Fiscal Decentralization and Spending Efficiency of Local Governments

An Empirical Investigation on a Sample of Italian Municipalities

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An Empirical Investigation on a Sample of Italian Municipalities

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Abstract. In Italy, as in other countries, recent legislative reforms (simply discussed or partially implemented) aim at increasing the fiscal autonomy of local governments, in order to align spending with funding responsibility and, by this way, to improve both the efficiency and the effectiveness of public services provided to the citizens. The purpose of this paper is to assess spending efficiency for Italian municipalities, and to investigate – in particular – the effects of fiscal decentralization, considering also the role played by electoral accountability of incumbent politicians. The analysis relies on a sample of 262 Italian municipalities and exploits both parametric (SFA) and nonparametric (DEA) frontier techniques to study efficiency performances and their main determinants. Consistently with fiscal federalism theories, our preliminary results suggest that more autonomous municipalities exhibit less inefficient spending behaviours. Moreover, the tighter budget constraint implied by the Domestic Stability Pact, which limits the deficit of some local governments, appears to be an important driver of spending efficiency. Finally, in line with the electoral budget cycle approach, we find that the shorter is the distance from next elections year the higher is excess spending with respect to the best-practice frontier. Other political features of governing coalition, such as for instance age and gender of the mayor, do not seem generally to exert any significant impact on inefficiency levels.

Keywords: Local government performance, Fiscal decentralization, Electoral accountability, Spending efficiency, Parametric and nonparametric frontiers

JEL: D24, H71, H72, H77, R51

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1. Introduction

In Italy, as in other countries, recent legislative reforms (simply discussed or partially implemented) aim at increasing the fiscal autonomy of local governments. Increasing fiscal autonomy implies a better alignment between spending and funding responsibilities and, as suggested by economists, a potential improvement of both the efficiency and the effectiveness of public services provided to citizens. Indeed, in analysing the role played by fiscal autonomy, modern theoretical literature on fiscal federalism has highlighted the importance of electoral accountability of incumbent politicians (e.g., Besley and Case, 1995, Besley and Smart, 2007, Bordignon *et al.*, 2004, Hindriks and Lockwood, 2008), leading empirical research to consider also this issue in assessing spending efficiency of local governments.

Following this line of research, the purpose of this paper is to assess spending efficiency for Italian municipalities, analysing – in particular – the impact of fiscal decentralization, taking also into account the influence of some political factors. Exploiting a sample of 262 municipalities belonging to the Province of Turin, we compute efficiency scores adopting two different reference technologies, one nonparametric (*Data Envelopment Analysis* model) and one parametric best-practice frontier (*Stochastic Frontier Analysis* model). According to existing empirical literature (e.g., De Borger and Kerstens,1995; Worthington, 2000; Afonso and Fernandes, 2006; Balaguer-Coll *et al.*, 2007), we selected output indicators that are proxies for the amount of services provided by municipalities in the most fundamental competencies both for their budget and for their citizens. Specifically, we consider as outputs 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 75 years old for measuring the needs of 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.

We assess the level of spending efficiency for all municipalities with both methodologies, characterise the returns to scale that dominate the provision of public services, and finally try to identify an optimal size for the municipalities. We then investigate the impact on spending efficiency of several variables, especially proxies for fiscal decentralization and political accountability, in two different ways. In the nonparametric approach we use a two-stage analysis based on a Tobit regression model, while in the 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 local (or 'municipal') taxes on current expenditure. We also augment our empirical models by considering the potential incentives towards higher efficiency due to the tighter budget constraint imposed to some local governments by the Domestic Stability Pact (DSP). Finally, we test whether the behaviour of incumbent politicians in proximity of new elections, as well as the political orientation of local government, significantly impact on spending efficiency levels. Our results show that all variables accounting for decentralization and accountability are almost always significant determinants of efficiency.

The remainder of the paper is structured as follows. In Section 2, we briefly review the relevant literature, focusing especially on inputs and outputs definitions in assessing local governments' performance. In Section 3, we present the data and the empirical methodology. Section 4 discusses inefficiency estimates and the analysis concerning the effects of fiscal decentralization and other inefficiency determinants. Section 5 provides final remarks and some preliminary conclusions.

2. Review of the literature on local governments' efficiency

The literature on efficiency measurement in economics is rather recent (e.g., Debreu, 1955). Early studies originated by an interest in industrial and agricultural firms. Indeed, the 'traditional' approach to evaluate production efficiency, using both input and output quantitative indicators and information about their prices, is easier to apply to manufacturing private firms. For public firms (and, more generally, for all firms

operating in the services sector), it is more difficult to find good indicators that express the quality of services provided (and the market prices for inputs and outputs given their not-for-profit nature). These difficulties are even more important when considering efficiency of local governments, a problem that the economic literature started dealing with since the Nineties.

It is possible to identify two groups of studies in the literature on local governments efficiency. On the one hand, there are studies that evaluate 'global' efficiency, covering all (or at least several) services provided by local governments (e.g., Athanassopoulos and Triantis, 1998, for Greek municipalities; Sousa and Ramos, 1999, for Brazilian municipalities; Balaguer-Coll *et al.*, 2007, for Valencian municipalities; Afonso and Fernandes, 2005, for Portuguese municipalities; De Borger and Kerstens, 1996, for Belgian municipalities; Worthington, 2000, for New South Wales municipalities; Lokkainen and Susiluoto, 2005, for Finnish municipalities). On the other hand, there are studies that evaluate the efficiency in the provision of a particular local service, as it is the case, for instance, of waste collection (e.g., Worthington and Dollery, 2001), fire prevention (e.g., Navarro and Ortiz, 2003), municipal police (e.g., (Diez-Ticio and Mancebón, 2002), or water services (García-Sánchez, 2006). Table A.1 in the Appendix provides a summary of the main features of these studies analysing 'global' efficiency of municipal spending. All these works follow a rather consolidate scheme, made of three successive steps:

1) first, one needs to choose indicators for inputs and outputs, and the methodology for efficiency measurement;

2) second, an analysis of efficiency scores and their statistical distribution is performed. In the case the researchers have used different techniques for measuring efficiency, they also analyse the correlation between results obtained with different methodologies;

3) finally, an investigation of the potential determinants of efficiency scores, generally using a Tobit model is considered. Table A.2 in the Appendix summarise the main results available in the literature on this point.

Because of its innovations and its accuracy, the study of De Borger and Kerstens (1996) on Belgian municipalities represents the reference for all the following literature on efficiency measurement in local governments. The authors were the first to use different methodologies (following both approaches, parametric-SFA and nonparametric-DEA) to measure the expenditure-efficiency of local governments. The use of more than one methodology to measure efficiency stems from the attempt to check the robustness of the results obtained through different measurement techniques. This example was followed, e.g., by Worthington (2000) and Athanassopoulos and Triantis (1998), while most of the authors preferred to avoid assuming a specific functional form for public services provision, and to rely exclusively on nonparametric techniques only.

In the literature, the choice of input and output variables is strongly influenced by the institutional framework under scrutiny. In particular, the output variables need to represent the largest possible share of all the functions performed by local governments. Therefore, according to the fundamental and juridical functions attributed to local governments, we find more attention: on infrastructures' maintenance and construction in the Australian context; on educational and social services in Belgium and Finland; on the efforts against poverty and illiteracy in Brazil; and on waste collection and territorial planning respectively in Spain and Greece. On the contrary, given its feature to be more comparable than other variables, almost every study individuates municipal current expenditure as the only input consumed in the production of local services.

As for the *determinants of efficiency*, the literature explored the role of economic, social, political, demographic, and geographic variables. Among all these, economic variables appear to play the most important role. In particular, 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 high local tax rates and efficiency scores emerges in Vanden Eeckaut *et al.* (1993) and De Borger and Kerstens (1996). Hence, the impact on efficiency and – especially – on political control of public spending depends on the main source of municipal revenue (taxes or grants). On the contrary, in Balaguer-Coll *et al.* (2002), a high per capita level of tax revenues, as well as of grants, has a negative influence on efficiency, because a larger availability of

public resources makes softer the budget constraint. These insights also characterize the modern literature on fiscal federalism (e.g., Oates, 2005). The availability of more revenues, both in the form of grants and local taxes, reduces the awareness of local politicians to control spending. However, besides this 'size' effect, also the composition of revenues matters. In particular, a higher dependency ratio (that is, a higher share of transfers from central government to finance local spending) creates room for the opportunistic behaviour of local politicians, because of bailout expectations and soft budget constraint problems.

Other variables frequently used as explicative factors for spending efficiency are the average municipal income and the educational level. They have an opposite impact on efficiency, respectively negative and positive, because of their different influence on citizens' awareness and interest in public spending. As for demographic and geographic controls, authors find a positive effect of population density and a negative effect of marginal location of municipalities on efficiency, both effects explained by the difficulties in services provision. Finally, political variables are almost all relevant but the political orientation of local administration. Indeed, while Vanden Eeckaut *et al.* (1993) and Athanassopoulos and Triantis (1998) highlight a negative relationship between spending efficiency and both the number of parties in the governing coalition and the parties affiliated to the central government, De Borger and Kerstens (1996) find that the political orientation of local government does not seem to have a clear impact.

3. Empirical strategy

3.1. Data and variables

Our sample is composed by 262 municipalities belonging to the Province of Turin. The Province of Turin represents an interesting case study, since it is the Italian 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 the demographical dimension (the Province includes Moncenisio, with 48 inhabitants, and Turin, with over 900,000 residents), but also in terms of territorial morphology (more than 10% of

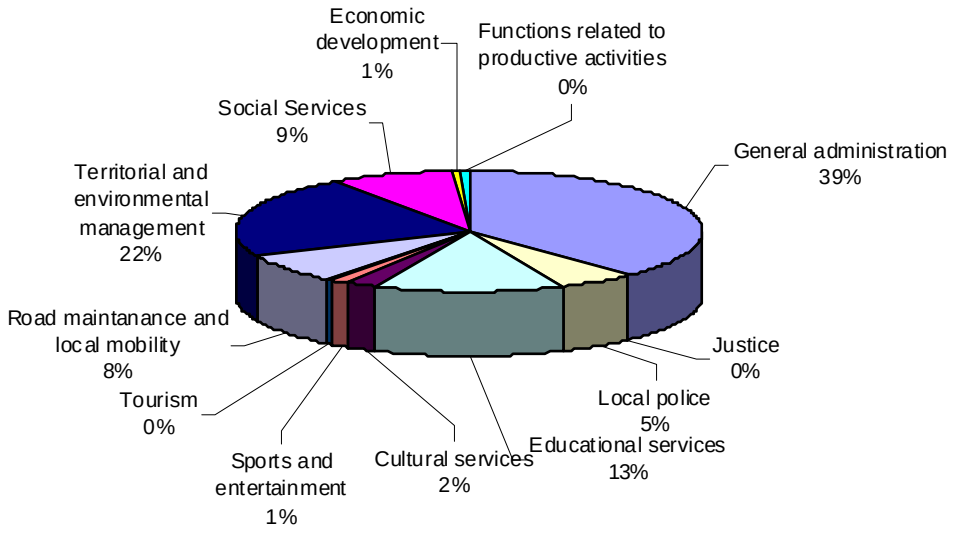
municipalities is situated over 1,000 metres of altitude), management of public services, political and economic characteristics, etc. However, at least to some extent, this huge heterogeneity introduces potential biases in our analysis, especially for the presence of municipalities that produce different services in different situations: the biggest municipalities and those located at a high altitude. Therefore, we have decided to exclude Turin and other municipalities over 15,000 inhabitants from the sample, because they are clearly not comparable along several dimensions (like the type of services produced) with the other ones[1]. Moreover, we excluded the municipalities located over 900 meters of altitude[2], as they show too high levels of expenditures with respect to other municipalities (on average, 1800 Euro against 560 Euro per capita), given the fact that their provision of services is strongly influenced not only by the morphology of their territory, but probably also by heavy tourist inflows.

Data we use in the empirical analysis were provided by different 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 variables, 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. Specifically, we selected indicators by looking at the most fundamental competencies, both for municipal budget and for citizens. In Italy, municipal current expenditure is classified in 12 macro-functions.

[1] For instance, the share of current expenditure in the four sectors considered in our analysis represents less than 80% of their current spending for largest municipalities. Notice that small municipalities are prevailing in the sample, with almost 60% having less than 2000 inhabitants. Furthermore, the upper bound of 15,000 inhabitants represents an important threshold also from the perspective of the Italian political framework, as it indicates the minimum number of inhabitants for a municipality to be subject to the second ballot in municipal elections.

[2] 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.

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



More than 90% of current expenditure in our sample is represented by five of these macro-functions (see figure 1): General administration (39%); Territorial and environmental management (22%); Educational services (13%); Child care, elderly care and other social services (9%); Road maintenance and local mobility (8%). Clearly, the share of these functions on local current expenditure varies according to the size of each municipality: 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 educational and social services increase respectively from 6% and 5% to 13% and 12%. In our analysis, we use current expenditures of municipalities (*EXP*) in each of these functions as input indicator. For General administration, Educational services, Road maintenance and local mobility we consider total expenditure as registered in the municipal budget. For Territorial and environmental management and for Social services we just consider a fraction of total expenditure. In fact, within Territorial and environmental management, Garbage collection and disposal covers only a share, although relevant, of total expenditure related to this function (60-70%). Therefore, we use only the expenditure dedicated to this service, and not the entire function's one, so as to improve the relationship with the selected output

indicator. Similarly, we separate from Social services' total expenditure the component specifically devoted to public welfare and elderly care. Our input represents, on average, 86% of *total* current expenditure, with little variations across different 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.

We have then selected four output indicators directly connected with these expenditure categories: the total population; the amounts of waste collected; the total length of municipal roads; 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). Even if it is clearly not a direct output of local production, total population (*POP*) is assumed to proxy for all the various administrative tasks 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 educational and care services. The amounts of waste collected (*WASTE*) is the direct result of the principal competence in territorial and environmental management, i.e. garbage collection and disposal. Total length of municipal roads (*ROAD*) is aimed at proxying especially the competencies of municipalities in managing existing road infrastructures – i.e. road maintenance, public lights, public transport arrangements, etc. – rather than in building new roads (that belong to the capital expenditure category). This choice is in line with the input variable as defined above. Table 1 shows the descriptive statistics for all output and input indicators used in DEA and SFA models.

It is worth noticing that our sample does not show input price variability. Indeed, there is no wage flexibility as salary scales and allowances of municipal personnel are completely fixed; moreover, all municipalities have access to the same capital market, and obtain most of their funds from the same specialized financial institutions. Thus, the hypothesis of identical input prices across municipalities is quite reasonable.[3] Consequently, throughout the analysis we focus on the measurement of 'global' cost efficiency or, better, *spending* efficiency, as it is more closely related to the nature of our data than pure technical efficiency.

[3] About this issue, see also the discussion in De Borger and Kerstens (1996).

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

VARIABLE DESCRIPTION	*NAME*	*Mean*	*Std. Dev.*	*Min*	*Max*
OUTPUTS					
Population (nr. of inhabitants)	*POP*	2,657	2,826	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	2,449
INPUTS					
Current expenditure (10^3 Euro) a) general administration b) garbage management c) road maintenance and local mobility d) education and elderly care	*EXP*	1,297	1,284	95	6,743

3.2. Methodology

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

In parametric techniques, the functional form of the efficient frontier has to be defined a priori, while in nonparametric techniques no functional form is pre-determined and only basic properties of the production set are imposed as constraints to obtain the estimates. On the other hand, SFA technique models both managerial inefficiencies and uncontrollable factors (i.e., stochastic disturbances) that might impact on production performances, while standard deterministic frontiers like DEA are able to account only for inefficiency. 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 its main determinants.

3.1. Data Envelopment Analysis

Data Envelopment Analysis, originating from Farrell (1957) seminal work and popularised by Charnes *et al.* (1978), assumes the existence of a convex production frontier. The production frontier in the DEA approach is constructed using linear programming methods. The terminology 'envelopment' stems from the fact that the production frontier really envelops the set of all observations.

The analytical description of the linear programming problem to be solved, in the Variable Returns to Scale (VRS) hypothesis, is sketched below. Suppose there are k inputs and m outputs for n DMUs. For the i-th DMU, q_i is the column vector of the outputs and x_i is the column vector of the inputs. We can also define X as the (k×n) input matrix and Q as the (m×n) output matrix. The DEA model is then specified as the mathematical programming problem in (1), for a given i-th DMU:

$$\begin{aligned} &\min_{\theta,\lambda} \ \theta && (1)\\ &\text{s.t.} \quad -q_i + Q\lambda \geq 0 \\ &\qquad \theta x_i - X\lambda \geq 0 \\ &\qquad I1'\lambda \leq 1 \\ &\qquad \Lambda \geq 0 \end{aligned}$$

In problem (1), θ is a scalar (that satisfies $\theta \leq 1$); more specifically, it is the efficiency score that measures technical efficiency of unit (x_i, q_i). It measures the distance between a decision unit and the efficient frontier, defined as a linear combination of 'best practice' observations. With $\theta < 1$, the decision unit is inside the frontier (i.e. it is inefficient), while $\theta = 1$ implies that the decision unit is on the frontier (i.e. it is efficient). The vector λ is a (n×1) vector of constants, which measures the weights used to compute the location of an inefficient DMU if it were to become efficient. The inefficient DMU would be projected on the production frontier as a linear combination, using those weights, of the peers of the inefficient DMU. The peers are other DMUs

that are more efficient than the one analysed, and are therefore used as benchmarks for the inefficient DMU. I1 is a n-dimensional vector of ones. The restriction $I1'\lambda = 1$ imposes convexity of the frontier, accounting for Variable Returns to Scale (DEA-VRS model). Dropping this restriction would amount to impose Constant Returns to Scale (DEA-CRS model). Additionally, notice that the problem has to be solved for each of the n DMUs in order to obtain the n efficiency scores. Assuming to have information on prices and assuming no unit price variability between the observations, as we do, then we can measure the expenditure efficiency as follows:

$$\begin{aligned} \min_{\lambda,\, xi^*} \quad & w_i' x_i^* \\ \text{s.t.} \quad & -q_i + Q\lambda \geq 0 \\ & x_i^* - X\lambda \geq 0 \\ & I1'\lambda = 1 \\ & \lambda \geq 0 \end{aligned} \tag{2}$$

where w_i are the unit price of input (in our case of expenditure) and x_i^* are the levels of expenditure that a municipality should have to be technically efficient (computed with the previous DEA-VRS model). Then, it is possible to evaluate the allocative efficiency component of total efficiency as the ratio between cost and technical efficiency.

2.2. Stochastic Frontier Analysis

We focus on the cost function representation of a given production technology. For an arbitrary i-th observation, the cost function $C(q_i, w_i; \beta)$ defines a lower bound to the expenditures C_i necessary to produce a given vector of outputs q_i for given input prices w_i. β is the vector of technological parameters to be estimated. Stochastic parametric frontiers are based on a composed error term which allows us to disentangle cost inefficiency from other stochastic disturbances. A symmetric component (v_i) captures usual random disturbances, while a one-sided (positive) error component (u_i) reflects

cost inefficiency. These error terms are assumed to be independent (i.e. $Cov[v_i, u_i] = 0$). Assuming a Cobb-Douglas technology with a multiplicative composite error term, our stochastic cost frontier specification expressed in logarithmic form is:

$$\ln C_i = \beta_0 + \Sigma_m \beta_m \ln q_{mi} + v_i + u_i \qquad (3)$$

where C_i are total costs (municipal current expenditure) and q_i are the output indicators. Besides output indicators, we have included in the SFA model also three dummies, respectively two for the extreme size classes – i.e. municipalities with less than 1,000 (*POP_UNDER1000*) and with more than 10,000 inhabitants (*POP_OVER10000*) – and one for the altitude class – i.e. municipalities over 600 meters (*ALT_600-900*), with the purpose to control for potential scale effects, as in DEA-VRS[4]. The lack of input prices in our empirical analysis and the coincidence of total costs with current expenditure (*EXP*) is due to the assumption of no unit price variability across the observations.

Several procedures are available to estimate frontier (3), depending on the adopted distribution for cost efficiency component. In this paper we assume the one-sided inefficiency term to be distributed as a truncated-normal – $u_i \sim N^+(\delta'Z, \sigma_u^2)$ – and estimate the frontier using the maximum likelihood (ML) technique proposed by Battese and Coelli (1995). This procedure allows cost inefficiency, which depends on the mode $\delta'Z$ of the truncated-normal distribution, to be influenced by a vector Z of environmental observable factors. As for the symmetric random noise component v_i, it is assumed to be independently and identically distributed as a $N(0, \sigma_v^2)$.

Table 2 shows the estimates of equation (3) for our sample of 262 municipalities, using *EXP* as dependent variable and the output indicators defined above and considering four different SFA specifications (from Model 1 to Model 4) according to the set of selected environmental variables.

[4] Thresholds were selected by looking at the distribution of per capita current spending of municipalities according to their size and altitude. Municipalities under 1000 and over 10000 inhabitants represent the extreme sides of the U-trend that shows per capita spending along the dimensional classes of local governments. Moreover, municipalities located at an altitude above 600 meters appear to have levels of per capita spending significantly higher than the average.

Table 2. Estimates of SFA spending model

Regressor	**C = *EXP* (Model 1)**	**C = *EXP* (Model 2)**	**C = *EXP* (Model 3)**	**C = *EXP* (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*	0.019* (0.011)	0.021* (0.013)	0.026** (0.011)	0.023** (0.010)
ln*DEPEND*	0.055* (0.032)	0.059* (0.032)	0.057* (0.032)	0.059** (0.029)
POP_UNDER1000	0.049* (0.026)	0.043 (0.026)	0.046* (0.026)	0.075*** (0.023)
POP_OVER10000	0.081** (0.040)	0.090** (0.042)	0.097** (0.041)	0.108*** (0.037)
ALT_600-900	0.052** (0.022)	0.055** (0.022)	0.054** (0.021)	0.038** (0.019)
σ^2 ($\sigma_u^2 + \sigma_v^2$)	0.013*** (0.001)	0.013*** (0.001)	0.013*** (0.001)	0.010*** (0.001)
γ [$\sigma_u^2/(\sigma_u^2 + \sigma_v^2)$]	0.686*** (0.234)	0.680*** (0.259)	0.687*** (0.228)	0.599*** (0.187)
Nr. observations	262	261	261	261
Wald test [p-value]	6825.54 [0.000]	6762.53 [0.000]	6794.52 [0.000]	8631.28 [0.000]

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

SFA estimates highlight the prevalence of inefficiency with respect to random noise in determining global error term ($u_i + v_i$): γ – the share of total variance due to deviations from the 'best practice' – varies from 0.687 in the SFA-Model 3 to 0.599 in the SFA-Model 4. The municipality population (*POP*) and the amounts of waste collected (*WASTE*) are particularly relevant in explaining the variability observed in current expenditure levels. Moreover, constant returns to scale seem to dominate municipal

services provision, given the sum of estimated elasticities with respect to the four outputs being very close to 1. This result depends crucially from the fact that 83% of our observations do not belong to the two extremes of dimensional classes (i.e. under 500 and between 10,000 and 15,000 inhabitants, respectively). The importance of demographical size and the altitude in defining cost frontier is also stressed by the significant coefficients for the three dummies *POP_UNDER1000*, *POP_OVER10000* and *ALT_600-900*, 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.

4. Results

4.1. Comparing SFA and DEA inefficiency scores

We begin the discussion of our results with a classification of our municipalities based on their size according to the number of inhabitants, that will help us in the analysis of efficiency scores. Municipalities are divided in seven dimensional classes, following the same classification introduced by the Ministry of Interior: under 499 inhabitants (13.5% of observations), between 500 and 999 (22%), between 1,000 and 1,999 (25%), between 2,000 and 2,999 (9%), between 3,000 and 4,999 (15%), between 5,000 and 9,999 (11%), and finally over 10,000 (3.5%). We compare the results obtained from five different models, one DEA-VRS and four SFA, where the last ones vary from the poorest to the richest as for the included inefficiency determinants (i.e. the vector Z).

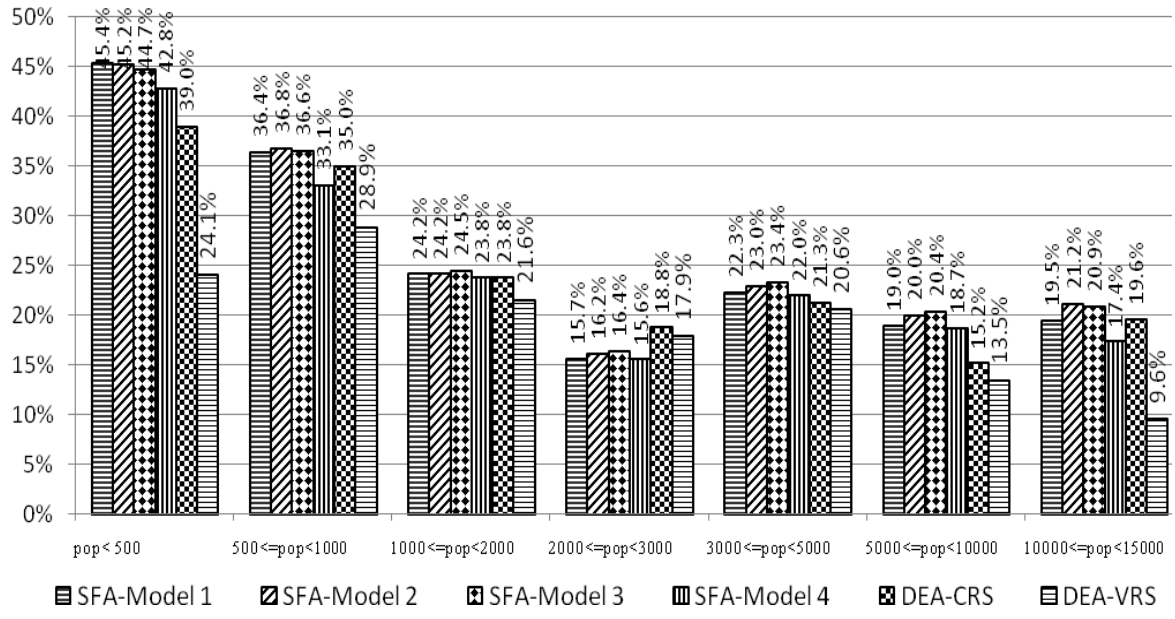
An elementary insight is obtained by considering the dichotomous classification of the observations as either efficient or inefficient according to DEA evaluation (in SFA, by construction, no observation is completely efficient): 22 municipalities – belonging especially to the biggest and smallest dimensional classes (between 10,000 and 15,000 and under 500 inhabitants) – emerge as efficient units with a score equal to 1 (table 3).

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
Nr. of fully efficient municipalities	22	-	-	-	-

Considering both methodologies and all models, average inefficiency score is close to 0.22 for DEA-VRS and between 0.26 and 0.28 for SFA. It means that municipalities, on average, could achieve the same output levels with about a 25% current spending reduction. The scores distributions appear concentrated around the mean in both DEA and SFA, since they exhibit a median close to the mean, and the 90% of observations with less than 50% of spending inefficiency. Not surprisingly, standard deviation does not show very high values, even if in SFA it is higher because of the presence of more extreme score estimates.

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



The correlation between DEA and SFA inefficiency scores is very high both for VRS and CRS specification. This means that the inclusion of the dummies for extreme dimensions in stochastic cost frontier help to control for the effects of variable returns to scale on efficiency estimates, like in DEA-VRS, even if they do not vanish completely. Indeed, as previously discussed, SFA models highlight practically constant returns to scale, like in DEA-CRS specification. Such a result is probably driven by the prevalence in our sample of municipalities of small and medium sizes (82% of observations), for which returns to scale appear to be constant looking at the difference between DEA-CRS and DEA-VRS (see figure 2). Variable returns to scale appear instead to characterise municipalities under 1,000 and between 10,000 and 15,000 inhabitants. The first ones show increasing returns to scale, perhaps because of the influence of fixed costs on current expenditures, that are very large for several services (e.g., waste collection, general administration). 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 elderly care and welfare spending (10% of current expenditures), that include different social assistance items. Notice that the adopted variable *DEPEND* is probably unable to fully capture the output results to be matched with the expenditure devoted to this category. As for the best dimensional scale for providing the essential public services considered in this study, the municipalities between 2,000 and 5,000 inhabitants seem to correspond to the optimal size; this evidence emerges by looking at both the difference between DEA-CRS and DEA-VRS scores and SFA inefficiency estimates (see figure 2).

As a final remark, in DEA-VRS model spending inefficiency (net of scale inefficiency) seems to decrease with municipal size. This probably means that public managers are subjected 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 possible determinants of estimated inefficiency.

4.2. Fiscal decentralization and other inefficiency determinants

We study the effects of fiscal decentralization and other possible explicative factors for estimated inefficiency by adopting two different approaches. For DEA-VRS spending model we use a standard two-stage analysis. Therefore, we take DEA-VRS inefficiency scores and regress them on a set Z of environmental variables. We rely on a second-stage Tobit regression, a censored model that permits us to make a proper inference on the factors underlying inefficiency scores, considering also the presence of fully efficient units. This choice is fundamental especially when using DEA, as the frontier includes efficient observations with scores that take value 1. As for SFA spending models, we adopt instead the single-stage estimation procedure proposed by Battese and Coelli (1995, BC95 from now on): explanatory variables for inefficiency levels are introduced directly in SFA equation (3) through a parametric specification of the error term u_i. Besides a measure of fiscal decentralization – the key issue of this study – the other environmental 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. Descriptive statistics for the determinants of spending inefficiency

VARIABLE DESCRIPTION	NAME	Mean	Median	Std. Dev.	Min	Max	%
ECONOMIC AND FISCAL INDICATORS							
Fiscal autonomy (% local taxes on current expenditures in general administration, garbage management, road maintenance and local mobility, education and elderly care)	*FISC_AUT*	62	85	17	34	120	-
Current Revenues per capita		702	646	198	452	1,739	-
High Revenues (Municipalities with a level of current revenues per capita over the median)	*HIGH_REVENUE*	-	-	-	-	-	50%
Fiscal Revenues per capita		440	437	102	190	895	
High Taxes (Municipalities with a level of fiscal revenues per capita over the median)	*HIGH_TAX*	-	-	-	-	-	50%

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

VARIABLE DESCRIPTION	NAME	Mean	Median	Std. Dev.	Min	Max	%
ECONOMIC AND FISCAL INDICATORS							
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)	*HIGH_EXTRA-TAX*	-	-	-	-	-	50%
Grants per capita		117	85	105	9	662	
High Grants (Municipalities with a level of grants per capita over the median)	*HIGH_GRANT*	-	-	-	-	-	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)	*MANDATE*	1.40	1	1.03	0	4	-
*Electoral mandate*Fiscal rule* (interaction of the number of post-election years for the governing coalition with the presence of DSP)	*MANDATE*PACT*	0.29	0	0.86	0	4	-
*Electoral mandate*Fiscal rule *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 expenditures)	*MAND*PACT*FISC_AUT*	1.35	0	3.98	0	19	-
POLITICAL INDICATORS							
Mayor's gender (Municipalities with a male mayor)	*SEX_MAYOR*	-	-	-	-	-	83%
Mayor's age	*AGE_MAYOR*	52	54	10	28	79	-
Civil list governing coalition	*CIV_LIST*	-	-	-	-	-	56%
Centre-left governing coalition	*CEN_LEFT*	-	-	-	-	-	23%
GARBAGE MANAG. INDICATORS							
Public Management	*PUBLIC*	-	-	-	-	-	77%
Public Management by a firm	*PUBLIC*FIRM*	-	-	-	-	-	32%
Public Management by a coop. firm	*PUBLIC*FIRM*COOP*	-	-	-	-	-	27%

Table 5. Analysis of spending inefficiency determinants (BC95 estimates)

Regressor	SFA scores (BC95 Model 1)	SFA scores (BC95 Model 2)	SFA scores (BC95 Model 3)	SFA scores (BC95 Model 4)
FISC_AUT	- 0.1946*** (0.0406)	- 0.1859*** (0.0406)	- 0.1673*** (0.0402)	- 0.4656*** (0.0510)
PACT	0.0006 (0.0362)	- 0.0080 (0.0353)	- 0.0143 (0.0509)	0.0265 (0.0453)
CIV_LIST	- 0.0143 (0.0219)	- 0.0135 (0.0215)	- 0.0125 (0.0213)	- 0.0354* (0.0201)
CEN_LEFT	- 0.0471* (0.0258)	- 0.0479* (0.0251)	- 0.0400 (0.0249)	- 0.0492** (0.0228)
MANDATE	0.0155* (0.0104)	0.0185** (0.0081)	0.0147 (0.0089)	0.0137* (0.0079)
HIGH_ REVENUE	0.1755*** (0.0234)	0.1752*** (0.0224)	0.1763*** (0.0218)	-
PUBLIC	- 0.0112 (0.0161)	- 0.0255 (0.0201)	- 0.0236 (0.0198)	- 0.0194 (0.0177)
*PUBLIC*FIRM*	0.0127 (0.0369)	0.0119 (0.0363)	0.0103 (0.0355)	0.0321 (0.0307)
*PUBLIC*FIRM*COOP*	- 0.0863** (0.0527)	- 0.0881** (0.0385)	- 0.0916** (0.0382)	- 0.0675** (0.0325)
SEX_MAYOR	-	-0.0225 (0.0219)	-0.0215 (0.0215)	-0.0079 (0.0189)
AGE_MAYOR	-	-0.0457 (0.0403)	-0.0488 (0.0395)	-0.0096 (0.0355)
*MANDATE*PACT*	-	-	1.517*** (0.5564)	0.7291 (0.4758)
*MAND*PACT* FISC_AUT*	-	-	- 0.3293*** (0.1220)	- 0.1634 (0.1045)
HIGH_TAX	-	-	-	0.2268*** (0.0251)
HIGH_EXTRA-TAX	-	-	-	0.0625*** (0.0159)
HIGH_GRANT	-	-	-	- 0.0121 (0.0223)
LR test [p-value]	115.6 [0.000]	118.7 [0.000]	133.8 [0.000]	199.7 [0.000]
Log-likelihood	212.4	212.9	217.1	250.0
Nr. observations	262	261	261	261

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

Table 6. Analysis of spending inefficiency determinants (Tobit estimates)

Regressor	DEA-VRS scores (Tobit Model 1)	DEA-VRS scores (Tobit Model 2)	DEA-VRS scores (Tobit Model 3)	DEA-VRS scores (Tobit Model 4)
FISC_AUT	- 0.0717*** (0.0267)	- 0.0675** (0.0269)	- 0.0529** (0.0265)	- 0.2177*** (0.0333)
PACT	- 0.0826*** (0.0206)	- 0.0821*** (0.0207)	- 0.0952*** (0.0332)	- 0.0702** (0.0317)
CIV_LIST	- 0.0134 (0.0166)	- 0.0127 (0.0166)	- 0.0118 (0.0163)	- 0.0162 (0.0156)
CEN_LEFT	- 0.0317* (0.0189)	- 0.0330* (0.0189)	- 0.0277 (0.0187)	- 0.0256 (0.0177)
MANDATE	0.0118* (0.0063)	0.0137** (0.0065)	-0.0104 (0.0072)	0.0092* (0.0068)
HIGH_ REVENUE	0.0984*** (0.0133)	0.1003*** (0.0134)	0.1039*** (0.0132)	-
PUBLIC	- 0.0138 (0.0160)	- 0.0112 (0.0161)	- 0.0083 (0.0158)	- 0.0019 (0.0149)
*PUBLIC*FIRM*	0.0016 (0.0287)	0.0025 (0.0287)	- 0.0054 (0.0281)	0.0075 (0.0264)
*PUBLIC*FIRM*COOP*	- 0.0501* (0.0296)	- 0.0503* (0.0296)	- 0.0517* (0.0291)	- 0.0410 (0.0273)
SEX_MAYOR	-	0.0011 (0.0169)	- 0.0009 (0.0166)	-0.0094 (0.0157)
AGE_MAYOR	-	-0.0384 (0.0307)	- 0.0488 (0.0395)	-0.0267 (0.0282)
*MANDATE*PACT*	-	-	1.5309*** (0.4145)	1.1025*** (0.3906)
*MAND*PACT* FISC_AUT*	-	-	- 0.3326*** (0.0908)	- 0.2421*** (0.0856)
HIGH_TAX	-	-	-	0.1170*** (0.0138)
HIGH_EXTRA-TAX	-	-	-	0.0426*** (0.0127)
HIGH_GRANT	-	-	-	- 0.0159 (0.0155)
LR test [p-value]	121.7 [0.000]	122.1 [0.000]	136.4 [0.000]	164.2 [0.000]
Log-likelihood	186.5	186.0	193.1	207.0
Nr. observations	262	261	261	261

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

Tables 5 and 6 present the results for the determinants of spending inefficiency obtained using SFA (BC95 model) and DEA-VRS (Tobit model) scores, respectively. We estimated four different models for each group of scores, 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 signs of coefficients, suggesting that our results are robust to alternative model specifications.

In both set of estimates, the index of *fiscal decentralization* appears to have an important influence on spending inefficiency. Similarly to other countries, Italian municipalities rely on three main different sources of revenues: local taxes, central government grants, and fees and charges. We define fiscal autonomy (*FISC_AUT)* as the percentage of current expenditures (in the selected five functions) covered by local taxes. Notice that it is the first time that such an indicator of fiscal decentralization is used as explanatory variable for spending inefficiency. It appears that a municipality with a higher share of current revenues derived from local taxes is more efficient, giving support to the theoretical insight that a higher accountability of local politicians can be obtained by increasing their responsibilities in terms of funding.

The impact of local taxes on municipal efficiency confirms previous findings in the literature, and suggest that the other sources of revenues act in the opposite direction. De Borger and Kerstens (1996) – using the local tax rates to proxy for fiscal autonomy – refer to the 'flypaper-effect' to explain this relationship. Taxpayers are not able to know the real entity of local government's budget constraint, when the degree of fiscal imbalance is high (Oates, 1999); in other words, citizens find more difficult to know the level of grants rather than that of taxes. Therefore, it is easier for local politicians to turn aside taxpayers' attention from their inefficient behaviour, providing more expenditure, just as the flypaper with the flies. Oates (1999) suggests also that transfers increase public spending more than an equally increase of citizens' income would increase their purchase. Therefore, the share of current expenditures covered by local taxes appears to have a positive effect on efficiency since local politicians are made more accountable, given the tighter control exerted by the citizens-taxpayers. Local representatives, in fact, use less easily local taxation than transfers and charges, as citizens are more aware of it.

In a similar vein, Silkman and Young (1982) underline another important aspect linked to the relationship between fiscal autonomy and spending efficiency. In their opinion, an inefficient behaviour of municipalities has a price, that is shared with other levels of government according with the volume of funds that local governments receive from them. In this case, local politicians can attribute bad management performance to superior governments. Hence, a more precise definition of responsibilities for local governments, not only from spending side but also from revenue side, should increase spending efficiency.

Finally, our evidence is also in accordance with the predictions provided by electoral accountability models, which the second-generation theory of fiscal federalism relies on (e.g., Besley and Case, 1995a, Besley and Smart, 2007, Bordignon *et al.*, 2004, Hindriks and Lockwood, 2008). According to this framework, the presence of asymmetric information between electorates (the principals) and politicians (the agents) can be seen as the main reason why the government's performance is inefficient. The crucial point here is that fiscal decentralization can create an incentive to reduce rent diversion and/or the influence of lobbies, leading to a higher probability of re-election of incumbent politicians through mechanisms of tax competition and yardstick competition among local governments.

The dummy *HIGH_REVENUE* is another fiscal variable showing a significant impact on inefficiency in all estimates. It is equal to 1 for the municipalities with a per capita level of current revenues over the median (over 646 Euro per capita)[5]. 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., Prud'Homme, 1995, McLure, 1967, Inman, 2003), it is important to observe the results obtained with Model 4. In this specification, municipal per capita current revenues have been decomposed into their three principal sources: taxes (*HIGH_TAX*), fees and charges (*HIGH_EXTRA-TAX*), and grants (*HIGH_GRANT*). Like for total revenues, for each source we individuated municipalities characterised by a per capita

[5] 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 1,739 Euro per capita.

level exceeding the median[6]. Contrary to most of 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 of taxes as well as fees and charges. This confirms the evidence emerged in Balaguer-Coll *et al.* (2002, 2007): a local government that is highly capable of generating own revenues would be less motivated to manage them efficiently. This insight also comes from property rights and principal-agent literature, that outlines several reasons why politicians and public managers may lack proper incentives to effectively audit and control expenditures. Moreover, the relevant result for taxes and fees and charges is justified by the nature of our sample, where 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%)[7]. Overall, these findings, linked to the previous one on the impact of fical decentralization, highlight that, while more autonomous municipalities tend to exhibit less inefficient spending behaviours, an excessively large disposability of public resources – in particular, from taxes and fees and charges – seems to exert a negative influence on spending efficiency, as it makes softer the budget constraint for local governors.

The importance of the budget constraint faced by the municipalities is also investigated directly trough the dummy variable *PACT*, that distinguishes local governments subject to the Domestic Stability Pact (DSP) from the other ones. The DSP is a set of fiscal rules that was introduced in Italy since 1999, as a consequence of the Stability and Growth Pact (Amsterdam Treaty, 1997), to limit local administrations' expenditures. Fiscal rules usually consist in a limitation to the budget deficit and/or a direct limit to the spending growth rate. The scope of the law spans over all levels of the Italian territorial administrative structure: regions, provinces and municipalities. However, starting from 2001, municipalities with less than 5,000 inhabitants were excluded from the DSP. From our analysis, the presence of the DSP appears to have a significant and reducing effect on spending inefficiency, even if only for DEA-VRS models (table 6), probably because in SFA models this factor partly captures a size effect. Thus, the

[6] See previous footnote.

[7] See IRES Piemonte, *Osservatorio sulla Finanza Locale del Piemonte*, and Ministero dell'Interno, *Dati sui Certificati di Bilancio dei Comuni*.

imposition of a tighter budget constraint should reduce the opportunistic behaviour of incumbent politicians and improve spending efficiency.

We now focus on some political features of municipalities. 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. The variable *MANDATE* assumes 5 different values (from 0 to 4) and represents the number of post-election years for the mayor and the governing coalition. This result is linked to previously quoted literature on political accountability and in line with the electoral budget cycle approach. According to this theoretical strand, incumbent politicians tend to enlarge spending in proximity of new elections in order to increase their chances to be re-elected. (e.g., Rogoff, 1990, Besley and Case, 1995b). Our empirical analysis seems to provide a clear evidence of the electoral budget cycle effect, as the shorter is the distance from new elections year the larger is the deviation from the best-practice frontier.

In Model 3, we have tested another landmark of the literature on the opportunistic behaviour of incumbent politicians based on their desire to be re-elected. Interacting the variable *MANDATE* with the variable *PACT*, we find that *MANDATE*PACT* impacts on spending inefficiency in a significant and positive way, while the pure effect associated to the number of post-election years loses its statistical significance. To summarize, as in the recent contributions by Mink and De Haan (2005) and Bartolini and Santolini (2009), there is evidence of an electoral budget cycle effect: spending inefficiency increases in proximity of the election year, and the DSP seems quite effective in controlling the budget of local administrations; however, the introduction of such a fiscal rule (DSP) tend to strengthen remarkably the opportunistic behaviour for those incumbent politicians that are closer to the end of their electoral mandate. We finally add the variable *MAND*PACT*FISC_AUT*, that interacts the above term with fiscal autonomy indicator; one can notice that a higher degree of fiscal decentralization seems to reduce the electoral budget cycle impact, even though exisiting literature signals decentralized setting as an incentive for incumbents' opportunistic behaviours related in particular to yardstick competition (Salmon, 1987; Besley and Case, 1995b).

We tried to control for possible relationships between the political orientation of governing coalition and inefficiency scores, using two dummy variables that assume

value 1 if coalition parties belong to a civic list (*CIV_LIST)* or to a centre-left list (*CEN_LEFT)*. As for *CEN_LEFT*, it emerges a significant and reducing impact on inefficiency in several specifications (BC95 Models 1, 2, 4 and Tobit Models 1, 2), while the coefficient for *CIV_LIST* appears significant only in BC95 Model 4. These results, however, are strongly influenced by a net prevalence in the sample of municipalities led by civic lists (172 observations), all concentrated in small-sized local governments. Notice that the positive effect on spending efficiency of centre-left leading coalition is somewhat in contrast with political economy literature, that often found in such a political orientation a propensity towards larger size governments (e.g., Edlund and Pande, 2002). Starting from Model 2 we have also included two variables pertaining to the age (*AGE_MAYOR*) and to the gender of the mayor (*SEX_MAYOR*). Both variables do not appear to affect significantly inefficiency, contrary to the bulk of the literature on the size and the composition of public expenditure, that – especially for female representatives – stresses their key role in determining policy preferences and spending outcomes (e.g., Lott and Kenny, 1999; Edlund and Pande, 2002; Funk and Gathmann, 2008; Pande, 2003; Chattopadhyay and Duflo, 2004; Svaleyrd, 2007; Geys and Revelli, 2009).

Finally, we use three dummies for capturing the different management models of waste collection and disposal that are observed in our sample. The choice to consider this particular service is enforced by the presence of several governance structures, and especially by the importance that the service has recently gained in Italy for judging a local administration to be good (think for example to the scandals of Naples and Palermo). This type of public service can be managed: *a*) directly by a local government; directly by a consortium of local governments with the possibility for a municipality to be *b*) either consortium head or *c*) a simple participant; through a single firm which can be either *d*) public or *e*) private; through *f*) a public cooperative firm involving more than one municipality. We summarize these six different governance schemes in three variables. A first dummy distinguishes the public ownership from the private one (*PUBLIC*), a second dummy indicates a firm management conditional to have public ownership (*PUBLIC*FIRM*), while a third dummy represents a cooperative management conditional to be a publicly-owned firm (*PUBLIC*FIRM*COOP*).

The results we have obtained – both for BC95 and Tobit models – highlight a significant effect of waste management type only for the latter dummy: 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 firm 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 publicly-owned cooperative firm would then represent a more efficient solution, probably as it associates the advantage of solving fixed costs problem (typical of consortium option) with the benefit of increasing expenditure control (typical of external firm option). Indeed, within an external firm, resource availability is lower, and then public managers are more aware of their behaviours. Moreover, a consortium among different municipalities allows them to share huge fixed costs.

5. Conclusions

The purpose of this paper is to assess spending efficiency for Italian municipalities, investigating, in particular, the role played by a set of variables reflecting the degree of fiscal autonomy. The analysis relies on a sample of 262 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 fiscal federalism theories and the available empirical literature on efficiency of local governments, our results suggest that more autonomous municipalities exhibit less inefficient spending behaviours. Moreover, the strictness of budget constraint due to the presence of some fiscal rules (here the Domestic Stability Pact) appears to be important in driving efficiency. Finally, the importance of political accountability highlighted by electoral budget cycle theories is confirmed empirically. As for the political features of government coalition, both age and gender of the mayor do not seem to exert any significant impact on inefficiency levels, while the political ideology belonging to the left-wings tends to reduce excess spending.

From a policy perspective, the evidence emerged in this study provides support to recent legislative reforms that aim at increasing 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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APPENDIX

Table A.1. Empirical studies measuring the efficiency of local governments

Authors	Sample	Methodology	Input indicators	Output indicators
Vanden Eeckaut, Tulkens and Jamar (1993)	235 Belgian municipalities	Nonparametric (DEA)	Current expenditure	Population, Nr. of beneficiaries of minimal subsistence grants, Nr. of students enlisted in local primary schools, Public recreational facilities, Population older than 65, Nr. of local crimes
De Borger and Kerstens (1996)	589 Belgian municipalities	Nonparametric (DEA and FDH) and parametric (deterministic and stochastic frontier)	Current expenditure	Population, Nr. of beneficiaries of minimal subsistence grants, Nr. of students enlisted in local primary schools, Public recreational facilities, Population older than 65
Athanassopoulos and Triantis (1998)	172 Greek municipalities	Non parametric (DEA) and parametric (SFA)	Current expenditure	Nr. of resident families, Average residential area, Building area, Industrial area, Tourism area
Sousa and Ramos (1999)	1103 Brasilian municipalities	Non parametric (DEA)	Current expenditure	Population, Homes with clear water, Homes with solid waste collection, Illiterate population, Nr. of enrolled students in primary and secondary local schools
Worthington (2000)	177 municipalities of New South Wales (Australia)	Nonparametric (DEA) and parametric (SFA)	Nr. full-time workers, Financial expenditures, Other expenditures (materials)	Population, Nr. of properties acquired to provide the following services: potable water and domestic waste collection, Kilometers of sealed and unsealed roads (urban and rural)
Prieto and Zofio (2001)	209 municipalities from Castilla to Leon with less than 20000 inhabitants	Non parametric (DEA)	Budgetary expenditure	Population, Tons of waste collected, Road infrastructure area, Nr. of lighting points, Area of public parks, Potable water, Cultural and sportive infrastructure

Table A.1. Empirical studies measuring the efficiency of local governments (continued)

Balaguer-Coll, Prior-Jimenez and Vela-Bargues (2002)	258 Valencian municipalities (panel)	Nonparametric (DEA)	Total expenditures	Population, Tons of waste collected, Road infrastructure area, Nr. of lighting points, Area of public parks, Quality of services
Lokkainen and Susiluoto (2004)	353 Finnish municipalities	Nonparametric (DEA)	Current expenditure	Children's day care centres (nr. of days), Children's family day care (nr. of days), Open basic health care (nr. of visits), Dental care (nr. of visits), Bed wards in basic health care (nr. of visits), Institutional elderly care (nr. of days), Institutional handicapped care (nr. of days), Comprehensive schools (teaching hours), Senior secondary schools (teaching hours, Municipal libraries (total loans)
Afonso and Fernandes (2005)	287 Portuguese municipalities	Nonparametric (DEA)	Current expenditure	Total municipal performance indicator composed by sub indicators grouped in the following dimensions: 1) general administration 2) education 3) social services 4) cultural services 5) domestic waste collection 6) environment protection

Table A.2. Determinants of the efficiency of local governments

Authors	Variables with a *positive* impact on efficiency	Variables with a *negative* impact on efficiency
Vanden Eeckaut, Tulkens and Jamar (1993)	High tax rates, Educational level of the adult population	Higher per capita incomes and wealth of citizens, Per capita block grant, Political characteristics (number of coalition parties)
Athanassopoulos and Triantis (1998)	High share of fees and charges in municipal income, High investment share in total expenditures	Population density, State grants, Parties affiliated to the central government
Balaguer-Coll, Prior-Jimenez and Vela-Bargues (2002)	Largest populations, Level of commercial activity	Higher per capita tax revenue, Higher per capita grants
Afonso and Fernandes (2005)	Population's purchasing power, Population with secondary education, opulation with tertiary education, Population density, Population variation	Distance of municipality to district capital
De Borger and Kerstens (1996)	Local tax rates, Level of education	Per capita block grant, Income level
Lokkainen and Susiluoto (2004)	Big share of municipal workers in age group 35-49 years, Dense urban structure, High education level of inhabitants	Peripheral location, High income level, Large population, High employment, Diverse service structure, Big share of services bought from other municipalities, A high share of costs covered by state grants reduced efficiency in first years after the end of matching grant era in 1993