WHAT DRIVES PUBLIC SECTOR PERFORMANCE?

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Abstract

The aim of this paper is to estimate the relationship between public sector expenditure and public sector output. The literature in this field is relatively scarce due to difficulties in measuring public sector output. In this study we construct an index for public sector performance based on the structure presented by Afonso et al. (2005), for a panel of OECD countries between the years 2000-2010. We then estimate the effect of general government expenditure, as well as other variables, such as public debt and demographic structure, on public sector performance. We find that public sector expenditure is characterized by diminishing returns. Maximal public sector performance is achieved when the general government share of GDP is at 52%-60%, dependent on the control variables used. However, this range represents only an upper bound for optimal government size as it does not consider the opportunity cost of public expenditure. Moreover, increasing public expenditure beyond this range leads to lower public sector performance.

1. INTRODUCTION

The measurement of public sector performance has broad policy ramifications but has thus far proven exceedingly difficult. Unlike firms in the private sector, which generate a measurable stream of revenues and profits, the public sector supplies a wide range of public goods, such as health, security and education, which are harder to quantify. To illustrate this point, suffice it to note that in the national accounts, there is no measure of the government's added value, unlike the business sector. Thus, data limitations and

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methodological difficulties have restricted the efforts to analyze the effectiveness of public sector expenditure in supplying public goods.

In this paper we build on an innovative methodology of measuring public sector performance (PSP) to estimate the relationship between public sector expenditure and output. The PSP index is based on the work of Afonso et al. (2005). It is calculated using indicators regarding the core functions of the public sector such as education, infrastructure and health. We compute this index for the 34 OECD countries over the period of 2000-2010.

The theoretical literature suggests that public sector expenditure is characterized by diminishing returns. Samuelson (1954), Diamond and Mirrlees (1971), and Barro (1990) have presented models which featured diminishing returns for public sector expenditure. This paper is, to the best of our knowledge, the first attempt to empirically test the relationship between public sector performance and expenditure. We find that this relationship is indeed convex, and that public sector expenditure is therefore characterized by diminishing returns.

The rest of the paper is organized as follows: In the next section we review the relevant literature and in section 3 we present the structure of the PSP index and its results. In section 4 we present the database for the study. Section 5 presents and discusses the estimation results, and section 6 summarizes.

2. LITERATURE

This paper is linked to various categories in the economic literature. A significant effort has been made in recent decades to estimate the effect of government size on GDP growth. Thus far, however, this effort has been inconclusive. To illustrate, Ram (1986) finds a positive relationship between government size and GDP growth, while Sala-i-Martin (1996) finds no significant correlation between government spending and growth and Levine and Renelt (1992) claim that the vast majority of results in this field are sensitive to small changes in the specification of the independent variables. Devarajan et al (1996) test the influence of the composition of public expenditure on GDP growth among developing economies, and find that public expenditure, excluding investments, contributes to per capita GDP, while investments may reduce the standard of living.

More recent literature investigates the relationship between public sector expenditure and indicators of "happiness" which may be considered as an indirect measure of public sector performance. Bjørnskov et al. (2007) estimate the effect of government size on life satisfaction using a cross-section of 74 countries and find that there is a negative correlation between the two. Ram (2009), however, argues that government size does not affect happiness and Di Tella et al. (2003) find that the welfare state has a positive impact on happiness.

Another approach has been to investigate the relationship between public sector performance and public expenditure in specific areas. Gupta et al. (1997) estimate the relationship between public spending on health and a number of key indicators, such as life

expectancy and infant mortality. They similarly estimate the relationship between public spending on education and the rates of school enrollment and illiteracy.

A different string of literature attempts to quantify aggregate public sector output and assess its relationship to government expenditure. Measuring public sector output is difficult due to two main reasons. First, as noted above, the public sector is responsible for providing a wide range of public goods and services that are hard to quantify, such as clean air, clean streets and personal safety. Second, it is difficult to distinguish between the effect of public sector expenditure, and the effects of other factors such as local culture, global developments and private sector performance (Mandl et al., 2008).

Afonso et al. (2005) develop the approach presented by Tanzi and Schuknecht (1997) who deal with problems concerning the quantification of public sector output by constructing a public sector performance index that is based on indicators from key aspects of public sector activity. The index is calculated for a sample of 23 OECD countries for the years 1990 and 2000. This index is used to compare public sector performance across countries. The authors compare the performance and efficiency of public sector expenditure and find that larger governments tend to be less efficient. Tanzi and Schuknecht (1997) show that on average a larger government does not improve the main economic indicators related to the public sector. Afonso et al. (2010) use a similar methodology to assess the performance and efficiency of the public sector in emerging economies and Conte et al (2009) use a similar methodology in order to construct an index of public sector efficiency in promoting research and development for the 27 European Union countries.

The approach proposed by Afonso et al. allows for empirical estimation of the factors that influence public sector performance. The key hypothesis which is empirically tested in this paper relates to the theoretical notion of diminishing returns of public sector expenditure. This notion was presented by Samuelson (1954) and Diamond and Mirrlees (1971), who assumed that public sector output is characterized by diminishing returns. This notion was also presented by Barro (1990) in a context of a theoretical endogenous growth model where he shows that the returns on public sector expenditure are diminishing.

3. METHODOLOGY

This work presents a public sector performance index (PSPi), based on the methodology described by Afonso et al. (2005). The index is based on 7 main components that relate to the core functions of the public sector: law and order, health, education, infrastructure, income distribution, economic stability and economic performance (see Figure 1). The first four components (the left side of Figure 1) relate to the provision of public services and the latter three relate to less-direct policy consequences (the right side of the Figure).

Figure 1
The Structure of the Public Sector Performance Index
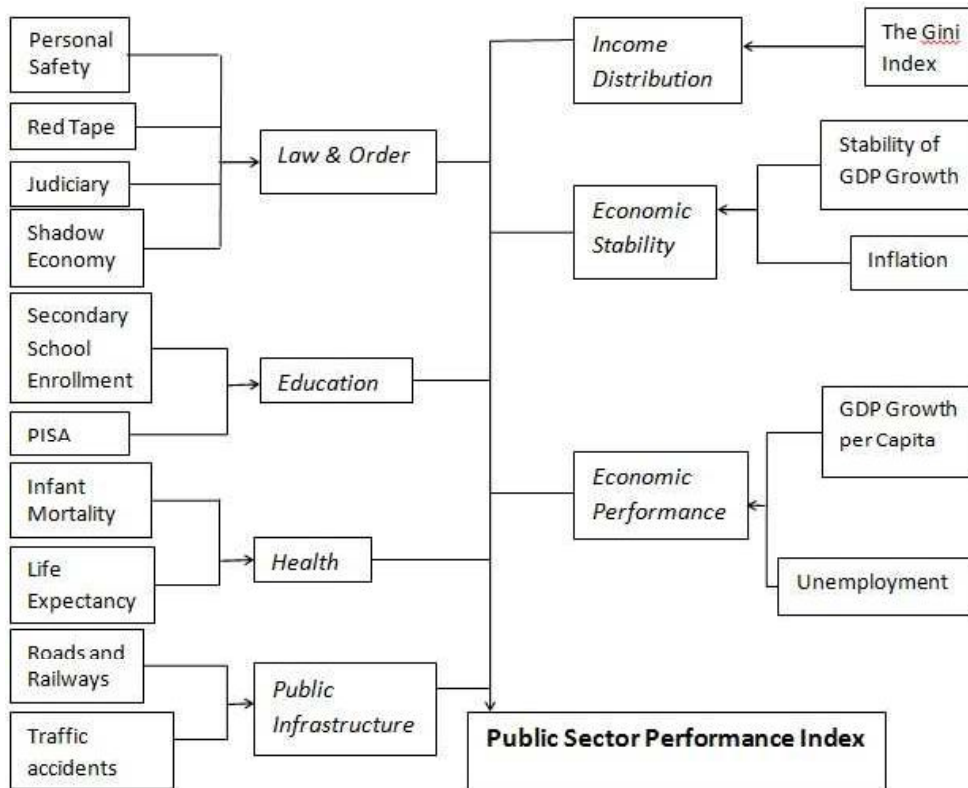
Each of the main components is based on an international comparison of a variety of indicators (for a description of all indicators, refer to the appendix). For example, in order to quantify public sector performance in the field of education, we used secondary school enrollment and average PISA test scores. In case of missing data, we use a linear approximation, based on the available data. The indicators for each component are normalized, in order to have identical moments of distribution (zero mean and standard deviation of one), and averaged to get the 7 main components. The main components are averaged again for the calculation of the PSP index. The PSP index and the main components for the year 2010 are presented in Table 1.

Table 1
**The PSPi and its Main Components, 2010**

	PSPi	Economic Performance	Stability	Income Distribution	Public Infrastructure	Health	Education	Law & Order
Norway	0.8	0.8	1.8	1.3	0.0	0.5	0.4	0.7
Sweden	0.7	-0.2	0.3	1.1	2.5	1.0	0.7	-0.2
New Zealand	0.5	-0.1	1.8	-0.5	-0.4	-0.1	0.9	2.0
Australia	0.5	0.6	2.5	-0.6	0.2	0.3	-0.2	0.7
Finland	0.4	-0.3	0.2	1.1	-0.3	0.7	1.4	-0.2
Denmark	0.4	0.6	0.4	1.4	0.1	-0.2	0.0	0.2
Japan	0.4	0.2	-0.9	-0.5	0.3	1.3	1.1	0.9
Iceland	0.3	-0.6	-1.0	0.1	1.6	1.9	0.0	0.3
Slovenia	0.3	0.3	-0.3	1.8	0.0	0.5	0.0	-0.1
Switzerland	0.3	1.2	-0.2	0.0	0.1	0.3	-0.1	0.8
South Korea	0.3	1.8	-0.1	-0.2	-0.8	0.0	1.2	0.1
Belgium	0.3	-0.3	0.7	1.1	0.5	0.2	0.1	-0.2
Netherlands	0.3	0.9	-0.4	0.2	1.0	0.1	0.1	0.1
Austria	0.2	0.7	-0.2	1.0	-0.3	0.3	-0.6	0.9
Luxembourg	0.2	0.2	-0.1	0.4	-0.2	1.0	-0.7	0.4
France	0.1	-0.5	0.2	0.2	-0.2	0.4	0.6	0.2
Czech R.	0.1	0.3	-0.1	1.2	-0.3	-0.3	0.1	-0.5
Germany	0.0	0.0	-0.5	0.2	0.0	0.2	0.1	0.1
Canada	0.0	-0.4	-0.1	-0.4	0.3	0.0	0.5	-0.2
Slovakia	-0.1	0.6	-0.5	1.1	-0.5	-1.5	0.6	-0.4
UK	-0.1	-0.5	0.2	-0.7	0.3	-0.2	0.2	0.1
Poland	-0.1	1.1	0.3	0.0	-0.4	-1.2	0.4	-0.7
Spain	-0.1	-1.1	0.5	-0.2	-0.1	0.3	0.0	-0.4
Israel	-0.2	0.4	1.2	-1.1	-0.4	0.4	-1.0	-0.8
Italy	-0.3	-0.8	0.0	-0.6	-0.3	0.6	0.0	-0.7
Hungary	-0.3	-0.7	-0.8	0.7	0.0	-1.6	0.6	-0.1
Ireland	-0.3	-1.4	-0.9	0.2	0.2	0.1	-0.1	-0.2
United States	-0.3	-0.5	0.1	-1.2	-0.4	-0.7	0.1	0.6
Greece	-0.4	-0.7	-0.5	0.0	-0.7	0.3	-0.3	-0.7
Portugal	-0.4	-0.5	0.1	-0.8	-0.5	0.2	-0.9	-0.4
Estonia	-0.5	-1.3	-1.0	-0.2	0.7	-1.6	0.5	-0.6
Chile	-0.8	0.2	-0.5	-2.3	-1.0	-0.4	-1.2	-0.6
Turkey	-1.0	-0.2	-1.0	-1.6	-0.5	-1.6	-1.4	-0.5
Mexico	-1.2	0.2	-0.9	-2.2	-0.5	-1.2	-3.1	-0.7

The construction of the PSP index, as presented in this paper, is based on the work of Afonso et al. (2005), but contains a number of important changes. First, our index includes only quantitative data and does not include subjective survey data. Using subjective data in an international comparison is problematic as different responses might reflect cultural differences and local standards rather than differences in public sector performance.

Second, we normalize the variance of the indicators, and not just the average, to ensure that indicators with a larger variance do not disproportionately affect the index. Third, we expand the set of indicators to include additional government functions such as personal safety (through the number of homicides committed per 100,000 inhabitants) and infrastructure quality (through the number of traffic accident fatalities per capita and per length of roads) that were not included in the original index. Fourth, we replace the GDP growth indicator with GDP growth *per capita* in order to better reflect economic performance. Fifth, we drop the GDP per capita indicator from the index, as public sector performance affects GDP per capita *growth*, which is already included in the index. Finally, we calculate the index for the 34 OECD countries for the years 2000 to 2010 (compared to 23 countries and two years in the work of Afonso et al (2005)).

In order to assess the results of the index, we compare the PSPi scores obtained for 2010 with the results of a well-being survey conducted by the OECD, based on the work of Boarini et al (2011). The comparison shows that there is a significant positive correlation between public sector performance, according to our index, and the well-being survey of the OECD (Figure 2).

Figure 2
PSPi and the How is Life Index, Scatter Graph, 2010
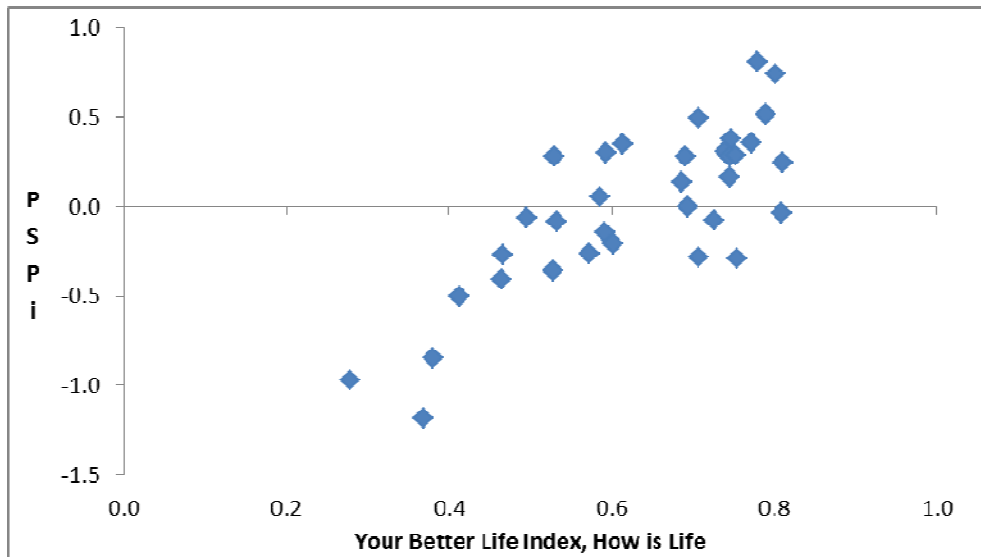
4. DATA

Table 2 presents the data used in the econometric analysis, which will be discussed in the fifth section. This data was collected from the OECD, IMF, World Bank, UN, and IMD.

Table 2
Descriptive Statistics, OECD, 2000-2010

	Mean	Median	Maximum	Minimum	Std. Dev.	Stationary	Observations	Source
PSPi	0.01	0.1	1.05	-1.34	0.45	yes	374	calculated
General Government Expenditure[a]	41.6	42.6	66.0	17.9	8.8	yes	372	IMF
Public Debt[a]	54.9	50.4	220.0	3.7	35.1	no	374	IMF
Latitude	40.9	47.3	65.0	-41.0	24.9	-	34	-
Dependency Ratio[b]	48.9	48.8	62.0	37.6	4.7	no	374	IMD
Private Health Expenditure[a]	2.4	2.2	8.3	0.6	1.3	yes	374	World Bank
Share of immigrants	0.11	0.09	0.38	0.01	0.09	yes	374	World Bank
Output Gap[a]	0.08	0.22	13.82	-10.12	2.93	yes	374	OECD
GDP per Capita	28,695	28,511	82,927	7,803	11,937	no	374	IMF
Adolescent Fertility[c]	17.5	13.2	75.7	2.2	15.2	yes	374	World Bank
Corruption Index	5.5	5.8	9.6	0.7	2.3	yes	374	IMD

[a] as a percentage of GDP.
[b] Population aged 15 and under, plus population aged 65 and over, divided by the rest of the population.
[c] births per 1,000 women aged 15-19.

5. ESTIMATION

a. Specification

In this chapter we estimate the relationship between public sector expenditure and the PSP index. This estimation allows us to test the hypothesis that public sector performance is characterized by diminishing returns. The hypothesis is consistent with theoretical models presented by Samuelson (1954), Diamond and Mirrlees (1971) and Barro (1990). We expect to find an inverted-U shaped relationship between general government expenditure and the PSPi for two main reasons. First, the law of diminishing returns should apply to several of the public sector functions; for example, raising life expectancy from 84 to 85 should be more expensive than raising it from 64 to 65. Second, a larger public sector share

of the economy crowds out the private sector, which could have a negative impact on economic performance.

We estimate the relationship between public sector performance and public expenditure's share of GDP while using different sets of controlling variables, which include public debt, demographic structure, latitude, private expenditure on health, the share of immigrants in the population, the output gap, GDP per capita, the birth rate among young women, a corruption index and regional dummy variables. The full specification, which includes the full set of control variables, is as follows:

$$(1) \qquad P_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 \left(E_{i,t}\right)^2 + \beta_3 \log\left(D_{i,t}\right) + \beta_4 PH_{i,t} + \beta_5 DR_{i,t} + \beta_6 L_i + \beta_7 PCY_{i,t} + \beta_8 FB_{i,t} + \beta_9 GAP_{i,t} + \beta_{10} TM_{i,t} + \beta_{11} C_{i,t} + Regional\ Dummies + \varepsilon_{i,t}$$

Where $P_{i,t}$ indicates the PSP index, $E_{i,t}$ indicates public expenditure as a percentage of GDP, $D_{i,t}$ indicates public debt as a percentage of GDP, $PH_{i,t}$ indicates private expenditure on health as a percentage of GDP, $DR_{i,t}$ indicates the dependency ratio, $L_{i,t}$ indicates geographic latitude, $PCY_{i,t}$ indicates GDP per capita, $FB_{i,t}$ indicates the share of immigrants in the population, $GAP_{i,t}$ indicates the output gap, $TM_{i,t}$ indicates the fertility rate of women aged of 15-19 and $C_{i,t}$ indicates the corruption index.

We expect to find that public debt has a negative impact on performance. The level of debt has a direct impact on interest payments which, for a given public expenditure, restricts the resources available for other expenditure (see Tanzi & Chalk, 2000). In addition, a high level of debt reduces the effectiveness of anti-cyclical fiscal policy. Thus, for instance, Reinhart and Rogoff (2010) found that growth in advanced countries with a debt to GDP ratio of more than 90 percent is 1 percentage point lower than for countries with lower debt. Kumar and Woo (2010) found similar results.

The performance of the public sector is also affected by the country's demographic composition, as a high dependency ratio (i.e. a large share of the population is either younger than 15 or older than 65) may lead to excessive education, health and welfare spending, to attain the same level of performance. Therefore, when we control for aggregate public expenditure, we expect to find a negative relationship between the PSPi and the dependency ratio.

The effect of the share of immigrants in the population is less clear. While a large stock of immigrants could lead to greater inequality in income distribution and to an excess of public expenditure on transfer payments, it may also lead to better economic performance due to increased international trade with the immigrants' native countries, as well as enhanced cultural diversity.

We also examine the effect of private health expenditure on the PSPi. For a given share of public expenditure in GDP, additional private spending on health services should have a positive effect on the performance of the health system, and thereby increase the PSPi. However, private health expenditure could also reflect the degree of privatization in the economy. Taking into account that a high degree of privatization might lead to higher inequality, private expenditure on healthcare may actually have a negative effect on the PSPi.

We expect that the output gap will have a positive correlation with the index, due to its relationship with the economic performance component. In addition, we expect to find that GDP per capita, which reflects the level of economic development, has a positive impact on public sector performance.

We also estimate the impact of the adolescent fertility rate (births per 1,000 women aged 15-19). We believe this variable captures cultural characteristics and that it will have a negative effect on public sector performance mainly due to a negative impact on education, labor force participation, and inequality in income distribution. We also expect to find that a low level of corruption (which is indicted by *high*er values of the corruption index) will be associated with improved public sector performance.

In addition, the estimation also includes regional dummy variables for North America, South America, Northern Europe, Southern Europe, Eastern Europe and Oceania[4]. The inclusion of dummy variables captures differences between countries that result from geographic location, common cultural characteristics, climate, etc.

Several works have found a connection between latitude and economic performance. This literature emphasizes the differences between the quality of institutions, management, and entrepreneurship found in northern and southern countries (Acemoglu et al., 2005). Thus, we add latitude to the estimation and expect this variable to have a positive effect on the PSPi.

b. Empirical results

Our key result is that public sector expenditure is characterized by diminishing returns, in accordance with the theoretical literature (see Figure 3). This relationship is evident across all specifications presented in Table 3. For example, according to specification (1) in Table 3, public expenditure of 52.8% of GDP maximizes public sector performance. Introducing various control variables does not significantly change the relationship between the PSPi and public sector expenditure; in all specifications the government share of GDP that maximizes the PSPi is found to be in the range of 52%-60%. Note that this maximum does not imply an optimal government size, as it does not consider the opportunity cost of public expenditure; rather, it implies that beyond the value at which the maximum PSPi value is obtained, a further increase in public sector expenditure will have a negative impact on performance. In addition, we estimate the relationship between civil expenditure (excluding defense expenditure) and the performance of the public sector (see Table 4). These results confirm our key finding of diminishing returns for public expenditure. In this specification the upper bound of the optimal size of government is higher because expenditure on defense does not contribute directly to public sector performance, and may also reflect a problematic geopolitical environment.

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[4] The regional classification is as follows: North America: the United States and Canada; South America: Mexico and Chile; Northern Europe: Austria, Belgium, Denmark, Finland, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland and the UK; Southern Europe: France, Spain, Italy, Portugal and Greece; Eastern Europe: Czech Republic, Hungary, Estonia, Poland, Slovakia, Slovenia and Turkey; Oceania: Australia, New Zealand, South Korea and Japan; Middle East: Israel.

Figure 3
Public Sector Expenditure and the PSPi
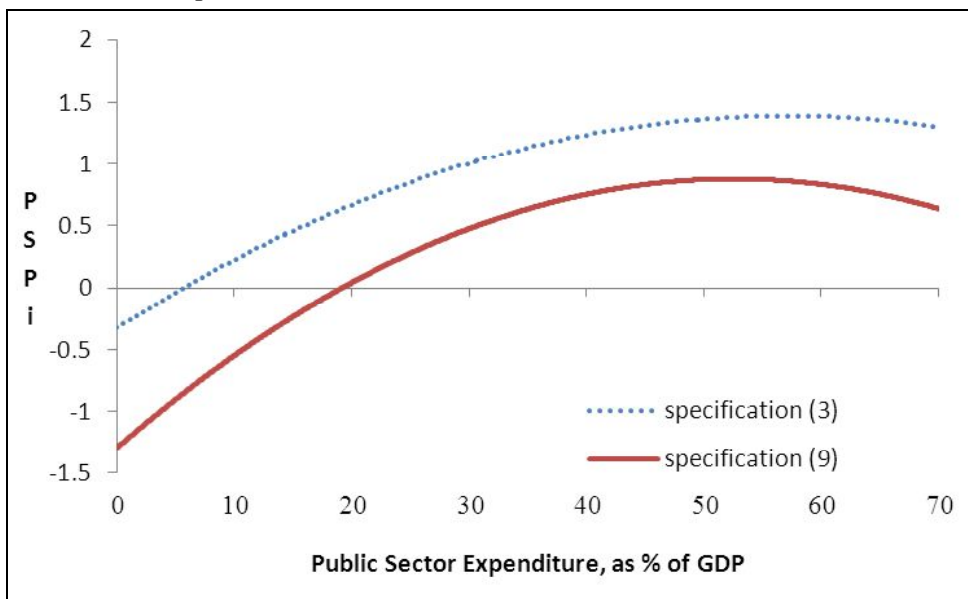
In order to further investigate these findings we decompose the PSPi into two indexes; one index for public sector services, which includes the law and order, education, health and infrastructure components of the PSPi, and another index for public sector policy, which includes the income distribution, economic stability and economic performance components. We then estimate the effect of public sector expenditure, as well as other controlling variables, on these indices (see Table 4).

Table 3
Main estimation results – Dependent Variable: PSPi

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Public Expenditure	0.0633	0.0438	0.0600	0.0866	0.0896	0.097	0.1045	0.0898	0.0826	0.0555
	$(0.0170)^{***}$	$(0.0145)^{***}$	$(0.0144)^{***}$	$(0.0142)^{***}$	$(0.0141)^{**}$	$(0.0147)^{***}$	$(0.0141)^{***}$	$(0.0144)^{***}$	$(0.0133)^{***}$	$(0.0126)^{***}$
(Public Expenditure)^2	-0.0006	-0.0004	-0.00052	-0.0008	-0.0008	-0.0009	-0.0009	-0.0008	-0.0008	-0.0005
	$(0.0002)^{***}$	$(0.0002)^{**}$	$(0.0002)^{***}$	$(0.0002)^{***}$	$(0.0002)^{***}$	$(0.0002)^{***}$	$(0.0002)^{***}$	$(0.0002)^{***}$	$(0.0002)^{***}$	$(0.0001)^{***}$
Public Debt		-0.0971	-0.0827	-0.1313	-0.1541	-0.1715	-0.1478	-0.1316	-0.1700	-0.0512
		$(0.0213)^{***}$	$(0.0209)^{***}$	$(0.0210)^{***}$	$(0.0227)^{**}$	$(0.0248)^{***}$	$(0.0238)^{***}$	$(0.0238)^{***}$	$(0.0226)^{***}$	$(0.0251)^{**}$
Dependency Ratio			-0.0193	-0.016	-0.0137	-0.0135	-0.0172	-0.0158	0.0027	-0.0071
			$(0.0040)^{***}$	$(0.0038)^{***}$	$(0.0039)^{**}$	$(0.0039)^{***}$	$(0.0038)^{***}$	$(0.0037)^{***}$	(0.0042)	$(0.004)^{*}$
Latitude				0.0061	0.0051	0.0059	0.0061	0.0050	0.0014	0.0042
				$(0.0009)^{***}$	$(0.0010)^{**}$	$(0.0011)^{***}$	$(0.0010)^{***}$	$(0.0011)^{***}$	(0.0011)	$(0.0011)^{***}$
Foreign Born Population					-0.5793	-0.5979	-0.4785	-0.8178	-1.6275	-1.1254
					$(0.2252)^*$	$(0.2248)^{***}$	$(0.2170)^{**}$	$(0.2316)^{***}$	$(0.2394)^{***}$	$(0.2269)^{***}$
Private Health Expenditure						0.0269	0.0386	0.0344	0.0282	0.0368
						$(0.0157)^{*}$	$(0.0151)^{**}$	$(0.0148)^{**}$	$(0.0138)^{**}$	$(0.0126)^{***}$
Output Gap							0.0434	0.0422	0.0397	0.0369
							$(0.0064)^{***}$	$(0.0063)^{***}$	$(0.0059)^{***}$	$(0.0054)^{***}$
GDP per Capita								0.0072	0.0067	0.0089
								$(0.0019)^{***}$	$(0.0018)^{***}$	$(0.0016)^{***}$
Adolescent Fertility Rate									-0.0153	-0.0120
									$(0.0020)^{***}$	$(0.0019)^{***}$
The Corruption Index										0.0844
										$(0.0101)^{***}$
Constant	-1.5537	-0.9414	-0.3224	-1.1869	-1.1034	-1.3177	-1.5915	-1.4891	-1.2953	-1.4541
	$(0.3246)^{***}$	$(0.3165)^{***}$	(0.3323)	$(0.3395)^{***}$	$(0.3384)^{**}$	$(0.3599)^{***}$	$(0.3436)^{***}$	$(0.3385)^{***}$	$(0.3146)^{***}$	$(0.2881)^{***}$
Regional dummies	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Period fixed effect	no	no	no	no	no	no	yes	yes	yes	yes
Observations	372	372	372	372	372	372	372	372	372	372
R-squared	0.133	0.671	0.691	0.725	0.730	0.732	0.767	0.776	0.808	0.841
Expenditure maximizing PSP	52.8	58.7	57.1	54.1	56.0	53.9	56.4	59.3	52.6	53.5

***, ** and * represent significance at 1%, 5% and 10% levels respectively. Estimation results for the regional dummies are presented in Table 8.

Table 4
Public sector expenditure, with and without defense spending—based on spec. (10)

Dependent variable, PSPi	Expenditures, including defense expenditures	Expenditures, not including defense expenditures
Public Expenditure	0.0555 (0.0126)***	0.0519 (0.0125)***
(Public Expenditure)^2	-0.0005 (0.0001)***	-0.0005 (0.0002)***
Public Debt	-0.0512 (0.0251)**	-0.0706 (0.0271)***
Dependency Ratio	-0.0071 (0.004)*	-0.0074 (0.0041)*
Latitude	0.0042 (0.0011)***	0.0044 (0.0010)***
Foreign Born Population	-1.1254 (0.2269)***	-1.1962 (0.2391)***
Private Health Expenditure	0.0368 (0.0126)***	0.0499 (0.0130)***
Output Gap	0.0369 (0.0054)***	0.038 (0.0056)***
GDP per Capita	0.0089 (0.0016)***	0.0089 (0.0017)***
Adolescent Fertility Rate	-0.012 (0.0019)***	-0.0119 (0.0019)***
The Corruption Index	0.0844 (0.0101)***	0.0825 (0.0105)***
Constant	-1.4541 (0.2881)***	-1.2702 (0.2621)***
North America	-0.1359 (0.0852)	-0.1682 (0.0872)*
Northern Europe	-0.1013 (0.0564)*	-0.169 (0.0577)***
Southern Europe	-0.2167 (0.0641)***	-0.2825 (0.0671)***
Oceania	0.4757 (0.0958)**	0.4518 (0.0882)***
South America	0.2451 (0.1172)**	0.2219 (0.1134)*
Eastern Europe	-0.1158 (0.073)	-0.181 (0.0780)**
Period fixed effects	yes	yes
Observations:	372	338
R-squared:	0.840	0.854
Expenditure maximizing PSP	53.5	56.2

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

As a result of the decomposition into two indices, we expect to find that the public sector services index is characterized by diminishing returns with regards to public sector expenditure, since, as we noted, increasing life expectancy from 84 to 85 is more expensive than increasing it from 64 to 65. This logic also applies to other public services such as education, infrastructure and personal safety. In contrast, we do not expect to find that the public sector policy index is characterized by diminishing returns, as the same logic does not apply to its components, such as economic stability and economic performance. The estimation results of the public sector services and policy indices are presented in Table 5. As expected, we find that the public sector services index is characterized by diminishing returns, while the public sector policy index is not. In addition, we see that the impact of public spending on the provision of public services is significantly greater than its effect on economic policy outcomes.

The estimated effects of the other variables on the PSPi are in line with our predictions. As expected, public debt has a negative effect on performance. We find that a reduction of 2 percentage points in the Debt-to-GDP ratio leads to a 0.1 percentage point increase in the PSPi. As mentioned above, the negative effect may be a result of interest payments crowding out other public expenditures, or due to decreased effectiveness of anti-cyclical fiscal policy for countries with high levels of debt. In order to distinguish between these two possible explanations, we re-estimate specification (10) in Table 3, by separating between interest payments and other government expenditures. Our results suggest that the negative impact of public debt on the PSP index stems from interest payments crowding out other government expenditures. The results presented in Table 6 show that including interest payments in the estimation renders the coefficient for public debt insignificant while the coefficient for interest payments is significant and negative. In addition, we add an interaction variable between public debt and expenditure to specification (10) in Table 3 (see Table 7). The results indicate that the mechanism by which public debt affects the performance of the public sector is through decreased public sector effectiveness in countries with high public debt, in accordance with the findings of Reinhart and Rogoff (2010).

We also find that the demographic dependency ratio has a negative impact on public sector performance. Thus, the expected increase in the dependency ratio in the next few decades, due to population aging in most OECD countries should lead to an increase in the public sector's share of GDP, or decreased public sector performance.

Table 5
Public sector services and policy indices, based on specification (10)

Dependent variable	Public Sector Services Index	Public Sector Policy Index
Government Expenditure	0.1110 (0.0149)***	0.0155 (0.0041)***
(Government Expenditure)^2	-0.0011 (0.0002)***	
Public Debt	-0.2323 (0.0251)***	-0.1930 (0.0348)***
Dependency Ratio	0.0143 (0.0045)***	-0.0120 (0.0063)*
Latitude	0.0017 (0.0012)	0.0006 (0.0016)
Foreign Born Population	-1.5877 (0.2553)***	-1.5128 (0.3583)***
Private Health Expenditure	0.0184 (0.0147)	0.0523 (0.0200)***
Output Gap	0.0080 (0.0063)	0.0750 (0.0088)***
GDP per Capita	-0.0002 (0.0019)	0.0091 (0.0027)***
Adolescent Fertility Rate	-0.0178 (0.0022)***	-0.0067 (0.0030)**
The Corruption Index	0.1193 (0.0167)***	0.0648 (0.0222)***
Constant	-1.9456 (0.3580)***	0.6838 (0.3105)**
North America	0.4641 (0.0935)***	-0.2517 (0.1299)*
Northern Europe	-0.0232 (0.0641)	-0.0383 (0.0898)
Southern Europe	-0.3975 (0.0707)***	-0.4427 (0.0992)***
Oceania	0.6009 (0.1138)***	-0.0170 (0.1496)
South America	0.0223 (0.1383)	-0.3576 (0.1690)**
Eastern Europe	-0.7049 (0.0722)***	-0.1863 (0.1003)*
Period fixed effects	yes	yes
Observations:	372	372
R-squared:	0.857	0.601
Expenditure maximizing PSP	50.1	-

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

Table 6
Specification with interest payments, based on Specification (10)

Dependent variable	PSPi	PSPi[a]
Government Expenditure	0.0555 (0.0126)***	0.0478 (0.0148)***
(Government Expenditure)^2	-0.0005 (0.0001)***	-0.0005 (0.0002)***
Interest Payments		-0.0299 (0.0089)***
Public Debt	-0.0512 (0.0251)**	0.0145 (0.0288)
Dependency Ratio	-0.0071 (0.004)*	0.0013 (0.0042)
Latitude	0.0042 (0.0011)***	0.0012 (0.0013)
Foreign Born Population	-1.1254 (0.2269)***	-1.2071 (0.2646)***
Private Health Expenditure	0.0368 (0.0126)***	0.0132 -0.0128
Output Gap	0.0369 (0.0054)***	0.0341 (0.0055)***
GDP per Capita	0.0089 (0.0016)***	0.0066 (0.0016)***
Adolescent Fertility Rate	-0.0120 (0.0019)***	-0.01 (0.0023)***
The Corruption Index	0.0844 (0.0101)***	0.0771 (0.0100)***
Constant	-1.4541 (0.2881)***	-1.5026 (0.3214)***
North America	-0.1359 (0.0852)	-0.0655 (0.083)
Northern Europe	-0.1013 (0.0564)*	-0.0313 (0.0591)
Southern Europe	-0.2167 (0.0641)***	-0.189 (0.0687)***
Oceania	0.4757 (0.0958)***	0.2624 (0.1119)**
South America	0.2451 (0.1172)**	
Eastern Europe	-0.1158 (0.0730)	-0.0336 (0.0795)
Period fixed effects	yes	yes
Observations:	372	340
R-squared:	0.841	0.753
Expenditure maximizing PSP	53.5	49.5

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.
a. The coefficients for public sector expenditure in this specification do not include interest payments.
Due to lack of data this specification does not include Mexico, Chile and Turkey.

Table 7
Specification with interaction variables for government expenditure with public debt and latitude, based on Specification (10)

Dependent variable	PSPi	PSPi
Government Expenditure	0.0555 (0.0126)***	0.0593 (0.0121)***
(Government Expenditure)^2	-0.0005 (0.0001)***	-0.0008 (0.0001)***
Public Debt	-0.0512 (0.0251)**	0.0769 (0.0325)**
Dependency Ratio	-0.0071 (0.004)*	-0.0035 (0.004)
Latitude	0.0042 (0.0011)***	-0.0126 (0.0039)***
Foreign Born Population	-1.1254 (0.2269)***	-0.4301 (0.2626)
Private Health Expenditure	0.0368 (0.0126)***	0.0625 (0.0130)***
Output Gap	0.0369 (0.0054)***	0.0423 (0.0052)***
GDP per Capita	0.0089 (0.0016)***	0.0102 (0.0016)***
Adolescent Fertility Rate	-0.0120 (0.0019)***	-0.0113 (0.0019)***
The Corruption Index	0.0844 (0.0101)***	0.0617 (0.0104)***
Constant	-1.4541 (0.2881)***	-2.0525 (0.3098)***
North America	-0.1359 (0.0852)	-0.2152 (0.0854)**
Northern Europe	-0.1013 (0.0564)*	-0.1138 (0.0537)**
Southern Europe	-0.2167 (0.0641)***	-0.123 (0.0635)*
Oceania	0.4757 (0.0958)***	0.779 (0.1051)***
South America	0.2451 (0.1172)**	0.2932 (0.1181)**
Eastern Europe	-0.1158 (0.0730)	-0.044 (0.0704)*
Government Expenditure*Latitude		0.0006 (0.0001)***
Government Expenditure*Debt		-0.0001 (0.0000)***
Period fixed effects	yes	yes
Observations:	372	372
R-squared:	0.84	0.856
Expenditure maximizing PSP	53.5	48.5

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

The country's latitude, which we treat as a proxy for the quality of institutions (see Acemoglu et al., 2005), is found to have a positive impact on public sector performance. In addition, Table 7 shows the estimation of the main specification of this work (Specification (10) in Table 3) with the addition of the interaction variable between latitude and government expenditure. The addition of the interaction variable shows that the mechanism through which latitude affects PSP operates is through a change in the effectiveness of public sector expenditure. Population heterogeneity, as reflected in the share of the immigrant population, has a negative impact on public sector performance. This may suggest that the negative impact derived from greater inequality in income distribution and its related negative implications (such as limited access to health services and education for parts of the population) outweighs the possible benefits resulting from increased foreign trade related to immigration.

Private health expenditure has a positive impact on the PSPi. For a given level of public expenditure, additional private spending on health should indeed increase the PSPi. Moreover, assuming that private health expenditure is correlated with the degree of privatization of public services, a positive coefficient may imply that the benefits to the economy of privatization are greater than the disadvantages.

The output gap has a clear positive effect on the PSPi, since the unemployment rate and growth of GDP per capita, which are correlated with the output gap, are part of the PSPi. GDP per capita is also positively correlated with the index. Economic development, as reflected in GDP per capita, may be associated with the level of technology which also supports the provision of public services. GDP per capita may also be related to the quality of institutions.

As expected, we find that the adolescent fertility rate has a negative impact on public sector performance. This finding is compatible with the notion that a high adolescent fertility rate has a negative effect on education, on the rate of participation in the labor force, and on inequality in income distribution. In addition, we find that corruption has a negative impact on public sector performance: an increase of 1.2 percentage points in the corruption index (that is, less corruption) leads to an increase of 0.1 percentage points in the PSPi.

The regional dummy variables reflect cultural differences, climate, and other factors which are not explicitly included in the regression. The results reveal that for most specifications the coefficients for the regional dummies of North America (model (2)), northern Europe, and Oceania are positive, while those for southern and eastern Europe and South America are negative (see Table 8).

Table 8
Main estimation results (table 3 continued), regional dummies coefficients. Dependent Variable: PSPi

Specification:	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
North America	0.2557	0.0863	0.0978	0.0869	0.0026	-0.0326	-0.0993	0.1134	-0.1359
	$(0.0800)^{***}$	(0.0850)	(0.0803)	(0.0798)	(0.0935)	(0.0891)	(0.0893)	(0.0873)	(0.0852)
Northern Europe	0.4376	0.3088	0.2466	0.2092	0.1957	0.1802	0.0971	0.0208	-0.1013
	$(0.0612)^{***}$	$(0.0650)^{***}$	$(0.0621)^{***}$	$(0.0633)^{**}$	$(0.0637)^{***}$	$(0.0604)^{***}$	(0.0634)	(0.0596)	$(0.0564)^{*}$
Southern Europe	-0.0083	-0.1494	-0.1167	-0.1857	-0.1896	-0.2172	-0.2523	-0.3919	-0.2167
	(0.0685)	$(0.0725)^{**}$	$(0.0686)^{*}$	$(0.0732)^{*}$	$(0.0730)^{***}$	$(0.0693)^{***}$	$(0.0687)^{***}$	$(0.0663)^{***}$	$(0.0641)^{***}$
Oceania	0.5889	0.4908	0.822	0.719	0.7756	0.8922	0.7996	0.4323	0.4757
	$(0.0786)^{***}$	$(0.0789)^{***}$	$(0.0895)^{***}$	$(0.0974)^{**}$	$(0.1026)^{***}$	$(0.0990)^{***}$	$(0.1003)^{***}$	$(0.1047)^{***}$	$(0.0958)^{***}$
South America	-0.5902	-0.5016	-0.1155	-0.3036	-0.2699	-0.0638	-0.1157	0.0202	0.2451
	$(0.1087)^{***}$	$(0.1070)^{***}$	(0.1164)	$(0.1367)^{*}$	$(0.1377)^{*}$	(0.1351)	(0.1334)	(0.1249)	$(0.1172)^{**}$
Eastern Europe	-0.1555	-0.3657	-0.3812	-0.4643	-0.4703	-0.4613	-0.4195	-0.4391	-0.1158
	$(0.0634)^{**}$	$(0.0751)^{***}$	$(0.0710)^{***}$	$(0.0775)^{**}$	$(0.0774)^{***}$	$(0.0744)^{***}$	$(0.0729)^{***}$	$(0.0676)^{***}$	(0.0730)

***, ** and * represent significance at the 1%, 5% and 10% levels respectively. No regional dummy variables were included for specification (1).

c. Robustness tests

We proceed to test the robustness of the results. First, we address the issue of the potential endogeneity of public sector expenditure with regards to public sector performance. Endogeneity in this case may derive from two possible channels: the omission of a relevant variable or reverse causality. Omitted variable bias could distort our results if the omitted variable affects both public sector performance and public sector expenditure. Reverse causality could be an issue if public sector performance affects the level of public expenditure. For instance, poor public sector performance could lead to higher public sector expenditure, in order to improve performance.

To address the potential bias resulting from the omission of a relevant variable, we take a number of steps. First, we include in our regressions regional dummy variables, which control for all regional characteristics that are constant over time (such as culture, climate, and so forth). Second, we employ a 2SLS methodology, which is intended to also deal with bias resulting from reverse causality. We use public sector expenditure for the years 1982 and 1995 as an instrumental variable. We show that past expenditure levels affect current expenditure, while assuming that they do not directly affect public sector performance during 2000-2010. The estimation results reported in Table 9 show that there is little difference between the OLS and 2SLS results, particularly with respect to the existence of diminishing returns of public sector performance. Therefore, we conclude that the potential endogeneity of public sector expenditure does not bias our results. In order to deal with the potential bias due to reverse causality we estimate specification (9) in Table 10 with lagged independent variables[5]. The results show that our main findings do not change significantly.

Table 9
Estimation results using instrumental variables, based on specification (9), Dependent Variable: PSPi

Estimation method	OLS - Full Sample	OLS - Partial Sample[a]	2SLS
Government Expenditure	0.0826 (0.0133)***	0.0765 (0.0139)***	0.3773 (0.1032)***
(Government Expenditure)^2	-0.0008 (0.0002)***	-0.0007 (0.0002)***	-0.0044 (0.0013)***
Public Debt	-0.1700 (0.0226)***	-0.1673 (0.0309)***	-0.3911 (0.0919)***
Dependency Ratio	0.0027 (0.0042)	0.0069 (0.0046)	0.0151 (0.0090)
Latitude	0.0014 (0.0011)	-1.5210 (0.2513)***	-1.5133 (0.4475)***
Foreign Born Population	-1.6275 (0.2394)***	0.0020 (0.0013)	0.0102 (0.0036)***
Private Health Expenditure	0.0282 (0.0138)**	0.0337 (0.0144)**	0.1037 (0.0343)***
Output Gap	0.0397 (0.0059)***	0.0453 (0.0073)***	0.0344 (0.0136)**
GDP per Capita	0.0067 (0.0018)***	0.0057 (0.0020)***	-0.0104 (0.0063)*
Adolescent Fertility Rate	-0.0153 (0.0020)***	-0.0131 (0.0021)***	-0.0209 (0.0047)***
Constant	-1.2953 (0.3146)***	-1.5302 (0.3297)***	-6.9672 (1.8972)***
North America	0.1134 (0.0873)	0.1409 (0.0894)	0.0931 (0.1585)
Northern Europe	0.0208 (0.0596)	0.0847 (0.0617)	0.1812 (0.1131)
Southern Europe	-0.3919 (0.0663)***	-0.3278 (0.0702)***	-0.2623 (0.1239)**
Oceania	0.4323 (0.1047)***	0.5369 (0.1153)***	1.1504 (0.2991)***
South America	0.0202 (0.1249)	-0.0370 (0.1289)	1.1564 (0.4603)**
Eastern Europe	-0.4391 (0.0676)***	-0.4694 (0.0712)***	-0.5910 (0.1286)***
Period fixed effects	yes	yes	yes
Observations:	372	327	327
R-squared:	0.808	0.828	0.493
First stage F-statistic	-	-	122.5
Expenditure maximizing PSP	52.6	54.6	43.0

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

a. Sample identical to the 2SLS specification, which is limited to countries which were independent in 1982.

Table 10
Sensitivity to lagged effects, Based on Specification (10)

Number of lags	No lags	1	2	3
Government Expenditure	0.0555 (0.0126)***	0.0516 (0.0141)***	0.0581 (0.0155)***	0.0666 (0.0165)***
(Government Expenditure)$^{\wedge 2}$	-0.0005 (0.0001)***	-0.0005 (0.0002)***	-0.0006 (0.0002)***	-0.0006 (0.0002)***
Public Debt	-0.0512 (0.0251)**	-0.0566 (0.0265)**	-0.0695 (0.0281)**	-0.0864 (0.0315)***
Dependency Ratio	-0.0071 (0.004)*	-0.0054 (0.0044)	-0.0040 (0.0047)	-0.0023 (0.0053)
Latitude	0.0042 (0.0011)***	0.0041 (0.0011)***	0.0038 (0.0012)***	0.0036 (0.0013)***
Foreign Born Population	-1.1254 (0.2269)***	-1.0942 (0.2407)***	-1.1101 (0.2541)***	-1.1304 (0.2755)***
Private Health Expenditure	0.0368 (0.0126)***	0.0343 (0.0130)***	0.0295 (0.0137)**	0.0283 (0.0146)*
Output Gap	0.0369 (0.0054)***	0.0370 (0.0056)***	0.0377 (0.0056)***	0.0381 (0.0057)***
GDP per Capita	0.0089 (0.0016)***	0.0086 (0.0017)***	0.0075 (0.0019)***	0.0061 (0.0021)***
Adolescent Fertility Rate	-0.0120 (0.0019)***	-0.0126 (0.0020)***	-0.0135 (0.0022)***	-0.0137 (0.0024)***
The Corruption Index	0.0844 (0.0101)***	0.0843 (0.0105)***	0.0783 (0.0110)***	0.0728 (0.0119)***
Constant	-1.4541 (0.2881)***	-1.4183 (0.3137)***	-1.4523 (0.3352)***	-1.5609 (0.3517)***
North America	-0.1359 (0.0852)	-0.1087 (0.089)	-0.0750 (0.0939)	-0.0520 (0.1015)
Northern Europe	-0.1013 (0.0564)*	-0.0893 (0.0581)	-0.0737 (0.0607)	-0.0488 (0.0643)
Southern Europe	-0.2167 (0.0641)***	-0.2043 (0.0664)***	-0.2148 (0.0698)***	-0.2017 (0.0752)***
Oceania	0.4757 (0.0958)***	0.4952 (0.0994)***	0.5055 (0.1040)***	0.5242 (0.1100)***
South America	0.2451 (0.1172)**	0.2695 (0.1228)**	0.2959 (0.1301)**	0.2839 (0.1364)**
Eastern Europe	-0.1158 (0.0730)	-0.0799 (0.0761)	-0.0986 (0.0807)	-0.1159 (0.0883)
Period fixed effects	yes	yes	yes	yes
Observations:	372	369	366	361
R-squared:	0.841	0.756	0.756	0.756
Expenditure maximizing PSP	53.5	58.6	53.2	53.0

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

Second, we test the effect of using country specific weights for the construction of the PSPi. The PSPi calculation method used throughout the paper assigns equal weights to each of the seven main components. This implies both that all components have the same importance, and that all countries have identical preferences. As an alternative, we also

employ a revealed preference approach to construct country-specific weights. For each component, the weights are based on public and private sector expenditure on the given component as a percentage of GDP. These weights are used to calculate an alternative version of the PSPi (henceforth, WPSPi). We find that using the WPSPi does not change the result regarding the diminishing returns for public expenditure (see Table 11). However, the share of public sector expenditure of GDP which maximizes the WPSPi is higher (63.0% compared to 52.6% with the PSP index).

Third, we examine the sensitivity of the results to changes in sample and the definition of the regional dummies. Robustness with respect to sample size is tested by excluding peripheral OECD countries from the sample[6] (see Table 12). No significant differences from the baseline results are evident. Finally, we also use more detailed regional dummies[7] (see Table 13). In this case as well we find no significant differences from the baseline results.

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[6] Chile, Mexico and Turkey, which registered the lowest scores on the PSP index.

[7] For the purpose of this test the regional classification is as follows: North America: United States and Canada; South America: Mexico and Chile; Northern Europe: Austria, Belgium, Finland, Germany, Iceland, Luxembourg, Netherlands, Switzerland; Scandinavia: Denmark, Norway and Sweden; Britain: Ireland and the UK; Southern Europe: France, Spain, Italy, Portugal and Greece; Eastern Europe: Czech Republic, Hungary, Estonia, Poland, Slovakia, Slovenia and Turkey; South Oceania: Australia, New Zealand; Southeast Asia: South Korea and Japan; Middle East: Israel.

Table 11
Estimation results with different weighting methods, based on specification (9)

Dependent variable	PSPi	WPSPi
Government Expenditure	0.0826 (0.0133)***	0.063 (0.0143)***
(Government Expenditure)$^{^2}$	-0.0008 (0.0002)***	-0.0005 (0.0002)***
Public Debt	-0.1700 (0.0226)***	-0.1385 (0.0242)***
Dependency Ratio	0.0027 (0.0042)	-0.0053 (0.0045)
Latitude	0.0014 (0.0011)	0.0022 (0.0012)*
Foreign Born Population	-1.6275 (0.2394)***	-1.2083 (0.2569)***
Private Health Expenditure	0.0282 (0.0138)**	0.025 (0.0148)*
Output Gap	0.0397 (0.0059)***	0.0446 (0.0063)***
GDP per Capita	0.0067 (0.0018)***	0.0089 (0.0019)***
Adolescent Fertility Rate	-0.0153 (0.0020)***	-0.0087 (0.0022)***
Constant	-1.2953 (0.3146)***	-1.1246 (0.3376)***
North America	0.1134 (0.0873)	0.1232 (0.0937)
Northern Europe	0.0208 (0.0596)	0.1844 (0.0640)***
Southern Europe	-0.3919 (0.0663)***	-0.2987 (0.0711)***
Oceania	0.4323 (0.1047)***	0.6505 (0.1123)***
South America	0.0202 (0.1249)	0.0483 (0.134)
Eastern Europe	-0.4391 (0.0676)***	-0.1981 (0.0726)***
Period fixed effects	yes	yes
Observations:	372	372
R-squared:	0.808	0.784
Expenditure maximizing PSP	52.6	63.0

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

Table 12
Sensitivity to inclusion of peripheral countries[c], based on specification (9)

Sample	Full	Restricted
Government Expenditure	0.0826 (0.0133)***	0.0684 (0.0147)***
(Government Expenditure)^2	-0.0008 (0.0002)***	-0.0007 (0.0002)***
Public Debt	-0.1700 (0.0226)***	-0.1531 (0.0256)***
Dependency Ratio	0.0027 (0.0042)	0.0114 (0.0047)**
Latitude	0.0014 (0.0011)	-0.0005 (0.0014)
Foreign Born Population	-1.6275 (0.2394)***	-1.9020 (0.2816)***
Private Health Expenditure	0.0282 (0.0138)**	0.0042 (0.0146)
Output Gap	0.0397 (0.0059)***	0.0335 (0.0062)***
GDP per Capita	0.0067 (0.0018)***	0.0058 (0.0018)***
Adolescent Fertility Rate	-0.0153 (0.0020)***	-0.0134 (0.0025)***
Constant	-1.2953 (0.3146)***	-1.2064 (0.3465)***
North America	0.1134 (0.0873)	0.2248 (0.0893)**
Northern Europe	0.0208 (0.0596)	0.1179 (0.0656)*
Southern Europe	-0.3919 (0.0663)***	-0.3378 (0.0754)***
Oceania	0.4323 (0.1047)***	0.3094 (0.1304)**
South America	0.0202 (0.1249)	
Eastern Europe	-0.4391 (0.0676)***	-0.3285 (0.0800)***
Period fixed effects	yes	yes
Observations:	372	341
R-squared:	0.808	0.672
Expenditure maximizing PSP	52.6	48.5

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

c. Mexico, Turkey and Chile.

Table 13
Specification with more detailed regional dummy variables, based on Specification (10)

Dependent variable	PSPi	PSPi
Government Expenditure	0.0555	0.0440
	(0.0126)***	(0.0125)***
(Government Expenditure)$^{\wedge 2}$	-0.0005	-0.0004
	(0.0001)***	(0.0001)***
Public Debt	-0.0512	-0.0624
	(0.0251)**	(0.0245)**
Dependency Ratio	-0.0071	-0.0044
	(0.004)*	(0.0044)
Latitude	0.0042	0.0100
	(0.0011)***	(0.0013)***
Foreign Born Population	-1.1254	-1.8402
	(0.2269)***	(0.2637)***
Private Health Expenditure	0.0368	0.0639
	(0.0126)***	(0.0128)***
Output Gap (no lags)	0.0369	0.0287
	(0.0054)***	(0.0052)***
GDP per Capita	0.0089	0.0102
	(0.0016)***	(0.0015)***
Adolescent Fertility Rate	-0.0120	-0.0155
	(0.0019)***	(0.0021)***
The Corruption Index	0.0844	0.0914
	(0.0101)***	(0.0102)***
Constant	-1.4541	-1.3269
	(0.2881)***	(0.2804)***
North America	-0.1359	-0.3614
	(0.0852)	(0.1000)***
Northern Europe	-0.1013	-0.3184
	(0.0564)*	(0.0646)***
Southern Europe	-0.2167	-0.3902
	(0.0641)***	(0.0708)***
Oceania	0.4757	
	(0.0958)***	
South America	0.2451	0.3356
	(0.1172)**	(0.1323)**
Eastern Europe	-0.1158	-0.2886
	(0.0730)	(0.0831)***
Britain		-0.224
		(0.0797)***
Scandinavia		-0.3476
		(0.0732)***
South Oceania		0.8546
		(0.1157)***
Southeast Asia		0.1299
		(0.1076)
Period fixed effects	yes	yes
Observations:	372	372
R-squared:	0.841	0.860
Expenditure maximizing PSP	53.5	55.0

***, ** and * represent significance at the 1%, 5% and 10% levels respectively.

6. SUMMARY

Measuring and understanding the factors that affect the performance of the public sector is instrumental for policy making and for the economic literature, particularly due to the dearth of academic research in this matter. However, the literature in this field has been hindered by the absence of a measure for public sector output. For example, in the national accounts, there is no measure of government added value, unlike the private sector.

Following Afonso et al. (2005), in this paper we measure the relative performance of the public sector in 34 OECD countries for the years 2000-2010 by constructing a public sector performance index. Two important modifications were made in the construction of the PSPi: first, our index includes only quantitative data and does not include subjective survey data. Second, we normalize both the variance and the mean of the indicators, so as to equalize the weights of the different indicators in the index.

We then proceed to identify the factors that affect public sector performance. To the best of our knowledge, this is the first study that has conducted such an analysis. We find that GDP per capita, private health expenditure, latitude and the output gap have a positive impact on public sector performance, while public debt, the dependency ratio, the share of foreign born in the population, corruption and the adolescent fertility rate have a negative impact.

One of the main contributions of this paper is the empirical support to the hypothesis that public sector expenditure is characterized by diminishing returns, a notion which has been discussed in the theoretical literature. According to our estimation, maximal public sector performance is achieved when the general government share of GDP is at 52%-60%. However, this range represents only an upper bound for optimal government size as it does not consider the opportunity cost of public expenditure. Increasing public expenditure beyond this range diminishes public sector performance. However, if public expenditure allocation is not optimal, it is possible that increasing a certain expenditure component can lead to improved public sector performance even beyond this threshold.

We hope that this study will contribute to the economic literature regarding the role of government in the economy and to discussion of the optimal size of government. We believe that there is need for additional research in this field. For example, our work may be extended to estimate the optimal government size. This will require better understanding of the demand for government services. In addition, further effort could be made to investigate the factors affecting public sector performance in developing countries.

Appendix
Full list of indicators that comprise the Public Sector Performance Index

Main Component	Indicator	Source	Comments
Law & Order	Personal safety	OECD	Homicides per 100,000 inhabitants
	Red tape	Doing business, World Bank	Days to start a business
	Judiciary	Doing business, World Bank	Average number of days to enforce contracts
	Shadow economy	Schneider et al. (2010)	Data available for 1999-2007
Education	Secondary school enrollment	World Bank	Data available up to 2009
	PISA scores	OECD	Simple average of scores in the three topics. Data available for 2000, 2006 and 2009
Health	Infant mortality	World Bank	
	Life expectancy	World Bank	Data available up to 2009
Infrastructure	Roads and railroads	World Bank	Normalized for land size and population density
	Traffic accidents	OECD	Normalized for land area and population density
Income distribution	The GINI index	OECD	Data available for the beginning, middle and end of the last decade
Stability	GDP growth stability	IMF	Variance of GDP growth in the last 4 years
	Inflation rate	IMF	4 years average, difference from 2.5%
Economic performance	GDP per capita growth	IMF	Moving average, last 4 years
	Unemployment rate	IMF	Moving average, last 4 years

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