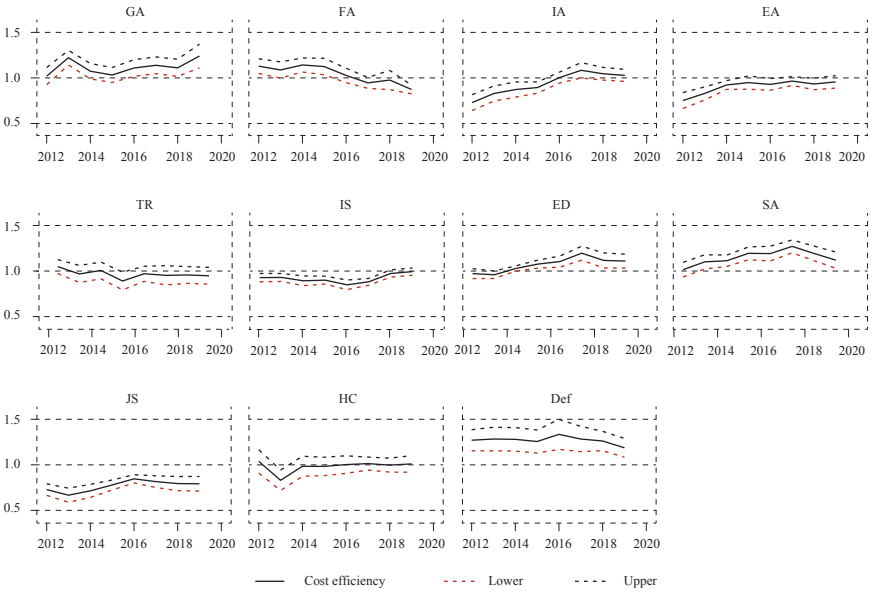
Departments: GA=general affairs; FA=foreign affairs; IA=interior affairs; EA=economic affairs; TR=treasury; IS=infrastructures; ED=education; SA=social affairs; JS=justice and safety; HC=health care; Def=defence.

Based on the estimates and application of equation (4), we calculate the cost efficiency per CGD. Figure 2 shows the cost efficiency of the CGD in the period 2012-2019. Cost efficiency is given as the ratio between the cost of the average practice and the actual cost. For example, a value of 0.90 means that the same production can be realized at 90 percent of the actual cost (relative to the average practice). In other words: there is an efficiency gain of 10 percent compared to the average practice. Figure 2 consists of eleven sub-figures, each one of them representing one CGD. Each subfigure presents the cost efficiency through the years for the specific CGD. In order to get an impression about the reliability of the estimates the subfigure also includes two dotted lines representing the 95% upper and lower bound of the estimates. This way of presentation makes it rather easy to compare the longitudinal and cross sectional outcomes.

Figure 2 shows that there are substantial differences between the cost-effectiveness of CGDs. For example, the efficiency of the CGDs IA, EA and JS appear to be on average only 70 to 80 percent over the years 2012-2019 compared to the average practice. Especially at IA, a considerable improvement can be seen in recent years. The CGD of Defence far exceeds the other CGDs in terms of cost efficiency. A negative trend can be observed at the CGD of FA.

FIGURE 2

Cost efficiency CGDs, 2012-2019 (including 95% confidence intervals)



The results have a certain degree of statistical uncertainty. Therefore, in addition to the point estimates, the area in which productivity falls with a certainty of 95 percent is also indicated. From this it becomes clear that only Def has a higher cost efficiency in all years than the average CGD. For GA and SA, this applies to seven of the eight years examined. The CGD of JS scores significantly lower than the average CGD for all eight years.

Based on the estimation results in table 2 we can also analyse the determinants of cost efficiency (θ_5, θ_7, θ_9, θ_{10}, and θ_{11}). A positive sign on the parameters as shown in table 2 implies an upward effect on costs and thus a lower cost efficiency. The explanation of the negative effect of absenteeism on cost efficiency is straightforward: absenteeism corresponds to higher costs for replacement or decreasing production. The positive cost efficiency effect of the entrance ratio is less evident. A high entrance ratio may initially lead to extra costs related to recruitment and on boarding. The entrance ratio can also be an indication of the influence of young workers with higher labour output or lower wage costs. Another hypothesis is that due to a new influx, the organization can be better aligned with actual needs, especially if they replace retirees who were less productive or entrenched in older bureaucratic norms. The negative effect of the working time factor reflects the positive contribution that part time employees make to the operation of the organization (Künn-Nelen et al., 2013; ROA, 2011). One hypothesis is that part time workers are more productive because they do not work the low-productive hours of the day or week (Collewet and Sauermann, 2017). On the other hand, more overhead costs are incurred per hour worked including office space, HRM

services and payroll administration. It cannot be ruled out that both theories are correct, but cannot be accommodated by the current linear model specification. External hiring can theoretically have two effects. On the one hand, external hiring is usually more flexible and therefore more efficient. On the other hand, the wage costs per hour worked are likely to be higher, because the margins for the intermediary company and a risk premium for idle periods for this type of staff are not covered by the CGD. The negative effect of a high cost share of material may indicate an overly "exuberant" purchase of goods and services. A well-known phenomenon is that surpluses in budgets at the end of the year are still spent for all kinds of purchases and hiring. Material expenditures lend itself better to this than personnel expenditures.

5 CONCLUSIONS AND RECOMMENDATIONS

Research into the productivity and efficiency of the public sector usually focuses on the provision of so-called final public services, such as health care or education. The productivity of public organizations involved in policy making and control is rarely examined due to a lack of a clear definition of services delivered. This analysis of productivity and efficiency of the Dutch CGDs is a first step to fill in this gap. It presents a limited set of available service indicators that also include – in a statistical sense – many underlying indicators. It shows that a very large part of cost variation of CGDs is represented by this set of indicators. In order to provide more insight in the underlying factors explaining productivity differences a set of efficiency determinants – mostly HRM related variables – are also included in the model and tested. Obviously, in a labour intensive industry like this may affect cost efficiency more substantially than in other sectors.

The database used for the analysis consists of 88 observations (8 years with 11 CGDs) and contains several product indicators, cost categories and efficiency determinants for each CGD. Based on the data and an advanced regression method, a cost function is estimated from which the research results are derived. On this basis, we can draw the following conclusions.

The most important conclusion is that cost efficiency varies greatly among CGDs. The most effective are the CGDs of GA, SA and Def. The CGD of GA owes its high score to the favourable working time factor and the low absenteeism due to illness, the CGD of SA mainly to the low use of material supplies and the CGD of Def mainly to the low absenteeism due to illness. The CDG of JS has the lowest cost efficiency, mainly caused by high absenteeism and a relatively high use of material supplies. Therefore, room for improvement exists, demonstrated by an improvement in recent years, due mostly to a relatively lower use of material supplies. The efficiency differences are independent of the case mix of the policy dossiers, since any differences in case mix have already been controlled for when determining the cost efficiency. Because case mix is not measured in a direct way, it cannot be ruled out that the estimated case mix absorbs some of the unobserved inefficiency. Since some relevant efficiency determinants might not be included,

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

some omitted variable bias may occur. The actual efficiency differences could therefore be even greater than presented. This occurs when a CGD turns out to be structurally inefficient.

The analysis of the effects of a number of efficiency determinants shows that high absenteeism rates, high working time factors, high shares of external hiring and material costs lead to low cost efficiency. A high entrance ratio of new employees ensures high cost efficiency. These results provide important indications of opportunities to improve efficiency. In addition, the most significant gains can be made in reducing absenteeism due to illness, increasing the number of part-timers and reducing the use of material supplies. This may vary per CGD.

Based on the research results, it appears that no generic productivity trend for the CGDs can be established in that there are no technical or institutional developments that equally affect the productivity of all CGDs. New IT systems and changed work processes, as well as new regulations in the field of safety or the environment could influence productivity. Additional costs to meet environmental requirements could even have contributed to lower generic productivity. Another cause may be the growing complexity of the tasks to be performed. This is a phenomenon that is difficult to influence, although there may be opportunities to reduce the increasing bureaucratic complexity. Further, the figures also show an extraordinarily high overhead.

The analysis also shows that there are significant differences in the average case mix. For example, at FA, handling a document or parliamentary question costs more than 120 percent more than average. For the CGDs of ED, SA, Def and GA, the case mix is only 60 percent of the average CGD. For the sake of completeness, we emphasize that the presented cost efficiencies have already been controlled for these case mix differences. Based on these findings, we make three recommendations.

1) Shrinking budgets

Given the large differences in cost efficiency between the CGDs, there still seems to be an opportunity for improvement in several CGDs. Because of the permanent intrinsic pressure to expand bureaucracy (Niskanen's Law, see Niskanen, 1968) and to make full use of available budgets (Bowen's Law, see Archibald and Feldman, 2008; Bowen, 1980), there are few incentives for the official leadership to use that room. It must therefore be enforced by politicians and then be addressed or settled by the management. As demonstrated in previous productivity research, the shrinkage of budgets is an effective tool. Of course, for the management of the CGDs it must be clear that costs can be reduced. To this end, the insights from this research can be helpful such as reducing absenteeism due to illness and increasing part-time work. A critical look at external hiring and the material costs can also yield efficiency gains. In the long term, this may result in an efficiency gain of tens of percent for some CGDs.

PUBLIC SECTOR ECONOMICS
47 (3) 335-351 (2023)

2) Targeted research into the causes of lack of productivity growth

Further research can be carried out into the cause of the lack of a generic productivity trend in the CGDs during the research period. Based on the findings using available data, it is impossible to deduce whether the constant productivity is the result of a lack of focus on productivity-enhancing innovations or whether the CGDs are increasingly confronted with more complex tasks and laws and regulations and with stricter requirements with regard to personnel policy, sustainability and quality assurance. To gain insight into these issues, more detailed data about the business operations are needed.

3) Accounting in order

To be able to carry out these types of analyses, it is important to have access to good government accounting. During our research, we found precise accounting was lacking. For example, it appears that not all departments define organizational costs in the same way, that financial reports in the sphere of shared services are handled carelessly and that delivered services and performance are not accounted for at all. The latter is particularly noteworthy because the CGDs do asses the underlying government agencies on this point. An improvement in transparency and accountability is therefore highly recommended.

Disclosure statement

The authors declare that there is no conflict of interest.

REFERENCES

1. Alvarez, A. [et al.], 2006. Interpreting and testing the scaling property in models where inefficiency depends on firm characteristics. *Journal of Productivity Analysis*, 25(3), pp. 201-212. https://doi.org/10.1007/s11123-006-7639-3
2. Archibald, R. B. and Feldman, D. H., 2008. Explaining Increases in Higher Education Costs. *The Journal of Higher Education*, 79(3), pp. 268-295. http://doi.org/10.1353/jhe.0.0004
3. Barton, L. and Barton, H., 2011. Challenges, issues and change: what's the future for UK policing in the twenty-first century*? Article in International Journal of Public Sector Management,* 25(3), pp. 415-433. http://doi.org/10.1108/09513551111109044
4. Bikker, J. and van der Linde, D., 2016. Scale economies in local public administration. *Local Government Studies*, 42(3), pp. 441-463. http://doi.org/10.1080/03003930.2016.1146139
5. Blank, J. L. T. [et al.], 2009. *Beleidsdruk gemeten*. Delft: TU Delft.
6. Blank, J. L. T. and Lovell, C., 2000. Performance assessment in the public sector: contributions from efficiency and productivity measurement. In: J. L. T. Blank (ed.). *Public provision and performance*. Amsterdam: Elsevier.
7. Blank, J. L. T. and Niaounakis, T. K., 2019. *Managing Size of Public Schools and School Boards: A Multi-Level Cost Approach Applied to Dutch Primary Education*. http://doi.org/https://doi.org/10.3390/su11236662
8. Blank, J. L. T. and Valdmanis, V. G., 2019. *Principles of productivity measurement; an elementary introduction to quantative research on the productivity, efficiency, effectiveness and quality of the public sectoritle.* Delft: IPSE Studies.
9. Blank, J. L. T., 2020. The use of the scaling property in a frontier analysis of a system of equations. *Applied Economics*, 52(49), pp. 5364-5374. http://doi.org/10.1080/00036846.2020.1763246
10. Blank, J. L. T., Enserink, B. and Van Heezik, A. A. S., 2019. Policy Reforms and Productivity Change in the Dutch Drinking Water Industry: A Time Series Analysis 1980-2015. *Sustainability,* 11(12), 3463. http://doi.org/10.3390/su11123463
11. Bowen, H. R., 1980. *The Costs of Higher Education: How much do colleges and universities spend per student and how much should they spend?* San Francisco: Jossey-Bass.
12. Collewet, M. and Sauermann, J., 2017. Working hours and productivity. *Labour Economics,* 47, pp. 96-106. https://doi.org/10.1016/j.labeco.2017.03.006
13. Fried, H. O., Lovell, C. A. K. and Schmidt, S. S., 2008. *The measurement of productive efficiency and productivity growth*. New York: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195183528.001.0001
14. Goede, M. [et al.], 2016. Drivers for performance improvement originating from the Dutch drinking water benchmark. *Water Policy*, 18(5), pp. 1247-1266. http://doi.org/10.2166/wp.2016.125
15. Haelermans, C. and Blank, J. L. T., 2012. Is a schools performance related to technical change? a study on the relationship between innovations and secondary school productivity. *Computers & Education*, 59, pp. 884-892. https://doi.org/10.1016/j.compedu.2012.03.027

16. Haelermans, C., De Witte, K. and Blank, J. L. T., 2012. On the allocation of resources for secondary schools. *Economics of Education Review,* 31(5), pp. 575-586. http://doi.org/10.1016/j.econedurev.2012.02.007
17. Hollingsworth, B., 2008. The measurement of efficiency and productivity of health care delivery. *Health Economics*, 17(10), pp. 1107-1128. http://dx.doi.org/10.1002/hec.1391
18. Hood, C. and Dixon, R., 2015. *A Government that Worked Better and Cost Less?: Evaluating Three Decades of Reform and Change in UK Central Government*. Oxford, UK: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199687022.001.0001
19. Kumbhakar, C. and Lovell, C., 2000. *Stochastic frontier analysis.* New York: Cambridge University Press. https://doi.org/10.1017/CBO9781139174411
20. Kumbhakar, S. C., Parmeter, C. F. and Zelenyuk, V., 2020. Stochastic Frontier Analysis: Foundations and Advances I. In: C. Ray et al. (ed.). *Handbook of production economics*. Springer Nature Singapore Pte Ltd. http://doi.org/10.1007/978-981-10-3450-3_9-2
21. Künn-Nelen, A., De Grip, A. and Fouarge, D., 2013. Is Part-Time Employment Beneficial For Firm Productivity? *ILR Review*, 66(5), pp. 1172-1191. https://doi.org/10.1177/0019793913066005O7
22. Lindstrom, M. J. and Bates, D. M., 1990. Nonlinear Mixed Effects Models for Repeated Measures Data. *Biometrics,* 46(3), pp. 673-687. http://doi.org/10.2307/2532087
23. Lopez, M., Dollery, B. and Byrnes, J., 2009. An empirical evaluation of the relative efficiency of roads to recovery expenditure in New South Wales local government, 2005/06. *Australasian Journal of Regional Studies*, 15(3), pp. 311-328.
24. Ministerie van Binnenlandse Zaken, 2009. *Beleidsdruk in beeld: een kwantitatieve vergelijking van directoraten-generaal.* Den Haag: Ministerie van Binnenlandse Zaken.
25. Niaounakis, T. K. and van Heezik, A. A. S., 2019. *Op afstand de beste? Een analyse van de productiviteitsontwikkeling bij IND, CJIB, SVB, RDW en het Kadaster*. Delft: IPSE Studies.
26. Niskanen, W. A., 1968. The Peculiar Economics of Bureaucracy. *American Economic Review*, 57(2), pp. 293-321.
27. Parmeter, C. F., 2018. Estimation of the two-tiered stochastic frontier model with the scaling property. *J Prod Anal*, 49, pp. 37-47. http://doi.org/10.1007/s11123-017-0520-8
28. ROA, 2011. *De arbeidsmarkt naar opleiding en beroep tot 2016. Reports.* Maastricht: Researchcentrum voor Onderwijs en Arbeidsmarkt/Maastricht University.
29. Wang, H. J. and Schmidt, P., 2002. One-step and two-step estimation of the effects of exogenous variables on technical efficiency levels. *Journal of Productivity Analysis*, 18(2), pp. 129-144. http://doi.org/10.1023/A:1016565719882
30. Weber, M., 1922. *Economy and Society*.

Tax distortions from inflation: What are they? How to deal with them?

SEBASTIAN BEER, Ph.D.*
MARK GRIFFITHS, D.Phil.*
ALEXANDER KLEMM, Ph.D.*

Article**
JEL: H20, E31
https://doi.org/10.3326/pse.47.3.3

* The views expressed in this paper are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.
The authors would like to thank Yongquan Cao, Ruud de Mooij, Andrea Lemgruber, Simon Naitram, two anonymous referees, as well as IMF and NIPFP seminar participants for valuable comments and Aieshwarya Davis for research assistance.

** Received: January 26, 2023
Accepted: May 2, 2023

Sebastian BEER
International Monetary Fund, 700 19th Street NW, 20431 Washington DC, USA
e-mail: sbeer@imf.org
ORCiD: 0000-0002-1272-4060

Mark GRIFFITHS
International Monetary Fund, 700 19th Street NW, 20431 Washington DC, USA
e-mail: mgriffiths@imf.org
ORCiD: 0009-0005-9857-7450

Alexander KLEMM
International Monetary Fund, 700 19th Street NW, 20431 Washington DC, USA
e-mail: aklemm@imf.org
ORCiD: 0000-0002-9892-3182

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

Abstract

Inflation that is fully anticipated has few real effects in purely private market economies, but this need not be the case in the presence of taxation. In practice, tax systems are not neutral with respect to inflation – though some countries have attempted make their tax systems inflation-neutral in the past – and this paper provides a comprehensive overview of the most relevant non-neutralities, drawing on existing literature, but also supplying new illustrations and evidence of the effects. The paper shows, for example, how taxing inflationary gains can have a large impact on effective tax rates – even at relatively low rates of inflation. It also shows how partial coverage of protection against inflation – for some types of incomes only – can create additional distortions. A new empirical analysis reveals how the erosion of the value of depreciation allowances through inflation affects investment. Finally, the paper discusses policy options to address such non-neutralities.

Keywords: tax policy, inflation, bracket creep, indexation, fiscal policy, income taxation

1 INTRODUCTION

Inflation rates around the world have risen. Inflation in advanced economies has reached its highest rate in forty years, increasing from 3.1 percent in 2021 to an estimated 7.2 percent in 2022. In emerging market and developing economies, inflation in 2022 is expected to have reached 9.9 percent (IMF, 2022). While there has been considerable discussion of the relative roles of monetary and fiscal policy (quantitative easing, fiscal stimulus to fight the pandemic and afterwards) versus supply shocks (Russia's invasion of Ukraine, and food and energy price increases) in causing inflation, less attention has been given to the impact of higher inflation on fiscal aggregates and the stance of fiscal policy, but also how does inflation interact with the tax system, what distortions does this give rise to, and how might they be corrected? The present paper considers this latter set of questions. It draws heavily on literature from the 1970s and 1980s,[1] when this topic was last studied in detail, probably because inflation started coming down soon after, at least in advanced economies, and the topic was then thought to be less relevant. However, this paper shows that the impact of inflation on tax revenues, marginal tax rates, and effective tax rates is not negligible, even at lower inflation rates.

In simple models of a private market economy with full market clearing, changes in nominal variables such as the money supply and the general price level – at least when anticipated – should not have significant real effects. While increases in the money supply may have short-run real effects due to wage or price rigidities, in the long-run wages and prices adjust, and agents base their decisions on real or relative prices and – abstracting away from hysteresis effects – the real equilibrium is unchanged (Friedman, 1968). With fully flexible prices the arguments for neutrality are stronger. Even in this case, surprise money supply and price level increases have

[1] Key contributions include Diamond (1975), King (1977, chapter 8), Aaron (1976).

PUBLIC SECTOR ECONOMICS
47 (3) 353–386 (2023)

the potential to have real effects, if they cause misperceptions that relative prices have increased thus leading to increased supply (Lucas, 1972). With fully flexible prices, expected changes in inflation should have few real economic implications, save for reduced real holdings of cash (and other unremunerated liquidity) and some additional printing costs (unless money is fully digitalized). However, save for the case of hyperinflation, the magnitudes are likely to be small.

In a mixed economy, however, where a significant share of income is collected through taxes and used for public spending, even inflation that is fully anticipated can have real effects, if the tax system is not neutral with respect to inflation.[2] By neutrality with respect to inflation, we mean that the impact of the tax system on incentives and tax burdens does not change with inflation. It does not necessarily mean that the tax system is more generally neutral in its impact on incentives (such as for investment or labour supply).

This paper describes and analyses various non-neutralities of the tax system with respect to inflation, both drawing on the existing literature and showing new illustrations and evidence of the effects. The paper shows how the taxation of income gains that are purely inflationary can have a tremendous impact on effective tax rates – even at relatively low rates of inflation. The paper also shows how partial adjustment for inflation – for only some types of incomes – can create additional distortions. A new empirical analysis reveals how the erosion of the value of depreciation allowances through inflation reduces investment. The paper also discusses a range of policy options to address these non-neutralities due to inflation, from specific measures that aim to address individual distortions to more comprehensive reforms of the tax system (which might also improve the efficiency of the tax system more generally).

There are further important links between inflation and tax that are not covered here, as they are not related to structural tax issues but instead to the macroeconomic linkages. These include seigniorage, sometimes known as the inflation tax, although "tax" is used metaphorically in that case. Also, tax policy, like any fiscal policy, affects aggregate demand and hence has a macroeconomic impact on inflation. Another issue is that taxes, especially those on consumption, such as a value-added tax (VAT) or sales tax, have an immediate (but one-off) impact on inflation.

In covering the main distortions of the tax system due to inflation, this paper is organized by the underlying cause of the distortion rather than by the type of tax or its economic importance. The focus is on the common causes of distortions, and how these apply to different types of tax. Section 2 covers distortions that arise due to the failure to adjust certain parameters of the tax system in line with inflation (examples include thresholds for paying tax that are fixed in nominal terms, or specific taxes that also are set in nominal terms). Section 3 examines the tax consequences resulting

[2] The same can also hold for the spending side if real public spending is not neutral with respect to inflation (for example, if spending items such as government wages or public pensions do not rise one for one with prices).

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

from timing effects, such as the lag with which taxes are collected and refunded, and how these interact with inflation. The paper then covers the more general problem caused by taxing nominal rather than real income, in particular capital gains and capital income. Given the length of this discussion, it is split into two parts: section 4 focuses on the household level while section 5 examines taxation at the corporate level. Section 6 provides a summary and concludes.

2 NON-ADJUSTMENT OF THE PARAMETERS OF THE TAX SYSTEM

The simplest way in which inflation can lead to unintended changes in taxes is when the parameters of the tax system are fixed in nominal terms without adjustment for inflation. The simplest example is taxes or fines that are fixed in domestic currency (specific taxes) rather than as a percentage (ad valorem). These include specific excises, lumpsum taxes, license fees, and certain simplified taxes (e.g., taxes per table in a restaurant). They also include nontax items such as fees, fines, or interest assessed for the late filing or payment of taxes. Finally, even ad valorem taxes can be affected if the thresholds for registration or for higher rate brackets are fixed in nominal terms.

2.1 SPECIFIC TAXES, FEES, AND PENALTIES

There are good reasons for some taxes to be specific rather than ad valorem. Excises levied to address an externality, such as a carbon tax or taxes on alcohol and tobacco, aim to internalize the real cost of consumption to society, and this real cost will depend on the amount consumed rather than the nominal value of the item consumed.[3] Fuel prices, for example, are very volatile, but the harmful effect of burning fuel does not increase with the price of fuel. Prices for wine vary tremendously with quality, but more expensive wine does no more harm than cheap wine.

However, inflation means that the real value of specific taxes, fees, and penalties is eroded over time. Where an excise was set at a value meant to internalize an externality, after inflation-induced erosion of the real value of the tax, it does not cover the externality in real terms anymore, and also leads to lower real revenues. Some countries define specific taxes, notably tariffs, in US dollars,[4] which might offer some protection against local inflation eroding the real value of the excise, provided the exchange rate adjusts over time to offset inflation. In practice this may not be the case, as exchange rate movements can differ quite substantially from purchasing power parity conditions (so will not offset one for one). Moreover, even when the exchange rate does adjust in a way that offsets inflation reasonably closely, over time, excises fixed in dollar terms would still have their real value eroded because of US inflation – which, although lower than in many developing countries, is clearly nonzero, with the official target at 2 percent, and current rates much higher. Adjustment is therefore

[3] Keen (1998) provides a broader discussion of specific versus ad valorem excises. Even absent externalities, there can be interesting tradeoffs, at least when competition is imperfect, or goods vary in quality. For identical goods, under perfect competition, there is no difference in specific or ad valorem taxes. Under a monopoly, however, ad valorem taxes can be shown to lead to both higher consumer welfare and profits. Results are ambiguous under oligopolistic competition. Considering goods of variable quality, specific taxes create stronger incentives to improve goods' quality.

[4] We have not found current examples of foreign-currency excises. Foreign-currency tariffs are also exceedingly rare, but there are some examples (e.g., East African Community).

still needed, though not as frequently as when specified in a currency that is marked by very high inflation and corresponding depreciation.

2.2 FIXED INTEREST RATES

Tax laws sometimes contain fixed interest rates for overdue payments, which tend to lower real revenues in inflationary times.[5] Sometimes a lower rate applies for some accidental under- and overpayment, and a higher penalty rate in cases of late filing or underpayment due to tax fraud. In either case, if the percentage rate is fixed in the law, its real value will be eroded by inflation. As a result, in high inflation periods, the real penalty for late payment is lower. In extreme cases it could effectively turn into a premium for late payment, if the interest rate in the tax law is lower than what the taxpayer can obtain in the financial market. The opposite occurs in times of very low inflation, such as the recent period during which many central banks had interest rates at zero or even negative rates. This encourages overpayment of taxation if refunds benefit from application of a fixed interest rate, even if it is set at a very low level.

2.3 THRESHOLDS

Taxes that are expressed as simple percentages adjust automatically with inflation. However, when rates are not flat, such as under a progressive income or inheritance tax, inflation can cause real tax increases when income tax brackets (thresholds) are fixed in nominal terms. Inflation shifts people into higher tax brackets, which typically have higher tax rates, and thus erodes the value of the tax-free personal allowance (and any other allowances or deductions). So real taxes paid increase, as does the marginal rate. This is known as bracket creep, and could be avoided by full inflation indexation of thresholds.

This issue does not arise for a truly proportional income tax system (with a flat rate starting from zero income)[6] or for consumption taxes such as VAT or sales tax. These taxes are naturally neutral with respect to inflation, except for any effect from registration thresholds being set in nominal terms (see below). Inflation will boost revenues from such proportionate taxes in nominal terms, but in real terms the tax remains the same. For goods with price increases that exceed the general inflation rate, the real value of tax revenues rises, but this increase then reflects the change in relative prices, not general inflation.

The reverse effect occurs with social security or national insurance contributions, as in some countries these are not levied beyond a certain income threshold. Higher inflation then leads to lower real payments, as the amount of income that exceeds the upper limit rises with inflation.

[5] Some countries (e.g., United States, Austria) link the rate to a flexible benchmark, such as the central bank's policy rate, plus a fixed surcharge, which provides some protection against inflation, as interest rates will generally be higher in inflationary times. Other countries adjust such rates rarely (e.g., Germany requires revisions only once every three years and only since 2021), making it more likely that the rate does not reflect changes in the inflationary environment.

[6] We found flat rate systems without general personal allowances, credits, or threshold in only 7 jurisdictions: Armenia, Bulgaria, Georgia, Hungary, Montenegro, Ukraine, and Uzbekistan.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

The extent of bracket creep depends on the structure of the tax system. Bracket creep does not exist for a completely flat tax and is more severe if there are many brackets or large differences in rates between brackets. Immervoll (2005) compared the impact of bracket creep for personal income tax in the Netherlands, Germany, and the United Kingdom. He found that the simulated effect of bracket creep is much lower in the United Kingdom because at that time it had few and wide tax brackets, meaning that fewer people were shifted into higher tax brackets as a result of inflation than in Germany (where there are infinite brackets, given the linearly rising marginal tax rate) or the Netherlands where there are various large jumps in brackets.[7]

Table 1

Adjustment of income tax thresholds

No inflation adjustment	Regular adjustment	
	Unclear process	Automatic
131 countries	Argentina	Austria[a]
	Azerbaijan	Canada
	Belgium	Chile
	Colombia	Denmark
	Costa Rica	Israel
	Ecuador	Netherlands
	Finland	Serbia[b]
	France	Taiwan, POC[c]
	Germany	United States
	Honduras	Venezuela
	Iran	
	Norway	
	Paraguay	
	Peru	
	South Africa	
	Sweden	
	Turkey	
	Ukraine	
	Uzbekistan	

[a] *All but the highest bracket are indexed since 2022.*
[b] *Adjusted for average wage growth.*
[c] *If inflation > 3%.*

Source: Authors' compilation based on IBFD and official websites.

A few countries adjust personal income tax thresholds automatically for inflation, but the majority either do not adjust them regularly, or do so in an ad hoc manner that may or may not be aligned with inflation (table 1). Of 160 countries from which we could obtain data, there are 131 countries (too many to list) that do not adjust thresh-

[7] This may not hold anymore, as the UK system has more brackets now than at the time of the study, including because of a provision to phase out the personal allowance for incomes above around £100,000.

olds regularly (defined as almost every year). Other countries do adjust regularly, but only in nine could we find an explicit legal or administrative reference to a process that adjusts for inflation. In the case of ad hoc adjustments – for example changing thresholds during the budget process – policy considerations (such as a potential need for fiscal consolidation) tend to be weighed against keeping the real tax system unchanged through inflation adjustment of thresholds. Raising thresholds but by less than the inflation rate (or even freezing them but then cutting tax rates) can appear a politically expedient way to raise real taxes by stealth, while appearing to lower them.

With the interaction of higher inflation and fixed nominal thresholds typically leading to increases in real tax revenues and marginal tax rates, some have argued that higher inflation increases income tax evasion. Simple models suggest that tax evasion depends on the probability of detection, the fine or penalty rate if detected, the tax rate, and the level of true income (Arrow's hypothesis that absolute risk aversion decreases as income increases). If inflation causes the tax rate to increase, then so does the incentive to evade taxes; however, the resulting fall in real income might offset this if it leads to greater risk aversion. Given such ambiguity, it is an empirical question which effect dominates. Crane and Nourzad (1986), using US data 1947-81, find that higher inflation leads to higher aggregate tax evasion. In addition, it seems likely that higher inflation reduces the fine or penalty rate (unless these are adjusted rapidly) which again would support the hypothesis that inflation increases tax evasion.

Similar issues can arise with registration thresholds. VAT typically has a registration threshold to limit coverage to businesses where expected revenues exceed the administrative cost. Inflation erodes the real value of this threshold. More businesses then have to register for VAT, creating administrative costs for the tax authorities and compliance costs for businesses. Unlike for personal income tax thresholds, there appears to be no country in the world that regularly adjusts VAT registration thresholds. In some countries, the original threshold might have been set too high, perhaps deliberately for the sake of being able to phase in the VAT. In those cases, inflation would raise additional revenues that exceed the additional administrative costs and would therefore benefit the public finances. However, even in those cases, it would be unlikely that the desired lowering of the real threshold would coincide exactly with the inflation rate.

2.4 SOLUTIONS TO THE EROSION OF SPECIFIC TAXES AND THRESHOLDS

Resolving the erosion of fixed parameters of the tax system is easy to solve technically. Indexing the parameters to a reliable inflation measure should fix the problem. The frequency of optimal adjustment depends on the inflation rate. For modest inflation, annual adjustment is sufficient, while high inflation could require more frequent adjustment.

In the case of interest rates and penalty rates, the problem could be solved if these could be defined as a markup over the inter-bank or government bond rate. In principle it could also be a fixed rate that is increased by the prevailing inflation rate,

PUBLIC SECTOR ECONOMICS
47 (3) 353–386 (2023)

but such precision might not be necessary. Moreover, from a taxpayer's perspective any decisions on later payments are likely to be based on comparisons of the rate in the tax law to that available in the financial markets, hence a markup over the latter would prevent the creation of incentives for payment delays in inflationary periods.

In the case of specific taxes, fixing them in a more stable foreign currency may help, but this will not ensure that their real value is stabilized. This approach only protects partially against domestic inflation and could lead to unwanted changes in taxes driven by exchange rate changes. The specific taxes would also need to be increased in line with foreign country inflation – especially in times of high global inflation. For a few excises the solution could also be to switch from specific to ad valorem, though as noted, such a move would have consequences that go beyond addressing inflation and may therefore often not be advisable.

While indexation is technically simple, it may face political obstacles but would be more transparent. The annual adjustment of thresholds allows the government to appear to cut taxes, while automatic indexation would make it more obvious that the system is merely being kept stable. Automatic indexation would also improve transparency in policy making. Upward changes to thresholds tend to benefit most those with high incomes. Hence any such adjustment can be portrayed as being regressive – even though in the case of an inflation adjustment it merely maintains the same real progressivity. These interactions between inflation adjustment and changes to progressivity can be avoided, if thresholds adjust automatically with inflation and debates on any additional changes in the threshold can focus on the desired progressivity of the system.

Unlike wage and price indexation, indexing thresholds does not perpetuate inflation, but prevents inflation from leading to arbitrary changes in real taxes. Wage and price indexation makes disinflation harder by making an initial burst of inflation more entrenched, both by leading to second rounds of cost and price increases and also by de-anchoring inflation expectations. Indexing thresholds has no such effect, although if not indexed then inflation does lead to a real increase in tax revenues which would help in disinflation. Indexation leaves real tax revenues unchanged, and thus is neither inflationary nor disinflationary. It is true that indexing thresholds reduces the tax distortions associated with higher inflation, and by making inflation less costly could reduce the incentives for policymakers to lower inflation, but this would seem a contrived argument for not addressing the distortions that inflation gives rise to.

To the extent that tax evasion increases with inflation (as explained above), this would call for devoting greater resources and efforts to tax compliance in times of high inflation.

PUBLIC SECTOR ECONOMICS 47 (3) 353-386 (2023)

3 TIMING ISSUES

3.1 LAGS IN COLLECTIONS AND REFUNDS

Even when taxes increase one for one with inflation, collecting revenues takes time, and this can erode tax revenues in real terms when there is inflation (Olivera, 1967; Tanzi, 1977). As argued in the previous section, the presence of fixed nominal income tax thresholds means that inflation leads to higher real revenues. This is the conventional result for economies with progressive income tax systems and prompt tax collection. However, income taxes collected in any given period typically depend on personal or corporate income earned some time earlier. In the presence of inflation, this collection delay results in lower real tax revenues. The effect is likely to be particularly significant for countries where the tax system is not elastic (i.e., which lack progressive income tax systems), where collection delays are significant (income tax or property tax, as opposed to VAT, sales taxes, and excises), and where inflation is high (so the real erosion is greater) (Tanzi, 1977).

VAT is typically paid on a quarterly or even monthly basis, with companies remitting net VAT – the difference between VAT collected on outputs and VAT paid on inputs – to the tax authority. The tax credits companies receive for the VAT they paid on intermediate inputs thus tend to retain their real value during normal commercial undertakings, even in the presence of inflation. However, for large-scale projects with extended construction periods, such as encountered in the natural resource or tourism sector, the lag between payment of input VAT and receipt of a corresponding input tax credit can take several years. Besides the cash-flow problems that a delayed refund creates, inflation also erodes the real value of the tax credit and thus increases the effective tax rate on (instantaneous) value added.

Fixed penalties or penalty interest rates are not only directly eroded by inflation (as noted in the previous section) but their deterrent effects also lessen as inflation increases the real value of postponing tax payments. The real cost of a penalty can be maintained by indexing the payment to inflation. Its deterrent effect is nevertheless reduced in a high inflation environment, because the real saving from making a later payment rises. Payments delays themselves can lengthen endogenously, as the benefits of delay increase with inflation. To prevent this, one would need to index the tax payment itself for inflation, or subject it to a variable penalty interest rate.

Investment is usually depreciated over time in most tax systems. As it is typically based on a percentage of historical costs, the value of depreciation deducted from profits in later years is eroded by inflation. The phenomenon will be discussed in greater detail in the section on taxing nominal profits. Similarly, loss-making firms can typically use losses against future profits (with restrictions that vary across countries), but the value of such losses carried forward is eroded over time in the presence of inflation.

PUBLIC SECTOR ECONOMICS
47 (3) 353–386 (2023)

3.2 POLICIES TO ADDRESS TIMING ISSUES

While a fully comprehensive solution to timing effects would involve the introduction of a fully inflation-neutral tax system (as will be discussed later), the simplest way to solve the problem of timing issues is to speed up tax payments. Options to prevent the amount of tax levied from declining in real terms in the presence of inflation include:

- Introducing withholding taxes so that income is taxed as it is earned, including through pay-as-you-earn schemes for wage taxes. If the precise tax liability cannot be determined, as would be the case in a comprehensive income tax system with progressive rates, a nonfinal withholding tax can still bring forward cash payments and improve incentives for the rapid filing of returns.
- Greater reliance on advance corporate income tax (CIT), which should be based on expected profits. If that tax base is estimated from historic profits, it should be adjusted for inflation.
- More frequent asset revaluations. Where the cost of updating is high, for example for property tax, some formulaic mechanism can be used in years in which properties are not due a full review, and this should reflect inflation.
- Once a tax has been determined, steps also need to be taken to discourage delays in its payment, as its value will fall in real terms with inflation. This includes inflation-adjusting payments (so that they rise if not paid on time) and having proper penalty rates (that do not fall in real terms just because of inflation).
- Other steps could include improving tax administration (for example by encouraging electronic payments, and more rapid payments), or placing greater reliance on taxes where collection delays are shorter.
- Indexing depreciation allowances with inflation would prevent the erosion of their real value because of inflation, and thus reduce the resulting disincentive to invest. A more direct approach might be to allow full expensing upfront of investment, which could have additional advantages beyond addressing the inflation distortion, as will be discussed in more detail in the following section.

4 TAXATION OF NOMINAL HOUSEHOLD INCOME

4.1 SAVINGS INCOME

Most personal income tax systems cover also capital income, though not necessarily at the same rate as labour income. Capital income is typically taxed, irrespective of whether it represents a normal return or an economic rent, and without adjusting for inflation. Another aspect – to which we will return later – is that capital income flows, such as interest and dividends are typically taxed immediately, while capital gains are often taxed only on realization.

Taxing the normal rate of return on savings is well known to distort household savings decisions. The extent of this distortion and the resulting optimal tax rate on normal returns is debated in the literature, with earlier contributions tending to find a rate of zero optimal (Atkinson and Stiglitz, 1976; Chamley, 1986; Judd, 1985), while some more recent papers that relax assumptions of infinite horizons or that give more weight to equity considerations provide arguments for taxing such returns (e.g., Straub and

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

Werning, 2020). The purpose of this paper is not to take a stance in this debate, but to analyse how inflation changes the effective taxation of normal returns and therefore the incentives to save.

To illustrate the effect of taxing savings income, consider a simple economy with zero inflation, a risk-free (or normal) real interest rate of r, and a capital income tax rate of t. In such an economy the real return to saving is reduced by taxation to $r(1-t)$. This reduction in the rate of return makes future consumption more expensive than it would be without taxation, and therefore likely reduces savings.

Inflation magnifies this distortion, since all nominal interest income is taxed, reflecting both real interest (which might include the normal rate of return) and inflation. With inflation, π, we assume that the Fisher equation holds,[8] so that the nominal return, i, on an asset is given by:

$$i = (1 + r)(1 + \pi) - 1 \tag{1}$$

Taxing this nominal return, reduces the after-tax return:

$$r_{after\ tax} = \frac{1+(1-t)i}{1+\pi} - 1 = \frac{1+(1-t)\left((1+r)(1+\pi)-1\right)}{1+\pi} - 1 = r(1-t) - \frac{t\pi}{1+\pi} \tag{2}$$

From equation (2) it can be clearly seen that taxing nominal returns reduces the real after-tax return by more than the tax rate. The additional reduction rises with inflation. This accordingly also raises the effective tax rate (ETR) on such investment:

$$\text{ETR} = \frac{r - r_{after\ tax}}{r} = t\left(1 + \frac{\pi}{r(1+\pi)}\right) \tag{3}$$

The ETR is increasing in inflation and declines with the rate of return. At the limit, with ever higher inflation, the ETR tends toward t/r. For ever higher returns, the ETR tends toward the statutory tax rate.

To illustrate the order of magnitude of the impact of inflation on ETRs, figure 1 shows a few examples assuming a tax rate of 25 percent and allowing 3 levels of real returns. In the absence of inflation, the ETR matches the statutory tax rate. Inflation, however, raises the ETR, and this effect is particularly strong at low rates of return. For example, with a real rate of return of 2 percent, the ETR reaches 100 percent when inflation hits 6 percent. At current levels of inflation that are close to double digits in many advanced economies, the ETR far exceeds 100 percent (or more generally, quadruple the statutory tax rate). However, even with inflation at 2 percent – which is the target of various advanced economy central banks – the ETR is still doubled for investors expecting to earn a 2 percent real rate of return. For investments

[8] In practice this assumption may not hold, and even in general equilibrium models it often does not hold in the presence of taxation (see Feldstein, 1976). Nevertheless, this is a useful starting point, if one wants to show that even in an otherwise fully adjusting economy, the tax system creates distortions.

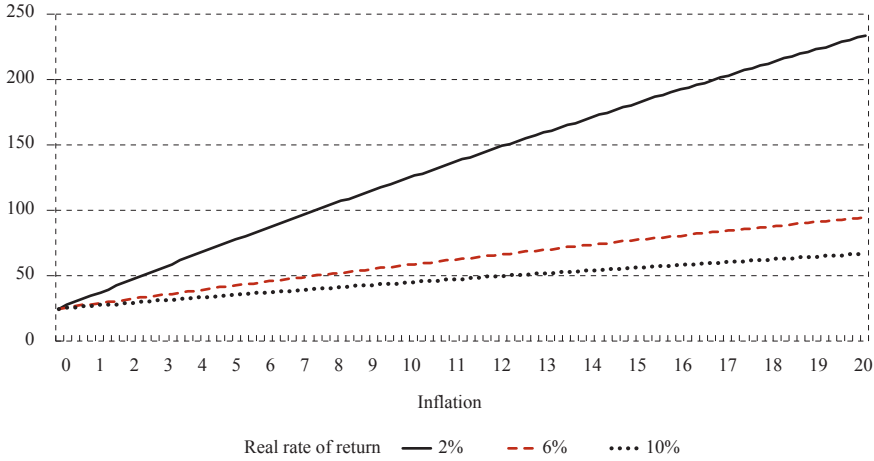
PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

with lower real returns (not shown), the ETR would be even higher, tending toward infinity as returns approach zero. And even with negative real returns tax must be paid, as long as the rate of inflation exceeds the real rate of return.

For investments earning higher real rates of return, the effect of inflation on ETRs is more muted. This adds an equity dimension, given that well-off investors are likely to enjoy higher rates of return on average, as they have greater ability to tolerate risk and access to better financial advice.

Figure 1

Effective tax rates on real savings returns (in %)



Notes: Assumed tax rate of 25 percent.

Source: Authors' calculations.

Even proponents of taxing capital are unlikely to support effective tax rates exceeding 100 percent (especially not in case of low returns), and the optimal tax rate – whatever it may be – is unlikely to vary with inflation. These very simple illustrations have shown that in practice such high effective tax rates can occur at combinations of inflation and interest rates that are not unusual. Indeed, effects are even non-negligible when inflation is close to most central banks' target values.

4.2 TAXATION OF CAPITAL GAINS

Similar arguments apply to the taxation of capital gains.[9] Since the comprehensive income tax base is based on nominal income, higher inflation increases nominal capital gains and thus capital gains tax payments. Just as for interest and dividend income, the real tax rate on capital gains increases as inflation rises, as the nominal component of the gain increases relative to the real gain, and both of these are taxed (Diamond, 1975).

[9] Another aspect is that unexpected inflation will have potentially very large effects on capital gains. Fixed income assets and liabilities would immediately lose value. Related gains would typically remain untaxed unless realized.

However, an additional complication comes from the fact that capital gains are usually taxed at lower rates than other income. Some jurisdictions exempt them (e.g., Belgium, Hong Kong SAR), some tax them at reduced rates (e.g., Germany, Canada, United States), and others apply standard rates (e.g., Denmark, Czechia).[10] Even in the case of standard rates, effective rates on capital gains tend to be lower, because taxation is deferred until realization (with very few exceptions that serve as anti-avoidance measures, such as accrual taxation of zero-coupon bonds in some countries). This realization principle provides a tax advantage for capital gains compared to dividends or interest income which are taxed each period. When looking at a one-period investment, this does not create any difference, but when an investment is held for multiple periods, the effective taxation of capital gains is lower, because such investment compounds at a (higher) untaxed rate of return. Specifically, if an investment yielding capital gains is held for n years, its after-tax value V reaches:

$$V_{capital\ gain} = (1 + i)^n - t\,((1 + i)^n - 1) = (1 - t)\,(1 + i)^n + t \tag{4}$$

This exceeds the value of an investment where the return is distributed (as interest or dividends) and hence taxed each period:

$$(1 - t)\,(1 + i)^n + t > (1 + i(1 - t))^n \ \textit{for all}\ n > 1 \tag{5}$$

Taxation at realization thus creates a well-known bias toward receiving capital income in the form of capital gains – and if the tax rate on capital gains is lower (or even zero) this bias is even greater. Another effect is to create an incentive to postpone the realization of capital gains, which is known as the "lock-in effect". This creates an incentive to hold on to assets that have appreciated even if their further expected gross return is lower than that on alternative investments, as long as the lower return is compensated by the tax saving.[11]

To analyse the impact of inflation on the tax preference for capital income, we need to consider a multi-period investment. For that we consider the net present value (NPV) of an n year investment, discounted at a real rate of d. The ETR is then the NPV of tax (capital income flow or realized capital gain) divided by the NPV in the absence of tax,[12] with the NPVs given by:

$$\mathrm{NPV}\left(no\,tax\right) = \left(\frac{1+i}{(1+d)(1+\pi)}\right)^n - 1 = \left(\frac{1+r}{1+d}\right)^n - 1 \tag{6}$$

[10] See pwc Capital Gains Tax Rates (https://taxsummaries.pwc.com/quick-charts/capital-gains-tax-cgt-rates).
[11] Auerbach (1991) suggested a capital gains tax with no such effect, where taxation is based on the number of years an asset is held and a statutory rate of return, not on the true capital gain. Such a tax has not been tried in practice.
[12] Note that the NPV in the absence of tax is completely independent of the inflation rate, because inflation cancels out of the fraction. This is expected, given the argument that expected inflation should not affect real decisions such as investment.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

$$\text{NPV}\left(income\ tax\right)=\left(\frac{1+i\left(1-t\right)}{\left(1+d\right)\left(1+\pi\right)}\right)^{n}-1 \tag{7}$$

$$NPV\left(realization\ CGT\right)=\left(\frac{1+i}{\left(1+d\right)\left(1+\pi\right)}\right)^{n}-1-t\frac{\left(1+i\right)^{n}-1}{\left(\left(1+d\right)\left(1+\pi\right)\right)^{n}} \tag{8}$$

$$=\left(\frac{1+r}{1+d}\right)^{n}\left(1-t\right)-1+\frac{t}{\left(\left(1+d\right)\left(1+\pi\right)\right)^{n}}$$

Figure 2 illustrates the impact of inflation on the relative taxation of capital gains and distributed capital income. It assumes a tax rate of 25 percent as before, a real rate of return of 3 percent, and a real discount rate of 0 percent. The figure assumes a 10-year investment horizon.

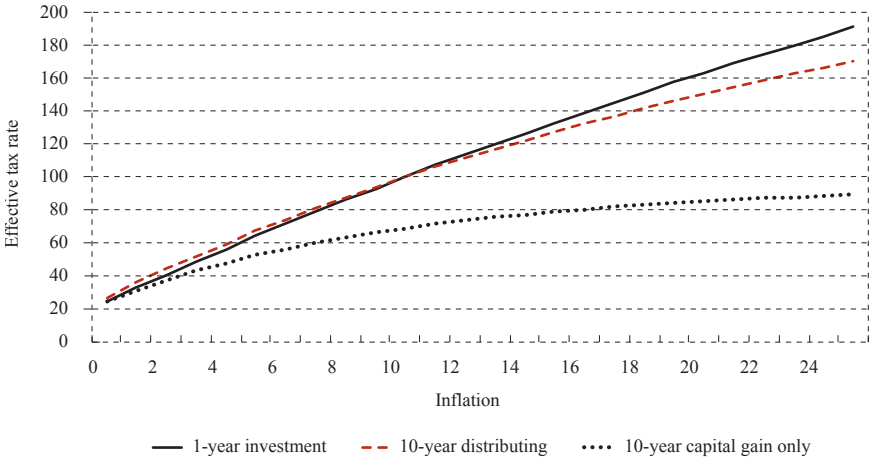
- The figure shows clearly how the tax preference for capital gains rises with inflation. At zero inflation, the ETRs look similar – though the one for the distributing asset is still higher at 28 versus 25 percent, given the accumulation at untaxed interest rate as discussed. For higher rates of inflation, the difference rises dramatically in favour of the investment that yields its return in the form of capital gains. This also implies that the lock-in effect is stronger, the higher the inflation rate.
- The figure also shows, for comparison, a one-year investment (where as noted, there is no difference between taxing accrued capital income or realized capital gains). In general, the longer-term investment has higher ETRs, because of the reduction in the rate of return. When the inflation rate is so high as to lift the ETR above 100 percent, the long-term investment has a lower ETR. Under these circumstances, the investment is loss-making after tax, so having a low return in the first year reduces the amount available for re-investment in such a value-reducing asset.

An additional aspect is that income from saving is often taxed at different rates, with some savings income tax exempt. Exempt capital income typically includes certain savings vehicles, such as pension funds, tax-free savings accounts, and the consumption return from owner-occupied housing. Capital gains, as noted, already benefit from being taxed on realization, but nevertheless in many countries also have preferential rates. Inflation interacts with these tax preferences:

- When comparing two assets with the same positive rate of return, inflation unambiguously increases any pre-existing tax preference from lower rates or from taxation at realization.
- When comparing assets with different rates of return, there is ambiguity if the high return asset is also the more highly taxed one. Inflation increases taxation in effective terms, but the impact is smaller on high-return assets.

Figure 2

The impact of inflation on the trade-off between capital gains and distributions (in %)



Assumptions: Tax rate: 25 percent, real return: 3 percent, real discount rate: 0 percent. For the 10-year distributing assets, all distributions (interest, rents, dividends) are assumed to be reinvested at the same conditions.

Source: Authors' calculations.

4.3 HUMAN CAPITAL

Once it has been shown that taxing nominal capital income leads to distortions, that the under taxation of capital gains leads to a tax preference for taking income in the form of capital gains, and that this tax preference rises with inflation, the natural question arises of whether investment in human capital is similarly affected. Would higher inflation encourage investment in human capital? After all, labour income is also taxed based on nominal rather than real values, and improvements in human capital are untaxed, just like unrealized capital gains in many countries. Closer analysis (Diamond, 1975), however, reveals that these analogies are incorrect and that investment in human capital is affected differently by inflation than investment in financial or real capital. Costs are twofold: forgone earnings while engaging in education and outright payments for education services or goods. In the case of forgone earnings, it is clear to see that inflation has no impact: what is given up now is real earnings, and what is gained is higher real earnings in the future. If inflation boosts earnings in the future by some additional amount, this does not imply any additional taxation. Provided the tax system is designed so as to avoid bracket creep, as discussed above, inflation should not add any additional discouragement of education beyond the one from a progressive labour income tax schedule. In the case of outright payments, these are not deductible in most countries, and certainly not depreciable over time, so that again there is no tax consequence. Moreover, the gain in human capital can only be reaped by earning income through work, it cannot be realized by selling an asset. Labour income is thus appropriately treated differently and, provided there is no bracket creep, it does not require an inflation adjustment even if one is granted to capital income.

4.4 SOLUTIONS TO TAXATION OF INFLATIONARY HOUSEHOLD INCOME

Finding solutions to the taxation of inflationary gains of households is more complex than fixing the erosion of fixed parameters of the tax system. Fixed parameters can simply be adjusted for inflation but moving away from taxing inflationary gains would imply a more fundamental change in the definition of tax bases.

One approach, suggested by Diamond (1975), is to provide a deduction of the inflation rate assessed on the value of assets. His proposal applies irrespective of whether these assets yield capital gains or other capital income, thereby avoiding a preference for capital gains.

Partial solutions, such as inflation-adjusting only select income flows, for example capital gains, can exacerbate rather than reduce non-neutralities. Adjusting capital gains for inflation – which is the most common case[13] – removes the inflation bias for this type of income. However, if other incomes are not similarly adjusted, it creates a distortion toward a preference for capital gains. In the particular example of capital gains, this exacerbates the existing distortion that arises from taxation at realization. Simplified approaches to addressing the impact of inflation on capital gains, such as lower capital gains tax rates for long-term gains as offered, for example in the United States, similarly exacerbate the existing tax preference for this type of income.

5 TAXATION OF NOMINAL PROFITS

Like household savings, corporate profits are taxed at their nominal value, but determining corporate profits is certainly more complex than figuring out financial income where there are no (or no significant) costs to offset. Profits, however, are the difference between sales and costs, including deductible financing costs. If sales and related costs always occurred simultaneously (or sufficiently close in time), there would be no issue for the tax system. Inflation would drive up both revenues and costs, and the resulting nominal profit would be higher, but given that CIT is usually charged at a flat rate, this would not have any tax consequence.[14]

More realistically, even in a very simple business, revenues and costs are spread out over time. When costs are incurred earlier (at lower prices) than corresponding sales, nominal profits are boosted by inflation. This effect rises with the lag between input costs and sales to final customers. Indeed, it is conceivable that a business could sell a good at a real loss, while making a nominal profit, in which case the loss would be compounded by the tax assessed on such nominal profit. Because every business has a different distribution of costs and revenues over time, the real profit cannot be obtained by simply adjusting nominal profits by some inflation-adjustment factor. Most clearly, if a business makes a real loss by selling at prices that exceed nominally

[13] A review of tax laws revealed that Botswana, Chile, Colombia, Cyprus, the Dominican Republic, Israel, Mexico, Luxembourg, and Portugal provided relief for inflationary capital gains, while the United Kingdom and Ireland did so in the past.

[14] Some countries have lower rates for small businesses or low profits, and the thresholds for those should of course be adjusted as discussed in the previous section.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

but not in real terms input costs, such nominal profit could not be correctly turned into a loss by applying such adjustment. The time lag between incurring costs and receiving profits is particularly long for investment, because the costs are depreciated over time rather than immediately expensed, and thus it merits a more detailed discussion.

5.1 DEPRECIATION

Inflation erodes the NPV of depreciation allowances. Investment I is not treated as an immediately and fully deductible expense in most countries, but instead depreciated over time (and the amount depreciated can be deducted from taxable income each period). Depreciation allowances are based on the historic cost of assets. With an increasing price level, the present value of the depreciation allowance falls increasingly short of the real cost of the asset. To see this effect more formally, denote by A the net present value of depreciation allowances as a share of the investment. When a share $\phi > 0$ of the cost of the investment can be deducted each year – that is if depreciation follows the declining balance method – the net present value of the allowances is given by:

$$A(\pi) = \frac{1}{I}\sum_{s=1}^{\infty}\frac{\phi I(1-\phi)^{s-1}}{\left((1+r)(1+\pi)\right)^{s-1}} = \phi\frac{(1+r)(1+\pi)}{(1+r)(1+\pi)-(1-\phi)} \tag{9}$$

where r is the real discount rate of the firm and π inflation. The net present value of immediate expensing ($\phi = 1$) is one. But for all other depreciation schemes that allow the deduction of just a fraction of the previous year's capital stock, the net present value of the depreciation allowance lies strictly between 0 and 1.[15] Figure 3.a shows how the NPV of depreciation allowances for three assets that are subject to declining balance depreciation rates of 5, 10, and 30 percent varies with the inflation rate, assuming that the real discount rate (or the marginal product of capital) is 5 percent.[16] With a constant price level, the NPV of these depreciation allowances ranges between 50 and 90 percent of the initial expense. But as inflation increases, the NPV of all three depreciation allowances declines, reducing the value of the allowance and thus discouraging investment.

Perhaps surprisingly, the effect does not increase monotonically with the durability of assets. This is most readily seen by differentiating expression (9) with respect to π:

$$\frac{\partial A}{\partial \pi} = \frac{(\phi-1)\phi(1+r)}{\left[\pi(1+r)+r+\phi\right]^2} \leq 0 \tag{10}$$

[15] This also holds for depreciation methods other than declining balance, as long as the total nominal amount to be deducted equals the cost of the asset. If, for example, straight line depreciation is used, the formula for the present value changes to: $A = \sum_{s=0}^{1/\phi}\frac{\phi}{\left((1+r)(1+\pi)\right)^{s}} = \phi\frac{(1+r)(1+\pi)}{\pi(1+r)+r}\left(1-\left(\frac{1}{(1+r)(1+\pi)}\right)^{1/\phi}\right)$.

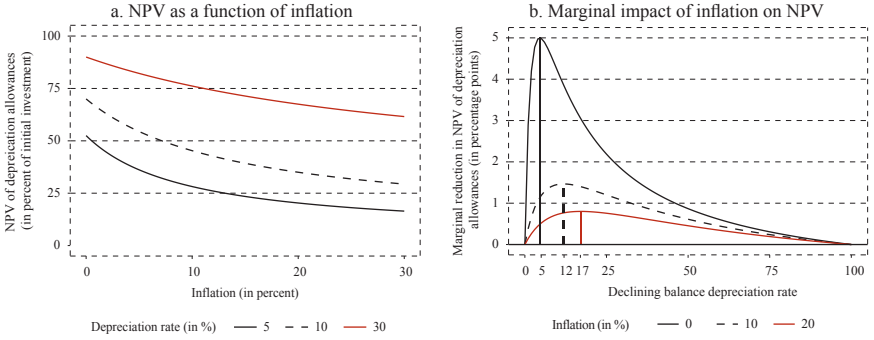
[16] The choice of a rate of 5 percent is supported by Reis (2021) who reports that the 10-year ahead expectation of US stock returns was around 5 percent in 2019 (and higher before). Real returns will of course vary across sectors and countries, partly depending on underlying risk.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

The marginal impact of higher inflation on the NPV of depreciation allowances is thus negative (save for full expensing or zero expensing) and depends on the current level of inflation and the depreciation rate. To illustrate, figure 3.b depicts the marginal reduction in A (on the vertical axis) for assets subject to depreciation rates ranging from 0 to 100 percent (on the horizontal axis). The graph further differentiates between three baseline levels of the inflation rate (0, 10, and 20 percent). The vertical lines depict values ϕ^* for which a marginal increase in inflation exerts the largest reduction in A.[17] For instance, when inflation increases marginally from a constant price level (solid line), the NPV of future depreciation allowances declines by up to 5 percentage points and this maximum decline is felt for assets characterized by $\phi^* = 0.05$. The NPV of depreciation allowances for other assets – both of shorter or longer useful life – declines less. The effect of inflation on A quickly subsides as inflation increases. For instance, when inflation increases marginally from a baseline level of 10 percent, the resulting marginal change in A is just 1.5 percentage points and the maximal decline is experienced for assets with $\phi^* = 0.12$.

FIGURE 3

The impact of inflation on the NPV of depreciation allowances



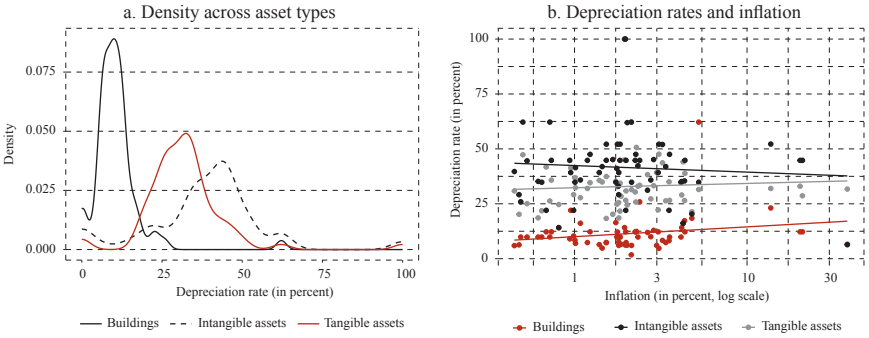
Source: Authors' estimates.

As depreciation allowances vary across countries and asset types, inflation could impact asset stocks asymmetrically. Figure 4.a illustrates the distribution of (implied) declining balance depreciation schemes for 68 countries and three different asset types: buildings, tangible assets, and intangible assets, between 2017 and 2020.[18] The mean declining balance rates for these asset types are 10 percent (for buildings), 25 percent (for tangible assets), and 38 percent (for intangible assets). Notably, across countries, there is no statistically significant correlation between the generosity of depreciation allowances and inflation (figure 4.b).

[17] Differentiating (2) with respect to ϕ we obtain: $\frac{\partial A}{\partial \pi \partial \phi} = \frac{(1+r)\left[\left(r+\pi(1+r)\right)(2\phi-1)+\phi\right]}{\left[\pi(1+r)+r+\phi\right]^3}$. The critical values are given by setting this equation equal to zero and solving for the depreciation rate, which gives $\phi^* = \frac{r+\pi(1+r)}{1+2\left(r+\pi(1+r)\right)}$.

[18] Data are taken from the OECD's effective tax rate database, which provides information on A for a hypothetical low interest (5 percent) and low inflation (2 percent) environment. The implied declining balance tax rates are calculated from A using $\phi = \frac{Ai}{1+i-A}$, where $i = 1.05 \times 1.02 - 1$.

FIGURE 4
Distribution of depreciation rates



Source: OECD's effective tax rate database, WEO database, authors' computations.

Lower effective capital allowances should depress optimal investment levels. To see this more formally, consider a firm contemplating an investment to reach a capital stock of K, which produces output determined by the function f. The capital stock depreciates at the true economic depreciation rate δ (which can be different from the depreciation allowance ϕ), so to keep it stable, the firm invests δK in all future periods. Profits are taxed at rate τ, and as before A is the NPV of depreciation allowances. The NPV of the investment is given by:

$$-K\left(1-A\tau\right)+\sum_{t=1}^{\infty}\frac{f\left(K\right)\left(1+\pi\right)^{t}\left(1-\tau\right)-\delta K\left(1-A\tau\right)\left(1+\pi\right)^{t}}{\left(1+i\right)^{t}} \qquad (11)$$

$$=-K\left(1-A\tau\right)+\frac{f\left(K\right)\left(1-\tau\right)-\delta K\left(1-A\tau\right)}{r}$$

To obtain the profit-maximizing investment, differentiate (11) with respect to K to obtain the first-order condition:

$$-\left(1-A\tau\right)+\frac{f^{'}\left(K\right)\left(1-\tau\right)-\delta\left(1-A\tau\right)}{r}=0\Leftrightarrow f^{'}\left(K\right)=\frac{r+\delta}{1\quad\tau}\left(1-A\tau\right) \qquad (12)$$

The firm will thus invest up the point where the marginal return to investment equals the real interest rate and depreciation, as well as some tax factors. From (12) it is clear that for full expensing ($A = 1$), tax has no impact on investment at the margin, as the cost of capital drops to $(r+\delta)$. For less generous depreciation rules, however, taxation raises the cost of capital, and inflation, by reducing the real value of depreciation allowances, and thus discourages investment.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

If the production function is Cobb-Douglas, a log-linear approximation of this first order condition implies that the (tax-driven) semi-elasticity of investments with respect to inflation is given by[19]

$$\frac{\partial K}{\partial \pi}\frac{1}{K} \approx \tau \frac{\partial A}{\partial \pi} < 0. \tag{13}$$

For instance, with a corporate tax rate of 22 percent, a depreciation rate of 25 percent and an inflation of 2 percent, the semi-elasticity of capital is 0.42, implying that the optimal investment level would decrease by 0.42 percent in response to a one-percentage point increase in inflation. In the presence of adjustment costs, this response would not happen instantaneously but over several years. Before analysing empirically the impact of changes in A on investment, we need to consider the counteracting impact from greater interest deductibility if the investment is financed partly or fully by debt.

5.2 DEBT BIAS

Another aspect in determining corporate profits is the deductibility of interest. There are various ways to achieve a tax system that does not distort investment decisions: first, by allowing full expensing and denying all interest deductions; second, by setting depreciation allowances at the value of true economic depreciation and then allowing interest deductibility; or third, by offering an allowance for corporate equity (ACE) discussed further below. In the presence of inflation (King, 1977), the first option remains neutral, as inflation cannot erode an immediate deduction, and the value of disregarded interest is irrelevant (King, 1977). For the second option to be neutral, however, interest deductibility should be restricted to the real interest rate, while depreciation should be based on replacement, not historical cost. As will be clear from the analysis below, the deduction of nominal interest will not fully offset the erosion of depreciation allowances, and vice versa.

As is well known (see for example De Mooij, 2011), the deductibility of interest creates a debt bias in corporate financing choices, given the non-deductibility of a similar return to equity. Standard corporate finance models, such as Modigliani and Miller (1963) also suggest that – once tax aspects are taken into account – firm value rises with the share of debt finance. The question of interest for this paper is whether such debt preference is affected by inflation.

To analyze this, consider the financial effect F of issuing one-period debt of B_t, which pays interest that is tax-deductible:

$$F = B_0 + \sum_{t=1}^{\infty} \frac{-B_{t-1}\left(1+i\left(1-\tau\right)\right)+B_t}{\left(1+i\right)^t} = B_0 + \sum_{t=1}^{\infty} \frac{-B_{t-1}\left(1+i\right)+B_t}{\left(1+i\right)^t} + \sum_{t=1}^{\infty} \frac{B_{t-1}\tau i}{\left(1+i\right)^t}. \tag{14}$$

As can be seen in (14), the tax-relevant flows are easily separated out from debt issuance and repayment.

[19] This follows from rewriting the first-order condition as $\ln(K) \approx \frac{\tau(1-A)}{(\beta-1)} - \ln(L)\frac{\beta}{1-\beta} + C$, where β is the capital share in total costs of production and C summarizes irrelevant constants. Combining this expression with the assumption that total real demand remains unchanged $d = \beta \ln(K) + (1-\beta)\ln(L)$ and differentiating K with respect to inflation gives equation (13).

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

To connect this with the investment decision considered above, assume that the firm finances a share s of its investment by debt. In subsequent years, the firm keeps the amount of debt stable in real times, in line with the value of capital, so that leverage remains unchanged. Annual debt issuance (starting from $t = 0$), is then given by:

$$B_t = sK(1 + \pi)^t. \tag{15}$$

Combining (14) and (15), it is clear that the nontax part is always zero, and the tax part simplifies to:

$$F = \sum_{t=1}^{\infty} \frac{sK\left(1+\pi\right)^{t-1}\tau i}{\left(1+i\right)^t} = \frac{sK\tau}{r}\left(r+\frac{\pi}{1+\pi}\right). \tag{16}$$

From (16) we can see that the financial effect is positive, as expected. Moreover, it is increasing in inflation, suggesting that inflation reduces the cost of capital through the debt effect, although this is counteracted by the impact on depreciation allowances discussed above. The overall cost of capital including a debt-financed share of investment is then obtained by adding (16) to (11), differentiating by K and rearranging:

$$f'\left(K\right) = \frac{r+\delta}{1-\tau}\left(1-A\tau\right) - \frac{s\tau}{1-\tau}\left(r+\frac{\pi}{1+\pi}\right). \tag{17}$$

From (17) it can be seen that the cost of capital declines with the debt share. The firm thus issues as much debt as possible, and if loans are limited to the amount of collateral, it will choose a debt share of 100 percent. Before considering how agency costs may lead to an interior solution, we can illustrate the impact with effective tax rates.

Using the framework developed by Devereux and Griffith (2003), as adjusted in Klemm (2012), and abstracting from investor-level taxes,[20] we can calculate[21] the effective marginal tax rate (EMTR) and the effective average tax rate (EATR). The EMTR is a measure of how investment is distorted at the margin, that is for an investment that just breaks even. The EATR considers a discrete inframarginal investment with some assumed profit rate and then relates the net present value of taxes paid in such projects to the NPV of profits. Both measures are shown in figure 5 for equity and debt finance (i.e., the share of debt is 0 or 100 percent).

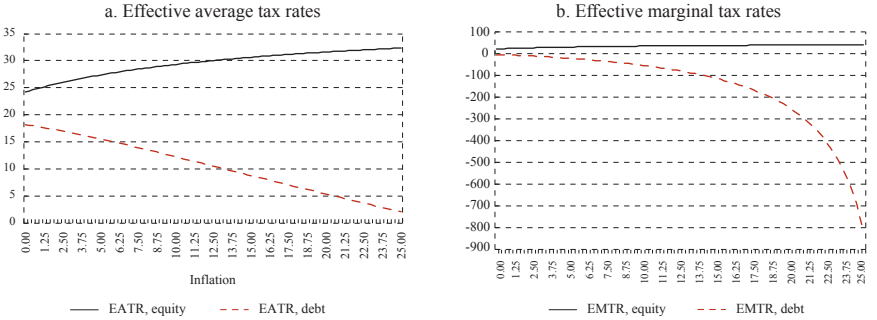
[20] That is taxes on dividends, capital gains, and interest. In terms of the Devereux-Griffith model this implies that the discount rate r is equal to the nominal interest rate i, and the factor that values dividends g equals 1. This assumption can be justified because the investor might be a tax-exempt pension fund, tax-favoured foreign investor, or simply because we wish to focus on the corporate side of taxation.

[21] The calculation is closely related to the framework discussed here. One difference is that in the Devereux--Griffith model, first-year depreciation is instantaneous, so that firms only need to fund $1 - \tau\phi$ of an investment. The resulting tax rates are thus defined as $\text{EMTR} = 1 - \frac{r(1-\tau)}{(1-\tau A-F)(r+\delta)-\delta(1-\tau)}$ and $\text{EATR} = \tau - \frac{\delta\tau-(\tau A+F)(r+\delta)}{p}$. Another point is that in the Devereux-Griffith model, investment is a one period perturbation of the capital stock with subsequent sale, while in the Klemm version it is a permanent investment that is allowed to depreciate; however, under a range of reasonable assumptions all approaches lead to the same first order conditions. A minor point is that Devereux and Griffith (2003) define A as the NPV of the tax saving from depreciation allowances, but for consistency with our definition above, our A is simply the NPV of depreciation allowances, and hence we multiply it by the tax rate τ to obtain the tax saving.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

FIGURE 5

Effective tax rates as a function of inflation



Notes: The calculations assume a CIT rate of 25 percent, both true economic depreciation and depreciation allowance of 12¼ percent, a real interest rate of 5 percent, and for the EATR, a financial return of 20 percent.

Source: Authors' calculations.

As illustrated by the figure,[22] rising inflation raises effective tax rates for equity-financed investments – unsurprisingly given the above analysis of the impact on depreciation allowances and the absence of any countervailing effect. Inflation, however, lowers effective tax rates for debt-financed investment, with the impact from interest deductibility dominating the loss in the value of depreciation allowances. The incentive to finance investments with debt thus clearly intensifies as a result of inflation.

To analyze how inflation impacts the debt bias, we include an additional cost component that is linked to the share of debt finance – such as increasing risk premia or agency costs – in the conceptual framework. For simplicity, we assume these costs reduce the NPV of the firm by $\frac{c(s)K}{r}$, where the cost function $c(s)$ is quadratic, so that $c'(s) = \frac{1}{\gamma}s$, with γ parameterizing marginal costs. As γ tends to zero, marginal costs of a given debt share tend to infinity. We add the additional cost component to (11) and differentiate with respect to K and s to obtain optimal investment and financing decisions. Rearranging the first order conditions, we obtain:

$$s^* = \tau\gamma\left(r + \frac{\pi}{1+\pi}\right) \tag{18}$$

$$f'(K) = \frac{r+\delta}{1-\tau}(1 - A\tau) - \frac{\tau s^*}{2(1-\tau)}\left(r + \frac{\pi}{1+\pi}\right) \tag{19}$$

[22] The negative debt-finance EMTR with extremely high absolute value is caused by dividing by a denominator (the cost of capital) that is very close to zero. The resulting figure is thus somewhat unintuitive, which is, however, a common phenomenon with this measure. The negative rate means that a marginal investment turns out to have a tax loss (because the interest and depreciation deductions are greater than the profit). Such a tax loss can be used to reduce taxes from other activities or in the future. In the absence of other profits, the tax rate is bound by zero, because revenue authorities do not pay out tax refunds on tax losses.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

Equation (18) defines the optimal debt share as a function of the cost parameter, γ, the corporate tax rate, the real interest rate, and inflation. It shows that inflation raises the optimal share of debt finance, and this effect is stronger in high-tax environments. Inflation thus increases the debt bias. Equation (19) expresses the cost of capital, but this time for a debt share that is endogenously determined. Implicitly differentiating equation (19) with respect to inflation shows that the overall impact of inflation on the cost of capital can be decomposed into three components:

$$-\frac{f^{''}(K)(1-\tau)}{\tau}\frac{\partial K^{*}}{\partial \pi}=(\delta+r)\frac{\partial A}{\partial \pi}+\frac{1}{2}\frac{s^{*}}{(1+\pi)^{2}}+\frac{1}{2}\frac{\partial s^{*}}{\partial \pi}\left(r+\frac{\pi}{1+\pi}\right) \qquad (20)$$

On the one hand, inflation reduces the NPV of depreciation allowances ($\frac{\partial A}{\partial \pi}<0$), which increases the cost of capital and thus depresses the optimal investment level. On the other hand, inflation impacts the cost of capital through a debt financing channel. There is a direct and an indirect effect. The direct effect, captured by the second term on the right-hand side in equation (20), is that inflation increases the tax privilege of existing debt, because higher inflation increases nominal, tax deductible interest payments, while leaving real cost unchanged. The indirect effect is that firms that are unconstrained in their financing decision will respond to the reduced cost of debt-financed investments by increasing their share of debt, $\frac{\partial s^{*}}{\partial \pi}=\frac{\tau\gamma}{(1+\pi)^{2}}>0$, which further depresses the cost of capital and increases the optimal investment. This effect is captured by the third term of equation (20).

A marginal increase in inflation thus has an ambiguous effect on the investment level. The effect depends on the tax system, the underlying asset class, and the unobservable cost parameter. To get a sense of likely directions, we set the right-hand side of equation (20) equal to zero to implicitly define a critical value of debt, denoted by s^{c}, for which a marginal increase in inflation would leave the optimal investment level unaffected, that is, $\frac{\partial K^{*}}{\partial \pi}=0$, when $s=s^{c}$. The optimal debt level is, of course, itself a function of the model's parameters. Rearranging the condition implies the critical debt level is defined by:

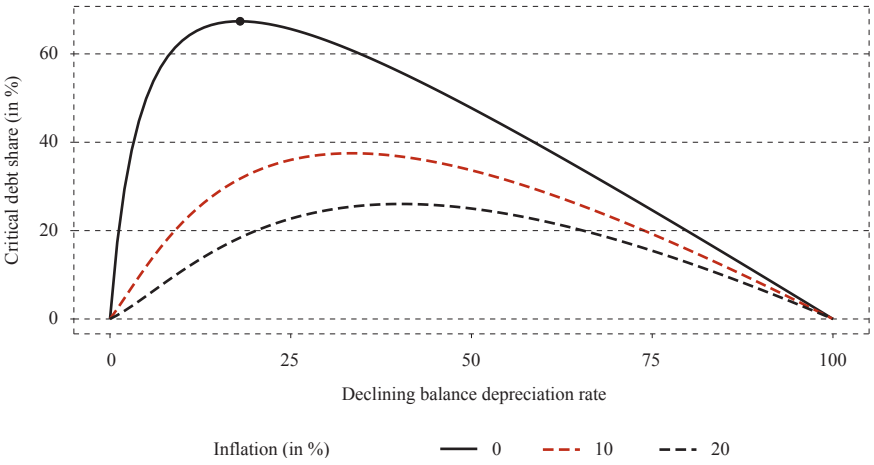
$$s^{c}\left(\gamma^{f}\right)=-(\delta+r)(1+\pi)^{2}\frac{\partial A}{\partial \pi}, \qquad (21)$$

where we now express the critical value as function of γ to make transparent its dependency on the unobservable cost parameter. Using the definition of optimal debt, equation (21) then implicitly defines an agency cost parameter γ^{f} as a function of inflation, the tax rate, the real interest rate, and depreciation (both tax and real). For this cost parameter, the debt level is given by $s^{c}(\gamma^{f})$, and a marginal increase in inflation leaves the optimal investment unaffected. If firms are heterogeneous in their agency costs, then all firms i characterized by $\gamma_{i}<\gamma^{c}$, will reduce their optimal investment level, as the eroding value of tax depreciation dominates the effect of tax deductibility of interest payments for such firms, while those with lower marginal agency cost (a higher γ_{i}) will increase their debt financing and optimal investment level.

Figure 6 illustrates critical debt shares s^c as a function of depreciation rates, holding constant the real interest rate at 5 percent, the tax rate at 25 percent, and assuming that tax depreciation coincides with economic depreciation. For instance, when the price level is initially constant, a marginal increase in inflation will have no effect on the optimal investment level of companies that lie on the solid line. One such company, depicted by the point on the solid line, is characterized by $s^c = 0.67$ and $\phi = \delta = 0.18$. Companies that employ the same asset (and thus face the same depreciation rules) but incur higher agency costs are less leveraged and will reduce their optimal investment level in response to the uptick in inflation. In contrast, more highly leveraged firms, lying above the solid line, will increase their investment level. Trivially, for firms that employ assets which are fully deductible in one year or not deductible at all, the debt-financing channel always dominates: these firms will increase their investment volume (which is represented by critical debt shares of zero in the graph). The dashed lines below characterize firms whose optimal investment decision is marginally unaffected at baseline inflation levels of 10 and 20 percent, respectively. Comparing these lines shows that the share of firms that raise their investment volume at the margin increases as inflation rises further (because a larger mass of firms lies above the dashed lines).

FIGURE 6

Critical debt shares as a function of depreciation rates



Notes: The graph gives debt shares (for three different inflation levels and a continuum of depreciation rates) for which a marginal increase in inflation leaves the optimal investment volume unaffected (equation 23). Firms with lower debt shares will reduce their investment volume in response to a marginal increase in inflation, while those above will increase it. The simulation assumes $\phi = \delta$, $r = 0.05$ and $\tau = 0.25$.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

Accordingly, a marginal increase in inflation tends to reduce the optimal investment volume of firms that (i) face high agency costs, such as micro and small enterprises, (ii) operate in low-inflation environments, and (iii) employ assets with relatively long useful lives (such as buildings).

5.3 EMPIRICAL ANALYSIS OF THE INFLATIONARY TAX EFFECT ON INVESTMENT

Information on country-level capital stocks can shed light on the importance of inflation for capital accumulation in practice. The conceptual considerations above suggest that inflation should reduce optimal capital stocks because of depreciation but increase the optimal capital stock for debt financed investments. To test which of these effects dominates, we estimate regressions of the form:

$$\Delta\% Asset_{it} = \beta_1 \pi_{it} + \beta_2 \tau_{it} + \beta_3 \pi_{it} \tau_{it} + \gamma' x_{it} + \varepsilon_{it} \quad (22)$$

The dependent variable is the growth rate of an asset stock expressed in percent (with the original series expressed in constant currency units) in country i and year t, π_{it} is the percentage point inflation rate, τ_{it} is the statutory tax rate (in percent) and x_{it} is a vector of country-level control variables that are expected to drive optimal investment decisions, including log gross domestic product (GDP), log population, the unemployment rate, GDP growth, as well as time- and country-fixed effects. The estimated coefficient on the interaction between the statutory tax rate and inflation gauges the effect of inflation on the optimal capital stock that is propagated through the tax system: a negative coefficient implies that the declining value of depreciation allowances outweighs the benefit of the reduced cost of capital for debt financed investments. We combine several data sources to estimate these specifications. Net fixed asset stocks at country-level between 2000 and 2021, measured in constant prices, are taken from the OECD's Annual National Accounts tables (OECD, 2022). The dataset distinguishes between different activities, such as total activity or manufacturing, and asset types (construction, intellectual property, machinery, and information and communication technology). We focus on net fixed assets in the manufacturing sector and winsorize the most extreme 1 percent of observed growth rates to reduce the impact of outliers. Macro-economic variables, including consumer price inflation, are taken from the IMF's World Economic Outlook database (IMF, 2022), and tax rates are taken from the OECD's Corporate Tax Rates Database.

Table 2 presents results, with columns differentiating between different types of assets. For ease of interpretation, the CIT rate and the inflation rate are centred at their mean and median, respectively. The results suggest that investments decrease by between 0.06 percent (intellectual property) and 0.24 percent (machinery) in response to a one percentage point increase in the CIT rate when inflation is at its median (4 percent in our sample). Those estimates are smaller than that obtained by Ohrn (2018), who examines the semi-elasticity of US plant machinery and equipment with respect to effective tax rates and reports an estimate of 4.7 percent. The difference is likely partly related to measurement problems associated with macro data, but it is also due to Ohrn's use of effective tax rates, which already include the impact of inflation, while our specification considers separately the impact of statu-

tory tax rates and their interaction with inflation. The first-order impact of inflation on investment is statistically insignificant when the CIT rate is at its average (25 percent in our sample). The interaction between inflation and the CIT rate measures the impact of inflation that is propagated through the tax system. For three types of investments (construction, intellectual property, and machinery), we find a statistically significant negative coefficient, suggesting that the eroding value of depreciation allowances outweighs any additional tax benefits from debt finance. The measured effect is strongest for investments in machinery: when the inflation rate is 2 percent, the estimated semi-elasticity of machinery with respect to the CIT rate is 0.17 percent (= -0.241 + 2 x 0.035); but it is 0.45 percent when inflation is at 10 percent (= -0.241-6 x 0.035). The estimated coefficients on the control variables are in line with expectations: investments increase during an upswing in the business cycle (as seen from the negative coefficient on unemployment and the positive coefficient on real GDP growth) while more developed and thus more capital-intensive countries (measured by the log of GDP per capita) experience slower investment growth.

Table 2

The impact of inflation on investment

Dependent variable: percentage change of real asset stock				
Type of investment asset	**Construction**	**Intellectual property**	**Machinery**	**ICT**
CIT rate	-0.156***	-0.057	-0.241***	-0.167
	[0.038]	[0.081]	[0.064]	[0.236]
Inflation	0.109	-0.195	-0.111	-0.145
	[0.084]	[0.202]	[0.119]	[0.800]
CIT rate*Inflation	-0.014*	-0.029*	-0.035**	-0.043
	[0.008]	[0.017]	[0.017]	[0.053]
log(Population)	-3.248	9.417	15.628***	22.128
	[2.405]	[5.876]	[3.206]	[18.456]
Unemployment rate	-0.299***	-0.466***	-0.371***	-0.904**
	[0.051]	[0.116]	[0.070]	[0.426]
log(GDP)	-6.004***	-3.374*	-5.413***	-21.718***
	[0.928]	[1.888]	[1.237]	[5.485]
GDP growth	0.026	0.117	0.218***	0.525*
	[0.811]	[1.744]	[1.653]	[5.348]
Intercept	53.681***	2.347	-10.237	83.126*
	[9.642]	[16.181]	[11.607]	[48.669]
Observations	500	522	520	401
Adjusted R^2	**0.561**	**0.448**	**0.63**	**0.228**

*Notes: Table summarizes results of OLS regressions. All specifications include a set of country and a set of year-fixed effects. The variable CIT rate is centred at its mean of 25 percent; the variable Inflation is centred at its median of 4 percent. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively. Standard errors in square brackets are heteroscedasticity robust.*

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

5.4 INTERACTION BETWEEN CORPORATE AND HOUSEHOLD INCOME

From the discussion of the impact of inflation on interest deductibility for businesses and the taxation of interest returns on savings of households, it is clear the former reduces, and the latter raises, effective taxes, prompting the question of whether the effect washes out economy-wide. This is unlikely to be the case, except under very specific conditions. First, the corporate and the personal income tax rates are not the same in most countries, with the former typically flat and the latter often progressive. It is unlikely for the tax rates for the marginal borrower and the marginal lender to be the same, save for a complete coincidence. Second, even if statutory tax rates matched across borrowers and lenders, the actual marginal lender might not face this same rate, for example, because it is either a tax-exempt pension fund, or a foreign investor (subject to some withholding tax and possibly additional tax in their home country). Third, even if all tax rates are aligned, the demand and supply of savings are unlikely to be equally elastic, hence the real rate of interest could change. Nevertheless, while the impact on households and business are unlikely to wash out perfectly, the offsetting effects on returns to and costs of capital will mitigate the impact of inflation in most cases.

Feldstein and Summers (1979) attempt to estimate the net impact on effective tax rates, including both CIT and investor-level taxes. Their calculations suggest that overall inflation increased effective tax rates (defined here as taxes divided by profits) by 50 percent in 1977. Of course, this calculation was done for a different economy and tax system, with one key difference being that there is now a much larger share of foreign investors in the U.S. economy. In any case, even at the time, the calculation was criticized on methodological grounds by Gravelle (1980) who argued that it relied on hard-to-make assumptions about what the tax system would have been like in the absence of high inflation, as well as some points regarding how to estimate the value of the replacement cost of capital. Another important angle is that stock prices can be affected by inflation through their interaction with personal and corporate taxes. Taking all mechanisms into account, overall theoretical predictions can be ambiguous with offsetting effects, but under some assumptions the combined interactions would decrease real stock prices, which would have a dampening effect on investment (see Feldstein, 1980; Edwards and Keen, 1985).

Another interaction occurs for small owner-managed businesses, where owners have some liberty to choose the share of income that they wish to declare as profits, which share they declare as salary (within legal constraints that differ across countries). The impact of inflation on that choice will clearly be country specific, but in many cases, one could expect an increase in declared profits over salaries, as the former is typically taxed at a flat rate, while the latter is subject to bracket creep.

5.5 SOLUTIONS TO THE TAXATION OF INFLATIONARY PROFITS

Finding comprehensive solutions to the taxation of inflationary gains at the corporate level is even more complex than for household savings. For corporate income, it would require tracking timings of each flow to be able to figure out the corresponding value of currency.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

One approach to do this is make tax calculations using fiscal units rather than nominal currency. This is an inflation-adjusted unit of account into which each nominal flow is converted. Depending on the severity of inflation, the conversion rate could be set yearly, quarterly, monthly, or daily. Such an approach would address the problem, but would also be costly to administer, and likely open up many opportunities for tax fraud, as manipulating dates of receipts and costs would have tax consequences. For most countries, the costs of such a system would likely exceed the benefits, especially if inflation is not extremely high or not expected to remain structurally high in the long run.

Nevertheless, some countries have experimented with variants of such systems. For example:

- Israel adopted a law in 1982 that dealt comprehensively with inflation, as described and analysed in Sadka (1991). Its main feature was an allowance for inflation that was applied to equity. This removes the additional benefit of debt finance from inflation (but unlike the ACE, discussed below, it does not address the general debt bias). As this achieves a comprehensive deduction of inflationary effects from both debt (through interest deductibility) and equity (through the allowance), it compensates for inflationary gains. Indeed, for capital gains, this allowance overcompensates, so that accrued inflationary capital gains were then made taxable to achieve symmetry (capital gains beyond inflation remained taxable under a realization principle, which is inefficient, but this is unrelated to inflation). Finally, to address the erosion of depreciation allowances, depreciation was calculated at end-of-year prices. Sadka (1991) also points to various difficulties and loopholes, including that determining the value of equity is tricky when it changes multiple times per year in a high-inflation environment such as Israel in the early 1980s and that industrial equipment and machinery were made exempt from inflation accrual (with the aim of supporting investment in such assets). He also points out that the effectiveness of the law was never put to the test, as inflation had fallen by the time the law had been properly phased in.
- Brazil used various approaches to determine real business incomes, including a system of monetary correction from 1976, and a more comprehensive "integral correction" from 1987. For a description of these systems and the evolution see Doupnik, Martins and Barbieri (1995). While the integral correction was used for accounting purposes, for tax purposes the less complete monetary correction was relevant, which did adjust many, but not all, flows, and notably still taxed inflationary inventory gains.

Alternative tax reform proposals that would change the tax base from total profits to economic rents would also resolve the issue of inflation affecting interest deductions or depreciation allowances. Such reforms have been proposed to make the CIT more efficient: that is, to make it neutral with respect to investment so that any investment that is viable in the absence of taxation would remain so under taxation. A beneficial side-effect is that such taxes can also achieve neutrality with respect to inflation. Two examples of such reforms are cash-flow taxation and the ACE.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

– There are various ways of implementing a cash flow tax. The one where the neutrality to inflation can be seen most easily is the "R-based" cash flow tax (see Meade, 1978). Under such a tax, investment is immediately expensed, which, as discussed above, reduces the impact of inflation on depreciation allowances to zero. Moreover, such a tax disregards financial flows, so that there is no interest deductibility, removing any impact of inflation through changes in the interest rate.
– The ACE applies deductible notional interest to equity, thereby achieving similar treatment of equity and debt.[23] It is neutral with respect to depreciation allowances, and hence also to any inflationary impact on them. This neutrality is achieved because any use of a deduction for depreciation reduces the value of equity, leaving the NPV of taxes unchanged.

6 CONCLUSIONS

This paper considered the impact of inflation on the tax system, and specifically the tax distortions created by higher inflation. We grouped the effects into three main categories.

First, non-neutralities caused by the parameters of the tax system being defined in nominal rather than in real terms. These effects include:

– Specific taxes or fees (revenues decline in real terms with inflation).
– Fixed nominal interest rate charges on overdue payments (which means lower real rates as inflation rises, thus making payment delays less costly. This itself could also encourage payment delays, for example for negative real interest rates, and thus gradually weakens tax compliance).
– Fixed nominal thresholds for paying taxes or "bracket creep" (typically results in higher real taxes, assuming a progressive income tax).

Second, non-neutralities caused by timing issues:

– Collection lags (revenues decline with inflation since they are worth less in real terms by the time they are collected). This can also encourage payment delays (without necessarily becoming overdue).
– Lags in paying refunds, which have the opposite effects to collections.

Third, distortions caused by the fact that the tax base for income and for income tax deductions is defined in nominal terms, so that nominal rather than real income is taxed:

– Taxation of the nominal return on savings (rather than just the real return) means that higher inflation leads to higher tax payments and thus a further reduction in the real after-tax rate of return.

[23] The ACE does not achieve full symmetry, because the interest rate on debt will be firm specific and could be different (and often higher) than the notional rate on equity. A solution that achieves full symmetry is the allowance for corporate capital, which denies the standard interest deduction, and instead applies the same notional interest rate to equity and debt (Kleinbard, 2005).

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

– Taxation of nominal rather than real capital gains means that higher inflation leads to higher capital taxation and increases lock-in effects (since this higher taxation only occurs on realization).
– Loss in the real value of depreciation allowances that are fixed in nominal terms (higher real revenues but at the cost of discouraging investment).
– Conversely higher inflation increases nominal debt interest payments, allowing greater deductibility from taxable income (and thus increasing the bias towards debt over equity).

That said, the cutoff between these three groups is at times arbitrary. For example, the impact of depreciation allowances is both because depreciation is only allowed over time (timing effects), but also because the allowances are typically specified in nominal terms (taxation of nominal gains). Likewise for the taxation of nominal capital gains: non-neutrality is caused by the delay in taxing capital gains (only on realization) and by the failure to index capital gains for inflation.

Many of the potential distortions having been covered, the question arises of gauging their relative importance. This will depend on each country's specific circumstances, notably the nature of the tax system that they have in place, and also how high the inflation rate is. Consider first an economy that has a strong reliance on personal income and general consumption taxes, with a monetary policy that generally ensures low inflation (i.e., a typical advanced economy). In such a case, bracket creep is likely to be the most pronounced problem, because even low inflation will cumulate over time. If, as is typical, capital gains are relatively undertaxed, then the tax preference toward these is increased by inflation. Consumption taxes are unlikely to create issues. Conversely, in an economy with less reliance on income taxes, and where an important share of consumption taxes is collected through specific excises, but where inflation is still low (e.g., a developing country with strong macroeconomic policies), erosion of the real value of excises would be a more pressing issue. Finally, in economies with very high inflation rates, timing issues might dominate all other effects, as the delay in tax payments rapidly erodes their real value (and very high inflation rates might create incentives to lengthen this delay). Of course, any of these effects might already be addressed by reform to the design of the tax system (e.g., indexation of thresholds), in which case their relevance would be diminished.

Another concluding question is the overall impact of inflation on tax revenue of these various effects that at times act against each other. Gains from revenue due to bracket creep (larger in countries with progressive income tax systems, which are typically higher income countries) need to be offset against the revenue loss from collection delays (more important for countries with weaker tax administration or higher inflation rates). Likewise in terms of incentives for savings and investment: higher inflation reduces the after-tax rate of return on saving but could lower the cost of debt finance of investment. That said, the impact of the various distortions identified in this paper can be quite large, even at relatively modest inflation rates.

PUBLIC SECTOR ECONOMICS 47 (3) 353–386 (2023)

Solutions vary both in nature and in scope. For many of the problems we identified, narrow solutions exist that are fairly easy (technically at least) to implement, though they might face political obstacles. For example, adjusting the basic parameters of the tax system (automatically) in line with inflation. More comprehensive solutions addressing all timing issues and relating to the taxation of nominal gains would be complex. Some simpler solutions, such as increased use of withholding taxes, increasing advance CIT payments, more frequent asset revaluations (say of house values for property tax) would not eliminate timing issues, but help reduce their impact. Some broader tax reforms, such as corporate cash-flow taxes or ACE systems would involve a more fundamental change, but have the advantage of increasing efficiency, as they tax only economic rents and thereby avoid distorting investment decisions.

For simplicity and to preserve neutrality, when adjusting the parameters of the tax system (thresholds, interest rates on overdue tax payments, specific taxes, the measurement of capital income), the same inflation rate should generally be used throughout. Consider specific taxes: if the fuel price increases, the fuel duty would increase but only in line with increases in the general price level. Likewise for wages: the threshold would not increase with wage increases, but only with some general measure of price increases.[24] Since the GDP deflator is only available with a lag, and is subject to revision, this would suggest indexing or adjusting parameters based on CPI inflation. For corporate incomes, the issue might be confusing: with different deflators being available for capital goods, producer, and consumer prices, one might wonder whether separate deflators should be used. If the aim is neutrality with respect to overall inflation, this should be avoided. A firm that buys inputs (including capital), whose prices change at different rates from general inflation, makes real valuation gains or losses, and there is no need to remove those relative gains or losses from the tax base.

The arguments could also be extended to the case of deflation which, until recently, was a pre-occupation of policymakers, and where the effects would operate in the opposite direction. Thus, specific taxes, fees, interest rates, thresholds would need to be reduced in line with the deflation. Collection lags and payments delays would lessen endogenously, and there could even be incentives for pre-payment if positive balances earn interest, while depreciation allowances would become too generous. Nominal capital gains and hence capital income taxes would fall as the real gains due to deflation would escape tax. Conversely the value of the interest rate deduction would fall since nominal interest rates would be lower, and the real value of the existing debt increase as the price level falls.

With the great difficulties in comprehensively addressing all distortions arising from inflation, one practical approach would be to focus on those where the costs to efficiency are likely high and the solution relatively simple, while simultaneously making efforts to bring inflation back down. However, such a selective approach would need

[24] One could argue for adjusting thresholds in line with average wage increases, thereby keeping the tax rate the same for the average earner and in relation to the average earner. However, this would mean a reduction in real taxes as real incomes rise – certainly a policy option, but one that goes beyond inflation neutrality.

PUBLIC SECTOR ECONOMICS
47 (3) 353-386 (2023)

to be careful in avoiding problems of the second best. Plus, the distributional impact should be considered too, which might require compensating measures. And quickly reducing inflation may be easier said than done: if the path to lower inflation takes longer, this will strengthen the need for gradually designing a more inflation-proof tax system, along the lines considered in this paper. Not to mention measures on the spending side (including government wages), which we have not considered in this paper, but where the combination of inflation and fixed nominal spending totals may lead to cuts in real government spending, and which would also seem a candidate for "inflation-proofing".

Disclosure statement

The authors declare that there is no conflict of interest.

REFERENCES

1. Aaron, H., 1976. Inflation and the Income Tax. *American Economic Review*, 66(2), pp. 193-199.
2. Atkinson, A. and Stiglitz, J., 1976. The Design of Tax Structure: Direct Versus Indirect Taxation. *Journal of Public Economics,* 6(1-2), pp. 55-75. https://doi.org/10.1016/0047-2727(76)90041-4
3. Auerbach, A., 1991. Retrospective Capital Gains Taxation. *American Economic Review,* 81(1), pp. 167-178.
4. Chamley, C., 1986. Optimal Taxation of Capital Income in General Equilibrium with Infinite Lives. *Econometrica,* 54(3), pp. 607-622. https://doi.org/10.2307/1911310
5. Crane, S. and Nourzad, F., 1986. Inflation and Tax Evasion: An Empirical Analysis. *The Review of Economics and Statistics*, 68(2), pp. 217-223. https://doi.org/10.2307/1925500
6. De Mooij, R., 2011. Tax Biases to Debt Finance: Assessing the Problem, Finding Solutions. *IMF Staff Discussion Note,* No. 111. https://doi.org/10.5089/9781463935139.006
7. Devereux, M. P. and Griffith, R., 2003. Evaluating Tax Policy for Location Decisions. *International Tax and Public Finance,* 10, pp. 107-126. https://doi.org/10.1023/A:1023364421914
8. Diamond, P., 1975. Inflation and the Comprehensive Tax Base. *Journal of Public Economics,* 4, pp. 227-244. https://doi.org/10.1016/0047-2727(75)90002-X
9. Doupnik, T., Martins, E. and Barbieri, G., 1995. Innovations in Brazilian Inflation Accounting. *International Journal of Accounting,* 30, pp. 302-317.
10. Edwards, J. and Keen, M., 1985. Inflation and Non-Neutralities in the Taxation of Corporate Source Income. *Oxford Economic Papers,* 37(4), pp. 552-575. https://doi.org/10.1093/oxfordjournals.oep.a041710
11. Feldstein, M. and Summers, L., 1979. Inflation and the Taxation of Capital Income in the Corporate Sector. *National Tax Journal,* 32, pp. 445-470. https://doi.org/10.1086/NTJ41862265
12. Feldstein, M., 1976. Inflation, Income Taxes, and the Rate of Interest: A Theoretical Analysis. *American Economic Review,* 66(5), pp. 809-820.
13. Feldstein, M., 1980. Inflation, Tax Rules, and the Stock Market. *Journal of Monetary Economics,* 6, pp. 309-331. https://doi.org/10.1016/0304-3932(80)90045-8
14. Friedman, M., 1968. The Role of Monetary Policy. *The American Economic Review,* 58(1), pp. 1-17.
15. Gravelle, J., 1980. Inflation and the Taxation of Capital Income in the Corporate Sector: A Comment. *National Tax Journal,* 33(4), pp. 473-483. https://doi.org/10.1086/NTJ41862334
16. IMF, 2022. *World Economic Outlook, October 2022*. Washington: International Monetary Fund.
17. Immervoll, H., 2005. Falling Up the Stairs: The Effects of 'Bracket Creep' on Household Incomes. *Review of Income and Wealth,* 51(1), pp. 37-62. https://doi.org/10.1111/j.1475-4991.2005.00144.x

18. Judd, K., 1985. Redistributive Taxation in a Simple Perfect Foresight Model. *Journal of Public Economics,* 28(1), pp. 59-83. https://doi.org/10.1016/0047-2727(85)90020-9
19. Keen, M., 1998. The Balance Between Specific and Ad Valorem Taxation. *Fiscal Studies,* 19(1), pp. 1-37. https://doi.org/10.1111/j.1475-5890.1998.tb00274.x
20. King, M., 1977. *Public Policy and the Corporation*. Chapman and Hall.
21. Kleinbard, E., 2005. The Business Enterprise Income Tax: A Prospectus. *Tax Notes*, January 3, 97-107.
22. Klemm, A., 2012. Effective Average Tax Rates for Permanent Investment. *Journal of Economic and Social Measurement,* 37(3), pp. 253-264. https://doi.org/10.3233/JEM-2012-0361
23. Lucas, R., 1972. Expectations and the neutrality of money. *Journal of Economic Theory*, pp. 103-124. https://doi.org/10.1016/0022-0531(72)90142-1
24. Meade, J., 1978. *The Structure and Reform of Direct Taxation*. London: Institute for Fiscal Studies.
25. Modigliani, F. and Miller, M., 1963. Corporate Income Taxes and the Cost of Capital: A Correction. *American Economic Review,* 53(3), pp. 433-443.
26. OECD, 2022. *Annual National Accounts – Table 9A, Fixed assets by activity and by asset*.
27. Ohrn, E., 2018. The Effect of Corporate Taxation on Investment and Financial Policy: Evidence from the DPAD. *American Economic Journal: Economic Policy,* 10(2), pp. 272-301. https://doi.org/10.1257/pol.20150378
28. Olivera, J., 1967. Money, Prices and Fiscal Lags: A Note on the Dynamics of Inflation. *Quarterly Review*, 20, pp. 258-267.
29. Reis, R., 2021. The Constraint on Public Debt When r < g But g < m. *BIS Working Papers,* No. 939.
30. Sadka, E., 1991. An Inflation-Proof Tax System?. *IMF Staff Papers,* 18(1), pp. 135-155. https://doi.org/10.2307/3867038
31. Straub, L. and Werning, I., 2020. Positive Long-Run Capital Taxation: Chamley-Judd Revisited. *American Economic Review*, 110(1), pp. 86-119. https://doi.org/10.1257/aer.20150210
32. Tanzi, V., 1977. Inflation, Lags in Collection, and the Real Value of Tax Revenue. *IMF Staff Papers,* 24(1), pp. 154-167. https://doi.org/10.5089/9781451956443.024

COVID-19 and participatory budgeting in North Macedonia and Slovakia

MÁRIA MURRAY SVIDROŇOVÁ, Ph.D.*
MARJAN NIKOLOV, Ph.D.*
VESNA GARVANLIEVA ANDONOVA, Ph.D. candidate*
ALENA KAŠČÁKOVÁ, Ph.D.*

Article**
JEL: H72, D72, O57
https://doi.org/10.3326/pse.47.3.4

* The authors are grateful to two anonymous referees who have contributed to the quality of the final version of the paper.
This paper is part of the international COST project "CA20123 Intergovernmental Coordination from Local to European Governance". This research is supported by "APVV-19-0108 Innovations in Local Government Budgeting in Slovakia".

** Received: December 1, 2022
Accepted: April 11, 2023

Mária MURRAY SVIDROŇOVÁ
Matej Bel University in Banská Bystrica, Faculty of Economics, Tajovského 10, 975 90 Banská Bystrica, Slovakia
e-mail: maria.murraysvidronova@umb.sk
ORCiD: 0000-0002-4414-479X

Marjan NIKOLOV
International Slavic University, Marshal Tito 77, 2220 Sveti Nikole, North Macedonia
e-mail: makmar2000@yahoo.com
ORCiD: 0000-0002-7902-0316

Vesna GARVANLIEVA ANDONOVA
Center for economic analyses, Blvd. Jane Sandanski 63/3, 1000 Skopje, North Macedonia
e-mail: vesna_nl@yahoo.com
ORCiD: 0000-0002-0735-1781

Alena KAŠČÁKOVÁ
Matej Bel University in Banská Bystrica, Faculty of Economics, Tajovského 10, 975 90 Banská Bystrica, Slovakia
e-mail: alena.kascakova@umb.sk
ORCiD: 0000-0001-6147-9770

PUBLIC SECTOR ECONOMICS
47 (3) 387–406 (2023)

Abstract

The practice of fostering citizen participation in public finance-related decision-making at local government level in North Macedonia and Slovakia has backslid during COVID-19. Since COVID-19 prompted a worldwide lockdown, governments were forced to introduce emergencies and/or develop "new" participation methods. The paper aims to explore the impact of COVID-19 on citizens' participation in financial decision-making using participatory budgeting among the local self-governments in North Macedonia and Slovakia and identify possible COVID-19-specific and general barriers to such participation, considering the particular context of the two countries.

Keywords: COVID-19 pandemic, participatory budgeting, local self-government

1 INTRODUCTION

Participation is often emphasised as an instrument for solving the democratic deficit and low public trust in institutions that gain the power to regulate the life of a society (Špaček, 2017). Local self-governments seek to be as open as possible by introducing various features that enable the citizens to engage in public (financial) decision-making beyond the scope of legally defined tools. Such tools include official municipal websites, municipal newspapers or newsletters, public consultations, opinion polls or surveys, etc. The methods and tools of participation that are becoming quite prevalent are participatory planning, participatory budgeting, co-creation and co-production, use of social networks or social media, Internet forums, applications for various incentives and reporting suggestions for improving the work of municipalities (Mikušová Meričková, Nemec and Svidroňová, 2015; Špaček, 2017; Vitálišová et al., 2017). Juza (2019) points out that one of the necessary conditions for the sustainability of contemporary democracies is political and civic involvement. Recently, the concept of civic involvement has been expanding: several typical or traditional tools have undergone a process of "modernisation" (e.g., from petition to e-petition). On the other hand, there are also completely new ways of involving individuals as well as groups (communities) in the community or local decision-making processes (civic involvement).

Citizen-centric budgeting (i.e., participatory budgeting) and reporting can raise citizens' awareness of the taxation system and sources spent on the provision of local public services (Manes-Rossi, Aversano and Tartaglia Polcini, 2020). These tools can also enable a better-informed participation in public debates, consultations and other interactions with local public administration (Cohen, Mamakou and Karatzimas, 2017). Consequently, public sector organisations, should seize the opportunity to create or improve specific tools (e.g., popular reports) and processes (e.g., participatory budgeting) that can offer opportunities for a dialogue with citizens through financial and nonfinancial disclosure (Anessi-Pessina et al., 2020). In this paper, we focus on participatory budgeting (PB) as one of the methods or tools to increase citizen participation in financial decision-making. Participatory budgeting is a concept that strengthens the democratic nature of public

PUBLIC SECTOR ECONOMICS
47 (3) 387–406 (2023)

budgeting thanks to the direct involvement of citizens in local budgetary processes. Participatory budgeting arrived in the Central and Eastern Europe region relatively late, more than 20 years after its origin in Porto Alegre, Brazil. It has quickly grown in popularity and has become one of the tools for citizen participation with a rather specific characteristic: participatory budgeting involves citizens in the centre of financial decision-making, enabling them to participate in the public budgets of the local self-governments and influence fiscal transparency.

The COVID-19 pandemic has brought unexpected challenges for the whole of society including the public sector, local self-governments and the process of participatory budgeting. This was the main motivation for researching how COVID-19 impacted participation mechanisms in North Macedonia and Slovakia given the fact that both these Eastern Europe countries have a similar communist past, have undergone many public administration reforms and in both countries, local government is trying to get closer to the citizens by various participatory mechanisms. The objective of this paper is to explore the barriers to participatory budgeting in general and the impact of COVID-19 on participatory budgeting among the local self-government units in North Macedonia and Slovakia.

After a brief introduction about participatory methods and participatory budgeting, the following section deals with participatory budgeting during COVID-19. The research question and methods are defined in the Research methodology, followed by the Results and discussion section where the findings are presented and discussed in relation to those of other studies. In the Conclusion, the main findings are recapitulated and the limitations of the research are summarised.

2 PARTICIPATORY BUDGETING DURING COVID-19

Participatory budgeting started in Porto Alegre, Brazil, thanks to the efforts of the Brazilian Workers' Party in the late 1980s. Considered the first step from representative democracy to direct democracy, PB has been referred to as a case of a radical democratisation of democracy. It was a practice whereby previously marginalised people from poor neighbourhoods could discuss with the municipality how part of its budget should be spent (De Vries, Nemec and Špaček, 2022). The main aim was for this to have redistributive effects with more significant public investment in poor neighbourhoods, which would likely lead to an overall increase in human development in the city (Abers, 2000; Avritzer, 2006; Baiocchi, Heller and Silva, 2008). However, instead of its contribution to social justice or the quality of local democracy, adopters of participatory budgeting in Europe have often preferred to understand it as a tool supporting the efficient allocation of public resources, a tool enhancing political accountability, or a tool supporting sustainable governance (Balážová et al., 2022). The essence of PB, i.e. the reallocation of a significant portion of municipal resources through genuine deliberation with previously marginalised groups, has lost importance compared to achieving effects that were initially considered secondary (De Vries, Nemec and Špaček, 2022).

The PB process may not involve actual devolution of budget-related powers; the process may not involve marginalised groups; the amount of money at stake may be different, and the reallocation of funds is irrelevant. All of the above may vary, resulting in six possible forms of PB: democratic participation, democratic proximity, participatory modernisation, multi-stakeholder participation, neo-corporatism and community development (Sintomer et al., 2013). Models of participatory budgeting in Europe vary considerably (Krenjova and Raudla, 2013; Sintomer et al., 2013); however, all models allow citizens to participate in forming the local budget either directly or in a mediated way by various representatives (non-governmental organisations or local initiatives within communities).

There is a plethora of studies and papers on COVID-19, including how the pandemic influenced participatory budgeting in various countries. In Brazil, where PB originated, COVID-19 obstructed the conduct of processes because of the imposition of restrictions on the mechanism. However, there is no majority perception about the cancellation of the processes during the pandemic or the impacts after the crisis (Maciel, Costa and Catapan, 2022). Research into Nepal identified no apparent mechanism in the PB processes to ensure that the citizens' proposals are expressed and genuinely reflected in decisions; another aspect is that the participation of the population was not perceived as necessary by local leaders (Bhusal, 2020).

In the context of Central and Eastern Europe, Cho, Jérôme and Maurice (2021) observed in France some cases in which there was a rise in PB in local communities, as some local self-government units continued with PB. On the other hand, some of them noted a drop in submitted projects. In other cases, some PB initiatives were postponed or cancelled. In contrast, another group of local self-governments in France introduced or even amplified the PB initiatives. Burkšienė, Burbulytė-Tsiskarishvili and Dvorak (2022) look at the impact of mayors on PB in Lithuania during COVID-19. The results show the impact of mayors' social and personal backgrounds on PB resilience. However, political affiliation, interactions with the council and administrative and political skills are supportive factors during difficult periods or crises. Their contribution suggests that mayors alone cannot ensure the resilience of PB in the face of funding shortages during crisis periods such as COVID-19. Romanian local self-governments rarely use PB, this tool being well established mostly in cities with large academic communities (Cluj-Napoca, Timișoara, and Brașov). Because of COVID-19, most of the PB processes were suspended, but there were some that have been digitalised and implemented entirely online (Boc and Lazăr, 2022).

Turning now to the V4 countries[1], the continuous growth of participatory budgets in local self-governments in Poland, the Czech Republic and Slovakia have been significantly disrupted by the outbreak of COVID-19 in 2020. For example, in

[1] V4 refers to the Visegrad countries of the Czech Republic, Hungary, Poland and Slovakia.

Poland some criticism from local self-governments was observed after the COVID-19 outbreak. Polish municipalities with district (powiat) status are obliged to apply participatory budgeting. In particular, this status is enjoyed by 66 municipalities, the main representatives of which demanded a change in the law. Their arguments concerned the negative consequences of the COVID-19 crisis, which were reflected in reduced tax revenues for local self-government. They thought that in a time of crisis, introduction of participatory budgets was an economic burden. However, an amendment to the law concerning the abolition of the obligation of participatory budgets for a given category of towns did not find parliamentary support (Baranowski, 2020). In the Czech Republic, based on data published by the non-governmental organisation Agora CE, almost 2/3 of the participatory budgets were carried on, while voting was changed to an online form (Kukučková and Poláchová, 2021). The participatory budgeting in V4 countries is the least developed in Hungary with PB starting only in 2016, with less than 0.5% of local self-governments using this tool. Due to COVID-19, citizens could present their proposals only online (Demnet, 2021). Slovakia is quite well documented regarding the impact of the pandemic on PB (see for example Bardovič and Gašparík, 2021; Klimovský, Nemec and Bouckaert, 2021; Mikuš, Brix and Šmatlánek, 2021; Buček, 2022). However, these papers focus on the barriers imposed by the global pandemic of COVID-19 on participatory budgeting, not in general as our research does. Moreover, to our knowledge and based on literature review, there have been no studies on PB in North Macedonia published.

3 RESEARCH METHODOLOGY

The objective of this paper is to explore the barriers to participatory budgeting in general and the impact of COVID-19 on participatory budgeting among the local self-governments in North Macedonia and Slovakia.

We formulated the following research questions:

- RQ1: What are the general barriers to participatory budgeting in North Macedonia and Slovakia?
- RQ2: What were the barriers to participatory budgeting in the context of COVID-19 in North Macedonia and Slovakia and how have they influenced the current situation?

The research sample consists of all 59 Slovak and 49 North Macedonian local self-governments that have implemented PB that is still running. The analysis covers the period from 2018 (pre-COVID-19) to 2022 (post-COVID-19). The data were collected by a qualitative analysis of websites and publicly available documents on participatory budgets, monitoring the work of local self-governments and participatory budgeting, including discussion forums on these websites and other related social networks, where citizens expressed their satisfaction, or the lack of it, with the participatory budgeting in the municipalities. Based on this analysis we found several barriers mentioned on the websites and social networks. To verify their validity, we approached experts from academia and practice on PB

PUBLIC SECTOR ECONOMICS
47 (3) 387–406 (2023)

with a short structured interview; the list of interviewees is in table 1. The interviewee selection was based on targeted and direct approach to relevant representatives who have been directly involved in the process of participatory budgeting at the relevant level of government and academia. The interviews were based on structured and concise questions on the barriers to PB in general and to PB in COVID-19 period. The interviews were conducted either in person or via online platforms (MS Teams, Zoom) and the average length of the interview was around 45 minutes. The interviews were recorded with the consent of the interviewees providing full anonymization during the analysis process.

Table 1

List of interviewees

Participant\Country	Slovakia	North Macedonia
Local government	1	5
Central government	1	0
Coordinator/facilitator of PB	1	1
Academia experts	3	2

Source: Authors.

Furthermore, we used a comparative analysis of the selected countries. It is a well-established view in the social sciences that such an analysis should be variable-based. However, even in some social sciences, research is case-oriented; it focuses on detailed descriptions of a few instances of a phenomenon. Comparative analysis responds to the need to expand the spatial scope and depth of information (Della Porta, 2008). The primary method is the case study, classified as a qualitative research method (Allgozzine and Hancock, 2006). The case study is a qualitative method because it perfectly fulfils the primary aim of qualitative research – as it examines phenomena in depth in their actual context, especially when the boundaries between the phenomenon and its context are unclear (Yin, 2009). Through the case studies, we will point out the barriers to participatory budgeting in general and barriers further brought in by COVID-19.

4 RESULTS AND DISCUSSION

On the one hand the limitations that the pandemic imposed on the implementation of PB were primarily and directly induced by the pandemic-caused restrictions, by states of emergency, and lockdowns, affecting people's movements and gatherings and limiting the possibility for this direct participatory democracy mechanism. On the other hand, the pandemic allowed the local self-governments some budget-related leeway and room for discretionary authority and varied interpretations. These have changed the forms and tools of communication with the citizens, often reflected in full suspension and/or cancellation of PB, causing an immediate negative impact that also has a potential for continued consequences in the post-crisis period. The already existing barriers to PB further intensified during the COVID-19. In the following text we present the results in a form of case studies.

4.1 CASE 1: PARTICIPATORY BUDGETING IN SLOVAKIA

Slovakia is a democratic country in Central and Eastern Europe established in 1993 with population of 5,449,270 as of 31 December 2021 and area of 49,035 km². The system of local self-government in Slovakia is characterised by relative fragmentation: two-thirds of the 2,890 municipalities are very small with populations of fewer than 1,000 inhabitants. Local self-government comprises two central bodies, the mayor and the local council, with the mayor's position being stronger but balanced by the council's decision-making powers. Thanks to some central governments' decentralisation approach in the past, local self-governments are strong in terms of their competences. However, their capacities remain limited in many cases (Klimovský and Nemec, 2021).

There is no legal definition of PB orobligation for municipalities to implement it. The first initiatives were a bottom-up process – PB was started by a local NGO and the work of volunteers (Džinić, Murray Svidroňová and Markowska-Bzducha, 2016). The three municipalities that implemented participatory budgeting were the city of Bratislava in 2011, followed in 2013 by the town of Ružomberok and the city of Banská Bystrica in 2014. At present, local self-governments in Slovakia are historically the "most open" to civic participation in deciding on sections of the budget. According to Transparency International Slovakia, a participatory budget was used by 17 of the 100 largest municipalities in 2018. It can be noted that since then, the total number of local self-governments offering participatory budgeting to their citizens has grown significantly to 59 municipalities in 2022 (Murray Svidroňová and Klimovský, 2022).

However, the unexpected COVID-19 pandemic became a real turning point. The pandemic period caused shortfalls in income tax yield, representing a substantial part of the local self-government budget in Slovakia. These shortfalls meant the local self-governments' total revenues dropped, while new expenditures occurred. The level of uncertainty has become too high from the point of view of the decision-makers, and various governmental restrictions have significantly limited the options for active public participation since February/March 2020. Under these conditions, most local self-governments with PB have temporarily suspended or cancelled the participatory budgeting processes altogether. In addition, some of those meant to have been introduced in 2020 have never begun (Murray Svidroňová and Klimovský, 2022). Since there are no central laws in Slovakia regulating participatory budgeting, each local self-government was able to react to pandemic situation as it wished.

Research by Bardovič and Gašparík (2021) indicates that a numerous and heterogeneous group of local self-governments decided to suspend participatory budgeting implementation in 2020. Some local self-governments decided to suspend participatory budgeting processes altogether without implementation in 2020. Other local self-governments implemented it at least until the project approval phase. Within the second group, there are three other sub-groups. The first

subgroup consists of those local self-governments that, thanks to their participatory budgeting model, did not face any of the challenges posed by the period of restricted meetings, as they did not foresee any public meetings (forums). The second subgroup is represented by those local self-governments that anticipated public meetings but had a timetable for implementation in place before the pandemic (especially at the beginning of the year). That is, there were no barriers to implementing this phase of participatory budgeting. Finally, the third subgroup comprises those local self-governments that had counted on meetings and active citizen participation but needed more time to hold them before the first constraints (Bardovič and Gašparík, 2021). The authors (ibid) also focused on PB enablers, which can be characterised as follows:

– The existence and use of online tools – mainly using the "wellgiving.sk" platform, which enables implementing almost the entire process from project submission to voting. However, in many cases, other online tools were used for voting. Facebook has played a vital role in promoting participatory budgeting, and some forums have been held as live-streamed meetings through this social media.
– Easing of anti-pandemic restrictions in the summer of 2020 – although this factor is outside the control of local self-governments and, as such, could not be directly influenced. All they could do was to act promptly, and several did.
– A two-year cycle – instead of one year, the whole PB process took two years from project submission to project implementation. However, it represents a solution that can potentially shift the obstacles in PB process into the future.

4.2 CASE 2: PARTICIPATORY BUDGETING IN NORTH MACEDONIA

The Republic of North Macedonia (RNM) is a parliamentary democracy that declared its independence in 1991 after the disintegration of Yugoslavia (with a resident population of 1,836,713 as of the 2021 Census, on an area of 25,713 km²). North Macedonia has a one-tier subnational government system, consisting of 80 municipalities plus one city, Skopje, as a separate local self-government unit (LSGU) composed of ten municipalities. Each of the LSGUs is a part of one of the eight statistical planning regions.

The system of local self-government of North Macedonia is characterised by fragmentation and symmetry in service provision, making it hard to serve the citizens effectively. North Macedonia's average LSGU has a relatively high average number of inhabitants, with a high concentration of citizens in the capital city, with a population of over half a million. Almost half of the municipalities are populated with between 5,000 and 10,000 inhabitants. Local self-governments consist of two central bodies, mayors and local councils. The mayor has the executive role, and the council is the representative body of the citizens, both elected through direct local elections.

Citizen participation through a formal institutionalised PB process is not legally prescribed for the LSGUs in North Macedonia. Nonetheless, the beginnings of PB at a local level in North Macedonia were initiated in 2006 and continued on an

on-and-off basis via the support and facilitation of the international donor community. Starting from 2006, and with a decade-long support programme, pioneered and funded by the Swiss Agency for Development and Cooperation, some sixty LSGUs went through the donor-supported process of learning and practising PB via the community forums tool (Hadzi-Vasileva et al., 2017). In the period following, various international donor community projects, predominantly implemented through the support of civil society, have also supported the implementation of participatory decision-making processes at a local level. Some LSGUs have accepted and endorsed the process of organising community budget forums. Some have amended their Statutes by including the community forum as a form of citizen inclusion in local decision-making and continued the practice regularly without external donor support. Other LSGUs have abandoned the practice once the donor support has ceased or else it is done on an ad-hoc basis.

Currently, according to the Center for Economic Analyses (CEA) monitoring, PB activities, among the local self-governments in North Macedonia, are still predominantly operating on an ad-hoc basis. However, they are encouraged when there is external support, with tendencies for institutionalisation and growing practical implementation. Namely, some form of PB process and tools were used in 2019 by 30% of the LSGUs, and in 2021 60% of the LSGUs implemented them. There is no clear designation of a model or a unified process or the tools used; thus, PB takes different forms, such as community forums, citizen parliaments, survey-based suggestion collection, and local community gatherings. Some may be categorised as merely informative presentation sessions on the budget without any real substantial inclusion or citizen consultation. However, others might not be locally referred to as activities for PB and may feature more intense participation procedures. For these reasons, it is a challenge to make the comparison possible, given that the data are predominantly based on the information provided by the LSGUs.

The COVID-19 pandemic has become a real hindrance to the widening of the PB process, and quite the opposite has been a downwards turning point. The pandemic period caused shortfalls, especially in own-source revenues among the LSGUs in North Macedonia, which, although they are highly dependent on the central budget transfers (the block grants from central government contribute to over half of the total revenues of the local self-governments in North Macedonia), has had an adverse effect (Garvanlieva Andonova, Nikolov and Petrovska, 2020). That mostly means that the total revenues of the local self-governments dropped, and the capital expenditure plans were downsized and relocated towards new unplanned COVID-19-induced expenditures.

More importantly, the numerous restrictions from the government have considerably limited the possibilities for active citizens' participation since March 2020. Most local self-governments cancelled any processes altogether, especially any PB activities, due to the public sector office work in North Macedonia being

PUBLIC SECTOR ECONOMICS
47 (3) 387–406 (2023)

considerably reduced by the stay-at-home policies. Local self-governments mainly chose to suspend communication with the citizens for joint decision-making, with the excuse of the need for timely preparation and adoption of budget documents (Government of RNM, 2020).

Nevertheless, the modalities for participation have been limited and primarily quasi-participatory methods and tools in the form of online meetings, online questionnaires, surveys and suggestion collection, or solely informative online sessions have been used.

4.3 BARRIERS TO PARTICIPATORY BUDGETING IN SLOVAKIA AND NORTH MACEDONIA

4.3.1 BARRIERS TO PARTICIPATORY BUDGETING IN GENERAL

General barriers of the PB process that lead to putting the citizens on the side lines of public policy and finance decisions that cannot be solely attributed to COVID-19, but may be related to institutional set-up, planning, power imbalance, and others are:

– **The socio-political environment** – as already mentioned, PB is neither regulatorily binding nor institutionalised. In North Macedonia, the administrative practice shows that processes such as PB depend on there being an obligation in a regulatory framework. When not enshrined in a legal document, there is no perception of something to be done, and thus it depends on the local authority's political will and determination. The most frequent response from the public administration as to why information and data are not available to the public is that the specific document, data, their preparation or disclosure are not required by law. Therefore, PB is also still occurring on an ad-hoc and voluntary basis and lacks consistency. Furthermore, the lack of a standardised process explicitly determining the features of what PB needs to cover results in inconsistent understanding and differences between informative and consultative and deliberative and decision-making PB. A Slovak expert from academia stated that "PB is still an underappreciated tool that is not understood, especially in local governments. They do not know its possibilities and impacts. They take it as a burden – they have more work to do with the process as well as approved activities during the year and then have to maintain them. Civil society likes to get involved, but after years it can burn out due to lack of interest and under-appreciation of self-government." The most likely suitable area for intervention is the Statute of the LSGUs, where citizen-direct decision-making processes can be further defined. For example, there is a Charter of Good Participatory Budgeting in Slovakia (Klimovský and Hrabinová, 2021), but this is non-binding and contains some principles or recommendations for municipalities. On the other hand, making PB binding by law might lead to the politicisation of PB, i.e. PB would become another tool for politicians to pursue their will (an example can be seen with the politicization of the science around vaccines, which might lead to decisions that directly increase the rates and harms of diseases, with potentially deadly consequences).

– **Insufficient political will** – PB involves power being shared between local officials and citizens. The PB process, complete with features for deliberation and practical voice and say in the decision-making of the budget allocation, can be perceived as a threat to the powers of the local politicians. Therefore, it is necessary to endorse the PB process for the political authorities to undergo periodical induction courses to clearly lay down the importance and benefits of PB and the role and responsibilities of each stakeholder in the process. In Slovakia, PB started as a bottom-up process. However, later on, the local politicians and mayors, or both, have adopted PB implementation as a strategy to increase their popularity among citizens (see, for example, Murray Svidroňová and Klimovský, 2022). According to a member of the Municipal Council, Municipality Center, North Macedonia: "The primary barrier [in participative budgeting] is the lack of will on the part of the Mayor and administration to continue with Budget consultation practices. We [Council Members] have not seen the draft programs, nor have we been consulted on the Budget [for 2023], while soon it will be up for adoption. While announced only a day in advance and presented as a consultative process [this year] the Mayor organized what can be described as a 'political party forum'. There is no trace of any kind of participatory process where at least the Council Members would be included, let alone the citizens."
– **Voluntary membership to the local communities' councils** (called "mesni zaednici" in Macedonia and "koordinačné rady" in Slovakia) – direct citizen and local community representative participation in PB is driven by primarily volunteer-based representatives who take on the responsibility and commitment, starting from the designing and collecting of ideas, to presenting and advocating them in front of the councils. Voluntary membership in representing the local communities does not guarantee participation, commitment and perseverance. However, when considered together with the often lack of accountability of the PB process, it is another factor that disincentivises volunteer involvement and diminishes citizens' confidence in their local community representatives. It is worth noting that the voluntary councils are often time-consuming and challenging to participate at the meetings during the daytime due to conflicting working hours (Craig et al., 2005). As a local government representative from Slovakia pointed out: "Local and regional governments should allocate sufficient personnel and financial capacities for the coordination of participatory budgets, regular monitoring and evaluation to create an environment for cooperation with civil society, which can continue, i.e. to make PB sustainable one cannot and should not count only on the volunteers." The LSGUs in North Macedonia face capacity limitations and also depend on central budget transfers and have low fiscal autonomy. Therefore, the municipalities have limited capacities and spending possibilities to take on investments and execute the citizens' proposals as defined by a proper participatory process.
– **Missing accountability and feedback loop** – an accountability step rarely follows PB processes. More precisely, even after the consultation, gathering of

ideas, and proposals are completed, the citizens rarely get any official feedback on which proposed projects have been adopted, implemented, or rejected with good reasons. PB processes can be described as linear rather than cyclical, as the evaluation and feedback are missing from the loop. The lack of follow-up can result in reactance associated with disappointment when a suggestion is not included in the budget programmes leading to a disincentive for further participation and distrust in the overall process. Moreover, there is practically no data on the cost of PB on the part of local governments. Usually, the PB process is distributed among various municipality employees, and the costs are "hidden" among other agendas. Therefore, it is difficult, if not impossible, to tell how efficient and effective PB is, leading to lower accountability. According to the facilitator and implementer of PB processes in RNM: "Both the citizens and the local authorities consider the consultative tools listed by law (referendum, citizen's initiative and citizen gathering) to be complex, and thus are rarely properly used, but only in a simplified form. Nevertheless, the municipalities can develop their own citizen participation mechanisms, regrettably often not adequately planned with resources or time for a proper PB process. Often a single budget public discussion is considered sufficient, and abiding solely by the [Mayor's] political election programs is considered enough for accountability. Such 'pro forma' citizen engagement consequently results in a lack of citizen interest." However, in Slovakia, some improvements were noted regarding accountability and mutual trust: "In Banská Bystrica, cooperation was initially low, or associated with mistrust (which is understandable, given the lack of previous experience, but also the setting of the 'culture' of communication with citizens). Later, however, the relationship gradually changed, and although it is still not ideal, it can be said that the level of trust and cooperation is higher" (local coordinator of PB).

- **Lack of citizen interest** and weak administrative capacities – citizens' interest is a decisive component affecting the sustainability of the PB process. Assuming there is political will and it does not pose a barrier to PB, the citizens' capacities and the administrative capacities might become a barrier. If the local administration's skills aredeficient, then the initiation and practice of PB may be challenging. Furthermore, when there is a lack of capacity within civil society due to an insufficient knowledge of technical budget documents and the PB process, in addition to awareness of their rights and obligations in decision-making, lack of transparency and thus trust, then a lack of interest may become a barrier. According to an administrative officer in the Municipality of Kavadarci, North Macedonia: "The municipal administration should be more active in reaching out and mobilizing citizens' active participation [in the PB process]. Furthermore, they [administration] should invest efforts in increasing the awareness of the citizens of their rights to have a voice in the budget preparation."
- Furthermore, in Slovakia, there has been a long-term challenge in promoting PB better among the citizens and choosing which channels to use to include various categories (e.g., senior citizens, minorities, and others). "We do not

PUBLIC SECTOR ECONOMICS
47 (3) 387–406 (2023)

know how to capture and involve groups of the population/citizens, such as the homeless, Roma, or other socially and health-disadvantaged citizens, and so they do not learn about the participatory budget, do not participate in it, whether as submitters of proposals/projects that would solve their situation and also do not participate in the decision-making process on proposals/projects (voting). And if so, then in a very small number", said a coordinator of PB at municipality of Banská Bystrica, Slovakia.

4.3.2 BARRIERS TO PARTICIPATORY BUDGETING TRIGGERED BY COVID-19

In North Macedonia, as in other countries, the COVID-19 pandemic had an adverse effect on the PB process at the local government level. Firstly, the restrictions caused by declaring states of emergency and the lockdowns entirely disabled the possibility for face-to-face consultations and budget planning processes. This was reflected in a significant drop in the PB sessions planned by the local self-governments in 2020. There have been instances however, when there have been attempts to digitally organise the planning process via online sessions or collection of citizens' suggestions via online surveying. According to a representative Department Head of the Municipality of Gazi Baba, North Macedonia: "There is a need [for the local governments] to establish digital and mobile platforms for interaction with the citizens. We are in the process of development of a digital application and expect improvement of the situation. Greater digitalisation will greatly strengthen all procedures and services in the municipality including participatory budgeting, which is especially necessary in extraordinary circumstances such as COVID-19, and consequently ensure greater accountability."

The local self-governments had to pass through an adjustment period to be able to function digitally. In most instances, the local self-governments were not prepared to undertake the process efficiently and effectively during the pandemic due to limitations in technical and human capacities. Moreover, in Slovakia, there is a general distrust of online voting (Bardovič, 2021). Indeed, online voting can shuffle the cards and change election outcomes, as e-voters are mostly citizens who identify themselves as irregular voters or abstainers, i.e. citizens on the margins of political participation (Chevallier, 2009). This problem with voting could go hand in hand with the assumption that online voting reduces the quality of decision-making in the PB process, as online voters would not usually attend any discussion forums, discuss project proposals or vote. In most cases, even when there was an established practice of PB consultation processes with the citizens, at the peak of the pandemic, most often, they were either entirely suspended and cancelled or partially organised online.

It is important to reiterate that the PB process among the local self-governments in Slovakia and North Macedonia is not legally binding, and there is no institutionalised and standardised process encompassing all PB features. Furthermore, it was the donor community that drove previous PB initiatives in North Macedonia. Therefore, it is expected for PB to drop significantly without the external motivator and

PUBLIC SECTOR ECONOMICS
47 (3) 387–406 (2023)

facilitator in a crisis situation. According to a representative from the Department Head of the Municipality of Bitola, North Macedonia: "The PB process first needs to be understood [by the executive] as necessary, despite being a non-obligatory process, and to be liberated from the political structure pressures, which subsequently directly affect the local governance and management performance."

We assume that, in line with the findings of other authors, there is also a degree of resistance among public administration and that when there is no regulatory obligation or political will, a particular process will be dropped (e.g. Amsler, 2016; Yang and Pandey, 2011; Zepic, Dapp and Krcmar, 2017). Moreover, the digital transformation of the public sector is another process in which North Macedonia is lagging due to, among other reasons, limited technical and human capacities.

It seems that COVID-19 has been intensifying the existing general barriers to PB as the municipalities have limited capacities and spending possibilities to take on investments and execute the citizens' proposals as defined by a proper participatory process, the budgetary restrictions. In addition, dincreased unplanned local expenditure on COVID-19 further reduced the availability of funds for implementing the citizens' proposals and their prioritisation. According to an expert and facilitator of PB forums in North Macedonia: "COVID-19 has revealed that the local governments are not ready or equipped for digital PB. Most of the municipalities did not seize the opportunity to develop and make use of digital approaches, platforms and tools. Some [municipalities] made attempts via simplified digital tools; however, due to a process inadequacy, and lack of digital skills, the results were compromised and not credible."

In Slovakia, there is a high degree of autonomy over a relatively small share of revenue; thus, the central budget transfers do not play an important role in local self-governments either continuing or dropping PB during the pandemic.

Considering that COVID-19 is a phenomenon not encountered previously, the barriers and effects of the pandemic on the PB processes are a relatively unexplored area, especially since it is specific to a defined geographic area. Some authors have considered the aspect of COVID-19 by analysing its barriers, effects, and consequences on PB. Our results are in line with their findings and with the literature review. Recent papers indicated that changes to PB processes during the COVID-19 were diversified between suspension, cancellation, and continuity with reduction. Moreover, some papers have started to explore whether the changes in PB caused by the pandemic are permanent. In the case of Poland, Poplawski (2020) discusses new contact-free democracy models driven by digitalisation, vitiated, however, by the pertinent digital exclusion barriers for groups of citizens, as well as the administration's resistance to change. In Portugal, Maciel, Costa and Catapan (2022) explore the administrative perception of the PB process in COVID-19, and conclude that there has been an overall negative impact; however, whether the impact will persist in the future is not conclusive.

5 CONCLUSION

This paper explored the impact of COVID-19 on citizens' participation in financial decision-making among the local governments in North Macedonia and Slovakia and identified possible general barriers to participation and those specific to the COVID-19 effect, considering the particular context of the two countries.

Regarding the participatory budgeting, at the beginning in Slovakia (2011), the civil sector/NGOs served as initiators and local self-governments as followers of this process. However, this position is steadily shifting towards the dominance of local self-governments and the marginalisation of the role of civil society. In North Macedonia, the first participatory budgets were initiated in 2006 and continued on an on-and-off basis with the support and facilitation of the international donor community, predominantly implemented through the help of civil society. Some local self-governments have regularly accepted and continued the practice regularly without external donor support. In contrast, others have abandoned the practice once donor support has ceased or it is continued on an ad-hoc basis.

In both countries, PB faced enormous challenges during COVID-19. In both countries, it has managed to survive even though the local self-governments found themselves unprepared to undertake the process efficiently and effectively during the pandemic, primarily due to limited technical and personnel capacities. In North Macedonia, there were a few attempts to organise the planning process digitally via online sessions or collecting citizens' suggestions via online surveys. In Slovakia, several local self-governments opted for online discussions and online voting. In general, online voting is considered to reduce the quality of decision-making in the PB process. For example, some local self-governments rather changed the one-year cycle for implementing PB projects to a two-year cycle so they could use the intervals in which there were no strict lockdowns for citizens to be able to meet, discuss, vote and implement the projects.

Regardless of COVID-19, general barriers to PB had already existed, and the pandemic seemed to intensify them. One such barrier is that PB is neither regulatorily binding nor institutionalised. Meanwhile in North Macedonia this step is considered vital in strengthening the sustainability of PB; in Slovakia, there is a slight worry that making PB legally binding might lead to the politicisation of the process. Still, both countries may find it beneficial to introduce rules for participatory budgeting in local self-government statutes or individual statutes approved by the local self-governments and make them publicly available.

Slovak and North Macedonian PB processes rely heavily on volunteer-based representatives from the ranks of citizens to organise discussion forums, collect ideas, support the preparation of project proposals, and the like. On the local self-government side, the process of PB is usually distributed among various municipality employees and the costs are "hidden" among other items. In addition, there needs to be a coordinator or other official responsible for the PB process, as the lack of

such a role will often lead to infrequent feedback for citizens concerning which proposed projects have been adopted, implemented, or justifiably rejected.

One of the limits of our research is that we focus only on two countries. Exploring other countries' barriers to PB and participation is an area for possible future research, which could broaden possible solutions to such barriers. Future research also might focus on other participation mechanisms and not just PB.

Disclosure statement

The authors declare that there is no conflict of interest.

REFERENCES

1. Abers, R., 2000. *Inventing local democracy: grassroots politics in Brazil*. Lynne Rienner Publishers. https://doi.org/10.1515/9781626371378
2. Allgozzine, B. and Hancock, D. R., 2006. *Doing case study research: a practical guide for beginning researchers.* New York: Teachers College Press.
3. Amsler, L. B., 2016. Collaborative governance: Integrating management, politics, and law. *Public Administration Review*, 76(5), pp. 700-711. https://doi.org/10.1111/puar.12605
4. Anessi-Pessina, E. [et al.], 2020. Reconsidering public budgeting after the COVID-19 outbreak: key lessons and future challenges. *Journal of Public Budgeting, Accounting & Financial Management*, 32(5), pp. 957-965. https://doi.org/10.1108/JPBAFM-07-2020-0115
5. Avritzer, L., 2006. New public spheres in Brazil: local democracy and deliberative politics. *International Journal of Urban and Regional Research*, 30(3), pp. 623-637. https://doi.org/10.1111/j.1468-2427.2006.00692.x
6. Baiocchi, G., Heller, P. and Silva, M. K., 2008. Making space for civil society: institutional reforms and local democracy in Brazil. *Social Forces*, 86(3), pp. 911-936. https://doi.org/10.1353/sof.0.0015
7. Balážová, M. [et al.], 2022. Determinants of combining budgetary innovations at the local level: experience from Slovakia. *Public Sector Economics*, 46(3), pp. 355-383. https://doi.org/10.3326/pse.46.3.2
8. Baranowski, J., 2020. Participatory budget and the Sars-Cov-2 pandemic in Poland. *Transylvanian Review of Administrative Sciences*, 16(SI), pp. 24-37. https://doi.org/10.24193/tras.SI2020.2
9. Bardovič, J. 2021 Volebný systém na Slovensku a jeho vybrané problémy v rokoch 1989-2019. In: T. Dvorský, J. Ruman and J. Šutajová, eds. *1989-2019: Dekády zmien. Kam kráčaš demokracia*. Košice: Univerzita Pavla Jozefa Šafárika v Košiciach, pp. 63-81.
10. Bardovič, J. and Gašparík, J., 2021. Enablers of participatory budgeting in Slovakia during the COVID19 pandemic. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration*, 29(1). https://doi.org/10.46585/sp29011248.
11. Bhusal, T., 2020. Citizen participation in times of crisis: Understanding participatory budget during the COVID-19 pandemic in Nepal. *ASEAN Journal of Community Engagement*, 4(2), pp. 321-341. https://doi.org/10.7454/ajce.v4i2.1103
12. Boc, E. and Lazăr, D. T., 2022. Participatory Budgeting in Romania. In: M. S. De Vries, J. Nemec and D. Špaček, eds. *International Trends in Participatory Budgeting*. Palgrave Cham: Macmillan, pp. 187-204. https://doi.org/10.1007/978-3-030-79930-4_10
13. Buček, J., 2022. Local Self-Government and Governance During Covid-19 Pandemic in Slovakia. *Local Government and the COVID-19 Pandemic*. Cham: Springer, pp. 481-505. https://doi.org/10.1007/978-3-030-91112-6_19

14. Burkšienė, V., Burbulytė-Tsiskarishvili, G. and Dvorak, J., 2022. Mayoral influence on participatory budgeting in Lithuania during Covid-19. *Emerging science journal: COVID-19: Emerging Research*, 6 (spec. iss.), pp. 151-164. https://doi.org/10.28991/esj-2022-SPER-011
15. Chevallier, M. 2009. Internet voting, Turnout and deliberation: A Study. *Electronic Journal of e-Government*, 7(1), pp. 71-86.
16. Cho, C. H., Jérôme, T. and Maurice, J., 2020. "Whatever it takes": first budgetary responses to the COVID-19 pandemic in France. *Journal of Public Budgeting, Accounting & Financial Management,* 33(1), pp. 12-23. https://doi.org/10.1108/JPBAFM-07-2020-0126
17. Cohen, S., Mamakou, X. J. and Karatzimas, S., 2017. IT-enhanced popular reports: Analyzing citizen preferences. *Government Information Quarterly*, 34(2), pp. 283-295. https://doi.org/10.1016/j.giq.2017.04.003
18. Craig, G. [et al.], 2005. *The paradox of compacts: Monitoring the impact of compacts*. London: Home Office.
19. De Vries, M., Nemec, J. and Špaček, D., 2022. *International Trends in Participatory Budgeting*. Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-79930-4
20. Della Porta, D., 2008. Comparative analysis: case-oriented versus variable-oriented research. *Approaches and methodologies in the social sciences: A Pluralist Perspective*. New York: Cambridge University Press, pp. 198-222. https://doi.org/10.1017/CBO9780511801938.012
21. Demnet, 2021. *Participatory Budgeting – Budapest Residents to Decide about 1 Billion Forints*.
22. Džinić, J., Murray Svidroňová, M. and Markowska-Bzducha, E., 2016. Participatory budgeting: a comparative study of Croatia, Poland and Slovakia. *NISPAcee Journal of Public Administration and Public Policy*, 9(1), pp.31-56. https://doi.org/10.1515/nispa-2016-0002
23. Garvanlieva Andonova, V., Nikolov, M. and Petrovska, A. M., 2020. *Municipalities and COVID-19 in North Macedonia: The implications on the public finances of the municipalities*. Center for Economic Analyses (CEA).
24. Government of the Republic of North Macedonia, 2020. *Decrees with legal force to prevent the spread of COVID-19*.
25. Hadzi-Vasileva, K. [et al.], 2017. 11 Step Manual Forum in the Community. ZELS.
26. Juza, M., 2019. After Late Modernity: Possible Scenarios for Future Social Changes. *Studia Humanistyczne AGH*, 18(3), pp.7-22. https://doi.org/10.7494/human.2019.18.3.7
27. Klimovský, D. and Hrabinová, A., 2021. The Introduction of the Charter of Good Participatory Budgeting in Slovakia: The Insiders' Story. *Politické vedy*, 24(4), pp. 198-202. https://doi.org/10.24040/politickevedy.2021.24.4.198-202
28. Klimovský, D. and Nemec, J., 2021. Local self-government in Slovakia. In: B. Brezovnik, I. Hoffman and J. Kostrubiec, eds. *Local self-government in Europe*, pp. 355-382.

29. Klimovský, D., Nemec, J. and Bouckaert, G., 2021. The COVID-19 Pandemic in the Czech Republic and Slovakia. *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration*, 29(1), 1320. https://doi.org/10.46585/sp29011320
30. Krenjova, J. and Raudla, R., 2013. Participatory Budgeting at the Local Level: Challenges and Opportunities for New Democracies. *Halduskultuur*, 14(1), pp. 18-46.
31. Kukučková, S. and Poláchová, M., 2021. The Impact of the D21 Method and Its Modification on Citizens' Participation in Participatory Budgeting. The Case of the Czech Republic. *Slovak Journal of Political Sciences*, 21(2), pp. 117-138. https://doi.org/10.34135/sjps.210201
32. Law on Free Access to Public Information 2019, OG of RNM 101/2019.
33. Law on Self-government 2002*,* OG of RNM 5/2002.
34. Maciel, L. R., Costa, C. S. and Catapan, A., 2022. Participatory budgeting in COVID-19 times: a perspective from Paraná and Portuguese municipalities. *International Journal of Professional Business Review*, 7(1), pp. 1-21.
35. Manes-Rossi, F. [et al.], 2021. Features and drivers of citizen participation: Insights from participatory budgeting in three European cities. *Public Management Review*, 25(2), pp. 201-223. https://doi.org/10.1080/14719037.2021.1963821.
36. Manes-Rossi, F., Aversano, N. and Tartaglia Polcini, P., 2020. Popular reporting: learning from the US experience. *Journal of Public Budgeting, Accounting and Financial Management,* 32(1), pp. 92-113. https://doi.org/10.1108/JPBAFM-01-2019-0013
37. Mikuš, D., Brix, R. and Šmatlánek, D., 2021. Specifications of Participatory Budgeting in Visegrad Group States and Possible Implementations for Slovakia. *Slovak Journal of Political Sciences*, 21(2), pp.161-185. https://doi.org/10.34135/sjps.210203
38. Mikušová Meričková, B. M., Nemec, J. and Svidroňová, M., 2015. Co-creation in local public services delivery innovation: Slovak experience. *Lex Localis,* 13(3), pp. 521-535. https://doi.org/10.4335/13.3.521-535(2015)
39. Murray Svidroňová, M. and Klimovský, D., 2022. Participatory Budgeting in Slovakia: Recent Development, Present State, and Interesting Cases. In: M. S. De Vries, J. Nemec and D. Špaček, eds. *International Trends in Participatory Budgeting*. Cham: Palgrave Macmillan, pp. 247-269. https://doi.org/10.1007/978-3-030-79930-4_13
40. Popławski, M., 2020. COVID-19 and Direct Contact-Free Democracy-Experiences from Poland. *Przegląd Prawa Konstytucyjnego*, 6(58), pp. 603-614. https://doi.org/10.15804/ppk.2020.06.49
41. Sintomer, Y. [et al.], 2013. Participatory budgeting worldwide. *Dialog Global*, (25), pp. 1-93.
42. Špaček, D., 2017. Social media usage and performance: the case of Czech regions. In: *25th NISPAcee Annual Conference*, 18th – 20th May 2017, Kazan, Russia.

43. Vitálišová, K. [et al.], 2017. *Verejná politika a úloha občana v nej*. Banská Bystrica: Belianum.
44. Yang, K. and Pandey, S. K., 2011. Further dissecting the black box of citizen participation: When does citizen involvement lead to good outcomes? *Public administration review*, 71(6), pp. 880-892. https://doi.org/10.1111/j.1540-6210.2011.02417.x
45. Yin, R. K., 2009. *Case study research: Design and methods*. Thusand Oaks: SAGE Publications Inc.
46. Zepic, R., Dapp, M. and Krcmar, H. 2017. Reasons for low participation in German participatory budgeting: A public administration perspective. In: *Proceedings of the 17th European Conference on Digital Government*. Lisbon: Academic Conferences Limited, pp. 262-269.

Institute of
Public Finance