Fiscal Decentralization and Public Sector Efficiency: Evidence from OECD Countries

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Abstract

This paper attempts to identify the effect of fiscal decentralization on public sector efficiency (PSE). We employ data envelopment analysis on a panel of 21 OECD countries over the period 1970-2000 to construct two alternative PSE indicators that reflect the governmental goals of economic performance and stability. In turn, using a novel technique that merges the methodologies of Simar and Wilson (2007) and Khan and Lewbel (2007), we regress the PSE scores obtained on an extensive set of alternative fiscal decentralization measures. Backed by strong empirical results, obtained from a number of different specifications, we contend that PSE is increasing with fiscal decentralization.

JEL Code: C14, C24, H11, H50.

Keywords: public sector efficiency, fiscal decentralization, semi-parametric models.

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1. Introduction

It has long been recognized that governments differ significantly in the efficiency of delivering public services (see e.g. Tanzi and Schuknecht, 1998; Afonso et al., 2005). Some are extremely wasteful and ineffective in performing basic activities, whereas others achieve their objectives in a systematic and comprehensive way. The strive to increase government/ public sector efficiency (PSE hereafter) has spawned a vigorous theoretical literature on channels that may affect it, with a quite prominent one being the design of fiscal relation across the levels of government. A strand of the ongoing debate argues that fiscal decentralization is positively associated with government efficiency and attributes this effect either to increased electoral control – that comes as a result of increased decentralization (see e.g. Seabright, 1996) – or to yardstick competition among local governments (see e.g. Besley and Case, 1995; Besley and Smart, 2007).[1] In contrast, other scholars note that local politicians and bureaucrats are likely to face increased pressure from local interest groups (see e.g. Bardhan and Mookherjee, 2000) and argue that fiscal decentralization, under these or similar state of affairs, undermines government efficiency (Prud'homme, 1995).[2]

In the recent years, there is a small, albeit growing, body of empirical work that aims at identifying the effect of fiscal decentralization on the quality of government (see e.g. Fisman and Gatti, 2002a; Enikolopov and Zhuravskaya, 2007). In most of these studies, the dependent variable is some internationally comparable outcome of government policy – usually captured by socioeconomic indices like infant mortality, the literacy ratio, immunization of population etc. – and the key explanatory variable is fiscal decentralization, measured as the ratio of sub-national government expenditures (resp. tax revenues) to total public spending (resp. tax revenues).[3] Yet, the theoretical hypotheses postulated above are

[1] Another branch of the literature argues that fiscal decentralization restricts the governments' Leviathan behavior and the consequent overspending by the politicians, through inter-jurisdictional fiscal competition (see e.g. Brennan and Buchanan, 1980; Edwards and Keen, 1996).

[2] This argument goes back to Alexander Hamilton, John Jay and James Madison who argued that the lower the level of government, the greater is the extent of vulnerability to vested interest and the less protected the minorities and poor tend to be [The Federalist Papers, 1787].

[3] Fisman and Gatti (2002a) and Mello and Barenstein (2001) find that increased decentralization (measured as the budgetary share of subnational governments) is associated with lower levels of corruption. In a similar vein, Fisman and Gatti (2002b) and Henderson and Kuncoro (2004) using sub-national data for the US and Indonesia, respectively, show that decentralization of public expenditure is effective in reducing corruption only if it is accompanied by increased power to raise revenue (i.e. increased tax autonomy). Robalino et al. (2001) and Khalegian (2003) in cross-country studies, also find support that fiscal decentralization is associated with lower infant mortality rates and immunization rates (taken as measures of the quality of governance). Finally, Enikolopov and Zhuravskaya (2007) examine the effect of decentralization on a set of four indicators of governance quality (namely the three indicators used in studies reviewed above plus the illiteracy ratio) and conclude that the effects of fiscal decentralization are beneficial only in countries that are also characterized by a high degree of political centralization.

not comprehensively addressed simply by employing socioeconomic indicators as measures of "good governance". This is because these measures do not encompass the size of government spending and thus fail to reflect the level of efficiency in delivering government services. In the words of Barankay and Lockwood (2007) "[…] these regressions do not estimate government "production functions" because they do not control for the inputs to the output that is the dependent variable. […] In the absence of controls for these inputs, these regressions cannot tell us much about the efficiency of government as any observed correlation between decentralization and government output can be due to omitted variable bias."

In an effort to construct a plausible connection between theory and identification, the purpose of this paper is to generate an empirical model that analyzes the relationship between fiscal decentralization and PSE. Therefore, we opt for direct measures of PSE, derived non-parametrically at a first stage of analysis. In particular, we use data envelopment analysis (DEA) on a panel of 21 OECD countries that covers the period 1970-2000 to construct two alternative PSE indicators that reflect the goals of economic performance and stability. By doing this, we implicitly assume that these indicators are derived from an underlying government production relationship, where public spending serves as the input in the production of public services.[4] In the subsequent stage of analysis, we regress the PSE scores obtained on a set of alternative fiscal decentralization measures following a technique that merges the methodologies of Simar and Wilson (2007) and Khan and Lewbel (2007).[5] Given this methodological novelty, the main contribution of our study is that our dependent variable allows for differences in the size of government spending and, therefore, does not give an unfair credit to wasteful governments, even when the latter achieve better outcomes.

Our main finding is that government efficiency increases with the degree of fiscal decentralization. This result appears to be robust to a number of different specifications and fiscal decentralization measures. More precisely, we employ alternatively fiscal decentralization measures as developed by Stegarescu (2005b), the measures reported in the IMF's Government Finance Statistics (2002), and measures of fiscal autonomy (reflecting vertical fiscal imbalance and taxation autonomy) and we show that the positive relationship between fiscal decentralization and PSE survives in all different specifications.

[4] This is as in Tanzi and Schuknecht (1998) and Afonso et al. (2005).
[5] We have resorted to this technique mainly because the second-stage analysis may not be robustly carried out with conventional econometric methods. For details see Section 4.

The structure of the rest of the paper emerges along the following lines. Section 2 presents the theoretical considerations. In Section 3 we describe the data used in our empirical analysis, as well as the DEA technique employed to obtain the government efficiency estimates. In Section 4 we illustrate the econometric methodology used to regress the government efficiency estimates on fiscal decentralization measures. In Section 5 we present and discuss the empirical results and, finally, Section 6 concludes.

2. Theoretical considerations

The theoretical literature on fiscal federalism identifies two benchmark channels through which fiscal decentralization is expected to affect positively the efficiency of governments. These are (i) increased electoral control and (ii) yardstick competition among local governments that comes as a result of decentralization.[6] On the other hand, it has been also pointed out that fiscal decentralization may be negatively associated with government efficiency. In the presence of economies of scale (see e.g. Stein, 1997) or differences in the quality of human capital between national and sub-national bureaucracies (Prud'homme, 1995), decentralization may lead to higher costs and thus increased inefficiency in the delivery of public services. In the present section, we briefly review these mechanisms and we set out the main testable hypotheses of our paper.

According to the electoral control mechanism, decentralization reduces the incentives for officials to divert rents and increases the probability of "bad" incumbents to be voted out of office, therefore affecting the overall efficiency of the government positively (Hindriks and Lockwood, 2005). More precisely, Seabright (1996) shows that rent-seeking politicians, when contesting in decentralized elections, face incentives to please the voters in each (local) constituency, whereas in national elections they should please the voters only in a majority of localities to get re-elected. Similar results are obtained by Persson and Tabellini (2000), Hindriks and Lockwood (2005) and Myerson (2006).

The second path through which fiscal decentralization can alter the incentives and the selection effects of elections is via yardstick competition. According to this theory (see e.g. Shleifer, 1985; Salmon, 1987; Besley and Case, 1995), citizens have an advantage in evaluating the performance of their policy makers when they are able to compare the policy

[6] Barankay and Lockwood (2007) suggest an additional mechanism through which fiscal decentralization may lead to increased efficiency, namely the decrease in lobbying by interest groups. However, since the theoretical literature (see e.g. Bardhan and Mookherjee, 2000; Bordignon et al., 2003; Redoano, 2003) appears to be rather inconclusive on this issue (mainly because under certain conditions there may be more lobbying with decentralization), we prefer not to include this mechanism in the ones we refer to as benchmark.

choices of their own political representatives with the corresponding choices of neighbor regions' policy makers.[7] Therefore, fiscal decentralization may raise PSE, since it provides citizens the chance to compare public services and taxes across jurisdictions and helps them to judge whether their government wastes resources through low human capital capacity or rent-seeking (Besley and Smart, 2007).

However, fiscal decentralization may also exert a negative impact on the efficiency of government. This impact may be attributed to a number of potential advantages of the provision of public goods by central governments. First, in the presence of economies of scale, decentralization may lead to higher costs (see e.g. Stein, 1997). Second, national government bureaucracies are more likely to offer talented people better careers and possibilities of promotion, which may in turn attract higher quality individuals (Prud'homme, 1995). Finally, other scholars underline the potential danger that local politicians and bureaucrats are likely to face increased pressure from local interest groups (see e.g. Bardhan and Mookherjee, 2000; Prud'homme, 1995). In view of these contradictory theoretical underpinnings, we provide below an empirical framework to analyze the relationship between fiscal decentralization and PSE.

3. The data

3.1. Public sector efficiency estimates using DEA

The measurement of PSE and the resulting comparison of individual countries in terms of the efficient functioning of their public sectors, present a number of difficulties related to the scarcity of publicly available data and the complicated problems that may emerge in the estimation procedure. In the present study, we opt for a direct estimation of productive PSE using Data Envelopment Analysis (DEA).[8]

DEA is a non-parametric programming technique that provides a linear piecewise frontier, by enveloping the observed data points, and yields a convex production possibilities set.[9] As such, it does not require the explicit specification of a functional form of the

[7] The theory of yardstick competition is also studied by Bordignon et al. (2004), Belleflamme and Hindriks (2003), Besley and Smart (2007) and Bodenstein and Ursprung (2001).
[8] Only recently a number of studies cultivated an effort towards the computation of PSE indicators. Concerning OECD economies, Afonso et al. (2005) employed a nonparametric method to estimate relative efficiency scores for several parts of the public sector during the 1980s and the 1990s, while Afonso and St. Aubyn (2005) focused on the efficiency of government spending on education and health. Using similar techniques, Gupta and Verhoeven (2001), Sijpe and Rayp (2007) and Afonso et al. (2006) focused on developing countries. Finally, Balaguer-Coll et al. (2007) considered using DEA to analyze the efficiency of local governments in Spain.
[9] For an excellent account on DEA, see Coelli et al. (2005).

underlying production relationship. To introduce some notation, let us assume that for N observations there exist M inputs in the production of public goods, yielding S outputs. Hence, each observation n uses a nonnegative vector of inputs denoted $x^n = (x_1^n, x_2^n, ..., x_m^n) \in R_+^M$ to produce a nonnegative vector of outputs, denoted $y^n = (y_1^n, y_2^n, ..., y_S^n) \in R_+^S$. Production technology, $F = \{(y,x) : x \text{ can produce y}\}$, describes the set of feasible input-output vectors, and the input sets of production technology, $L(y) = \{x : (y,x) \in F\}$ describe the sets of input vectors that are feasible for each output vector (Kumbhakar and Lovell, 2000).

To measure productive efficiency we use the following input-oriented DEA model,[10] where the inputs are minimized and the outputs are held at their current levels:

$$
\begin{aligned}
&\theta^* = \min \theta, \text{ s.t.} \\
&\sum_{j=1}^{n} \lambda_j x_{ji} \le \theta x_{i0} \quad i = 1,2,...,m; \\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{r0} \quad r = 1,2,...,s; \qquad (1) \\
&\sum_{j=1}^{n} \lambda_j = 1 \\
&\lambda_j \ge 0 \qquad j = 1,2,...,n;
\end{aligned}
$$

where public sector 0 represents one of the N public sectors under evaluation, and x_{i0} and y_{r0} are the ith input and rth output for public sector 0, respectively. If $\theta^* = 1$, then the current input levels cannot be proportionally reduced, indicating that public sector 0 is on the frontier. Otherwise, if $\theta^* < 1$, then public sector 0 is inefficient and θ^* represents its input-oriented efficiency score. Finally, λ is the activity vector denoting the intensity levels at which the N observations are conducted. Note that this approach, through the convexity constraint $\Sigma\lambda = 1$ (which accounts for variable returns to scale) forms a convex hull of intersecting planes, since the frontier production plane is defined by combining some actual production planes.

[10] DEA may be computed either as input or output oriented. Input-oriented DEA shows by how much input quantities can be reduced without varying the output quantities produced. Output-oriented DEA assesses by how much output quantities can be proportionally increased without changing the input quantities used. The two measures provide the same results under constant returns to scale but give slightly different values under variable returns to scale. Nevertheless, both output and input oriented models will identify the same set of efficient/inefficient public sectors (see Coelli et al., 2005). Also, a constant returns to scale assumption is only appropriate when all public sectors are operating in an optimal scale (imperfections, asymmetries, etc. are not present), and therefore we opt for a variable returns to scale specification.

Obviously, to measure PSE some "performance measures" are required that could be interpreted as outputs of total public spending (which naturally serves as the input of the production of public services) and should reflect the objectives (or alternatively the tasks) of government. Following the rationale of the relevant literature (see e.g. Afonso et al., 2005; Angelopoulos and Philippopoulos, 2005), we utilize two well-established performance indicators that reflect benchmark tasks of government. These are: (i) the economic performance indicator (*EcPerf*) and (ii) the economic stability indicator (*EcStab*).[11]

The *EcPerf* measure assumes that the government output is composed by the unemployment rate, GDP per capita and the annual GDP growth rate. More precisely, lower scores in the unemployment rate and higher scores in GDP per capita and GDP growth reflect better economic performance. Data for the unemployment rate are taken from OECD's Economic Outlook (2005), whereas data for GDP per capita and GDP growth are obtained from World Bank's Development Indicators (2004). On the other hand, the *EcStab* indicator consists of the standard deviation of the GDP growth rate, which is interpreted as a measure of economic fluctuations, and of the inflation rate. In this case, lower scores in both measures reflect higher economic stability. Data for standard deviation of the GDP growth rate are taken from OECD Economic Outlook: Annual and Quarterly Data (2007)[12] and data for the inflation rate are obtained from World Bank's Development Indicators (2004). Finally, data for total public spending (the input) are also obtained from the World Bank's Development Indicators (2004). Our dataset consists of 21 OECD countries and spans the period 1970-2000.[13]

Space constraints prevent reporting the yearly results of estimation of Program 1 and, therefore, we present 10-year averages for each country on the Figures in Appendix B.[14] The first set of four graphs presents the relative efficiency scores when the government target is economic performance and the second set the equivalent when the government target is economic stability. Scores where data for any of the input or output of the production process are missing are not derived for the particular country. Sensitivity analyses performed on

[11] As Tanzi and Schuknecht (2000, pp. 75) state: "It is difficult or even impossible to consider all the social and economic objectives (and thus all the socioeconomic indicators) that the governments might want to influence with this spending. By necessity, the analysis will include fewer indicators than might have been desirable to include".

[12] Annual data on standard deviation of the growth rate is obtained by utilizing the quarterly data available in the Economic Outlook.

[13] The countries in our sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA.

[14] The full set of Stage 1 results is available upon request.

Program 1 showed that efficient public sectors remained efficient to any simultaneous data changes in the respective inputs (for a detailed discussion of the sensitivity analysis on DEA estimates see Zhu, 2003).

When the government goal is economic performance, the PSE frontier is mainly shaped by Japan (if data is available) and Switzerland, with USA, Luxembourg, Canada and, most importantly, Ireland gaining significant ground towards the end of the period. Besides these countries, and although the ranking of public sectors appears to change through time, we note that Australia and Norway are characterized by relatively efficient public sectors, whereas Belgium, France, Greece, Italy and Ireland (in the beginning of the sample period) are the poor performers. The results are strikingly similar when the government goal is assumed to be economic stability. The frontier is shaped by exactly the same countries and the patterns of change remain unaltered, with Ireland, Canada and USA substantially improving their PSE scores by the end of the sample period. A noticeable development is that most countries tend to achieve higher PSE scores towards the end of the period examined, even if they are among the relatively poor performers. Overall, these results seem to be reasonable approximations of prior academic belief and are aligned with findings of previous research (see e.g. Afonso et al., 2005).

3.2. Fiscal decentralization measures

The best approximation of the degree of fiscal decentralization has been an issue of considerable disagreement among empirical studies. Usually, it is proxied by the budgetary share of sub-national units as recorded by the IMF's Government Financial Statistics (GFS).[15] However, this widely employed measure bears major shortcomings, since it fails to integrate vital aspects of intergovernmental relations. Most importantly, it fails to capture the real degree of sub-national governments' autonomy that is to reflect the extent to which decisions regarding revenues and expenditures are truly assigned to lower levels of government (see Ebel and Yilmaz, 2003; Stegarescu, 2005b; Barankay and Lockwood, 2007). In particular, it has been pointed out that the GFS measure tends to overestimate the share of government expenditure and tax revenues that is controlled by sub-national governments and that it does so in a way that varies widely across countries (Ebel and Yilmaz, 2003). For example, consider the extreme case of a country where all taxes are set nationally, but where the revenues are shared with local governments via a fixed formula.

[15] Previous empirical studies based on the GFS measure of fiscal decentralization are Jin and Zou (2002), Davoodi and Zou (1998), Fisman and Gatti (2002a) and Enikopolov and Zhuravskaya (2007).

The share of tax revenues going to sub-national governments is measured in the GFS statistics as sub-national revenue, even though local governments have no control over the tax rate and the tax base. Similar problems arise on the expenditure side from policies that are controlled by central government, but implemented by sub-national governments (Stegarescu, 2005b; Barankay and Lockwood, 2007).[16]

In view of these difficulties, Stegarescu (2005b) developed new measures of fiscal decentralization and sub-national tax autonomy, based on the detailed data provided by OECD (1999). The advantage of the OECD (1999) survey is that it classifies in a very analytical way the taxes of sub-national governments according to the degree of decision-making autonomy.[17] More precisely, it separates taxes that are set by sub-central governments (i.e. sub-central governments determine the tax rate and the corresponding tax base) from those that are determined by the central government at a national level and in turn shared with sub-national units. To this end, Stegarescu's measures of fiscal decentralization reflect the "real" tax-raising autonomy of sub-national units, since they count as local tax revenues only those strictly determined by sub-national governments.[18]

In this study, we employ both the decentralization measures developed by Stegarescu (2005b) and the decentralization indicators of the public finance statistics reported in the GFS database. More precisely, we employ (i) the tax revenue decentralization indicator, (*TaxRevDec*) and (ii) the revenue decentralization indicator as constructed by Stegarescu (*RevDec*);[19] (iii) the GFS expenditure decentralization measure (*DecGFS1*) and (iv) the GFS revenue decentralization measure (*DecGFS2*).[20]

Finally, following the paradigm of Jin and Zou (2002), we also use measures of revenue and expenditure autonomy of the local governments. These measures are: (i) *TaxAut*, defined as sub-central government own tax revenue as a share of sub-central government total tax revenue (obtained from Stegarescu, 2005b); (ii) *TaxAutGFS*, defined as sub-national tax revenue as a share of sub-national revenue and grants (taken from GFS, 2002); (iii) *VertImb1,* defined as transfers from other levels of government as a share of sub-national

[16] Stegarescu (2005b) finds that the GFS measure of tax revenue decentralization overestimates the extent of fiscal decentralization. This is particularly the case for Austria (28.4% versus 3.5%), Belgium (44.4% versus 24.6%) and Germany (49.4% versus 7.3).The percentages refer to data from 1999 and 2000.
[17] See Appendix A for details.
[18] To our knowledge, empirical application of these measures is limited to Fiva (2006), Stegarescu (2005a) and Lessmann (2006).
[19] The *RevDec* indicator represents the vertical structure of all the sources of public revenue. Thus, compared with the *TaxRevDec* index, it additionally accounts for the structure of non-tax revenue (e.g. user charges or operational surplus of public enterprises).
[20] See Appendix A for details and definitions and Appendix C for correlations between these measures.

expenditures; and (iv) *VertImb2*, defined as transfers from other levels of government as a share of sub-national revenues and grants.[21] The latter two indices (both taken from the GFS database) are measures of vertical fiscal imbalance and are expected to affect PSE negatively. This is because voters view intergovernmental grants and "own resources" through different lenses and they are more likely to sanction overspending by politicians when local governments are purely financed by intergovernmental grants (see e.g. Oates 1979, 1991).[22] In contrast, *TaxAut* and *TaxAutGFS* are expected to affect PSE positively, as higher values for both variables indicate higher degree of tax autonomy.

3.3. Other controls

To ensure correct econometric identification, we use a series of additional controls. First, we employ a standard demographic variable, namely the dependency ratio of the population (i.e. the share of population aged below 16 and above 65 to total population), denoted as *depend*. *Depend* is expected to exert a negative impact on PSE. This is because a higher proportion of economically dependent population generates fiscal needs for programs targeted towards the dependant group. Note that these programs are mainly transfers that do not directly affect (what is assumed here to be) government output, while at the same time they increase total government spending.[23] Data for *depend* are obtained from the WDI (2004).

In order to control for the overall level of productivity in the economy, we employ a total factor productivity growth index (denoted as *TFP*), which is estimated as the residual of the regression of the growth rate of per capita capital on the growth rate of per capita output, for each country in our sample (see Solow, 1957; Barro and Sala-i-Martin, 2004). Countries that present higher productivity growth are expected to be characterized by higher productivity in their public sectors as well. Note, that the causality between *TFP* and PSE may be reverse (i.e. higher PSE may lead to increased overall productivity). Therefore, in the empirical specification, we assume that these variables are endogenous.

[21] See Appendix A for details and definitions and Appendix C for correlations between these measures.

[22] As it is usually suggested, intergovernmental grants create the picture that local public spending is funded by non-residents. This is because local voters within a central legislature receive benefits from grants without internalizing their full cost (Weingast el al 1988, Rattsø 2000).

[23] This effect holds only for the measures of government output we employ here. Certainly, as transfer programs are expected to create additional effects in the economy (e.g. changes in inequality) they also affect other government activities and, therefore, may represent forms of government output. Had we measured the efficiency of government in providing such outputs, the relationship between *Depend* and government efficiency may have been different from the one suggested in the text.

Moreover, we employ two measures of the constraints that the government faces, (i) a simple openness indicator (i.e. total trade over GDP) corrected for country size[24] (*Open*) and (ii) an index of government regulation (*EconFreedom)* as measured by Gwartney and Lawson (2004), in which higher values reflect less interventionist governments. For three main reasons we expect both variables to be positively associated with PSE. First, more trade and domestic restrictions create rents and therefore higher waste through rent seeking activities (Krueger, 1974; Gatti, 1999). Second, lower international openness and greater government intervention imply lower product market competition within the country, which is also associated with increased government waste (Ades and Di Tella, 1999). Finally, within an international setting, the domestic government must be more efficient if it seeks to attract foreign investors (Wei, 2000).

To measure the propensity of the state to employ redistributive policies, we use a measure of population heterogeneity. According to Alesina et al. (2003), La Porta et al. (1999) and Alesina and La Ferrara (2005), countries with high ethno-linguistic fractionalization are expected to exhibit inferior government performance. Once again many reasons have been put forward to justify this relationship. First, high ethnic fractionalization results into pressures for redistribution between groups (Easterly and Levine, 1997). Moreover, it may lead to high demand for publicly provided private goods, especially those that can be targeted towards specific groups (Alesina et. al., 2003). It is also possible that a relationship between fractionalization and corruption is formed. Finally, in more extreme circumstances, increased ethnic fractionalization may lead to ethnic hatred and ultimately to violent civil wars that disrupt the workings of government (see Fearon, 2003). Following Easterly and Levine (1997), we control for ethno-linguistic fractionalization using a Herfindahl index (named *Ethnolig*), which is calculated on the basis of the share of each

[24] There are several reasons why the uncorrected for size measure of openness does not correctly reflect the constraints that the economy faces from the international environment. The first is a simple statistical bias: when a large and a small country trade with each other, the volume of trade is the same for both, but trade shares as a portion of GDP differ. Second, in the presence of increasing returns to scale in production, the market size affects the overall level of productivity. This argument goes back to Adam Smith who argued that the size of the market imposes a constraint on the division of labor. Therefore, small countries that are relatively closed to international trade must experience a lower level of productivity. Ades and Glaeser (1999), Wacziarg (2001) and Alesina *et al*. (2000) provide empirical evidence consistent with these ideas: large countries experience smaller dynamic gains from trade. Finally, according to Frankel and Romer (1999, p.382), "smaller countries may engage in more trade with other countries simply because they engage in less within-country trade". For further details on the relationship between openness and country size see also Alesina and Spolaore (2003, chapter 6) and Alesina and Wacziarg (1998, pp.306-307). To correct for this bias we run a regression with total trade over GDP as the dependent variable and the share of country *i*'s GDP to the average GDP of our sample (at the same time period) as the independent variable. Then, we use the residuals from this regression as an indicator for openness (see Bretschger and Hettich, 2002).

separate ethno-linguistic group over total population (data are obtained from La Porta et al., 1999).

The final set of controls we employ includes variables that refer to the structure of the elected government. Therefore, we use the variable *NSM*, taken from Mierau et al. (2007), which reports the number of ministers that directly use part of the government budget (i.e. the total number of ministers excluding the minister of finance). Since we expect that these ministers care about the size of the budget they control,[25] the relationship between *NSM* and PSE should be negative.[26] Finally, the variable *coalition*, taken from Tavares (2004), is a dummy variable taking the value 1 if a coalition cabinet that includes ministers from two or more parties is in power. As the number of parties involved in the government increases, the accountability of each of the parties usually diminishes, thus providing fewer incentives for efficiency. In addition, coalition governments are typically associated with a shorter life span (see Schofield, 1993; Müller and Strøm, 2000) and therefore are less concerned with superior performance.

4. Empirical methodology

Based on the theoretical considerations of the previous section, we estimate the following empirical model:

$$p_{it} = \alpha_0 + \beta_k z_{it} + u_{it} \qquad (2)$$

where p_{it} are government efficiency estimates derived from Program (1) and z_{it} are the set of explanatory variables described above.

Unfortunately, it turns out that estimation of Eq. (2) is not a trivial econometric issue. In particular, when non-parametrically derived measures (like the DEA efficiency scores) are regressed against a number of determinants, conventional censored regressions (such as Tobit regressions) yield biased results.[27] Only very recently Simar and Wilson (2007) proposed a robust procedure to overcome the associated difficulties. Specifically, they offer an algorithm, comprised of subsequent steps, that begins with a truncated regression and ends with the estimation of confidence intervals. Still, as discussed above, the total factor productivity variable may be endogenous in the PSE measures. To account for this

[25] Ministers care about the size of the budget they receive for many reasons, which may include participation in rent-seeking activities, increase in the size of the bureau they control (Niskanen, 1973) and the ability to make income transfers as a means for controlling a larger political clientele.

[26] This effect is consistent with the idea that there may exist diseconomies of scale in the administration of government (see Stein, 1997).

[27] This is mainly due (but not limited) to the fact that DEA efficiency estimates are serially correlated (for a proof and further details, see Simar and Wilson, 2007).

endogeneity we follow the methodology put forth by Khan and Lewbel (2007), who for the first time suggested a truncated regression model with endogenous regressors.[28] To this end, we merge the algorithm suggested by Simar and Wilson (2007) with the two-stage least squares truncated regression model put forth by Khan and Lewbel (2007). We consider all observations as cross sections and therefore we drop subscript *t* in Eq. (2). Consequently, the following procedure may be used to provide inference on the determinants of PSE:

1. Obtain maximum likelihood estimates $\hat{\alpha}_k$ of α_k and $\hat{\sigma}_u$ of σ_u in the endogenous truncated regression of $\hat{p}_i$ on its k determinants (z_i) in Eq. (2), where $\hat{p}_i \leq 1$. The instrument used is the one period lag of the endogenous variables (i.e. lagged one period *TFP*).[29]
2. Loop over the next three steps L=2000 times to obtain a set of bootstrap estimates $\mathrm{B}_i = \left[(\hat{\alpha}^*, \hat{\sigma}_u^*)_b \right]_{b=1}^{L}$

   For each i=1,…,m, draw u_i from the $N(0, \hat{\sigma}_u^2)$ distribution with left-truncation at $(1 - z_i\hat{a})$.

For details on how to draw from a left-truncated normal distribution see the Appendix of Simar and Wilson (2007).

Again for each i=1,…,m, compute $p_i^* = z_i\hat{\alpha} + u_i$.

Use the maximum likelihood method to estimate the endogenous truncated regression of p_i^* on z_i, yielding estimates μ_μ^*, ν_ν^*.

3. Use the bootstrap values in B and the original estimates α, σ_u to construct estimated confidence intervals for each element of α and for σ_u. This is done by using the jth element of each bootstrap value $\hat{\alpha}^*$ to find values μ_π^*, ν_π^* such that $\Pr\left[-\nu_\pi \leq (\hat{\alpha}_j^* - \hat{\alpha}_j) \leq \mu_\pi^* \right] \approx 1 - \pi$, for some small conventional value of π, $\pi = 0.05$ in the present analysis. The approximation improves as $L \to \infty$. Substituting μ_π^*, ν_π^* for μ_π, ν_π in $\Pr\left[-\nu_\pi \leq (\hat{\alpha}_j - \alpha_j) \leq \mu_\pi \right] = 1 - \pi$ leads to an estimated confidence interval $(\hat{\alpha}_j + \mu_\pi^*, \hat{\alpha}_j + \nu_\pi^*)$.

[28] Their simulation results show that their new estimator performs well, while they specifically state that their method is applicable in general contexts involving two-stage analyses with a nonparametric first stage, such as ours.

[29] The results of the paper remain intact if more lags as instrumental variables.

5. Results

In this section we discuss the results obtained by estimating Eq. (2), using the data described in Section 3 and the empirical methodology presented in the previous section. The baseline results are presented in Tables 1 and 2, while the extensive sensitivity analyses performed are presented in Tables 3 and 4.[30]

5.1. Basic results

Table 1 reports the results of the regressions of PSE on alternative measures of fiscal decentralization. In column 1, the government efficiency estimates are regressed on *TaxRevDec*, as well as on our set of control variables (i.e. *Coalition, NSM, EconFreedom, Depend, TFP, Open, Ethnolig*). In all estimated equations, we include regional dummies (see Appendix A) and a time trend. Evidently, the coefficient on *TaxRevDec* bears a positive sign and is significant at the 1% level, suggesting a strong positive link between fiscal decentralization and PSE. This result is aligned with the propositions of the theoretical debate discussed in Section 2. Focusing on the rest of the explanatory variables, we observe that coefficients on both *Coalition* and *NSM* present negative signs and are significant at conventional levels, indicating that coalition governments and large cabinets exert a negative impact on PSE. In contrast, *EconFreedom* is positive and highly significant, whereas the coefficient on *Open* is positive and marginally significant. These results may be explained by the beneficial effects of internal and external market constraints on the function of governments. Finally, *Depend* and *Ethnolig* appear to be insignificant determinants of PSE.

In column 2, we re-estimate the model by using *Revdec*, instead of *TaxRevDec*, as a proxy for fiscal decentralization. As we have already pointed out, the *Revdec* indicator is a more general measure of fiscal decentralization, since it accounts for the vertical structure of non-tax revenues (such as user charges and operational surpluses of public enterprises), which is not encompassed in *TaxRevDec*.[31] Markedly, the main result of this second specification remains unaffected. The coefficient on *Revdec* is positive and highly significant, thus confirming the positive effect of fiscal decentralization on government efficiency. As regards the rest of the explanatory variables, we observe that only slight changes in the results emerge (compared to those presented in column 1). Specifically, the coefficients on *Coalition* and *TFP* appear to lose their statistical significance, whereas

[30] Note that in all estimated equations presented in the first two tables, we include regional dummies (see Appendix A), which are not reported to save space. The full set of results is available upon request.
[31] For details on this see Appendix A.

Ethnolig enters with a positive and significant coefficient. It should be noted that this result is not in line with our theoretical priors, since it implies that the relationship between ethno-linguistic fractionalization and PSE is positive.

In column 3 we employ as a proxy for fiscal decentralization the GFS expenditure decentralization measure (*DecGFS1*), which is also found to be positively and significantly related to government efficiency. As a final test, in column 4 we use *DecGFS2*, reaching similar conclusions. In these last two specifications, the behavior of the control variables is much similar to that observed in column 2.

Table 2 presents the results of the regressions of PSE on the two alternative measures of tax autonomy and the two alternative measures of vertical fiscal imbalance. In column 1, the DEA government efficiency estimates are regressed on the Stegarescu (2005b) tax autonomy measure (denoted as *TaxAut*), as well as on the rest of the explanatory variables. The results suggest that *TaxAut* bears a positive sign and appears to be highly significant, which is consistent with our theoretical priors outlined in Section 2. Indeed, increased tax autonomy (or alternatively decreased dependency of local governments on intergovernmental transfers) explains, at least in OECD economies, higher levels of PSE. As suggested above, this relationship is probably associated with the adverse effect of tax autonomy due to the "common pool" problem. Turning to the rest of the explanatory variables, we observe that our results are similar to those presented in Table 1. More precisely, the coefficients on *Coalition* and *NSM* are negative and significant, whereas the coefficients on *EconFreedom*, *TFP* and *Open* are positive and significant. Finally, *Depend* and *Ethnolig* appear to be insignificant at conventional levels of statistical significance.

In column 2 we employ the GFS tax autonomy measure (denoted as *TaxAutGFS*) instead of the *TaxAut* and we re-estimate Eq. (2). As expected, *TaxAutGFS* enters with a positive sign and is significant at the 1% level, validating the positive relationship between tax autonomy and PSE. Concerning the rest of the variables, our results remain practically unaffected, with the exception of *Coalition* (which loses its significance) and *Ethnolig* (which presents a positive and significant effect on PSE).

In column 3, we employ a vertical fiscal imbalance measure (denoted as *VertImb1*) in order to capture the fiscal dependency of local governments on intergovernmental transfers. We observe that the coefficient on *VertImb1* bears a negative sign and is significant at the 1% level. This result is in accordance with our previous findings on the relationship between tax autonomy and PSE, as well as the dominant view of the theoretical literature (see e.g. Oates 1979, 1991). A similar result is reached by using an alternative fiscal dependency measure,

(i.e. *VertImb2* in column 4). In both estimations presented in columns 3 and 4, the behavior of the control variables is similar to that observed in column 2.

5.2. Sensitivity analysis

In this section we inquire into the robustness of our results. First, we examine the sensitivity of our estimates with respect to individual outliers, as well as with respect to regional characteristics. Next, we re-estimate our model using five year averages, in order to ensure that our results are not driven by the noise generated by annual data. Finally, we re-estimate our benchmark model using an alternative measure of government efficiency, namely the economic stability (*EcStab*) indicator, as defined above.[32]

Seeing that our sample consists of 21 OECD countries, which are quite heterogeneous in many aspects, we first examine the sensitivity of our estimates to individual outliers or to regional characteristics. To account for the first issue, we re-estimate our benchmark model, this time excluding all observations with an error term in the upper or lower 5th percentile (i.e. we drop 10% of our sample). The results, presented in column 1 and 2 of Table 3, indicate that the conclusions presented in Sections 5.1 are firm as regards the influence of individual outliers. The second issue that relates to the potential effect of regional characteristics has been (partially) addressed by including the three dummies *Scandinavian, Anglo-Saxon, Mediterranean* in the empirical models. Here we further examine whether the results change when we exclude each of these groups in turn. The results, presented in columns 5 to 10, suggest that the effects of *Taxrevdec* and *TaxAut* on PSE remain positive and significant at conventional levels.

Another potential drawback of the analysis of the previous section is the annual nature of the dataset. This was the preferred choice with the aim of increasing the size of our sample, which may however come at the expense of also increasing the noise in the data.[33] This would imply that observed changes in PSE may be due to random factors (such as the business cycle), which are not necessarily related to changes in the explanatory variables. For this reason, we re-examine our two propositions using simple five-year averages of our data. The results, reported in column 3 and 4 of Table 3, suggest that even though for most of the control variables the statistical and economic significance drops, the variables of main

[32] For expositional brevity, in Table 3 we present the results from using only *Taxrevdec* as the measure of decentralization. We have verified, however, that our results carry through to the rest of the measures used in Table2 1 and 2.

[33] Rodden (2003) underlines the importance of panel studies in examining fiscal decentralization and argues that cross-national studies fail to capture important aspects of this issue, since they do not account for the fact that the process of decentralization unfolds overtime.

interest remain practically unaffected. We attribute the increase in the standard errors to the fact that our sample is now confined to about 100 observations and it is well-known that maximum likelihood estimators usually produce a bias in small samples, with this bias diminishing as the sample increases. Nonetheless, as the coefficients on *TaxRevDec* and *TaxAut* remain significant, we are confident that the positive relationship in hand is robust to the larger time span of our observations.

An important sensitivity analysis involves estimation of Eq. (2) using a different dependent variable (namely *EcStab*) that looks into economic stability as the ultimate goal of governments.[34] Once again, we use a number of alternative specifications that capture the relationship between fiscal decentralization and PSE and between fiscal dependency and PSE. The results, reported in Table 4, suggest no discrepancy from previous findings: Increased fiscal decentralization and tax autonomy exert a positive impact on PSE, with the results in some cases being enhanced compared to their counterparts of Tables 1 and 2.[35] Concerning the rest of the explanatory variables our results also remained analogous to our previous findings.

6. Conclusions

In this paper we specified an empirical framework to investigate the effect of fiscal decentralization on public sector efficiency. With this aim we (i) directly measured PSE using DEA, thereby specifying an underlying production process of public goods; and (ii) examined the impact of the variables of interest on PSE via the amalgamation of two prominent semi-parametric techniques. Therefore, we proceeded in two stages. The first involved estimation of PSE, in terms of assuming governments to aim for either economic performance or stability, while the second entailed regressing the PSE scores derived in stage 1 on a number of well-established indicators for fiscal decentralization. The analysis was carried out on a panel that included 21 OECD economies over the period 1970-2000. Backed by strong empirical results, obtained from a number of different specifications and sensitivity analyses, we contend that public sector efficiency is increasing with fiscal decentralization. This relationship calls for a deeper understanding of the inter- and intra-country mechanisms that shape it; however, before moving on to another issue, we have better bring this entry to a close.

[34] Note that until now we assumed that governments aim at improved economic performance.
[35] The vertical fiscal imbalance indicators enter the estimated equations (columns 5 and 6) with negative and significant coefficients, much like in Table 2.

Table 1
Public sector efficiency and fiscal decentralization

PSE(EcPerf)	**(1)**	**(2)**	**(3)**	**(4)**
Taxrevdec	0.005***			
	(5.99)			
Revdec		0.004***		
		(4.19)		
DecGFS1			0.002**	
			(2.35)	
DecGFS2				0.003***
				(2.69)
Coalition	-0.068**	-0.015	-0.042*	-0.038
	(-2.46)	(-0.55)	(-1.70)	(-1.53)
NSM	-0.008***	-0.020***	-0.018***	-0.019***
	(-2.94)	(-8.32)	(-7.84)	(-7.90)
EconFreedom	0.104***	0.146***	0.135***	0.138***
	(4.90)	(8.01)	(7.28)	(7.38)
Depend	0.227	0.311	0.191	0.239
	(0.94)	(1.34)	(0.86)	(1.06)
TFP	1.802***	0.769	0.447	0.446
	(2.98)	(1.57)	(0.02)	(0.02)
Open	0.003**	-0.001	0.001	0.001
	(1.97)	(-0.75)	(0.78)	(0.33)
Ethnolig	-0.166	0.373***	0.561***	0.511***
	(-1.34)	(2.99)	(5.23)	(4.60)
Obs	495	398	468	468
Wald	216.72	363.87	308.51	316.53
Sigma	0.237	0.193	0.205	0.204

Note: **,*** denote statistical significance at 5% and 1% level of statistical significance respectively. Country dummies are included in all estimated equations

Table 2
Public sector efficiency and fiscal dependency of local governments

PSE(EcPerf)	**(1)**	**(2)**	**(3)**	**(4)**
TaxAut	0.001**			
	(2.62)			
TaxAutGFS		0.002***		
		(3.49)		
VertImb1			-0.002***	
			(-2.77)	
VertImb2				-0.003***
				(-3.46)
Coalition	-0.088***	-0.039	-0.011	-0.012
	(-3.55)	(-1.52)	(-0.45)	(-0.45)
NSM	-0.013***	-0.018***	-0.019***	-0.017***
	(-5.34)	(-7.67)	(-8.16)	(-6.86)
EconFreedom	0.119***	0.119***	0.128***	0.115***
	(5.91)	(6.05)	(7.10)	(5.96)
Depend	-0.267	-0.045	0.147	0.078
	(-1.17)	(-0.21)	(0.71)	(0.36)
TFP	1.441***	1.000**	1.286***	1.231***
	(2.99)	(2.16)	(2.88)	(2.69)
Open	0.006***	0.001*	0.000	0.001**
	(3.43)	(1.86)	(-0.15)	(2.41)
Ethnolig	0.188*	0.361***	0.610***	0.465***
	(1.75)	(3.16)	(5.56)	(4.08)
Obs	581	473	469	469
Wald	214.60	268.04	331.05	289.10
Sigma	0.245	0.214	0.203	0.210

Note: *, **, *** denote statistical significance at 10%, 5% and 1% level of statistical significance respectively. Country dummies are included in all estimated equations

Table 3
Sensitivity analysis I: Accounting for outliers, short-run dynamics and regional effects

PSE(EcPerf)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Taxrevdec	0.005***		0.041***		0.008***	0.005***	0.003***			
	(5.95)		(2.68)		(7.52)	(5.39)	(3.22)			
TaxAut		0.001***		0.001**				0.001**	0.001***	0.001**
		(2.77)		(2.34)				(2.43)	(3.56)	(2.17)
Coalition	-0.069**	-0.075***	-0.125**	-0.107*	-0.029	-0.083***	-0.116***	-0.073**	-0.111***	-0.088***
	(-2.51)	(-3.10)	(-2.17)	(-1.82)	(-0.76)	(-2.79)	(-3.45)	(-2.27)	(-3.74)	(-2.85)
NSM	-0.008***	-0.011***	-0.011*	-0.007	-0.004	-0.009***	-0.015***	-0.012***	-0.013***	-0.017***
	(-2.82)	(-4.40)	(-1.81)	(-1.28)	(-1.26)	(-3.18)	(-4.27)	(-4.75)	(-5.24)	(-6.12)
EconFreedom	0.118***	0.116***	0.071**	0.053*	0.136***	0.111***	0.116***	0.144***	0.129***	0.136***
	(5.01)	(5.63)	(2.21)	(1.82)	(5.32)	(4.96)	(4.10)	(6.03)	(5.97)	(5.36)
Depend	0.322	-0.130	0.176	0.398	0.652**	0.099	1.132***	-0.270	-0.428*	0.606*
	(1.21)	(-1.22)	(0.43)	(0.96)	(2.26)	(0.39)	(3.07)	(-1.05)	(-1.69)	(1.88)
TFP	1.722***	1.426**	3.900*	6.199***	3.134***	1.969***	0.732	1.840***	1.391**	1.050**
	(2.71)	(2.39)	(1.79)	(3.39)	(3.93)	(3.03)	(1.02)	(3.21)	(2.64)	(1.98)
Open	0.003*	0.005**	0.007**	0.006	0.002	0.003*	0.018***	0.005***	0.004***	0.019***
	(1.90)	(2.48)	(2.24)	(1.58)	(0.95)	(1.74)	(3.98)	(3.16)	(2.76)	(4.88)
Ethnolig	-0.141	0.139	0.329*	0.667***	-0.400***	-0.092	0.166	0.158	0.266**	0.267*
	(-1.22)	(1.40)	(1.67)	(3.38)	(-3.01)	(-0.66)	(1.05)	(1.41)	(2.23)	(1.82)
dscand	0.055*	0.101*	0.103*	0.046		0.069**	0.100**		0.116***	0.127***
	(1.83)	(1.80)	(1.93)	(0.80)		(2.04)	(2.59)		(3.62)	(3.59)
das	0.046	0.048	0.141*	0.121*	0.003	0.030		-0.002	-0.007	
	(1.12)	(1.31)	(1.82)	(1.85)	(0.07)	(0.73)		(-0.05)	(-0.20)	
dmed	0.171***	0.164***	0.254***	0.186***	0.250***		0.159***	0.229***		0.259***
	(3.29)	(3.02)	(3.92)	(2.69)	(4.77)		(3.19)	(5.09)		(5.66)
Obs	446	523	100	117	356	450	352	440	485	436
Wald	233.72	213.75	82.92	82.18	242.67	220.15	168.97	223.73	219.52	194.93
Sigma	0.214	0.234	0.192	0.198	0.238	0.240	0.237			

Note: *, **, *** denote statistical significance at 10%, 5% and 1% level of statistical significance respectively. Country dummies are included in all estimated equations

Table 4
Sensitivity analysis II: Using economic stability as a measure of government performance

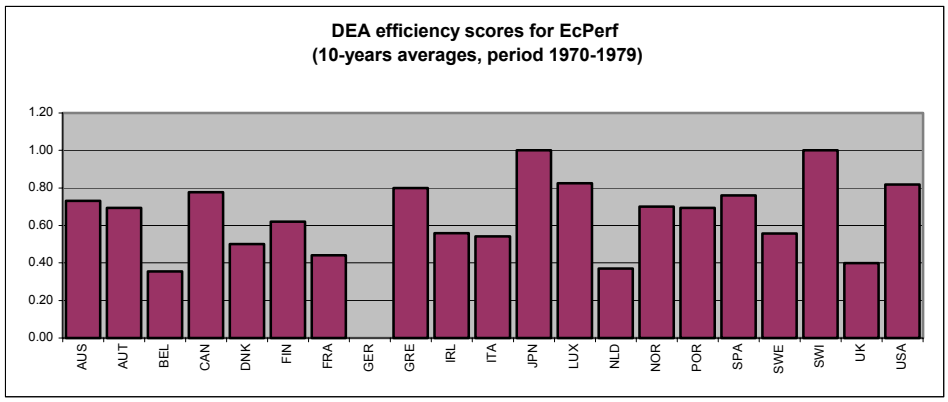
PSE(EcSstab)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Taxrevdec	0.007***							
	(7.26)							
Revdec		0.007***						
		(6.80)						
DecGFS1			0.004***					
			(3.23)					
DecGFS2				0.002**				
				(2.09)				
VertImb1					-0.002**			
					(-2.18)			
VertImb2						-0002**		
						(-2.59)		
TaxAut							0.003***	
							(8.04)	
TaxAutGFS								0.003***
								(2.87)
Coalition	-0.008	0.029	-0.016	-0.015	-0.006	-0.004	-0.044*	-0.012
	(-0.27)	(0.93)	(-0.56)	(-0.52)	(-0.19)	(-0.13)	(-1.68)	(-0.40)
NSM	0.004	0.001	-0.001	-0.001	-0.001	-0.001	0.001	-0.001
	(1.49)	(0.18)	(-0.37)	(-0.46)	(-0.46)	(-0.40)	(0.24)	(-0.31)
EconFreedom	0.147***	0.155***	0.153***	0.149***	0.136***	0.137***	0.102***	0.144***
	(6.13)	(7.13)	(6.99)	(6.73)	(6.26)	(6.11)	(4.75)	(6.44)
Depend	0.803***	0.728**	0.548**	0.457*	0.296	0.216	-0.099	0.212
	(2.97)	(2.64)	(2.10)	(1.72)	(1.19)	(0.84)	(-0.41)	(0.83)
TFP	1.532**	1.247**	1.233**	1.206**	1.261**	1.265**	1.567***	1.135**
	(2.25)	(2.13)	(2.35)	(2.28)	(2.35)	(2.29)	(3.06)	(2.06)
Open	0.002	0.000	0.004*	0.004*	0.004**	0.005**	0.007***	0.005**
	(1.10)	(0.00)	(1.90)	(1.71)	(2.13)	(2.39)	(3.73)	(2.41)
Ethnolig	0.031	0.444***	0.883***	0.871***	1.022***	0.931***	0.403***	0.803***
	(0.22)	(2.99)	(7.00)	(6.60)	(7.73)	(6.91)	(3.53)	(6.03)
Obs	495	398	468	468	469	469	581	473
Wald	245.16	287.78	259.97	254.68	258.75	215.93	281.69	212.18
Sigma	0.264	0.233	0.243	0.244	0.244		0.259	

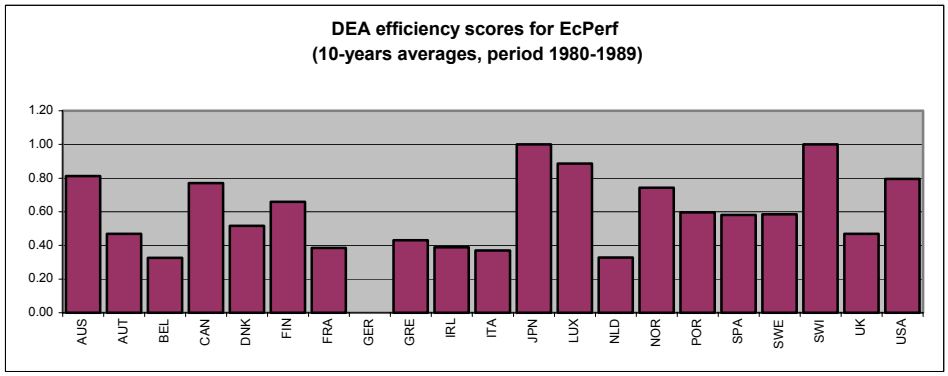
Note: *, **, *** denote statistical significance at 10%, 5% and 1% level of statistical significance respectively. Country dummies are included in all estimated equations

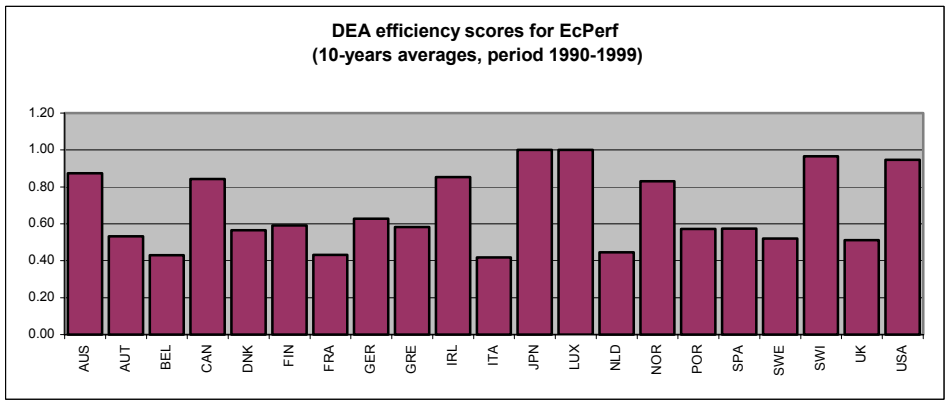
Appendix A : Data Sources and Descriptive Statistics

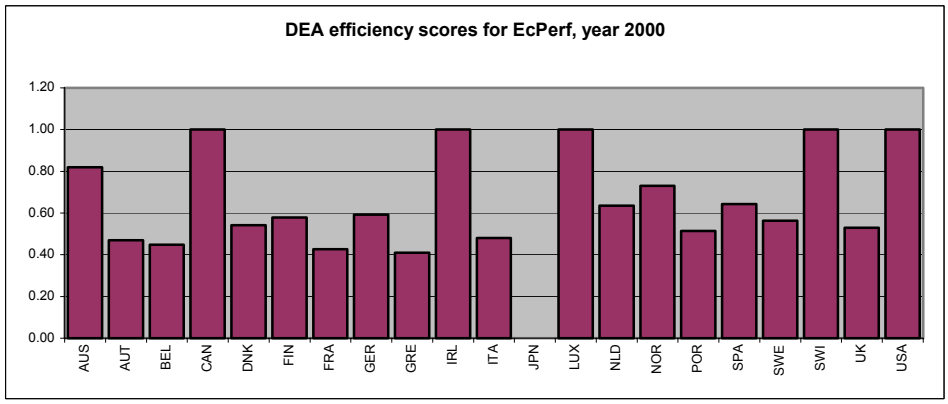
	Description	Obs.	Mean	Std. Dev.	min	max	Sources
PSE (EcPerf)	DEA efficiency scores when the output is Economic Performance	630	0.58	0.29	0.28	1	Own calculations based on Afonso et al. (2005).
PSE (EcStab)	DEA efficiency scores when the output is Economic Stability	630	0.61	0.32	0.27	1	Own calculations based on Afonso et al. (2005).
Taxrevdec	Sub-Central Government own tax revenue as a share of General Government total tax revenue.	522	22.40	17.09	0.27	61.50	Stegarescu (2005b)
Revdec	Sub-Central Government own tax and non-tax revenue as a share of General Government total tax revenue	403	25.23	15.89	4.13	64.69	Stegarescu (2005b)
DecGFS1	Sub-national Expenditures as a share of total expenditures	481	31.70	13.76	1.45	59.18	Government Financial Statistics. IMF (2002)
DecGFS2	Sub-national Revenues as a share of total revenues	481	23.20	14.21	1.61	54.60	Government Financial Statistics. IMF (2002)
TaxAut	Sub-Central Government own tax revenue as a share of Sub-Central Government total tax revenue	623	77.27	33.91	2.83	100	Stegarescu (2005b)
TaxAutGFS	Sub-national tax revenues as a share of sub-national revenues and grants	486	40.59	17.09	2.15	108.73	Government Financial Statistics. IMF (2002)
VertImb1	Transfers from other levels of government as a share of sub-national expenditures.	483	40.04	16.61	8.39	82.00	Government Financial Statistics. IMF (2002)
VertImb2	Transfers from other levels of government as a share of sub-national revenues and grants	483	41.42	17.70	8.45	86.41	Government Financial Statistics. IMF (2002)
Coalition	Dummy variable taking the value 1 if a coalition cabinet is in power	609	0.55	0.49	0.00	1.00	Tavares (2004)
NSM	Number of Spending Ministers	633	15.30	4.79	5.00	33.00	Mierau et al. (2007)
EconFreedom	Index of Economic Regulation	651	5.89	0.81	4.30	8.30	Gwartney and Lawson (2006)
Depend	Population 16- and 65+ as a share of total population	651	0.52	0.05	0.44	0.74	World Bank Development Indicators(WBDI) (2004)
TFP	Total Factor Productivity	630	0	0.02	-0.20	0.10	Own Calculations as described in Section 3.3. Data from Penn World Tables (2006)
Open	Residuals from regression of Size on (Exports+Imports)/GDP	630	0	10.77	-43.35	78.83	Own Calculations as described in Section 3.3. Data from WBDI (2004)
Ethnolig	Index of ethno-linguistic fractionalization	651	0.13	0.11	0.003	0.376	La Porta et al. (1999)

Appendix B : Graphs of PSE(EcPerf) and PSE(EcStab)

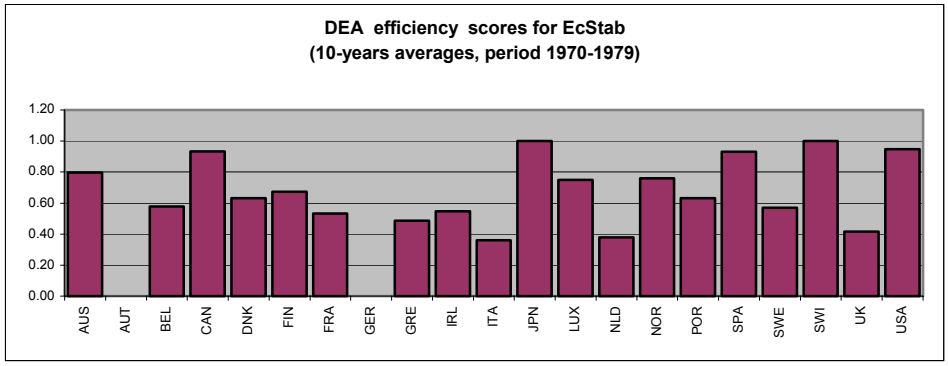


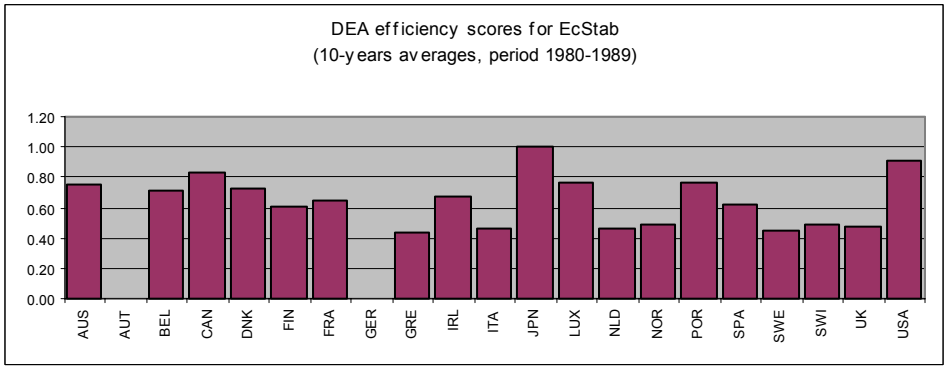


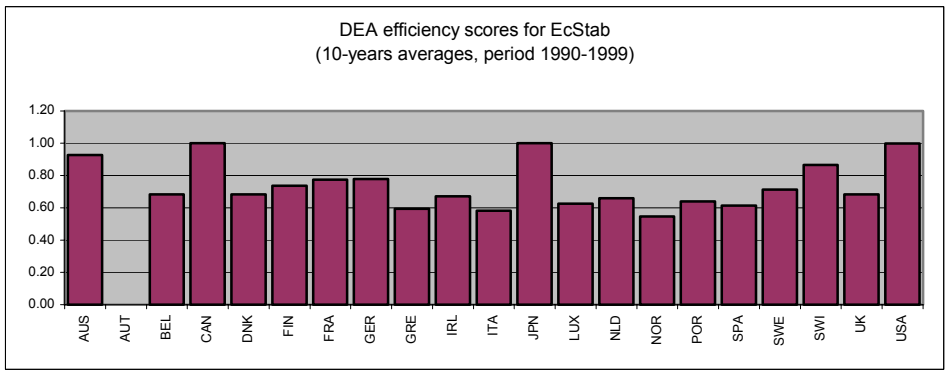


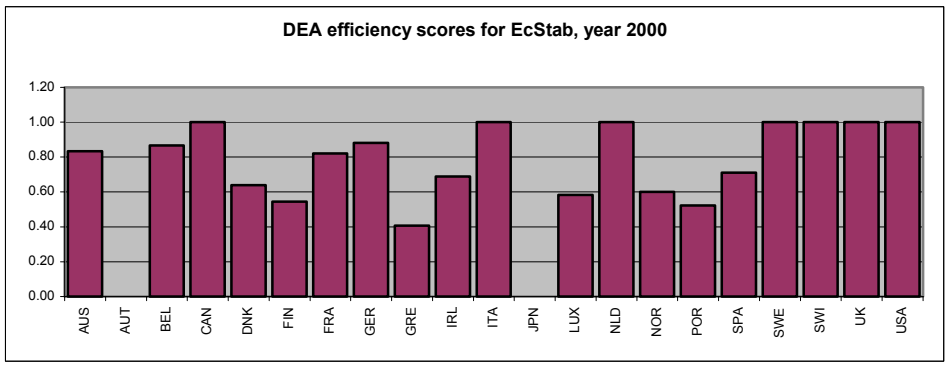


Note: Estimates of PSE(EcPerf) for Gernany prior to 1991 and for Japan after 1994 are not available due to the unavailability of the data for unemployment and public spending respectively.









Note: Estimates of PSE(EcStab) for Austria, for Germany prior to 1991 and for Japan after 1994 are not available due to the unavailability of the data for standard deviation of growth, inflation and standard deviation of growth and public spending respectively.

Appendix C : Correlation Matrix

	DecGFS1	DecGFS2	Taxrevdec	Revdec	VetrImb	VertImb2	TaxAut	TaxAut GFS	Coalition	NSM	Depend	Econ Freedom	TFP	Open	Ethnolig
DecGFS1	1														
DecGFS2	0.93	1													
Taxrevdec	0.71	0.78	1												
Revdec	0.81	0.87	0.97	1											
VetrImb	-0.45	-0.70	-0.52	-0.57	1										
VertImb2	-0.47	-0.73	-0.53	-0.59	0.97	1									
TaxAut	0.19	0.033	0.45	0.35	0.29	0.29	1								
TaxAutGFS	0.44	0.66	0.57	0.57	-0.92	-0.86	-0.21	1							
Coalition	-0.02	-0.06	-0.13	-0.08	0.11	0.13	-0.13	-0.07	1						
NSM	-0.14	-0.12	-0.08	-0.16	-0.06	0.01	0.11	0.17	-0.25	1					
Depend	-0.30	-0.35	-0.22	-0.27	0.22	0.27	0.19	-0.27	-0.23	0.09	1				
Econ Freedom	0.32	0.26	0.30	0.32	0.09	0.04	0.42	-0.09	-0.21	0.07	-0.07	1			
TFP	-0.02	-0.02	-0.05	-0.04	0.07	0.06	-0.05	-0.05	-0.03	-0.02	-0.03	0.04	1		
Open	0.24	0.31	0.20	0.27	-0.18	-0.21	0.045	0.12	-0.16	-0.20	-0.01	0.29	0.02	1	
Ethnolig	0.10	0.20	0.45	0.41	-0.09	-0.07	0.22	0.14	-0.11	-0.04	-0.20	0.19	-0.06	0.063	1

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