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DECENTRALIZATION AND LOCAL GOVERNMENTS' PERFORMANCE: HOW DOES FISCAL AUTONOMY AFFECT SPENDING EFFICIENCY?

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Decentralization and Local Governments' Performance: How Does Fiscal Autonomy Affect Spending Efficiency?*

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Abstract. In Italy, as in other countries around the world, recent reforms share the goal of increasing the fiscal autonomy of lower tiers of governments, from Regions to Municipalities, in order to align spending with funding responsibilities and increase the efficiency in the provision of essential public services. The purpose of this paper is to assess spending efficiency of local governments and to investigate the effects of tax decentralization, focusing on the role played by incumbent politicians' accountability. The analysis relies on a sample of Italian municipalities and exploits both parametric (SFA) and nonparametric (DEA) techniques to study spending inefficiency and its main determinants. Consistently with modern fiscal federalism theories, our results show that more fiscally autonomous municipalities exhibit less inefficient behaviours. We also find that the shorter is the distance from new elections, the higher is excess spending, thus giving further support to the traditional "electoral budget cycle" argument. Other political features of governing coalition, such as age and gender of the mayor, do not seem to exert any significant impact on inefficiency levels.

Keywords: Local governments, Fiscal autonomy, Political accountability, Spending efficiency, Parametric and nonparametric frontiers

JEL: D72, D78, H71, H72, H77, R51

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1. Introduction

In Italy, as in other countries around the world, recent reforms (simply discussed or, at least partially, implemented) share the goal of increasing the fiscal autonomy of lower tiers of governments, from Regions to Municipalities. Increasing fiscal decentralization implies a better alignment between spending and funding responsibilities and, as suggested by economists, a potential improvement of the efficiency (as well as of the effectiveness) of public services provided to citizens. The mechanism to explain these improvements in public spending efficiency and voter welfare suggested by modern theoretical literature on fiscal federalism highlights the importance of electoral accountability of incumbent politicians, obtainable by increasing the degree of fiscal autonomy (e.g., Hindriks and Lockwood, 2009; Weingast, 2009).

Is fiscal decentralization really effective in reaching this end? The available empirical literature considered mostly the impact of fiscal decentralization on the *size* of spending, basically assuming that a *large* spending is inefficient (e.g., Fiva, 2006; Borge and Rattsø, 2008). Very few papers attempted at identifying *efficient* spending, by exploiting the literature on production and cost frontiers estimation (Coelli *et al.*, 2005), thus, separating productive inefficiencies from total spending. Moreover, the few works on the *determinants of efficiency* in local governments has explored the role of several variables (socio-economic and political characteristics, geographic location, etc.), but in a very small number of cases these determinants could be related to fiscal federalism and the incentives it creates. Among all these variables, it is interesting to note the role of grants and taxes. In all the studies, it appears that a high level of dependency from Central government transfers worsens the efficiency scores. As for taxation, results are somewhat mixed. A positive relationship between higher local tax rates and efficiency scores emerges in De Borger *et al.* (1994), De Borger and Kerstens (1996), and Vanden Eeckaut *et al.* (1993). On the contrary, the recent study by Balaguer-Coll *et al.* (2007) points out a negative impact of higher per capita tax revenues on productive efficiency.

Following this line of research, the purpose of this paper is to assess the impact of fiscal decentralization on local spending efficiency, taking also into account the influence of some political features of governing coalitions. Relying on a sample of 262 Italian municipalities, we compute efficiency scores adopting two different reference technologies: one *nonparametric* frontier (estimated by *Data Envelopment Analysis* – DEA) and one *parametric* frontier (estimated by *Stochastic Frontier Analysis* – SFA). Following the scant empirical literature on productive efficiency of municipalities (e.g., De Borger and Kerstens, 1996; Prieto and Zofio, 2001; Balaguer-Coll *et al.*, 2007; Giménez and Prior, 2007), we selected output indicators that are proxies for services provided by local governments in their most fundamental competencies, both for their budget and for their own citizens. Specifically, we proxy outputs with the number of inhabitants, the total length of municipal roads, the amounts of waste collected, and the sum of the number of pupils enrolled in nursery, primary and secondary schools and the number of people over age 75 (to capture the needs for education, elderly care and other social services). Inputs are represented by *disaggregated* current expenditures in general administration, road maintenance and local mobility, garbage collection and disposal, education, elderly care and other social services. This represents an improvement with respect to previous literature, that so far has relied on a crude measure of current expenditure considered as a whole.

After estimating the level of spending efficiency for all municipalities with both methodologies, we then investigate the impact of several proxies for fiscal decentralization and political accountability in two different ways. In the DEA nonparametric approach we rely on a two-stage analysis based on a Tobit regression model, while in the SFA parametric one we include the explicative factors for inefficiency directly in the frontier model, following the approach proposed by Battese and Coelli (1995). To this end, we consider as a measure of fiscal decentralization the ratio of municipal taxes on current expenditure, which represents a measure of *vertical imbalance* and – in our view – the best

proxy for electoral accountability of local politicians. We also augment our empirical models by considering the potential incentives towards higher efficiency stemming from fiscal rules implemented by the Central government (the so-called *Domestic Stability Pact*), imposing a tighter budget constraint to largest municipalities. Finally, we test whether the behaviour of incumbent politicians closer to new elections, as well as the political orientation of local government, significantly impact on spending efficiency. Our results show that all variables accounting for tax decentralization and politicians' accountability are almost always significant determinants of efficiency.

The remainder of the paper is structured as follows. In Section 2, we briefly review the vast theoretical literature on fiscal federalism, focusing in particular on inefficiencies and the role played by tax decentralisation. In Section 3, after discussing institutional details on Italian municipalities, we present our data and the empirical methodology. Results about the effects of fiscal decentralisation and other economic and political factors on spending inefficiency are discussed in Section 4. Section 5 ends the paper.

2. Two generations of fiscal federalism theories

In this section, we briefly review the vast literature on fiscal federalism, by focusing in particular on the theoretical interpretation of tax decentralisation. Economic literature on fiscal federalism has always been embedded in public finance, and it shares with public finance the view of governments and their functioning. According to Oates (2005), *First Generation Theory* of fiscal federalism (FGT from now on) developed within a tradition of studies in public economics that looked at government agencies as "custodians of the public interest", with the objective of maximising social welfare, because of benevolence of politicians, or some sort of social pressure from citizens in democratic societies. Starting from these premises, in presence of differentiated preferences at the local level for public goods (such as roads or waste management), it is not surprising the improvement in social welfare obtainable

by decentralising their provision, a result well-known in the literature as "decentralization theorem" (Oates, 1972). Local governments can adjust the provision of public goods to meet local demands, hence improving the social outcome obtained with a uniform provision defined at the central level. Notice that, in this framework, the only possible *inefficiencies* might arise from interjurisdictional spillovers in the provision of local public goods. And this explains well the normative suggestion of using matching grants as pigouvian subsidies to local governments, provided from the Central government in order to internalize external benefits from local policies. Following these arguments, then, the case for decentralisation was based on a sort of trade-off between two sources of "inefficiencies": on the one hand, when the provision of local public goods is centralised, uniform provision is inefficient if local demands are differentiated; on the other hand, when the provision is decentralised, local governments might not take into account positive externalities for other jurisdictions. Hence, the crucial problem in FGT was the proper assignment of functions to different levels of government, and – in turn – the "tax-assignment" problem (Oates, 2005). As for the first challenge, the suggestion was to assign local governments the provision of local services with geographically differentiated preferences. As for the second problem, the normative suggestion was to assign the *property tax* to local governments, because it can work as a benefit tax and can be used to provide mobile economic units (like households and firms) with an efficient (and differentiated) level of local services.

The types of inefficiencies on which FGT concentrates are not, however, those that typically makes newspapers' headlines, from mismanagement of public resources to real cases of corruption. To understand dissipation of public monies one needs to recognise: first, that politicians do not typically act to maximise social welfare, but their own interest; second, that their effort in pursuing public goals cannot be directly observed by voters; third, that political institutions affects the heterogeneity of politicians (Oates, 2005; Besley, 2006;

Weingast, 2009). These are arguments at the core of the *Second Generation Theory* of fiscal federalism (SGT from now on), which analyses a different trade-off with respect to the one crucial for FGT. In particular, the "centralisation versus decentralisation" issue is based now on the comparison between the higher degree of policies coordination under centralisation (which guarantees the internalisation of externalities) and the higher degree of *accountability* of local politicians under decentralisation. Hence, from a normative point of view, decentralisation should be pursued not only when there are differences in tastes for local services, but also as a tool to achieve a better control on politicians' performance.

Of course, decentralisation does not come without dangers. As Prud'Homme (1995) observes, one such danger is the exploitation of "fiscal commons", i.e., the opportunistic behaviour of local communities that inflate spending and free-ride on the nation as a whole to cover additional unnecessary expenditure. The opportunistic behaviour originates from the *expectations* that somebody else will help in footing the bill, which makes fiscal indiscipline more likely. As the literature puts it, the budget constraint of local governments becomes soft (e.g., Kornai *et al.*, 2003); the problem then is how to harden local budget constraints. Oates (2005) suggests two fundamental avenues: a reliable and effective local system of taxation, and a system of intergovernmental grants which is not subject to manipulation. While the second of these suggestions poses several problems, the property tax is thought to be the answer for making a reliable and effective system of local taxation. Differently from FGT, however, here the role of property tax relies on the incentives for local governments toward the provision of local public goods that maximises property values, and – in turn – revenues (Tiebout, 1956; Glaeser, 1996). As Weingast (2009) puts it, «subnational governments that raise a substantial portion of their own revenue tend to be more accountable to citizens, to provide market-enhancing public goods, and to be less corrupt».

The evidence on this incentive effect stemming from local property tax is quite limited, and seems to be restricted to Norway so far. Fiva and Rønning (2008) suggest that – conditional on resource use – the local property tax increase school quality, measured by students' achievements in national standardised tests. Borge and Rattsø (2008) find that local governments with property tax have 20% lower sewage costs than local governments without property tax. These estimated impacts are surprising given the Norwegian institutional setting, where 90% of local governments' revenues are from Central government grants and regulated income taxes, while the remaining 10% comes from user charges and property taxes. Moreover, the evidence is only indirectly related to productive *efficiency* in the provision of local services. In the remainder of the paper we concentrate on the Italian case, where local taxes fund a substantial share of total expenditures, and we focus on *efficiency* in the provision of most of the services provided by Municipalities.

3. Empirical strategy

The aim of the paper is to test the "accountability effect" of local taxes, a central proposition of the SGT of fiscal federalism. To this end, differently from the previous literature, we identify the inefficient component of municipal spending for the provision of local public services, and test whether and how such inefficiency is affected by the degree of tax decentralisation and other political economy variables. We first present some institutional details and the data, and then describe the two methodologies used to estimate inefficient spending.

3.1. Institutional features of Italian municipalities

The Italian Public Administration structure is characterised by different layers of governments: Central State, Regions, Metropolitan Areas, Provinces, and Municipalities. The Republican Constitution – implemented in 1948 and amended in 2001 – assigns different tasks to these different local governments. In particular, excluding Metropolitan Areas (which are basically a selection of the biggest cities in different regions), Municipalities are in charge of a wide

array of services: from administrative services provided directly to citizens (including, for instance, the Registry office) to local police, from local mobility to waste management and social services (like childcare or care for the elderly). Funding for Municipalities also include a number of different sources of revenues, from own taxes and charges for specific services to grants received from Regional and Central governments. According to aggregate data at the national level, about 2/3 of expenditure is funded with autonomous revenues, while the remaining 1/3 is received as a transfer from upper-level governments.[1] The most important autonomous source of tax revenues is represented by the Italian local property tax, the so-called *Imposta Comunale sugli Immobili* (*ICI*), which brings about almost 1/4 of total municipal revenues. It applies on both domestic and business properties, according to a set of rules defined at the national level. Local governments can however freely set both the tax rate, in a range between 0.4% and 0.7%, and – up to a certain degree – total or partial exemptions for specific types of property. Other two important local tax revenues are represented by a surcharge on the Personal Income Tax (*Addizionale Comunale IRPEF*) and the specific charges for waste collection and management (*TARSU*). As for the first, which represents more than 10% of total revenues at the national level, Municipalities can only modify – within a very limited extent – the tax rate. As for the second – which is slowly changing from a tax to a tariff for the service provided – it is computed relying on a vague proxy of waste production (i.e., the size of the dwelling), and Municipalities can freely decide both rates and exemptions; it represents almost 10% of total revenues for Municipalities at the national level. Distribution of the tax base is of course very different among municipalities, especially for the local property tax and the surcharge on the personal income tax.

Differences among municipalities arise also in terms of administrative and political rules, according to the size of the town as measured by total population.

[1] It is worth highlighting that the situation is very much differentiated across the country: indeed, Northern municipalities are funded with about ¾ of autonomous revenues, while for Southern municipalities the corresponding figure is only around ¼ .

For instance, the size of the municipal council varies between 12 members (for municipalities below 3,000 inhabitants) to 50-60 members (for municipalities above 500,000 inhabitants). The remuneration of the mayor and of council members increases with population size too. The monthly gross wage of the mayor ranges between 1,291 euro to 7,798 euro; gross wage for council members is computed as a percentage of the mayor one: it is 15% for small municipalities, and increases up to 75% for the largest ones. Electoral rules are also different, with a threshold fixed at 15,000 inhabitants: below this limit there is a single round of voting; above this limit, the rule is for runoff plurality voting. Term limits for the mayor are however the same: no more than two consecutives mandates are at present allowed. A single threshold operates also for the possibility to create neighbourhood councils within the city. These are sub-levels of local governments with independent budgets and are allowed for municipalities with more than 30,000 inhabitants. Finally, as local governments' budgets are consolidated in the Italian whole public budget and contribute to define the national deficit – which is relevant for the fiscal rules defined in the European *Stability and Growth Pact* [2], Italy has introduced a so-called *Domestic Stability Pact* (*DSP*) since 1999. The fiscal rules for municipalities and other sub-national governments have often been varied by Central State, that imposed restraints alternatively on expenditure growth or the size of the deficit. The scope of the law spans over all levels of Italian territorial administrative structure: Regions, Provinces and Municipalities. However, starting from 2001, municipalities with less than 5,000 inhabitants were excluded from the *DSP*.[3]

Besides tax structure, political rules and fiscal restraints, a last important dimension along which the municipalities appear to be different concerns the management form for a locally provided service, namely waste collection and

[2] The *Stability and Growth Pact*, first introduced in 1997 and successively revised in 2005, is an agreement among EMU member states aimed at mantaining and enforcing fiscal discipline in the EMU. For more details, see Brunila *et al.* (2001).

[3] For a discussion of strengths and weaknesses of Italian *DSP* fiscal rules, refer to Gastaldi and Giurato (2009). A critical analysis of the main European experiences is provided in Ambrosanio and Bordignon (2009).

disposal.[4] The observed alternatives range from direct production within the municipality (i.e., the so-called *in-house* provision), to the resort to a specific firm (publicly or privately owned), up to the creation of a cooperative company aggregating two or more municipalities in the management of the service[5].

3.2. Data

Our sample is composed by 262 municipalities, all belonging to the Province of Turin. The Province of Turin represents an interesting case study within the Italian landscape, since it is the province with the highest number of local governments (315), thus ensuring a great variability in the data. This variability is confirmed not only by looking at population size (included are Moncenisio, with 48 inhabitants, as well as Moncalieri, with 55,000 inhabitants, besides Turin, the capital of Piedmont Region, with over 900,000 residents), but also in terms of territorial morphology (more than 10% of municipalities is located over 1,000 metres of altitude), the management of public services, and political and socio-economic characteristics.

However, at least to some extent, this huge heterogeneity across Province units introduces potential biases in our study, especially for the presence of some municipalities that are subject to different political rules and produce the analysed services within different environmental contexts. Therefore, we have decided to exclude from the sample – besides Turin (because it is one of the Metropolitan Areas envisaged by the Constitution) – all the towns over 15,000 inhabitants, as they are clearly not comparable along several dimensions with other smaller municipalities. In terms of spending, the share absorbed by the four sectors considered in our analysis represents less than 80% of total current

[4] In principle, the differences among municipalities as for the management form would involve also education and social services, like those provided by retirement homes and day nurseries. However, differently from waste management, spending for education and social services included in the municipal budget only represent direct transfers to the citizens to subsidize the access to these services, while operating costs are ruled out.

[5] As for the environmental services, it is worth highlighting the importance of the national law *D.Lgs. 05/02/1997* (the so-called called *Decreto Ronchi*), which assigns different competencies to Central State, Regions, Provinces and Municipalities in this field. In particular, it establishes the power of Municipalities to define the management form for waste collection and disposal.

expenditure for the largest municipalities (see the discussion below). As for the political rules, these big municipalities are subject to a runoff voting mechanism, which can exert a specific impact on political outcomes and policy choices (e.g., Osborne and Slivinsky, 1996; Bordignon and Tabellini, 2009). Moreover, we excluded the municipalities located over 900 meters of altitude, as they show remarkably higher levels of expenditures compared to other municipalities (on average, 1800 Euro against 560 Euro per capita); this feature can be due to the fact that their provision of services is strongly affected not only by the particular morphology of the territory, but probably also by heavy tourist inflows[6].

3.2.1. Input and output measures

The data we use in the empirical investigation were provided by different public institutions and refer to the year 2005. The most relevant information comes from the Budgets of Italian municipalities published by the Ministry of the Interior (the so-called *Certificati Consuntivi*). Other important data, especially for output indicators, have been obtained from the statistical services of *Regione Piemonte* and *Provincia di Torino*. The selection of input and output variables is strongly influenced by the Italian institutional framework depicted above. More precisely, we have selected the indicators by looking at the most fundamental competencies, both for the municipal budget and for the citizens.

[FIGURE 1 HERE]

In Italy, municipal current expenditure is classified in 12 macro-functions. More than 90% of current expenditure in our sample is represented by five of these functions (see Figure 1): "General administration" (39%); "Environmental management" (22%); "Educational services" (13%); "Social services" (including child and elderly care) (9%); "Road maintenance and local mobility" (8%). Clearly, the share of each function on local current spending varies according

[6] Dividing the municipalities according to their altitude, one can observe that just starting from 900 meters they show levels of average current spending beyond 1000 Euro per capita.

to municipal size: for instance, moving from the smallest municipalities (0-500 inhabitants) to the biggest ones (between 10,000 and 15,000 inhabitants), the weight of "General administration" decreases from 54% to 31%, while the shares of "Educational services" and "Social services" increase from 6% and 5% to 13% and 12%, respectively. We use current expenditure of municipalities in each of these items as an input indicator (*EXP*). For "General administration", "Educational services", "Road maintenance and local mobility", we consider the whole expenditure as registered in the municipal budget. In order to strengthen the connection between spending and selected output indicator, for "Social services" and "Environmental management" categories, we just retain a fraction of total expenditure devoted to these functions. Spending for "Environmental management" only includes the sub-item "Garbage collection and disposal", which represents a relevant share of the whole expenditure related to this task (60-70%). Similarly, from total spending in "Social services", we disentangle the component specifically devoted to public welfare and elderly care. Our final input represents, on average, 86% of total current expenditure, with very little variations across demographical classes of municipalities. Notice that this selection procedure represents a significant improvement with respect to previous literature on local governments' efficiency, which has so far relied on a crude measure of current expenditure considered as a whole.

Following the available literature,[7] we then defined four output indicators directly linked with these spending categories: (1) the total served population as output for "General administration"; (2) the amounts of waste collected for "Garbage collection and disposal"; (3) the total length of municipal roads for "Road maintenance and local mobility"; (4) the number of people in needs of care (i.e., those under 14 years old – enrolled in nursery, primary and secondary schools – and those over 75 years old) for "Educational services" and "Social services". Even if it does not exactly represent a direct output of municipal production, total population (*POP*) is usually assumed to proxy quite well for

[7] See, among others, De Borger *et al.* (1994), De Borger and Kerstens (1996), Prieto and Zofio (2001), Balaguer-Coll *et al.* (2007), Giménez and Prior (2007).

all the various administrative tasks the municipalities are involved in (e.g., maintaining the register of births, marriages, and deaths; issuing certificates, etc.). The number of people under 14 years old and over 75 year old (*DEPEND*) represents a consistent fraction of the needy and it is strictly connected to the provision of educational and care services. The amounts of garbage collected (*WASTE*) is the direct result of the principal competence in environmental management. The total length of municipal roads (*ROAD*) is aimed at proxying especially the output of municipal competencies in managing existing road infrastructures – i.e., road maintenance, public lights, local public transport arrangements, etc. – rather than in building new roads (which belong to a capital expenditure category); this choice is in line with the input variable defined above (spending for "Road maintenance and local mobility"). Table 1 shows the summary statistics for all output and input indicators used in the following empirical analysis.

[TABLE 1 HERE]

It is worth noticing that our sample does not show any variability in input prices at which the municipalities buy the productive factors used to perform the five functions. Indeed, there is no wage flexibility, as salary scales and allowances of municipal personnel are completely fixed. Moreover, since we are considering only the Province of Turin, all municipalities have access to the same capital market, and obtain most of their funds from the same specialized financial institutions at the same interest rate. Thus, the hypothesis of identical input prices across municipalities is quite plausible.[8] Consequently, throughout the analysis we focus on the measurement of *overall* cost inefficiency or, better, *spending* inefficiency, as it is more closely related to the nature of our data than pure *technical* inefficiency.[9]

[8] About this issue, see also the discussion in De Borger and Kerstens (1996).
[9] As for the decomposition of *overall* cost inefficiency into *allocative* and *technical* inefficiency, refer to Coelli *et al.* (2005, chapter 10).

3.3. Empirical models

The techniques adopted to assess productive efficiency are usually classified in parametric and nonparametric methods. We estimate here both a *nonparametric deterministic* frontier (DEA model) and a *parametric stochastic* frontier (SFA model). Each methodology actually presents advantages and disadvantages, but the literature has not been able so far to establish when a technique is strictly superior to the other (Coelli *et al.*, 2005).

Generally, when considering parametric techniques, the functional form of *best-practice* frontier has to be defined a priori, while, relying on nonparametric techniques, no functional form needs to be pre-determined and only the basic microeconomic properties of production set are imposed as constraints to a linear programming problem. On the other hand, SFA technique models both inefficiencies and variables outside the control of decision makers that might impact on production performances, while standard deterministic frontiers like DEA are able to account only for inefficiency, ruling out the role of stochastic disturbances. Given these pros and cons, it is therefore important to check the robustness of our results, by using both approaches to investigate municipal spending efficiency and the role played by fiscal decentralisation.

3.3.1. The DEA model

The DEA approach to efficiency measurement, first proposed in Charnes *et al.* (1978) seminal work, assumes the existence of a convex production set. The corresponding frontier is then built using a linear programming technique, given specific assumptions on the returns to scale.

Let us define: q_i as the column vector of the outputs and x_i as the column vector of the inputs for the i-th municipality; X as the (4×n) input matrix and Q as the (4×n) output matrix, with n the number of municipalities included in the sample. The DEA model is then specified as the solution to the mathematical programming problem in [1], for each of the n municipalities:

$$\text{Min}_{\theta,\lambda}\ \theta \qquad [1]$$

$$\text{s.t.}\quad -q_i + Q\lambda \geq 0$$

$$\theta x_i - X\lambda \geq 0$$

$$N1'\lambda = 1$$

$$\lambda \geq 0$$

In problem [1], θ is a scalar (that satisfies $\theta \leq 1$); more specifically, it is the score that assesses technical efficiency of unit (x_i, q_i). It measures the distance between a municipality and the efficient frontier, the latter being defined as the linear combination of *best-practice* observations; when $\theta < 1$, the municipality lies inside the frontier (i.e., it is inefficient), while $\theta = 1$ implies that the municipality belongs to the frontier (i.e., it is fully efficient). The vector λ is a $(n \times 1)$ vector of constants to be estimated, representing the peers' weights used to project an inefficient unit onto the efficient frontier; the peers are other municipalities that belongs to the best-practice frontier, and are therefore used as benchmarks for the inefficient units. $N1$ is a n-dimensional vector of ones: the restriction $N1'\lambda = 1$ imposes the convexity of the frontier, accounting for *Variable Returns to Scale* (the so-called DEA-VRS model); dropping this restriction would amount to assume *Constant Returns to Scale* (the so-called DEA-CRS model).

Once no price variability across the n observations is assumed, as we do, following De Borger and Kerstens (1996), the measure of *spending* efficiency can be obtained as follows:

$$\text{Min}_{\lambda, x_i^*}\ (w_i' x_i^*) \qquad [2]$$

$$\text{s.t.}\quad -q_i + Q\lambda \geq 0$$

$$x_i^* - X\lambda \geq 0$$

$$N1'\lambda = 1$$

$$\lambda \geq 0$$

where w_i is a vector of unitary input prices and x_i* are the levels of inputs (here expenditure) – computed according to the DEA-VRS model [1] – that a municipality should employ to be technically efficient.

In order to investigate the effects of fiscal decentralisation on municipal spending inefficiency within the DEA framework, we rely on a standard two-stage analysis (Coelli *et al.*, 2005). Thus, we take DEA-VRS inefficiency scores and regress them on a set Z of explicative variables (the so-called *inefficiency determinants*). We specify a second-stage Tobit regression, a censored model that allows us to make proper inference on the factors underlying the estimated inefficiency, considering that fully efficient municipalities show a value of 1, and no values above 1 can be observed.[10]

3.3.2. The SFA model

Within the SFA approach, originating from the pioneer contribution of Aigner *et al.* (1977), we focus here on the *cost function* representation of a given production technology for municipal services. For an arbitrary i-th observation, the cost function $C(q_i, w_i; \beta)$ defines a lower bound for spending C_i necessary to provide output levels q_i at given input prices w_i. The vector β is the set of technological parameters to be estimated. Stochastic parametric frontiers are based on the specification of a composed error term, which allows to disentangle spending inefficiency from stochastic disturbances: a *symmetric* component (v_i) captures the usual random noise, while a *one-sided* (positive) error term (u_i) is introduced to measure cost inefficiency.

When a Cobb-Douglas technology with no variability in input prices w_i is assumed, the resulting SFA spending (or cost) model, expressed in logarithmic form, is:

[10] Recent developments in DEA (Simar and Wilson, 2007) permit to estimate the efficiency levels conditionally to the influence of exogenous variables Z, without assuming different distributions for the scores in the two stages of the analysis (which represents the main shortcoming of the standard Tobit procedure). However, the implementation of this advanced methodology faces computation difficulties and it is not essential in our context, given the aim of understanding the impact of fiscal decentralization, for which we check robustness of our results by exploiting both DEA and SFA techniques to assess productive efficiency.

$$\ln C_i = \beta_0 + \sum_m \beta_m \ln q_{mi} + \sum_k \delta_k d_{ki} + v_i + u_i \qquad [3]$$
$$\text{with } i = 1, \ldots, n$$

where C represents municipal current spending in the selected functions (*EXP*) and q_m are the corresponding output indicators (with m = 1, ..., 4). In order to control for potential scale effects, similarly to the DEA-VRS model, we also include in the SFA model three dummies, d_k: two variables capturing the impact on spending of extreme population size classes – i.e., municipalities with less than 1000 (*POP-1000*) and with more than 10,000 inhabitants (*POP-10,000*) – and one variable capturing the impact of geographical altitude – i.e., municipalities located over 600 meters (*ALT-600*).[11]

Several procedures are available to estimate the SFA model [3], depending on the statistical assumptions with regard to the cost inefficiency component u_i. Here, we rely on the maximum likelihood (ML) technique proposed by Battese and Coelli (1995, BC95 from now on), and assume the one-sided inefficiency term to be distributed as a truncated-normal: $u_i \sim N^+(\eta' Z, \sigma_u^2)$. This specification allows the mean of spending inefficiency to be influenced – trough the vector of coefficients η – by the same set of observable exogenous factors Z included in the second-stage Tobit model discussed above. As for the symmetric random noise component v_i, it is assumed to be distributed as a standard $N(0, \sigma_v^2)$.

[11] Thresholds were selected by looking at the distribution of per capita current spending of municipalities according to their population size and altitude. The municipalities under 1000 and over 10,000 inhabitants represent the extreme sides of a ∪-shaped trend that shows per capita spending along different dimensional classes. Moreover, the municipalities located at an altitude over 600 meters typically exhibit per capita spending levels significantly higher than the average of the sample. Interestingly, the 600 meters limit is also considered by the Italian Law 991/1952 to define mountain municipalities.

4. Results

4.1. Comparing SFA and DEA inefficiency scores

Table 2 shows the estimates of SFA spending model [3] for our sample of 262 municipalities, considering four different specifications (from MODEL 1 to MODEL 4), according to the set of selected inefficiency determinants Z (see Section 4.2).

[TABLE 2 HERE]

First, SFA estimates highlight the prevalence of spending inefficiency with respect to random noise in determining global error term ($u_i + v_i$): γ – the share of residual variance due to deviations from best practice frontier, $\sigma_u^2/(\sigma_u^2 + \sigma_v^2)$ – ranges from 0.687 in MODEL 3 to 0.599 in the MODEL 4, therefore supporting the argument that a traditional *average* spending function with the term u_i equal to zero does not adequately represent observed local governments' performances. Population served (*POP*) and waste collected (*WASTE*) are particularly relevant in explaining current spending variability (β_{POP} ranges between 0.65 and 0.70, β_{WASTE} between 0.16 and 0.20), while outputs *ROAD* and *DEPEND* play a minor role. Moreover, constant returns to scale seem to dominate municipal services provision, as the sum of estimated elasticities with respect to the four outputs is very close to 1 (it ranges between 0.94 and 0.96). Notice, however, that this result crucially depends on the fact that 83% of our municipalities do not belong to the two extreme size classes (i.e., under 500 and between 10,000 and 15,000 inhabitants, respectively)[12] and are located under 600 meters of altitude. The importance of population size and the altitude in defining cost frontier position is also remarked by the positive and significant coefficients for the dummies *POP-1000*, *POP-10,000* and *ALT-600*, which point to the presence of some adverse scale impact on current spending for the smallest and the biggest municipalities, as well as for the mountainous (and tourist) ones.

[12] Following the classification adopted by the Ministry of Interior, the municipalities have been divided into seven size classes: under 499 inhabitants (13% of observations), between 500 and 999 (22%), between 1000 and 1999 (25%), between 2000 and 2999 (9%), between 3000 and 4999 (15%), between 5000 and 9,999 (11%), and finally over 10,000 (4%).

[TABLE 3 HERE]

Summary statistics for inefficiency scores obtained from our five different models, one DEA-VRS and four SFA (ordered from the poorest to the richest as for the number of included inefficiency determinants *Z*), are reported in Table 3. A first elementary insight is provided by the dichotomous classification of the observations as either fully efficient or partially inefficient according to the DEA model: 22 municipalities – belonging especially to the biggest and smallest size classes (over 10,000 and under 500 inhabitants) – emerge as efficient units with a score equal to 1. Considering both methodologies and all models, the mean inefficiency is about 0.22 for DEA-VRS and between 0.26 and 0.28 for SFA. It means that municipalities, on average, could provide the same output levels with a 22%-28% current spending reduction. Inefficiency distributions appear concentrated around the mean both in DEA and SFA models, since they exhibit a median very close to the average value, and 90% of observations show values of spending inefficiency lower than 0.50. Not surprisingly, standard deviations are generally small, and tend to be higher for SFA estimates due to the presence of more extreme scores.

[FIGURE 2 HERE]

More importantly, the correlation between DEA and SFA inefficiencies is very high, both considering VRS and CRS specifications for DEA. As already discussed, the inclusion of the three dummies in the stochastic cost frontier help controlling for the impact of variable returns to scale on efficiency estimates, like in a DEA-VRS, even if these effects do not vanish completely. Indeed, as previously discussed, SFA models highlight almost constant returns to scale, similarly to a DEA-CRS specification. Such a result is probably driven by the prevalence in our sample of medium-sized municipalities, for which returns to scale appear to be actually constant looking at the difference between DEA-CRS and DEA-VRS (see Figure 2). Variable returns to scale characterise instead the municipalities under 1000 and over 10,000 inhabitants. The first ones show increasing returns to scale, perhaps because of the stronger influence of fixed

costs on current spending, especially with regard to waste management and general administration services. The second ones mainly exhibit decreasing returns to scale, probably as they produce a wider range of more complex services; this is particularly true for social welfare spending (10% of current expenditures).[13] As for the definition of the proper scale for providing the essential services analysed in this study, the municipalities with a number of served inhabitants from 2000 to 5000 seem to correspond to the optimal size; this evidence emerges by looking at both the differences between DEA-CRS and DEA-VRS scores and SFA inefficiency estimates in Figure 2.

As a final remark, spending inefficiency (net of scale inefficiency) seems to decrease with municipal size in DEA-VRS model. A possible interpretation of this result relies on the argument that public managers are probably subject to a more severe control from their citizens when the latter can ask for differentiated and more effective services. To explore this issue more in depth, we turn now our attention to the analysis of the determinants of estimated inefficiency.

4.2. Fiscal autonomy and other inefficiency determinants

We study the effects of tax decentralization and other possible explicative factors for estimated inefficiency by adopting the two different approaches discussed in Section 3.3. As for DEA, results are derived using a second-stage Tobit model. As for SFA, results are instead obtained by using the single-stage BC95 estimation procedure. Besides a measure of fiscal autonomy – the key issue of this study – the other variables included in both the Tobit and BC95 specifications embrace a variety of economic, political and institutional factors. Descriptive statistics for all the potential determinants of spending inefficiency are shown in Table 4.

[TABLE 4 HERE]

[13] Notice also that the proxy variable *DEPEND* is probably unable to fully capture the outputs generated by the expenditure devoted to this category.

Tables 5 and 6 present the results for the determinants of spending inefficiency obtained using SFA and DEA-VRS scores, respectively. We estimated four different models within each frontier approach, by augmenting the basic specification (MODEL 1) with a richer set of explanatory variables (from MODEL 2 to MODEL 4). All the estimates are extremely similar in terms of both the statistical significance and the sign of coefficients, showing that our findings are quite robust to alternative model specifications.

a) *Fiscal autonomy, revenue level, and discipline rules.* Similarly to other countries, Italian municipalities rely on three main different sources of revenues: local taxes, grants from upper-level governments, fees and charges. We define *fiscal autonomy* (*FISCAUT)* as the percentage of current expenditures in the selected functions covered by local taxes (i.e., *ICI* + *Addizionale Comunale IRPEF* + *TARSU*).[14] It is important to remark that it is the first time that such an indicator of *vertical imbalance* is used as an explanatory variable for spending inefficiency. In both set of estimates, the coefficient for this index of fiscal decentralization appears to play an important role, giving support to the theoretical insight that a higher accountability of local politicians can be obtained by increasing their responsibilities in terms of funding (e.g., Weingast, 2009). In particular, the higher the share of current revenues derived from local taxes the more efficient is the municipality in spending. The positive impact of local taxes on municipal efficiency supports some previous findings in the literature (Vanden Eeckaut *et al.*, 1993; De Borger *et al.*, 1994; De Borger and Kerstens, 1996), while suggesting that the other sources of revenues – in particular, grants from upper-level governments – act in the opposite direction.

[TABLES 5 AND 6 HERE]

We introduce another fiscal variable in the analysis, the dummy *HREV*, which is equal to 1 for the municipalities with a *per capita level* of total current

[14] On the use of this ratio as an indicator of fiscal decentralization, see Akai and Sakata (2002).

revenues over the median (i.e., 646 Euro per capita)[15]. The first three models using both SFA and DEA scores show a positive influence of this variable on spending inefficiency. However, before interpreting this result in the light of the literature on soft budget constraint and fiscal bailout problems in decentralized settings (e.g., McLure, 1967; Prud'Homme, 1995; Inman, 2003), it is important to comment on the results obtained with MODEL 4. In this specification, per capita current revenues have been decomposed into their three principal sources: own taxes, fees and charges, and grants; like for total revenues, for each source we identified the municipalities characterised by a per capita level exceeding the median (*HTAX*, *HEXTRA*, *HGRANT* = 1, respectively).[16] Contrary to most of the previous literature, our findings show that the significant and positive effect of higher current revenues on inefficiency is not due to a stronger incidence of grants, but to the role of taxes, as well as of fees and charges. This confirms the evidence emerged in Balaguer-Coll *et al.* (2007): a local government that is highly capable of generating own revenues would be less motivated to manage them efficiently. The result for *HTAX* and *HEXTRA* is justified in the light of the structure of our sample, in which the average weight of the central and regional transfers on the local current revenues is very low (16%) with respect to the national mean (25%)[17]. Overall, these findings – linked to the previous one on the impact of tax decentralization – highlight that, while more autonomous municipalities tend to exhibit less inefficient spending behaviours, an excessively large availability of resources (in particular, from taxes and fees and charges) seems to exert a negative influence on spending efficiency, since it contributes to ease the budget constraint for local politicians.

The importance of budget constraint faced by the municipalities is further investigated directly trough the dummy variable *PACT*, that distinguishes local governments subject to the *DSP* (see Section 3.1) from the municipalities with

[15] We use this kind of indicator because the distribution of per capita current revenues exhibit a particular variability: the values under the median are rather close (between 477 and 646 Euro per capita), while over the median they jump from 646 to 1739 Euro per capita.
[16] See previous footnote.
[17] Data are taken from IRES Piemonte, *Osservatorio sulla Finanza Locale del Piemonte*, and Ministry of Interior, *Dati sui Certificati di Bilancio dei Comuni*.

less than 5,000 inhabitants, which, starting from 1999, have been excluded from this *discipline rule*. From our analysis, the presence of the *DSP* has a significant and reducing effect on spending inefficiency, even if only for DEA-VRS models (Table 6), probably because this factor partly captures a size effect in SFA models. Thus, the imposition of a tighter budget constraint seems to increase the accountability of incumbent politicians and improve spending efficiency.

b) *Political variables.* We now focus on some political features of municipalities. The variable *YGOV* assumes 5 different values (from 0 to 4) and represents the number of post-election years for the mayor and the governing coalition. Both DEA-VRS and SFA estimates in MODEL 1, 2 and 4 show that electoral mandate has a significant and positive influence on spending inefficiency. This finding is in line with the empirical literature on the opportunistic behaviour of local governments linked to the "electoral budget cycle" argument (e.g., Galli and Rossi, 2002; Veiga and Veiga, 2007): in an effort to signal their competence to the voters, so as to increase their chances to be re-elected, incumbent politicians tend to enlarge spending when they are closer to new elections, i.e., when the number of post-elections years increases. Our result provides fresh evidence in support of this "electoral budget cycle" effect, by clarifying that the observed increase in municipal spending can be interpreted as a higher waste with respect to an efficient expenditure level.[18]

[18] A control for the robustness of this result is provided introducing the dummy *2GOV*, which distinguishes the municipalities with a mayor facing a second term limit from those with a mayor that can be re-elected. The theoretical literature suggests that the impossibility to be re-elected influences the opportunistic behaviour of the incumbents, especially in proximity of the new elections (e.g., Besley and Case 1995, 2003; Smart and Sturm, 2006). However, testing the effect of this variable – considered alone or interacted with the years of mandate – we did not observe any significant impact on the inefficiencies. A plausible explanation for this evidence could be found analyzing more in depth municipalities included in our sample: the dummy *2GOV* is equal to one for 26.5% of these municipalities. Among these, in the following elections (between 2006 and 2009), a person belonging to the previous governing coalition was elected as mayor in the 58% of the cases; in another 22% of cases, a person belonging to the previous governing coalition has been presented as one of the main candidates to become mayor. These statistics stress the role of a party affiliation and party discipline in identifying candidates and their behaviors once elected. Therefore, incumbents' interests, merging in the party's ones, do not vanish simply with their impossibility of re-election.

In MODEL 3, we test another landmark of the literature on the opportunistic behaviour of incumbent politicians linked to their desire to be re-elected, by interacting *YGOV* with the variable *PACT*: we find that *YGOV*PACT* impacts on spending inefficiency in a positive and significant way, while the pure effect associated to the number of post-election years loses its statistical significance. As found in the recent contributions by Mink and De Haan (2005) and Bartolini and Santolini (2009), there is then evidence of a stronger "electoral budget cycle" effect for municipalities subject to a fiscal discipline rule: while spending inefficiency increases in proximity of the election year, and the *DSP* seems quite effective in hardening local administrations' budget (see the above discussion), the introduction of such a discipline rule tends to strengthen remarkably the opportunistic behaviour for those incumbents that are closer to the end of their electoral mandate; this could be due to a forward-looking behaviour, which leads to magnify *DSP* compliance in the early years of government, so as to exploit higher margins for increasing spending in proximity of new elections. We finally include the triple interaction *YGOV*PACT*FISCAUT*, to study how fiscal discipline rules and fiscal autonomy jointly influence the "electoral budget cycle". One can notice that a higher degree of fiscal autonomy has the effect of dampening the "electoral budget cycle" impact on spending inefficiency observed for the municipalities under the *DSP*, hence increasing the importance of the argument of a higher accountability obtainable trough tax decentralization.

We also control for the political orientation of governing coalition, using two dummy variables that assume value 1 if coalition parties belong to a centre-left list (*LEFT)* or to a so-called *civic list* with no clear ideological orientation (*CIVIC*). As for *LEFT*, it emerges a significant and reducing impact on spending inefficiency in several specifications (BC95 MODEL 1, 2, 4 and Tobit MODEL 1, 2), while the coefficient for *CIVIC* appears significant only in BC95 MODEL 4. These results, however, are probably influenced by a net prevalence in the sample of municipalities led by civic lists (172 observations), all concentrated in small-

sized local governments. Notice also that the positive effect of centre-left leading coalitions on spending efficiency can be added to the existing political economy literature, which often found a propensity of the governments towards a larger expenditure associated to this political orientation (e.g., Blais *et al.*, 1993; De Haan and Sturm, 1994). According to our evidence, the presence of a larger spending does not necessarily mean a higher inefficiency.

Starting from MODEL 2, we have finally included two variables pertaining to mayor's age (*MAYORAGE*) and gender (*MAYORSEX*). Both variables do not appear to affect significantly inefficiency levels. Again, this result adds to recent literature on the size and the composition of public expenditure, which stresses the key role of female representatives in determining policy preferences and spending outcomes (e.g., Edlund and Pande, 2002; Chattopadhyay and Duflo, 2004; Funk and Gathmann, 2008).

c) *Management models for services provision.* We finally introduce three dummies for capturing the different management models of waste collection and disposal that are observed in our sample. This particular service is provided by different municipalities using several governance forms. The importance that the service has recently gained in Italy for judging the behaviour of local politicians can be considered in the light of yardstick competition between municipalities, and stresses the meaning of efficiency in spending for the local administrations.[19] Waste collection can be managed: directly by the local government; directly by a consortium of local governments with the possibility for a municipality to be either consortium head or a simple participant; through a specialized external firm, which can be either publicly or privately owned; through a public-owned cooperative firm involving more than one municipality.

We summarize these six different governance schemes in three variables. A first dummy (*PUBLIC*) distinguishes the public ownership from the private one; a second dummy (*PUBLIC*FIRM*) indicates that the service is provided by

[19] Examples of the importance of waste management for evaluating local administrators include the recent garbage crisis and the subsequent scandals in Naples and Palermo. See, e.g., "Naples burns as residents protest at garbage crisis", *The Guardian*, May 27th, 2007.

an external firm, conditionally on this firm having public ownership; finally, a third dummy (*PUBLIC*FIRM*COOP*) represents a cooperative firm, conditionally on being a publicly owned firm. The results we obtain – both for BC95 and Tobit models – highlight a significant effect only for the latter dummy, *PUBLIC*FIRM*COOP*: they show that it is neither important that the ownership of this local service is public or private, nor that the provision is through a company or directly from the municipality. It is, instead, relevant that, besides being public and run through a firm, garbage collection and disposal is managed cooperatively. The scheme of a public-owned cooperative firm would then represent a more efficient solution, probably because it associates the advantage of sharing huge fixed costs (typical of the consortium option) to the benefit of increasing expenditure control (typical of the external firm option).

5. Conclusions

This paper assesses spending efficiency of local governments, investigating, in particular, the role played by tax decentralization, as measured by the degree of fiscal autonomy in covering the costs associated to the provision of essential public services. The analysis relies on a sample of 262 Italian municipalities belonging to the Province of Turin, and exploits both nonparametric (DEA) and parametric (SFA) frontier techniques to study efficiency performances and their main determinants.

Consistently with modern fiscal federalism theories, our results show that more autonomous municipalities – i.e., local governments with a higher share of current spending covered by own taxes – exhibit less inefficient behaviours. The strictness of budget constraint due to some fiscal discipline rules (here the *Domestic Stability Pact*) appears to be another important driver of spending efficiency. Moreover, the presence of opportunistic behaviours by the incumbent politicians highlighted by the theoretical literature on the "electoral budget cycle" finds new empirical support. Finally, as for the political features of government coalition, both age and gender of the mayor do not seem to exert

any significant impact on the inefficiency level, while the political ideology belonging to left-wing coalitions is mainly associated with a lower excess spending.

From a policy perspective, the evidence emerged in this study support the recent waves of reforms towards tax decentralization, observed all around the world, with the aim of increasing the fiscal autonomy of local governments, in order to improve both the efficiency and the effectiveness of public services provided to the citizens.

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Figure 1. Macro-functions of municipal current expenditure in the Province of Turin

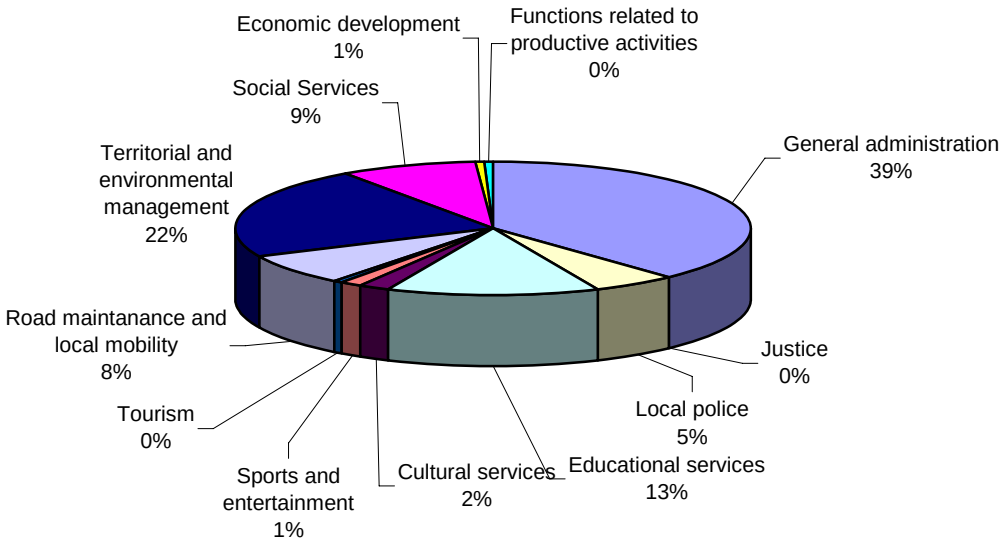

Table 1. Summary statistics for output and input indicators of DEA and SFA spending models

VARIABLE DESCRIPTION	NAME	Mean	Std. Dev.	Min	Max
OUTPUTS (q)					
Population (nr. of served inhabitants)	*POP*	2657	2826	102	13,835
Amounts of waste collected (quintals)	*WASTE*	12,117	13,914	486	76,107
Total length of municipal roads (km)	*ROAD*	33	28	3	240
Total number of pupils and old people (pupils enrolled in nursery, primary and secondary school + over 75 inhabitants)	*DEPEND*	466	488	16	2449
INPUTS (x)					
Current expenditure (10^3 Euro) a) general administration b) garbage management c) road maintenance and local mobility d) education and elderly care	*EXP*	1297	1284	95	6743
CONTROL VARIABLES (d)					
Dummy for *less than 1000 inhabitants*	*POP-1000*	0.35	0.48	0	1
Dummy for *more than 10,000 inhabitants*	*POP-10,000*	0.04	0.19	0	1
Dummy for *altitude over 600 meters*	*OVER-600*	0.17	0.37	0	1

Table 2. Estimates of SFA spending model [3]

Regressor [a]	MODEL 1	MODEL 2	MODEL 3	MODEL 4
ln*POP*	0.667*** (0.047)	0.653*** (0.048)	0.647*** (0.047)	0.697*** (0.044)
ln*WASTE*	0.195*** (0.030)	0.199*** (0.029)	0.203*** (0.029)	0.160*** (0.029)
ln*ROAD*	0.039* (0.011)	0.041* (0.013)	0.036** (0.011)	0.033** (0.010)
ln*DEPEND*	0.055* (0.032)	0.059* (0.032)	0.057* (0.032)	0.059** (0.029)
POP-1000	0.049* (0.026)	0.043* (0.026)	0.046* (0.026)	0.075*** (0.023)
POP-10,000	0.081** (0.040)	0.090** (0.042)	0.097** (0.041)	0.108*** (0.037)
ALT-600	0.052** (0.022)	0.055** (0.022)	0.054** (0.021)	0.038** (0.019)
$\sigma^2 = (\sigma_u^2 + \sigma_v^2)$	0.013*** (0.001)	0.013*** (0.001)	0.013*** (0.001)	0.010*** (0.001)
$\gamma = [\sigma_u^2/(\sigma_u^2 + \sigma_v^2)]$	0.686*** (0.234)	0.680*** (0.259)	0.687*** (0.228)	0.599*** (0.187)
Nr. observations	262	262	262	262
Wald test [p-value]	6725.54 [0.000]	6762.53 [0.000]	6794.52 [0.000]	8631.28 [0.000]

[a] Dependent variable: ln*EXP*.

*, **, ***: statistically significant at the 1%, 5%, 10%, respectively.

Table 3. Summary statistics for DEA and SFA inefficiency scores

	DEA-VRS	SFA MODEL 1	SFA MODEL 2	SFA MODEL 3	SFA MODEL 4
Mean	0.22	0.28	0.28	0.28	0.26
Standard deviation	0.12	0.17	0.17	0.17	0.17
Median	0.22	0.26	0.26	0.26	0.25
Max	0.52	0.90	0.88	0.87	0.97
Min	0.00	0.04	0.04	0.03	0.02
Fully efficient municipalities	22	-	-	-	-

Figure 2. Distribution of DEA and SFA inefficiency scores by municipal size classes

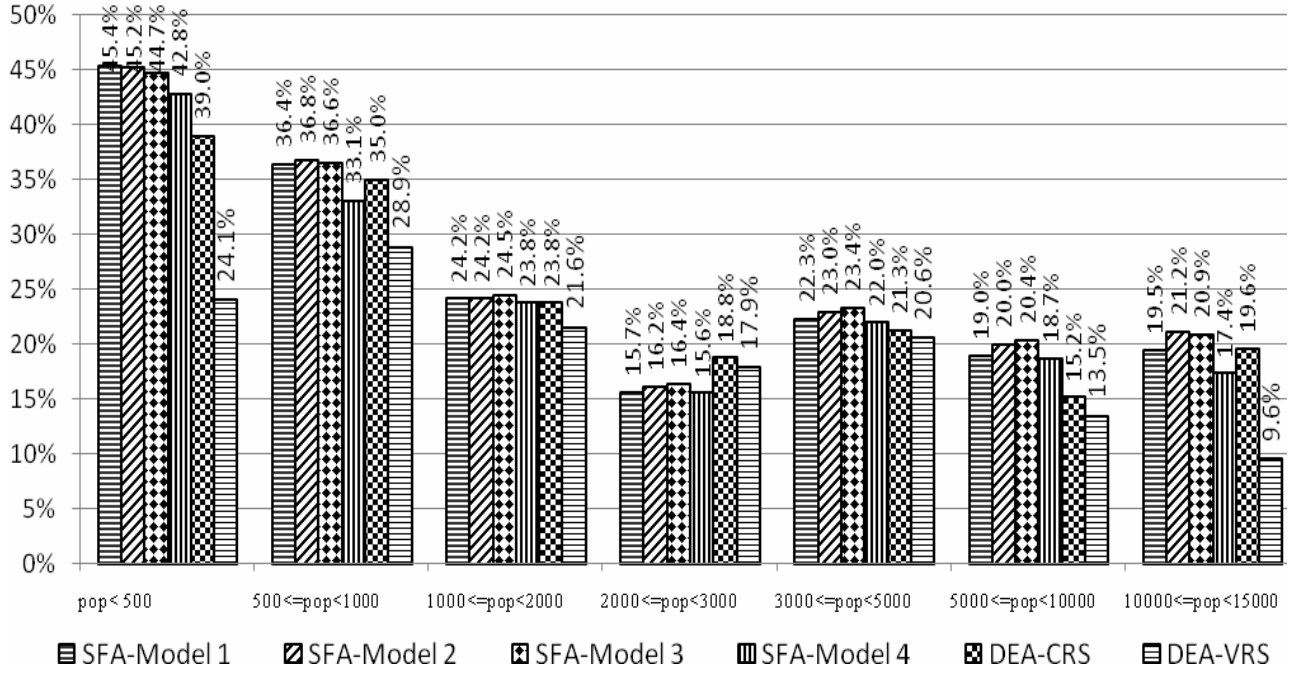

Table 4. Descriptive statistics for the determinants of spending inefficiency

VARIABLE DESCRIPTION	NAME	Mean	Median	Std. Dev.	Min	Max	%
FISCAL INDICATORS							
Fiscal autonomy (% local taxes on current spending in general administration, garbage management, road maintenance and local mobility, education and elderly care)	*FISCAUT*	62	85	17	34	120	-
Total current revenues per capita		702	646	198	452	1739	-
High revenues (Municipalities with a level of total current revenues per capita over the median)	*HREV*	-	-	-	-	-	50%
Tax revenues per capita		440	437	102	190	895	
High taxes (Municipalities with a level of tax revenues per capita over the median)	*HTAX*	-	-	-	-	-	50%
Fees and charges per capita		146	116	109	31	904	
High extra-taxes (Municipalities with a level of fees and charges per capita over the median)	*HEXTRA*	-	-	-	-	-	50%
Grants per capita		117	85	105	9	662	
High grants (Municipalities with a level of grants per capita over the median)	*HGRANT*	-	-	-	-	-	50%
Domestic Stability Pact (Municipalities subject to the *DPS*)	*PACT*	-	-	-	-	-	15%
POLITICAL INDICATORS							
Electoral mandate (number of post-election years for the governing coalition in 2005)	*YGOV*	1.40	1	1.03	0	4	-
*Electoral mandate*DSP* (interaction of the number of post-election years for the governing coalition with the presence of *DSP*)	*YGOV*PACT*	0.29	0	0.86	0	4	-
*Electoral mandate*DSP*Fiscal autonomy* (interaction of the number of post-election years for the governing coalition with the presence of *DSP* and the % of local taxes on current spending)	*YGOV*PACT*FISCAUT*	1.35	0	3.98	0	19	-

Table 4. Descriptive statistics for the determinants of spending inefficiency (continued)

VARIABLE DESCRIPTION	NAME	Mean	Median	Std. Dev.	Min	Max	%
POLITICAL INDICATORS							
Mayor's gender (Municipalities with a male mayor)	*MAYORSEX*	-	-	-	-	-	83%
Mayor's age	*MAYORAGE*	52	54	10	28	79	-
Civil list governing coalition	*CIVIC*	-	-	-	-	-	56%
Centre-left governing coalition	*LEFT*	-	-	-	-	-	23%
GARBAGE MANAGEMENT MODELS							
Public management	*PUBLIC*	-	-	-	-	-	77%
Public management by a firm	*PUBLIC*FIRM*	-	-	-	-	-	32%
Public management by a cooperative firm	*PUBLIC*FIRM*COOP*	-	-	-	-	-	27%

Table 5. Analysis of spending inefficiency determinants (SFA scores)

Regressor	BC95 MODEL 1	BC95 MODEL 2	BC95 MODEL 3	BC95 MODEL 4
FISCAUT	-0.195*** (0.041)	-0.186*** (0.041)	-0.167*** (0.040)	-0.466*** (0.051)
HREV	0.176*** (0.023)	0.175*** (0.022)	0.176*** (0.022)	-
PACT	0.001 (0.036)	-0.008 (0.035)	-0.014 (0.051)	0.027 (0.045)
YGOV	0.016* (0.010)	0.019** (0.008)	0.015 (0.009)	0.014* (0.008)
CIVIC	-0.014 (0.022)	-0.014 (0.022)	-0.013 (0.021)	-0.035* (0.020)
LEFT	-0.047* (0.026)	-0.048* (0.025)	-0.040 (0.025)	-0.049** (0.023)
PUBLIC	-0.011 (0.016)	-0.026 (0.020)	-0.024 (0.020)	-0.019 (0.018)
*PUBLIC*FIRM*	0.013 (0.037)	0.012 (0.036)	0.010 (0.036)	0.032 (0.031)
*PUBLIC*FIRM*COOP*	-0.086** (0.053)	-0.088** (0.039)	-0.092** (0.038)	-0.068** (0.033)
MAYORSEX	-	-0.023 (0.022)	-0.022 (0.022)	-0.008 (0.019)
MAYORAGE	-	-0.046 (0.040)	-0.049 (0.040)	-0.010 (0.036)
*YGOV*PACT*	-	-	1.517*** (0.556)	0.729 (0.476)
*YGOV*PACT* FISCAUT*	-	-	-0.329*** (0.122)	-0.163 (0.105)
HTAX	-	-	-	0.227*** (0.025)
HEXTRA	-	-	-	0.063*** (0.016)
HGRANT	-	-	-	-0.012 (0.022)
Nr. observations	262	262	262	262
Log-likelihood	212.4	212.9	217.1	250.0
LR test [p-value]	115.6 [0.000]	118.7 [0.000]	133.8 [0.000]	199.7 [0.000]

*, **, ***: statistically significant at the 1%, 5%, 10% respectively.

Table 6. Analysis of spending inefficiency determinants (DEA-VRS scores)

Regressor	Tobit MODEL 1	Tobit MODEL 2	Tobit MODEL 3	Tobit MODEL 4
FISCAUT	-0.072*** (0.027)	-0.068** (0.027)	-0.053** (0.027)	-0.218*** (0.033)
HREV	0.098*** (0.013)	0.100*** (0.013)	0.104*** (0.013)	-
PACT	-0.083*** (0.021)	-0.082*** (0.021)	-0.095*** (0.033)	-0.070** (0.032)
YGOV	0.012* (0.006)	0.014** (0.007)	-0.010 (0.007)	0.009* (0.007)
CIVIC	-0.013 (0.017)	-0.013 (0.017)	-0.012 (0.016)	-0.016 (0.016)
LEFT	-0.032* (0.019)	-0.033* (0.019)	-0.028 (0.019)	-0.026 (0.018)
PUBLIC	-0.014 (0.016)	-0.011 (0.016)	-0.008 (0.016)	-0.002 (0.015)
*PUBLIC*FIRM*	0.002 (0.029)	0.003 (0.029)	-0.005 (0.028)	0.008 (0.026)
*PUBLIC*FIRM*COOP*	-0.050* (0.030)	-0.050* (0.030)	-0.052* (0.029)	-0.041** (0.017)
MAYORSEX	-	0.001 (0.017)	-0.001 (0.017)	-0.009 (0.016)
MAYORAGE	-	-0.038 (0.031)	-0.049 (0.040)	-0.027 (0.028)
*YGOV*PACT*	-	-	1.531*** (0.415)	1.103*** (0.391)
*YGOV*PACT* FISCAUT*	-	-	-0.333*** (0.091)	-0.242*** (0.086)
HTAX	-	-	-	0.117*** (0.014)
HEXTRA	-	-	-	0.043*** (0.013)
HGRANT	-	-	-	-0.016 (0.016)
Nr. observations	262	262	262	262
Log-likelihood	186.5	187.0	193.1	207.0
LR test [p-value]	121.7 [0.000]	122.1 [0.000]	136.4 [0.000]	164.2 [0.000]

*, **, ***: statistically significant at the 1%, 5%, 10% respectively.

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