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ABSTRACT: It is generally accepted that fiscal decentralization increases citizens' control over politicians, fostering accountability and increasing efficiency. This article identifies the socioeconomic characteristics of citizens (potential voters) that increase their control over local policy-makers and thus generate greater efficiency in a decentralized context. We also highlight the fiscal characteristics of local governments that influence this control and efficiency. The study examines a sample of Spanish municipalities, applying a methodology based on the conventional procedure of two-stage estimation. In the first stage we estimate the efficiency of local public services by calculating a new version of a global output indicator using the DEA technique. In the second stage, using a Tobit type estimation (censored models) and bootstrap methods, we show how the factors mentioned may influence efficiency. The results suggest that strong presence of retailers, retired people, and people entitled to vote favour citizens' control, which fosters accountability and efficiency. A factor that facilitates this control, and therefore greater efficiency, is the presence of low opportunity costs for obtaining information regarding local public service management.

JEL Codes: H11, H71, H72

Keywords: Technical efficiency, local governments, citizens' control, socioeconomic and fiscal variables.

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1. Introduction

Several theories in economic science support the decentralization of government powers. The common denominator of these theories is the assertion that decentralization raises efficiency. Foremost among them is fiscal federalism, though other areas of economic science have also used the efficiency argument in support of decentralization. Oates (2005) notes the adoption of industrial-organization models by fiscal federalism theory, justifying decentralization on the grounds of the existence of asymmetric information and accountability. On this view, fiscal decentralization is justified not only by the existence of differences in citizens' preferences but by the fact that their proximity to the government responsible for the provision of public services increases their control over politicians. In the same vein, one of the arguments that political economy uses to support the decentralization of government or political power (Lockwood, 2006) is the increase in political accountability: politicians' rent-seeking activities are under tighter control in a decentralized context because citizen-voters are more involved and better-informed. This resulting increase in citizen participation fosters government accountability and raises efficiency.

So if we accept that fiscal decentralization increases the control citizens have over politicians, fosters accountability, and raises efficiency, the next step is to analyse the socioeconomic characteristics of citizens (potential voters) that increase their control over local policy-makers in a decentralized context, and thus improve efficiency in the provision of local public services. A primary objective of the present article is, therefore, to examine the relationship between the socioeconomic characteristics of the population and technical efficiency.

We examine the following socioeconomic variables: the population's income and educational levels, the level of commercial and tourist activity in the local economy, the proportion of pensioners, and the proportion of the population entitled to vote in local elections. Even though the relationships between income, educational levels of the

population and levels of efficiency have frequently been examined[1], this article provides a new focus and a new theoretical argument. Giménez and Prior (2007) and Balaguer and Prior (2009) studied the influence of commercial and tourist activity on efficiency, but did not use these variables to carry out a theoretical analysis on citizens' control. In our study, we examine the degree of control exerted by population groups active in retail trade or tourism and the consequences of this control in terms of efficiency. These groups are particularly relevant to our study because they have a strong economic interest in maintaining or improving the quantity and quality of local public services and are likely to act as local lobbies. The retired are another population group of interest to us, because for them controlling local government activity has a low opportunity cost. As for the proportion of the population entitled to vote, this variable is representative of the demographic structure of the population and also reflects the relative weight of the percentage of immigrants without voting rights (Geys et al., 2009). The entitlement to vote affects the degree of control that citizens can exercise over politicians through local elections.

The second objective of the article is to analyse the relation between the fiscal characteristics of local governments and efficiency. Here, we investigate whether the fiscal characteristics of the municipality influence accountability and the degree of control that citizens exercise over local politicians. The fiscal variables analysed are the levels of taxation and transfers. Does a high level of taxation increase citizen control over local policy-makers? Does a high level of transfers produce fiscal illusion and thus reduce the control citizens may exercise over politicians? Some studies have related these variables to efficiency (for example De Borger et al., 1994; De Borger and Kerstens, 1996a, 1996b; Balaguer and Prior, 2009), but none to date have analysed them together with the socioeconomic characteristics mentioned above. Our analysis aims to offer a broad perspective of the fiscal and socioeconomic factors that increase citizens' control over the activities of politicians.

The study is restricted to a sample of 102 Spanish municipalities of between 5,000 and 20,000 inhabitants in the Autonomous Community of Catalonia. All data refer to 2005.

[1] See, for the case of income level, De Borger et al. (1994), De Borger and Kerstens (1996a) (1996b), for educational levels De Borger and Kerstens (1996a), Afonso and Fernandes (2008); finally Geys and Moesen (2009) who study both variables (levels of income and education).

As the municipalities are from the same region and have the same level of responsibility, the sample has a high degree of homogeneity[2], but efficiency levels show enough statistical variation. In contrast to previous literature reports which have considered municipalities with highly varied populations, this study explores whether the factors that influence local efficiency may differ between municipalities of very similar characteristics. We expect that certain factors which appear to be decisive when explaining differences in efficiency will no longer appear to be so, given the great similarity of responsibilities and characteristics; at the same time, other factors analysed will gain in explanatory power.

The efficiency analysis is global, that is, we examine the technical efficiency of the total set of municipal public services. This analysis allows us to determine the global management capacity of local governments, treating them as multi-service production units. This is important from the point of view of accountability, because citizens evaluate the activity of the government as a whole and do not simply concentrate on one particular service. Similarly, the analysis of global efficiency makes sense when the explanatory variables of efficiency refer to the institutions of the government of the municipality (Borge et al., 2008), and, in the present study, to its residents as well. A thorough review of similar studies can be found in De Borger and Kerstens (2000) and Worthington and Dollery (2000a). Afonso and Fernandes (2008) describe studies that measure global municipal efficiency using non-parametric techniques. More recent studies that analyse global efficiency at a municipal level are those of Balaguer et al. (2007), Borge et. al (2008), Geys and Moesen (2009), and Giménez and Prior (2007).

In contrast to the majority of analyses of global efficiency, which are multi-output, this study uses a composite indicator for municipal activity based on data relating to the output of different municipal services as an output variable. Few studies to date have used a global output indicator representing all municipal public services (Borge et al., 2008; Afonso et al., 2005; Afonso and Fernández, 2006, 2008). In addition, the method used for calculating the global indicator in this article introduces a variation from the one used in the studies mentioned. This, together with the use of a broad range of

[2] The responsibilities of Spanish municipalities vary according to ranges of population size. For this reason, municipalities in the 5,000 to 20,000 inhabitant range have the same responsibilities with regard to revenue and expenditure.

information relating to the output of local public services, is another strong point of the analysis presented here.

Our methodology is based on the conventional procedure for two-stage analysis which estimates first the efficiency levels of each of the municipalities and then the factors that explain this efficiency. Specifically, we estimate the technical efficiency of the municipalities from the production frontier calculated with the Data Envelopment Analysis (DEA) linear programming technique. In the second stage, using a Tobit type estimation (censored models) and bootstrap methods developed by Simar and Wilson (2007), we show how the above-mentioned variables can influence efficiency scores.

The rest of the article is organized as follows. In section 2, the analysis of efficiency carried out is presented: the methodology, the variables used, and the results. Section 3 contains the second stage of the analysis and includes a description of the econometric model and the hypothesis for the impact of citizens' socioeconomic characteristics and of the fiscal and control variables on efficiency. Finally, the main conclusions of the study are gathered together in section 4.

2. Efficiency analysis

2.1. Methodology: Data Envelopment Analysis (DEA) framework

DEA (Data Envelopment Analysis) is a non-parametric approach for measuring the technical efficiency of a set of productive units. Being a non-parametric method, DEA does not *a priori* specify a functional form, but some formal properties that satisfy the points of the production set. Farrell's study (1957) was a forerunner of this approach and established the hypothesis of free disposal of inputs and outputs, convexity, and proportionality. In general, the term DEA is used for methods assuming convexity and for methods calculating efficiency through linear programming techniques. DEA was developed by Charnes et al. (1978a and 1978b), based on Farrell's seminal work. The model uses linear programming techniques to compare the efficiency of a set of units that produce similar outputs from a common set of inputs.

It is not the purpose of this study to describe DEA in detail. We only indicate that this technique can be understood as an extension of the traditional analysis of input/output ratios analysis. The efficiency of the unit under evaluation is defined as the ratio of the weighted sum of outputs in relation to a weighted sum of inputs. The weights used are generated by the technique itself. Therefore, if we take *n* units consuming *m* inputs and producing *s* outputs, the efficiency of a unit can be measured as follows:

$$Max(h_0) = \frac{\sum_{r=1}^{s} U_r Y_{r0}}{\sum_{i=1}^{m} V_i X_{i0}} \qquad (1)$$

Subject to:

$$\frac{\sum_{r=1}^{s} U_r Y_{rj}}{\sum_{i=1}^{m} V_i X_{ij}} \leq 1 \qquad j = 1....n$$

$U_r, V_i \geq 0 \qquad r = 1....s \qquad i = 1....m$

where:

h_0: is the score of efficiency of the unit evaluated.

Y_{r0}: is the quantity of output *r* produced by the unit evaluated.

X_{i0}: is the quantity of input *i* consumed by the unit evaluated.

Y_{rj}: is the quantity of output *r* produced by the unit *j*.

X_{ij}: is the quantity of input *i* consumed by the unit *j*.

U_r: is the weighting assigned to output *r*.

V_i: is the weighting assigned to input *i*.

By solving the linear programming problem, for each of the units analysed we can calculate the set of weights for the inputs and outputs that produces a score of greater efficiency, with the sole condition that using the same set of weights none of the other units examined obtains a ratio of efficiency greater than one. If in this way a group of weights can be found with which the score of efficiency of the unit being evaluated is equal to one, the unit will be considered efficient. If this is not the case, the unit will be considered relatively inefficient.

The above formulation corresponds to fractional programming. However, the model can easily be presented as a problem of linear programming. In the input-orientation, and supposing variable returns to scale, the model can be presented as follows:

$$\text{Min } \theta_0 \qquad (2)$$

subject to:

$$\theta_0 X_{io} \leq \sum_{j=1}^{n} X_{ij} \lambda_j \qquad \text{i} = 1\ldots.\text{m}$$

$$Y_{ro} \leq \sum_{j=1}^{n} Y_{rj} \lambda_j \qquad \text{r} = 1\ldots.\text{s}$$

$$\sum_{j=1}^{n} \lambda_j = 1 \qquad \lambda_j \geq 0$$

where θ_0 is a score of the efficiency of the unit 0.

DEA provides specific information on the units analysed, offering individual scores of efficiency for each one. It also provides reference groups and objectives for consumption and production for the units evaluated as inefficient.

2.2. Estimation of municipal efficiency

2.2.1. Sample

The sample analysed in this study comprised Catalan municipalities of between 5,000 and 20,000 inhabitants. In this way we guarantee a large number of observations and a similar level of responsibility and ensure that the units being compared are highly homogeneous. Article 26 of Spain's Local Government Act (Amended) defines the following minimum responsibilities for all municipalities: public lighting; cemeteries; refuse collection; street cleaning; domestic drinking water supply; sewerage; road

access to towns and villages; paving of public roads; control of food and drink. In municipalities of more than 5,000 inhabitants, the following are also obligatory: public parks; public libraries; markets; waste disposal treatment.

In addition, municipalities may carry out complementary activities in areas that are generally the responsibility of other government offices: for example, in education, culture, support for women, housing, health, and protection of the environment. As all our municipalities belong to a single Autonomous Community, we ensure that this set of responsibilities is homogeneous throughout our dataset.

Our analysis focuses on 2005, and all the variables used refer to that year. The budgetary data come from the accounts of local entities available on-line from the Ministry of Economy and Public Finance.

Of the 131 Catalan municipalities with 5,000 to 20,000 inhabitants in 2005, 29 were eliminated due to lack of data. The analysis was therefore carried out for 102 municipalities.

2.2.2. Characteristics of DEA estimation

Efficiency can be estimated from two viewpoints: output orientation, and input orientation. Here we use input orientation: that is to say, the object is to reduce the consumption of inputs while maintaining the level of output. In Farrell's terms, efficiency is the fraction of the total inputs that suffices to keep the level of production constant. This is the approach used by most studies of the efficiency of local governments, as it is understood that they have greater ability to decide over inputs than over outputs, given that the latter are determined by the institutional context that imposes uniformity on the goods and services to be provided.

Similarly, efficiency has been estimated with variable returns to scale. Most studies apply this type of return as it gives the model greater flexibility and helps to adapt it to the context of the municipality.

The model presented here consists of two inputs and one output. These variables are described in detail below.

2.2.3. Input indicators

We used two variables as inputs: current operating expenditure, and capital expenditure (non-financial investment and capital grants). Both variables are expressed in per capita terms. This expenditure is representative of the cost of the municipal services provided. In addition, including capital expenditure means considering the investment expenditure that local entities make on a regular basis, such as expenditure on the maintenance of municipal facilities and equipment, which has a direct repercussion on the quality of the services provided. Current operating expenditure and capital expenditure are used as inputs in most studies of the overall efficiency of local governments (De Borger and Kerstens, 1996b; Afonso and Fernandes, 2008, Balaguer et al. 2007; Balaguer and Prior, 2009; Muñiz and Zafra, 2009). As Afonso and Fernandes (2006) point out, using municipal expenditure per capita ensures that all inputs are considered in the analysis.

2.2.4. Output indicator

Studies that analyse efficiency come up against the problem of defining and quantifying output (because of the multiplicity, intangibility and indivisibility of the various public services) and the lack of a market price for this output (De Borger and Kerstens, 1996a; Levitt and Joyce, 1987). The solution provided in most studies is to use approximate variables as outputs, related in some way to the services provided by municipal governments (De Borger and Kerstens, 1996a) and, specifically, physical indicators that are representative of public production. At this point it is important to avoid the problem of confusing indicators of demand with indicators of results. To do so, we pay attention to the specific responsibilities that councils have in the different areas, although at times it is difficult or impractical not to use the same indicator as the statistics on indicators of results at a municipal level are very limited or may even be non-existent.

The indicator of output must represent the set of services that the municipalities provide. Given that the services offered by municipalities are very varied and not all

have the same cost or the same budgetary weight, we constructed a global municipal output indicator following Afonso and Fernández (2006, 2008) and Borge et al. (2008), but included a variation that improved the measurement. Specifically, Afonso and Fernández construct a global output indicator giving the same weighting to the different output indicators that make up the global indicator. On the other hand, Borge et al. (2008) weight each indicator for the various services according to the relative importance that the expenditure on the service has in the local budget in aggregate terms in order to create the global output indicator. This means that each output indicator is given a specific weighting which is the same in all the municipalities.

In this study, each output indicator included in the global output indicator was weighted according to the relative weight of the expenditure on the service in the accounts of each municipality. The construction of the global municipal output indicator (GMOI) is detailed below.

Firstly, in order to find the output indicators that best represent the provision of local services, we used the functional classification of the budgets of the local entities, disaggregating them to the greatest detail possible. For each function (disaggregation to two digits) or sub-function (disaggregation to three digits) we chose the output indicator that best represents the provision of the service.

In this study we had a very broad budget database which allowed us to determine the cost of very specific municipal services. In addition, we used a large number of output indicators which in turn are much more precise than those used in previous studies of Spain and offer a better representation of the municipal services provided. Among the interesting new indicators are the number of local police officers, the number of infants registered in municipal nurseries, the number of infant and primary classes in publicly-funded schools, and the consumption of water.

Table 1 displays the functional classification in detail, the aggregate amount provided for each function or sub-function by the set of municipalities that make up the sample, the relative weight of each function or sub-function, and the output indicator used.

[Insert Table 1 about here]

Specifically, for the function ‘civil defence and public security’ the variable used, the number of local police officers, approximates the result (which would be the level of security). It is assumed that the higher the number of police officers the greater the security.

For the municipal nursery service, the indicator of results is the number of infants registered in public centres. In this case, this indicator does not need to reflect demand for the service (which may be greater than the number of places offered) but expresses the result directly (children in nursery school). This indicator has not been used as an output in studies of Spain because it is difficult to obtain.

Expenditure on primary and secondary education (the largest part of education spending) covers the expenditure made by councils as part of their responsibility to collaborate in the construction of schools and take charge of maintenance and cleaning in the centres for children aged from three to twelve. Given the content of this responsibility, we used the number of classrooms as the indicator of output at municipal level, rather than the number of pupils.

For the rest of the spending on education (transport, grants, school meals, etc.), since no data were available on the beneficiaries of these activities and they are services of a personal nature, the output variable was considered to be the number of pupils aged from three to twelve in the municipality.

The indicator used as output for sewerage, water supply and distribution was the consumption of municipal water.

We used the number of tons of refuse and kilometres of paved roads as the output of the refuse collection and the street cleaning services. This latter indicator was also taken as output for the sub-function roads, neighbourhood paths and urban public roads, given that the greatest part of this expenditure corresponds to investment in maintenance.

As regards outputs relating to the sub-functions of culture and sports, we used the area allocated to cultural activities and the area of covered and open spaces for sports, since more precise indicators of services and activities of this type are unavailable at municipal level. Nevertheless, these variables approximate the output, since the cultural facilities variable includes cultural centres, libraries, civic centres and museums, and the sports facilities variable includes sports complexes, sports grounds, swimming pools, ball-game courts, and so on.

The rest of the functions and sub-functions mainly involve basic regulatory administrative services, and so we used the population as an approximate variable for output. Although this variable is not a direct output, most studies consider it representative of this type of service (De Borger and Kerstens, 1996a; Worthington and Dollery, 2000b; Afonso and Fernández, 2006; Balaguer et al., 2007; Giménez and Prior, 2007; Balaguer and Prior, 2009 and Geys et al., 2009).

Table 5 in the Appendix provides the definitions and statistical sources of the output variables used.

Once the values of all the output variables used were obtained, we normalized them with respect to the average value of the sample to make the sample average was equal to one.

The third step consisted in weighting each representative variable of the various municipal outputs according to the relative weight of spending on the service inside the municipal budget as a whole. This feature distinguishes our method from the one used by Afonso and Fernandes (2006, 2008) and by Borge et al. (2008); it adapts better to specific situations, as the level of services offered may vary from municipality to municipality in accordance with the preferences of the residents.

Table 6 in the Appendix shows the value of the global municipal output indicator (GMOI) for the 102 municipalities analysed.

2.2.5. DEA results

To measure the technical efficiency of the provision of municipal services, we used the global municipal output indicator (GMOI) as the output and the current operating expenditure and the capital expenditure in per capita terms as inputs.

Table 7 in the Appendix shows the results of the DEA obtained with the specification of the model with one output/two inputs, input orientation, and with variable returns to scale for the year 2005.

As can be seen, of the 102 municipalities, eight (approximately 8%) are totally efficient. The mean efficiency of the set of municipalities is 71%, so there is a margin for improvement in the global provision of municipal services.

To qualify the efficient units we applied a method that is widely used in the DEA literature. We recorded the number of times that an efficient unit appears in the reference group of the inefficient units: a unit that appears in a large number of reference groups is taken to be genuinely efficient, but if a unit appears only in its own reference group or in a very small number of units its efficiency is considered suspect[3].

The top position is occupied by Santa Margarida de Montbui (mentioned 79 times), followed by Cervera (45 times) and La Sènia (38 times). The rest of the units that serve as references for other units are Caldes de Motbui (15 times), Berga (13 times), Súria (7) and Vilassar de Mar (2). Santa Coloma de Cervelló comes last, with only one reference for a single municipality.

3. Explaining factors of efficiency: citizens' control

3.1. Econometric specification

The standard DEA model presented only incorporates controllable and discretionary inputs. It does not take account the presence of environmental or non-discretionary

[3] Smith and Mayston (1987).

inputs although these factors may play an important role in the determination of output levels.

It is therefore interesting to explain the efficiency scores obtained in the DEA using environmental or non-discretionary variables such as the socioeconomic characteristics of citizens and the fiscal characteristics of local governments. This is the aim of this article. In order to do so, we carry out a second stage analysis through Tobit or truncated regressions, as the dependent variable (score of efficiency) presents a range between zero and one. This procedure has been used in previous studies[4].

The econometric analysis is based on the following model:

$$E_i = \alpha + \beta Z_i + \varepsilon_i \tag{3}$$

where E_i represents the efficiency scores in local government i, Z_i is a vector of explanatory variables representing the socioeconomic characteristics of citizens and local government, fiscal and environmental factors, and ε_i is the error term.

The two-stage method has been criticized on the grounds that the results in small samples are likely to be biased[5]. This means that in equation (3) the error term ε_i is serially correlated in a complicated and unknown way. As the sample increases in size, this correlation gradually disappears in the DEA context. An additional source of bias comes from the fact that non-discretionary variables in equation (3) are correlated to the error term ε_i output. This correlation derives from the correlation between non-discretionary inputs and the outputs, and therefore from the estimated efficiency scores. Again, this last correlation also disappears asymptotically, but at a slow rate[6].

[4] Studies that analyse local global efficiency using non-parametric methods and explain efficiency scores using a second-stage Tobit analysis include the following: De Borger et al. (1994), De Borger and Kerstens (1996a, 1996b), Athanassopoulos and Triantis (1998), Worthington and Dollery (2000b), Moore et al. (2005), Afonso and Fernandes (2008), Giménez and Prior (2007) and Balaguer and Prior (2009).
[5] See Coelli, Rao and Batesse (1998), p.171, and Simar and Wilson (2007).
[6] Afonso and Aubyn (2005).

Consequently, the standard approach (Tobit) is not valid for small samples. To solve this problem Simar and Wilson (2007) propose using bootstrap methods. In our study, we applied algorithm 2 proposed by these authors with a total of 2,000 iterations.

3.2. Explanatory variables

To analyse the possible influence of the socioeconomic characteristics of the population on efficiency in the provision of municipal public services, we used the following variables which are described in Table 2 (along with these covariates).

- *Municipal income level*. The literature demonstrates that citizens' level of income and wealth affects the incentives for politicians and taxpayers to control the level of public expenditure. For example, Silkman and Young (1982) and Wyckoff (1990) show that higher incomes on a municipal level encourage politicians and administrators to grant excessive subsidies, thus increasing inefficiency. Nevertheless, it might also be supposed that high-income citizens are less motivated to control municipal expenditure because of opportunity costs. A negative relation between income level and efficiency can be found in the following studies: De Borger et al. (1994), De Borger and Kerstens (1996a) (1996b) and Giménez and Prior (2007), so we expect to find a negative relation in our study as well.
- *Citizen with higher educational level*. De Borger and Kerstens (1996a) and Afonso and Fernandes (2008) find that a high educational level has a positive effect on efficiency. This relationship suggests that citizens with a high level of education exercise greater control over local politicians because for these individuals the opportunity cost of exercising this control is low. Consequently the expected sign for this variable is positive.
- *Level of commercial activity in the municipality*. This variable is used by Balaguer and Prior (2009) and Giménez and Prior (2007). They find a positive relationship between the level of commercial activity and efficiency. If greater commercial activity means stronger associations or groups of retail traders, the positive relationship mentioned can be explained by supposing that these associations exercise greater control over local government, fostering efficiency. Nevertheless, from the point of view of the theory of interest groups, strong commercial

associations would also be expected to lead to less efficient municipal policies (Mueller and Murrell, 1986). For this reason the relationship between this variable and efficiency is ambiguous.

- *Level of tourist activity in the municipality.* This variable can be interpreted from a double perspective, like the one above. On the one hand, from the point of view of the theory of interest groups, the rent-seeking activities of the tourist business can lead to more inefficient municipal policies; on the other, it could also be argued that tourism entrepreneurs may exercise greater control over local policy-makers, as do traders. In Spain, Balaguer and Prior (2009) and Giménez and Prior (2007) find a negative relation between this variable and efficiency. This may be due to the fact that tourism entrepreneurs act in a rent-seeking manner, but also to the costs of congestion of tourism and its seasonal nature. Consequently, the relationship between this variable and efficiency is also ambiguous.
- *Retired people.* Retired people are a group with low opportunity costs in obtaining information about local government, as they do not have work commitments. For this reason, they can exercise greater control over local government. Persson and Tabellini (2000) and Besley and Pratt (2006) argue that the more informed voters are, the more accountability is fostered. In addition, retired people often take part in organisations of a local nature which can, in turn, lead them to act as a lobby or rent-seeking group. As with the above variables, the sign of this variable is ambiguous.
- *Potential electors*. In many of our municipalities a considerable part of the population does not have the right to vote as they are not citizens of the European Union. It is to be expected that the greater the number of citizens entitled to vote, the greater the potential control they can exercise through various elections (Geys et al, 2009). Therefore, the relation between this variable and efficiency is expected to be positive.

The other variables that are used to explain efficiency are of a fiscal nature (see Table 2):

- *Municipal taxes*. De Borger and Kerstens (1996a) show that there is a positive relation between tax rates and efficiency, in agreement with Davis and Hayes (1993), who defend the notion that a high level of taxation can increase taxpayers'

control of public management. Nevertheless, Balaguer et al. (2007) and Balaguer and Prior (2009) find a negative relation between the level of taxes per capita and efficiency. The explanation is that if a municipality can generate revenue easily, its managers are less motivated to manage resources efficiently. Similarly, if a high level of taxes increases control over public expenditure, this can ultimately produce inefficiency as it may distort the choices of inputs made by bureaucrats, who may choose the ones that are most visible and not those that would be most efficient for the production process (Lindsay, 1976). For example, police cars are more visible than police training (Grosskopf and Hayes, 1993). In addition, it may be that less efficient municipalities need higher levels of financing and, given that resources from transfers are limited, another way of obtaining more revenue is to make a greater fiscal effort. Consequently, an ambiguous relationship is to be expected between this variable and efficiency.

- *Municipal revenue from transfers*. Transfers are expected to have a negative influence on efficiency as they create fiscal illusion and, consequently, what is known as the "flypaper effect" (Bradford and Oates, 1971; Hines and Thaler, 1995; and Heynelds, 2001). In addition, Geys et al. (2009) indicate that when citizens are confronted with financing through transfers they do not exercise as much control over politicians, as the local revenue does not come from their own pocket. De Borger and Kerstens (1996a), and Balaguer et al. (2007) and Balaguer and Prior (2009) verify this hypothesis, finding empirical evidence of this negative influence. For this reason the relation between this variable and efficiency is expected to be negative.

[Insert Table 2 about here]

3.3. Empirical results

The results of the econometric estimation are shown in Tables 3 and 4. Table 3 presents the Tobit estimation whilst Table 4 estimates the various specifications using the correction proposed by Simar and Wilson (2007). The results hardly change after correcting the estimations with this procedure. Model 1 shows the influence of the

socioeconomic variables on efficiency. Model 2 shows the impact of the fiscal variables, while model 3 includes both the socioeconomic and the fiscal variables.

With regard to the socioeconomic variables:

- The income variable, as expected, presents a negative sign and is statistically significant in models 1 and 3. Consequently, the hypothesis is verified that the citizens in the richer municipalities exercise less control over local government activity, due to the question of opportunity costs.

- The level of commercial activity in the municipality is also statistically significant with a positive sign in models 1 and 3. This result confirms the hypothesis that people in commerce exercise firm control over local government, leading to more efficient management.

- The level of tourist activity is statistically significant in models 1 and 3, showing a negative effect. These results corroborate those obtained by Balaguer and Prior (2009) and Giménez and Prior (2007). This negative relationship may be due to the rent-seeking activities of tourism entrepreneurs, or to the cost of congestion of tourism and its seasonal nature.

- The proportion of retired people in the municipal population shows a positive effect on efficiency, but this variable is not statistically significant when we control with fiscal variables. This result provides some support for the hypothesis that groups of citizens for whom obtaining information has a low opportunity cost exercise greater control over local policy-makers.

- The proportion of the population with the right to vote is significant and positive only in model 1, so the empirical evidence is weak. Nevertheless, this behaviour is compatible with the result for the previous variable. If a municipality has an ageing population, with a large number of retired people, control over local politicians is greater. For this reason, as the number of citizens without voting rights grows (immigrants and the population under 18 years old) this control diminishes.

With regard to the fiscal variables:

- The per capita tax variable is also statistically significant with a negative sign in models 2 and 3. This confirms that a higher level of taxes leads politicians and bureaucrats to act less efficiently, as Balaguer et al. (2007) suggests. It may also be taken to mean that inefficiency leads to demands for higher taxes.

- The transfers per capita variable has a negative sign and is significant in models 2 and 3. This confirms the "fly-paper" hypothesis.

Finally, the level of higher education in the population is not statistically significant in any of the models.

[Insert Tables 3 & 4 here]

4. Conclusions

This paper presents an empirical examination of the socioeconomic characteristics that citizens (potential voters) need in order to exercise greater control over local policy-makers, and of the fiscal characteristics of local governments that influence this control. In so far as control fosters politicians' accountability, it can be assumed to increase efficiency. Therefore, we examine the relation between a set of socioeconomic and fiscal variables and the efficiency of the provision of local public services.

The empirical analysis carried out was restricted to 102 Spanish municipalities of between 5,000 and 20,000 inhabitants, which were highly homogeneous in terms of revenue and expenditure responsibilities.

Efficiency was measured using the DEA input-orientation technique. We compiled a global municipal output indicator (GMOI) as a single measure of local government activity; this was the only output variable in the DEA analysis. The results of the DEA

show a mean efficiency of municipal activity of 71%, indicating that there is room for improvement in the global provision of municipal services.

In a second stage, efficiency in the provision of municipal services was explained using a Tobit analysis and bootstrap methods proposed by Simar and Wilson (2007). The examination provides a certain amount of empirical evidence that a strong commercial sector, a significant proportion of retired people and a high proportion of population with the right to vote have a positive effect on local government efficiency. The explanation is that these groups exercise greater control over local politicians. For retired people, for example, obtaining information has a lower cost; and, as their level of information improves, they exert more control. In the case of retail traders, their economic interests encourage them to exercise greater control over local government. And as regards voting rights, those entitled to vote have more incentive to control local government management than those who are not.

The opportunity cost of obtaining information means is also reflected in the fact that citizens with higher income levels exercise less control over their local government; in their case, obtaining information has a high opportunity cost.

Similarly, a high level of tourist activity, a high municipal tax level and a high proportion of transfers in local financing have a negative impact on efficiency in the provision of local public services. The arguments that can explain this relationship are not related to citizens' control but to other factors. Tourism activity brings with it congestion costs and seasonality in the demand for local public services, which have a negative influence on efficiency. Perhaps contrary to expectations, a high level of taxation does not lead to greater control by citizens, but the ease of obtaining income may demotivate local government and have a negative impact on its efficiency. We also demonstrate what is known as the "fly-paper effect" which is generated by finance by transfers.

Finally, a last conclusion drawn from our article is that it provides empirical evidence that citizens who have lower opportunity costs in obtaining information regarding the

management of local public services exercise greater control over local politicians, thus enhancing accountability and encouraging efficiency.

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Table 1 Municipal expenditures by functions

Functions	Euros	% of total	Output variables
0 Public Debt	77,798,633.82	7.4%	Population
1 General Services	158,207,687.93	15.1%	Population
2 Civil Defence and Public Security	64,447,085.25	6.1%	Number of local police officers
3 Security, Protection, and Social Assistance	80,183,009.60	7.6%	Population
4 Production of Public Social Goods	506,721,941.18	48.3%	
41 Health	14,266,759.61	1.4%	Population
42 Education	64,827,969.59	6.2%	
42a Nursery education	2,479,808.73	0.2%	Number of pupils registered in public nurseries
42b Primary and secondary education	55,331,369.59	5.3%	Number of classrooms for children aged from three to twelve in public centres
42c Transport services, school meals, grants and support	2,982,260.69	0.3%	Number of infant (2nd cycle) and primary pupils registered in public centres
42d Other education services	4,034,530.58	0.4%	Number of infant (2nd cycle) and primary pupils registered in public centres
43 Housing and Urban development	138,437,382.94	13.2%	Population
44 Community welfare	127,816,380.80	12.2%	
441 Drainage, supply and distribution of water	29,070,752.01	2.8%	Cubic metres of water consumed
442 Refuse collection and street cleaning	80,997,707.20	7.7%	Tons of refuse and square kilometres of road
443 Cemeteries and funeral services	3,175,103.32	0.3%	Population
44a Other social welfare services	14,572,818.27	1.4%	Population
45 Culture	147,151,571.77	14.0%	
451 Promotion and dissemination of culture	64,203,933.94	6.1%	Square metres of cultural facilities
452 Physical education, sport and recreation	74,501,973.04	7.1%	Square metres of sports facilities
453 Archaeology and protection of the Historical-artistic heritage	8,445,664.79	0.8%	Population
46 Other social and community services	14,221,876.47	1.4%	Population
5 Production of Economic Goods	113,586,210.14	10.8%	
51 Infrastructures	104,522,832.13	10.0%	
511 Roads, neighbourhood paths, urban public roads	96,475,776.22	9.2%	Kms of paved roads
512 Water resources	2,091,647.00	0.2%	Population
513 Land, sea, river and air transport	3,49,.309.79	0.3%	Population
51a Other basic infrastructures and transport	2,462,099.12	0.2%	Population
52 Communications	3,143,090.02	0.3%	Population
53 Agricultural infrastructure	5,718,212.04	0.5%	Population
54 Scientific, technical and applied research	26,184.77	0.0%	Population
55 Basic information and statistics	175,891.18	0.0%	Population
6 General economic regulation	31,997,735.17	3.1%	Population
7 Economic regulation of productive sectors	13,879,259.53	1.3%	Population
9 Transfers to Public Administrations	2,002,543.20	0.2%	Population
Total expenditure budget	1,048,824,105.82	100.0%	

Table 2 Descriptive statistics for covariates

Variables	*Definition*	*Mean (s.d.)*	*Range*	*Source*
Municipality income level	Gross family disposable income per capita in the municipality	14,213.82 (1,998.09)	[10,960.61, 23,539.17]	Catalan Institute of Statistics: Municipal data bank
Citizen with higher education level	% of the population with post-compulsory education	35.28 (6.94)	[20.13, 62.51]	National Institute of Statistics: Population and housing census 2001: Municipal territorial indicators
Level of commercial activity	Index capturing importance of commerce in the municipality	17.51 (12.04)	[4.00, 74.00]	La Caixa: The Spanish Annual Commercial Report
Level of tourist activity	Index capturing importance of tourism in the municipality	18.19 (48.01)	[0.00, 333.00]	La Caixa: The Spanish Annual Commercial Report
Retired people	% Population 65 years and above/Total population	15.05 (3.80)	[7.42, 26.71]	National Institute of Statistics: Population by municipalities
Potential voters	% Potential voters/Total population	72.91 (6.16)	[47.95, 97.22]	Institute of Social and Political Science (Autonomous University of Barcelona)
Municipal taxes	Taxes paid per inhabitant	447.92 (181.59)	[202.08, 1,059.13]	Ministry of Economics and Public Finance: Territorial Statistics
Municipal revenues from transfers	Revenue from transfers per inhabitant	296.41 (92.46)	[163.89, 707.16]	Ministry of Economics and Public Finance: Territorial Statistics

Table 3 Tobit estimation results

	(1)	(2)	(3)
Municipality income level	-0.00002 (0.00001)*		-0.00002 (0.00001)***
Citizens with higher education level	0.00055 (0.00317)		0.00101 (0.00221)
Level of commercial activity	0.00317 (0.00138)**		0.00317 (0.00095)***
Level of tourist activity	-0.00089 (0.00035)**		-0.00048 (0.00025)*
Retired people	0.01176 (0.00488)**		0.00169 (0.00358)
Potential voters	0.00638 (0.00311)**		0.00012 (0.00224)
Municipal taxes		-0.00073 (0.00007)***	-0.00072 (0.00007)***
Municipal revenues from transfers		-0.00026 (0.00012)**	-0.00017 (0.00012)
Constant term	0.29682 (0.23341)	1.12066 (0.04495)***	1.27980 (0.18828)***
N	102	102	102
$\chi 2$	31.63 (0.00)	68.14 (0.00)	102.45 (0.00)
Log likelihood	31.388	54.819	66.802

Note: standard deviations are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively.

Table 4 Tobit corrected results by the procedure suggested in Simar and Wilson (2007)

	(1)	(2)	(3)
Municipality income level	-0.00002 (0.00001)*		-0.00003 (0.00001)***
Citizens with higher education level	0.00013 (0.00404)		0.00080 (0.00282)
Level of commercial activity	0.00440 (0.00176)**		0.00446 (0.00121)***
Level of tourist activity	-0.00121 (0.00046)***		-0.00070 (0.00032)**
Retired people	0.01495 (0.00620)**		0.00209 (0.00452)
Potential voters	0.00858 (0.00398)**		0.00039 (0.00286)
Municipal taxes		-0.00042 (0.00012)***	-0.00096 (0.00009)***
Municipal revenues from transfers		-0.00063 (0.00028)**	-0.00029 (0.00017)*
Constant term	0.04095 (0.29826)	0.95996 (0.08868)***	1.35542 (0.23951)***
N	102	102	102
$\chi 2$	33.59 (0.00)	11.92 (0.00)	111.10 (0.00)
Log likelihood	16.447	0.2879	55.090

Note: standard deviations are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively.

Appendix

Table 5 Data and statistical sources used to create the global municipal output indicator (GMOI)

Indicator	Variable	Observations	Statistical source
Population	Municipal population on 1st January 2005		National Institute of Statistics (INE): Municipal records
Local Police Officers	Number of local police officers per 1000 inhabitants	Some municipalities do not have police officers but security guards. In this case the information was obtained from information on municipal employees in provincial bulletins	Catalan Institute of Statistics (IDESCAT): Municipal data bank
Pupils in nursery schools	Pupils aged 3 - 4 in publicly-funded schools		Generalitat of Catalonia: Department of Education: Annual statistics/Year 2005-2006
Classrooms for pupils aged 3 - 12 at publicly-funded schools	Classrooms for pupils aged 3 - 12 at publicly-funded schools		Generalitat of Catalonia: Department of Education: Annual statistics/Year 2005-2006
Pupils aged 3 - 12 at publicly-funded schools	Pupils aged 3 - 12 at publicly-funded schools		Generalitat of Catalonia: Department of Education: Annual statistics/Year 2005-2006
Water consumption	M^3 of water consumed	The information is only available at the district level so an estimation was made for the municipalities on the basis of the weight of its population in the total for the district	Catalan Water Agency (ACA): Municipal statistics
Tons of refuse	Tons of refuse		Catalan Waste Agency: Municipal statistics Metropolitan Environmental Agency: Environmental data
Kilometres of paved roads	Surface area of paved roads		Ministry of Public Administration (MAP): Survey of local infrastructures, 2000
Area of cultural facilities	M^3 of indoor cultural centres	Includes arts centres, libraries, civic centres, museums and other facilities	Ministry of Public Administration (MAP): Survey of local infrastructures, 2000
Area of sports facilities	M^3 of indoor and outdoor sports facilities	Includes sports halls, sports courts, swimming pools, ball-game courts and others	Ministry of Public Administration (MAP): Survey of local infrastructures, 2000

Table 6
Global municipal output indicator (GMOI) 2005

Municipality	GMOI	Municipality	GMOI
Abrera	0.9154	Santa Eulàlia de Ronçana	0.6651
Ametlla del Vallès (L')	0.8669	Santa Margarida de Montbui	0.8226
Arenys de Munt	0.7852	Santa Maria de Palautordera	0.8569
Argentona	1.2404	Sant Vicenç de Castellet	0.7655
Begues	0.7816	Súria	0.6758
Berga	1.4598	Taradell	0.7662
Bigues i Riells	0.8071	Tona	0.6145
Cabrils	0.7000	Torelló	1.2129
Caldes de Montbui	1.3992	Vallirana	1.1253
Calella	1.3853	Viladecavalls	0.8691
Canet de Mar	1.0966	Anglès	0.6514
Canovelles	1.2318	Arbúcies	0.5862
Cardedeu	1.2860	Banyoles	1.7119
Cardona	0.5343	Bisbal d'Empordà (La)	1.4192
Castellbisbal	0.7044	Cassà de la Selva	0.8369
Centelles	0.6495	Castelló d'Empúries	0.9251
Cervelló	0.9840	Escala (L')	1.1306
Corbera de Llobregat	0.6323	Llagostera	0.6915
Cubelles	1.1974	Palamós	1.2869
Gelida	0.7365	Puigcerdà	1.4019
Llagosta (La)	1.1208	Roses	1.7172
Llinars del Vallès	0.9937	Sant Hilari Sacalm	0.7818
Lliçà de Vall	0.7380	Santa Coloma de Farners	1.0522
Malgrat de Mar	1.3210	Tossa de Mar	0.6671
Manlleu	1.7069	Vidreres	0.7252
Masquefa	0.8681	Agramunt	0.5159
Matadepera	0.6798	Alcarràs	0.7850
Montmeló	0.9855	Almacelles	0.7347
Montornès del Vallès	1.4207	Balaguer	1.3744
Navarcles	0.5211	Borges Blanques (Les)	0.6712
Navàs	0.4657	Cervera	2.2514
Palau-solità i Plegamans	1.3252	Mollerussa	1.1598
Pallejà	0.8581	Seu d'Urgell (La)	1.2651
Parets del Vallès	1.5812	Tàrrega	1.4075
Polinyà	0.8488	Tremp	0.7938
Roca del Vallès (La)	0.8338	Vielha e Mijaran	0.9310
Roda de Ter	0.5641	Alcanar	0.7237
Sallent	0.7744	Amposta	1.9334
Santpedor	0.6127	Calafell	1.9565
Sant Andreu de Llavaneres	1.0244	Sènia (La)	0.6467
Sant Celoni	1.4864	Cunit	0.9603
Sant Esteve Sesrovires	0.6354	Montblanc	0.7222
Sant Fost de Campsentelles	0.6816	Mont-roig del Camp	1.2261
Sant Fruitós de Bages	0.7821	Móra d'Ebre	1.2831
Vilassar de Dalt	0.7583	Riudoms	0.5975
Sant Joan de Vilatorrada	1.0510	Roquetes	0.5488
Vilassar de Mar	1.6220	Sant Carles de la Ràpita	1.1129
Premià de Dalt	1.1317	Torredembarra	1.0798
Sant Quirze del Vallès	1.5861	Ulldecona	0.7317
Sant Sadurní d'Anoia	1.1089	Vila-seca	1.8793
Santa Coloma de Cervelló	0.7909	Deltebre	1.0054
Average			1.0052
Standard deviation			0.3729
Maximum			2.2514
Minimum			0.4657

Table 7
Results of the DEA: 1 output (GMOI) and 2 inputs (per capita operating expenditure and per capita capital expenditure)

Municipality	DEA	Municipality	DEA
Abrera	0.5500	Santa Eulàlia de Ronçana	0.6830
Ametlla del Vallès (L')	0.6000	Santa Margarida de Montbui	1.0000
Arenys de Munt	0.6500	Santa Maria de Palautorder	0.8170
Argentona	0.6860	Sant Vicenç de Castellet	0.8920
Begues	0.4810	Súria	1.0000
Berga	1.0000	Taradell	0.8560
Bigues i Riells	0.5970	Tona	0.6470
Cabrils	0.5640	Torelló	0.9310
Caldes de Montbui	1.0000	Vallirana	0.6350
Calella	0.7260	Viladecavalls	0.6020
Canet de Mar	0.6970	Anglès	0.7010
Canovelles	0.9460	Arbúcies	0.6860
Cardedeu	0.8880	Banyoles	0.9670
Cardona	0.9080	Bisbal d'Empordà (La)	0.8090
Castellbisbal	0.4180	Cassà de la Selva	0.7250
Centelles	0.6240	Castelló d'Empúries	0.3210
Cervelló	0.7110	Escala (L')	0.3740
Corbera de Llobregat	0.5750	Llagostera	0.6580
Cubelles	0.6460	Palamós	0.8030
Gelida	0.6890	Puigcerdà	0.7230
Llagosta (La)	0.9730	Roses	0.4800
Llinars del Vallès	0.6990	Sant Hilari Sacalm	0.6960
Lliçà de Vall	0.4030	Santa Coloma de Farners	0.6860
Malgrat de Mar	0.7880	Tossa de Mar	0.2610
Manlleu	0.8680	Vidreres	0.6730
Masquefa	0.7640	Agramunt	0.7890
Matadepera	0.5490	Alcarràs	0.5860
Montmeló	0.7500	Almacelles	0.8030
Montornès del Vallès	0.7140	Balaguer	0.8920
Navarcles	0.7820	Borges Blanques (Les)	0.7330
Navàs	0.6990	Cervera	1.0000
Palau-solità i Plegamans	0.7250	Mollerussa	0.6980
Pallejà	0.7130	Seu d'Urgell (La)	0.6740
Parets del Vallès	0.6880	Tàrrega	0.7170
Polinyà	0.5290	Tremp	0.6850
Roca del Vallès (La)	0.6330	Vielha e Mijaran	0.6640
Roda de Ter	0.7610	Alcanar	0.8490
Sallent	0.6610	Amposta	0.9710
Santpedor	0.6280	Calafell	0.5720
Sant Andreu de Llavaneres	0.5450	S,nia (La)	1.0000
Sant Celoni	0.7070	Cunit	0.3650
Sant Esteve Sesrovires	0.3400	Montblanc	0.6620
Sant Fost de Campsentelles	0.6090	Mont-roig del Camp	0.4360
Sant Fruitós de Bages	0.5660	Móra d'Ebre	0.9880
Vilassar de Dalt	0.5490	Riudoms	0.7340
Sant Joan de Vilatorrada	0.8480	Roquetes	0.9010
Vilassar de Mar	1.0000	Sant Carles de la Ràpita	0.8500
Premià de Dalt	0.7020	Torredembarra	0.4740
Sant Quirze del Vallès	0.8010	Ulldecona	0.8980
Sant Sadurní d'Anoia	0.5880	Vila-seca	0.5520
Santa Coloma de Cervelló	1.0000	Deltebre	0.9290
Average			0.7116
Standard deviation			0.1724
Maximum			1.0000
Minimum			0.2610

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