The determinants of efficiency in municipal governments

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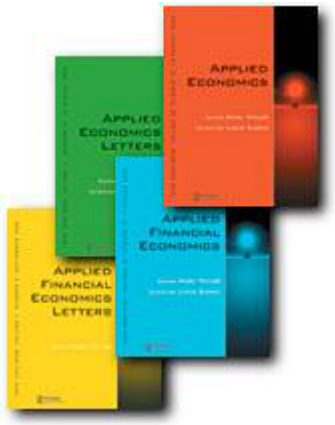

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Explaining differences in efficiency: an application to Spanish municipalities

This paper investigates efficiency in the municipal sector of the Region of Murcia (Spain). With that aim, data of 31 municipalities (69% of the response rate) have been collected. Services analyzed are: police, culture, sports, green areas, refuse collection and water supply. Ratios of efficiency have been related to other control variables, such as economic level, size of the municipality, decentralization, political sign and financial situation. A weak positive relation between economic level and efficiency arises. Some weak evidence also exists that public management of refuse collection is more efficient than private. In water supply, public management by means of a company controlled by the local government is clearly more efficient than private. It also seems that the higher the tax burden, the greater the efficiency in providing services.

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Explaining differences in efficiency: an application to Spanish municipalities

1. Introduction

At the present time there is a clear concern in the developed countries about the improvement of effectiveness and efficiency in public sector activities. This is a consequence, on the one hand, of the demand of more and better public services and on the other hand, of the limitations on public incomes and indebtedness. In this respect, the Monetary Union in the European Community has established that all the participating member states must achieve the budgetary stability. These provoked that the Spanish government enacted the General Law of Budgetary Stability, 18/2001, 12 December 2001. These Law obliges the public sector and different agencies (Central Government, Autonomous Communities, Local Authorities, Social Security, and owned public companies) to close their books in balance. Deficit is only contemplated in exceptional circumstances and this law gives legal expression to the balanced budget principle to carry out the budget balance and economic growth.

Public management analysis has been receiving more and more attention. On the one hand, the available amount of government resources is limited: rising taxes is politically costly, and there are legal limitations to increasing indebtedness. On the other hand, there is a growing demand for public services. Therefore, the public sector is bound to boost its efficiency in order to provide more services (output) restricted to a limited amount of resources (input).

Once the need to evaluate the public sector is stated, methodologies for this analysis have been developed. Among them, we can emphasize the Data Envelopment Analysis (DEA), as the mathematical technique internationally accepted by the literature. This methodology has been successfully applied to public services provided by municipalities of several Spanish regions (Diez-Ticio *et al.*, 2000; Bosch *et al.*, 2000;

Giménez and Prior, 2003; Prieto and Zofio, 2001; Balaguer *et al.*, 2007; Giménez and Prior, 2007).

The implementation of techniques of management efficiency analysis is essential. In this way, the Spanish Public Administration (Intervención General de la Administración del Estado, IGAE, 1997) has made great efforts in the measurement of objectives achievement (with the development of specialized software). Similar efforts have been developed in other highly developed countries (Australia, Denmark, Finland, Norway, Sweden and Switzerland) [1].

In an international scope, it is worth to mention the case of the United States. In this country, Governmental Accounting Standards Board (GASB) has issued documents providing the methodology for the municipalities to calculate and disclose efficiency indicators (Fountain and Roob, 1994; GASB, 1990, 1994). In addition, GASB has promoted the establishment of standardized municipal efficiency indicators that allow both the comparison between different municipalities and the analysis of the evolution of the efficiency in one municipality. Likewise, in Spain, the Association of Accounting and Business Management (Asociación Española de Contabilidad y Administración de Empresas, AECA) issued a document entitled "Management Indicators for Public Organizations", becoming a guide for Public Organizations to implement management indicators in order to evaluate effectiveness, economy and efficiency. In this document, DEA methodology is acknowledged as an appropriate technique to make this evaluation (pp. 78-80). This document has been complemented by another one entitled "A System of Management Indicators for Municipalities", which describes a list of indicators to be used to evaluate municipal management. Furthermore, it shows a set of rules, characteristics and methodological guidelines to ensure the quality of these indicators.

[1] For an insight on these countries' projects, see Joumard *et al.* (2004) and this OECD web page: http://www.oecd.org/home/0,2987,en_2649_201185_1_1_1_1_1,00.html (on 9 June 2007)

Focusing on the Spanish local sector, Andalusian and Catalan municipalities (Navarro, 1998; Ortiz, 2003; Giménez and Prior, 2000) have already developed efficiency analysis projects.

In the Spanish health system (Pina and Torres, 1992 and García *et al*., 1999) DEA methodology is being successfully applied in the last years. In this way, the Region of Murcia[2] has already developed several projects that have allowed it to improve efficiency levels. These projects have become essential to provide useful information to the political decision making.

The problem of the measurement of inputs/outputs, that in the private sector is relatively simple, gets complicated in the public sector, because of the difficulty to establish these parameters. As a result of this, a number of works have been devoted to establish and validate efficiency indicators in the public sector in general. For example, Navarro (1998), Ortiz (2003) and AECA (2004) develop a battery of useful indicators for several municipal services, such as: police, culture, sports, green areas, housing, fire-fighting services, refuse collection, water supply and cleaning, street lighting, general services and financial, economic and budgetary management. Some of these services are investigated in this paper.

The paper is organized as follows. Section 2 provides a detailed description of the research objective and methodology. Section 3 reviews previous literature on evaluation of municipal management. Section 4 describes the sample of municipalities and the inputs/outpus used in the empirical research. Besides, it presents the variables that are going to be related with efficiency indicators. Section 5 examines relationships among variables. Finally, section 6 summarizes conclusions, presents limitations and proposes further research.

[2] In terms of surface area the Region of Murcia is the ninth largest of the Spanish autonomous communities and lies at the centre of the **Spanish Mediterranean coastal arch**. According to the most recent census figures (1 January 2005) the Region of Murcia has a population of 1,335,792 inhabitants**.**

2. Objective and methodology

So far, few works have focused on the evaluation of municipal efficiency. However, a great number of works have analyzed other sectors such as education or health. We think the main reasons lie, on the one hand, in the problems faced when trying to collect municipal data, and on the other hand, on the troubles arising in the measurement of public outputs. From the perspective of the municipal management we can emphasize the contributions made by Vanden Eeckaut *et al.* (1993); De Borger *et al.* (1994) and De Borger and Kerstens (1996), who analyze the Belgian experience of municipal efficiency evaluation; Worthington (2000), who evaluates by means of econometric techniques and linear programming the efficiency of local governments (LG) in Australia; Taïrou (2000), who evaluates the efficiency of the French municipalities from the point of view of its financial condition; Waldo (2001), who investigates local administration efficiency in Sweden; Hollingsworth *et al*. (2002), who assess the cost and production efficiency of local government programs for childhood immunization in urban and rural settings in Australia; Sampaio and Stosic (2005), that estimate the DEA technical efficiency for 4796 Brazilian municipalities; and Loikkanen and Susiluoto (2005), who study the cost efficiency of basic welfare service provision in 353 Finnish municipalities in 1994-2002.

In Spain, we can highlight the works of Vilardell (1998); Diez-Ticio *et al.* (2000); Bosch *et al.* (2000); Giménez and Prior (2003); Prieto and Zofio (2001); Balaguer (2004), Balaguer *et al.* (2007) and García-Valiñas and Muñiz (2007).

Our work is aimed to contribute to the Local Government (LG) literature, with regard to the efficiency assessment. Thus, we analyze the efficiency of 6 local services of Spanish LG of the Region of Murcia by means of DEA methodology: police, refuse collection, culture, sports, green areas and water supply. We sent a questionnaire[3] to all of them asking for information about year 2002. The reason for choosing this year is that in the middle of 2004 some LG may have not closed 2003 budget. In a second

[3] The questionnaire was sent to all LG financial managers of the Region of Murcia on 15 June 2004. The reception of questionnaires finished on 31 May 2005.

phase, we checked all the information with the department heads of all services included in the study for each LG. The objective was to correct the missing information and information errors. The sample obtained covers a high proportion of the population of LG of the Region of Murcia (69%). The LG structure of this Spanish Region enhances our analysis. On the one hand, it is composed of a small number (45) of relatively large LG. On the other hand, we find an appropriate variability of LG characteristics, since for example it has one of the largest LG of Spain in terms of km^2 (Lorca), together with a LG with high population density (Alcantarilla). In this way, our sample presents a suitable variability in our control variables.

The efficiency indicators have been related to other municipal variables, such as economic level (per capita income), LG size, decentralization level, political sign and fiscal effort. Thus, we investigate which variables, according to the literature, influence LG efficiency. Municipal variables have been selected based essentially upon the works of Vanden Eeckaut *et al.* (1993); De Borger *et al.* (1994); De Borger and Kerstens (1996); Worthington (2000); Bosch *et al.* (2000); and Giménez and Prior (2003).

From our point of view, our results are relevant not only for politicians, public managers and researchers, but also for the citizens. The latter, as taxpayers and recipients of municipal services, on the one hand, demand information about LG activities and on the other, request improvement of LG performance.

DEA is a technique based on linear programming, used to measure the relative activity of organizational units when there are multiple resources (inputs) and multiple results (outputs). A great variety of applications of DEA have been developed to evaluate the activity of diverse types of organizations from different sectors in several countries. One of the reasons of the broad use of DEA could be the problems faced by other approaches because of the complex (often unknown) nature of the relationships between resources and results of these activities.

DEA analysis has also been applied to provide new approaches about activities (and organizations) that had previously been evaluated using other methods.

The evaluation of the organizations' activity can be tackled through a variety of indicators. Some of them are established as a quotient:

$$\frac{output}{input}$$

Usually this ratio is used in order to assess the organizations' efficiency.

Productivity measures also assume ratio form when they are used to evaluate the activity of workers: sales per worker, units made by worker and hour, etc. These measures we can be referred to more exactly as partial productivity measures, in order to distinguish them from measures of total productivity of the factors. The latter try to obtain a similar ratio, but they take into account simultaneously all the resources (inputs) and all the results (outputs).

One of the advantages of DEA is that it does not require a previous specification of the weights of each input/output. Furthermore it does not require assumptions about the form of the production function, which are so common in statistical regressions and in many other circumstancies. That is why relationships between variables are evaluated by means of bivariate statistical tests. Eventually, since it uses mathematical programming techniques, it is able to handle a high number of variables and relationships (restrictions).

Thus, DEA is usually used in the evaluation of the efficiency of a certain number of producers, comparing each one of them only with the best producers.

Unlike usual statistical approaches evaluating units in reference to their average, DEA is a method of extreme point, defining a border where efficient units are located. Inefficiency is established in relation to this efficiency border.

A common measurement of relative efficiency is:

$$\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}}$$

As an initial assumption, this measurement needs a common set of weights to be applied to all the analysed units. Two problems arise when it comes to reach an agreement to obtain this set of weights: on the one hand, the difficulty to measure inputs and outputs and, on the other hand, the allocation of weights itself, which is a controversial process because of its subjectivity. Accordingly, this measurement of the efficiency with a common set of weights does not seem correct.

According to Charnes *et al.* (1978), our analysis allows each unit to establish its own set of weights, in order to reach the most favourable combination in comparison with the rest of the units. Thus, the efficiency of the unit (j_0) can be obtained by solving the following problem:

To maximize the efficiency of unit j_0, conditional to that the efficiency of all the units is ≤ 1.

The unknown quantities of this problem are the weights, and the solution shows on the one hand, the most favourable weights to the unit, and on the other, the efficiency measurement of each unit.

The mathematical model is as it follows:

$$Max\ h_0 = \frac{\sum_r u_r y_{rj_0}}{\sum_i v_i x_{ij_0}}$$

$$s.t. \frac{\sum_r u_r y_{rj}}{\sum_i v_i x_{ij}} \leq 1 \quad j = (1,2,....N)$$

$$u_r, v_i \geq \varepsilon$$

Where y_{rj} and x_{ij} represent outputs and inputs of unit j respectively. The variables of the problem are u_r and v_i (weights). These latter are supposed to be greater or equal

than a certain small positive amount, in order to prevent some input or output from being totally ignored in the efficiency assessment.

The solution to this problem yields a value of h_0 between 0 and 1, which is a measurement of the relative efficiency of unit j_0. If h_0= 1, then unit j_0 is efficient in relation to the other units, and if h_0<1, other units are more efficient than j_0.

This flexibility in the election of the weights means at the same time a weakness and strength of DEA. It is a weakness because a correct election of weights of a unit (it is likely that this choice is not related to values of inputs and outputs) may allow this unit to appear as efficient. However, this efficiency may have to do more with the election of weights than with its inherent efficiency. Simultaneously, it is a strength since if one unit is inefficient, it is so with the most favourable set of weights. Thus, the argument that the inefficiency is due to incorrect weights is not acceptable.

In our DEA analysis, variable returns to scale (Models BCC) and output oriented models (output orientation) have been considered, that is to say, aimed at maximize the results with a given level of resources[4].

3. Revision of Literature

3.1. Economic level and tourist character

Some authors show that the greater the economic level of the LG and therefore the greater the income it collects, the less pressure exists on LG politicians and managers in order to reach efficiency in the provision of municipal services (Spann, 1977; Silkman and Young, 1982). In a similar way, De Borger and Kerstens (1996) find that greater economic level is linked to more inefficiency. However, Giménez and Prior (2003) analyse the impact of municipal economic level on efficiency. They conclude that differences in economic level are not significant when evaluating efficiency.

4 The application used to solve the mathematical problem has been DEA-Solver-LV developed by Cooper *et al.* (2000) on Microsoft Excel.

With regard to the tourist character of the LG, some authors (Mathieson and Passell, 1976; Díez-Ticio and Mancebón, 2003) explain that seasonal populations have an impact on municipal services, specifically on police (which is one of the services this paper evaluates). The argument is based on two points. On the one hand, the more stable the population is, the narrower the relationship with police is expected, leading to a greater collaboration to solve problems arising in the neighbourhood. On the other hand, population variability means a lower identification of the people with their place and, consequently, a smaller concern about collective problems.

If we take a look at other works investigating the tourist condition of municipalities, we see there is not agreement in the literature. Bosch *et al.* (2000) find that tourist level of the LG has an impact on efficiency. On the contrary, Bel (2006) concludes that tourist activity is not significant when it comes to assessing the efficiency of municipalities of Cataluña (Spain).

3.2. Size of the Local Government

With respect to police, Díez-Ticio and Mancebón (2003) state a negative link between LG size and police efficiency. They argue that an increase in the territory reduces intensity of the patrol services. On the other hand, the greater the population is, the greater the dedication to more responsibilities is, and accordingly the less efficiency in the provision of the service appears (Carr- Hill and Stern, 1979; Darrough and Heineke, 1979; Gyimah-Brempong, 1987 and 1989; and Cameron, 1989).

Regarding the service of refuse collection, Stevens (1978), Dubin and Navarro (1988) and Callan and Thomas (2001) also find greater efficiency in municipalities with smaller population. Nevertheless, for the same service, Kitchen (1976) finds economies of scale while LG size increases up to 324.000 inhabitants[5].

Considering the global efficiency of the LG, Giménez and Prior (2003), find that greater population is linked to higher inefficiency in a sample of Spanish LG. De

[5] Which is very similar to the size of greater LG of the sample, Murcia.

Borger and Kerstens (1996) also find that lower population density leads to greater inefficiency.

3.3. Public vs. private management

Although being an old discussion, private vs. public and in-house vs. out-house management comparisons have become quite fashionable in the last decades due to New Public Management reforms. Although a "magic recipe" for achieving efficiency in public services is far to be unambiguously stated, we think it is interesting to add more evidence on this issue to the literature.

So far, the majority of the DEA studies have focused on investigating whether the public service is more efficiently provided by the LG or by private companies. There is not agreement in the literature (Lovell and Muñiz, 2003, and Bosch *et al.*, 2000, make a very complete revision of these works).

Tang (1997), in a revision of previous literature, finds that private management is more efficient in refuse collection, cleaning, residual water treatment and fire-fighting services. Nevertheless, in water supply and railroads results are not conclusive.

3.4. Political sign

The political-economic literature supports the thesis that "partisan politics matters", i.e., that ideology matters in public sector management and performance (Cusack, 1997). However, empirical findings are not totally conclusive, specially at the municipal level. For instance, Abizadeh and Gray (1993), Benito and Bastida (2004) and Hagen and Vabo (2005) fail to prove a poorer performance of progressive municipal parties. All these works are connected with the so-called "convergence" school of thought, which argues that societies of the twentieth century have become increasingly similar, facing the same kind of problems and thus using the same kind of solutions. Consequently, political differences do not matter much when it comes to explain variations in policy outputs (Skinner, 1976; Thomas, 1980). Likewise, other authors argue that over the last two decades partisanship differences have narrowed.

Because of financial and economic integration, partisan preferences have become less important in implementing public policies. This could explain that there is only mixed empirical evidence of the "partisan politics matters" thesis.

Few works focus on the impact of political factors on LG efficiency. De Borger and Kerstens (1996) conclude that socialist party participation in government coalitions of Belgian LG means higher degree of efficiency than liberal party participation. De Grauwe (1985) drew a similar conclusion. On the contrary, Vanden Eeckaut *et al.* (1993) do not find significant influence of the political sign of the incumbents. We think it is interesting to know if incumbents' political sign influences efficiency, as the "partisan politics matters" thesis assumes.

3.5. Financial constraints: fiscal burden, indebtedness, working capital

We define the fiscal burden as the proportion coming from taxes out of the total municipal income. At the outset, we assume that the greater fiscal burden is, the greater the demand by taxpayers for efficient provision of services will be (Spann, 1977; Davis and Hayes, 1993; De Borger and Kerstens, 1996).

However, it is not possible to predict the influence of indebtedness on the efficiency. In a first approach, following Worthington (2000), we could argue that it will affect negatively. The greater the level of municipal indebtedness, the more resources will be devoted to attend debt payments. Thus, less resources will finance the provision of LG services (cultural, sports, etc.).

Dijkgraaf *et al.* (2003) argue that LG with financial problems are concerned about services efficiency improvement, which leads to obtain costs savings. We have considered the working capital as an indicator of the LG short term financial situation.

4. Sample and variables

The sample is composed by 31 municipalities of the Region of Murcia (69% of response rate and a population of 91% of the total population of the Region of Murcia). Our selection of outputs is based on the works of Navarro (1998), Ortiz

(2003) and AECA (2004), who developed a group of indicators to assess several areas of municipal management. Regarding inputs, we have used actual budget figures instead of budget estimates (Giménez and Prior, 2003; Prieto and Zofio, 2001; Taïrou, 2000; Vanden Eeckant *et al.*, 1993). This makes us face a time lag due to the months LG need to elaborate final budget reports. However, we think actual figures essential, since it is generally known that budget estimates overestimate incomes and underestimate expenditures. Eventually, when a public service is provided by a company, we use as inputs the corresponding information from their income statement (issued in accordance with the Spanish Chart of Accounts).

Out of the total initial input/output variables, table 1 shows inputs and outputs finally used to measure efficiency of each service. The selection has been made, on the one hand, for the sake of relevance, and on the other, considering its availability in the municipalities surveyed (i.e., minimum number of missing values). This is the reason why not all LG have been included in all the partial analyses, due to the lack of available data about variables for the analysis.

(Insert Table 1)

Focusing on each service, maximum efficiency is achieved by the following LG, ordered from minimum to maximum proportion of efficient LG: green areas 3/23 (13%), water supply 4/21 (19%), refuse collection 4/19 (21%), police 10/27 (37%), culture 9/23 (39%), sports 16/23 (70%). Green areas is the service where we find the lowest number of efficient LG. However, sports is a more homogeneous service, where 7 out of 10 LG achieves maximum level of efficiency (1).

As stated above, in order to investigate which characteristics of LG are related to efficiency, we have created several variables. Table 2 shows descriptive statistics of these variables.

(Insert Table 2)

Variables *econlevel* and *tourindex* were drawn from La Caixa (2004). Variables *iecon_00*, *isbie_00* and *rfdpc_00* correspond to 2000 (latest available data). Variables *population* and *sqkmext* are available in the Spanish National Institute of Statistic web page. *Polsign* comes from Ministry of the Interior web page. The web page of the General Department of Territorial Finances provides data of municipal budgets, needed to calculate *taxburdrev*. The Local Administration Department of the Region of Murcia provides data to create variables *lrdebtpc* and *wcapitalpc* (available as of 31.12.2001).

Next section investigates relationships between efficiency indicators and other LG features. As we said above, relative efficiency has been calculated in different LG services (police, culture, sports, green areas, refuse collection and water supply).

5. Determinants of the efficiency

5.1. Economic level and tourist character

With respect to LG economic level, we do not find significant relationships (table 3). Nevertheless, it is worth to mention that most of the correlations (70.83%) are positive, which gives idea that certain relationship exists between economic level and efficiency in the services. On the one hand, this lack of significance agrees with the work of Giménez and Prior (2003). On the other hand, the positive sign of most of correlations seems to go against of Spann (1977), Silkman and Young (1982) and De Borger and Kerstens (1996), who postulated that the greater the economic level is, the higher the inefficiency is.

With regard to tourist level, in four out of the six services (66.67%), correlation is positive, although there is no statistical significance. We obtain the same result than Bel (2006), and thus we cannot confirm the conclusions of Bosch *et al.* (2000), Mathieson and Passell (1976) and Díez-Ticio and Mancebón (2003) (these two latter works, regarding police service).

(Insert Table 3)

5.2. Size of the LG

LG size, measured by its population[6], shows, in general, positive correlations with ratios of efficiency (see table 4). Only in police and refuse collection correlations are negative, although with a significance extremely reduced (0.73 and 0.97 respectively). The only significant correlation appears in water supply, revealing economies of scale.

(Insert Table 4)

With respect to LG extension (*sqkmext*), in general correlations are also positive, except in culture and green areas, but significance is low.

Population density (*density*) is positively but weakly correlated with efficiency. The only significance arises in green areas, since the greater dispersion of the population makes maintenance services more difficult. In this service, our results confirm the work of De Borger and Kerstens (1996). In conclusion, both predominance of positive correlations and low significance do not allow us to verify the conclusions obtained by Giménez and Prior (2003), who found that the greater the size of the LG, the greater the inefficiency.

5.3. Public and private management

Tables 5 to 9 depict efficiency measures of services depending on the form of management chosen by LG[7]. In general, we do not find significant differences in efficiency according to the way of management used by the LG.

Furthermore, analysis of these tables reveals the pattern of municipal services provision in the Region of Murcia. In culture, sports and green areas, direct management predominates, i.e., the own LG provides the service. In terms of sample mean, in culture and green areas, this direct management is not more efficient than the other forms of management, although this conclusion must be taken with caution due

[6] Neperian logarithm of the number of inhabitants (*lnpopulation*).
[7] In this section, police service was excluded, since according to Spanish laws, it must be provided directly by the LG.

to the lack of significance. However, sports management by the LG seems more efficient (in terms of sample mean).

(Insert Table 5)

(Insert Table 6)

(Insert Table 7)

With respect to refuse collection, Dijkgraaf *et al.* (2003) show that, according to literature, private provision of refuse collection service is more efficient in general. In our case, although with low significance, we obtain some evidence making us think private management is not more efficient than public. Thus, we cannot confirm the work of Dijkgraaf *et al.* (2003).

On the other hand, these authors show the percentage of city councils providing this service through private management in several countries: United Kingdom 30%, Ireland 39% and Netherlands 40%. In the case of Region of Murcia, this percentage is quite superior: 68.4% of LG decided to privatize the service.

(Insert Table 8)

In water supply, highly significant results demonstrate public management through a LG-controlled company is more efficient than private management. This result is contrary to Tang (1997), who showed results in this service are not conclusive.

(Insert Table 9)

On the other hand, following Dijkgraaf *et al.* (2003), we have divided management according to two classifications: in-house/out-house and public/private (see table 10).

(Insert Table 10)

Public management of refuse collection and water supply is more efficient than private management, though significance is not conclusive. Dijkgraaf *et al.* (2003), in a

revision of literature on refuse collection efficiency, concluded that almost all works find private provision more efficient.

In refuse collection, in-house management is also more efficient than out-house management. The fact that both in-house and public provision of refuse collection service are more efficient may be revealing the collusion effect pointed out by Dijkgraaf and Gradus (2005). Only two public companies (see table 8) do not enhance enough competence in the market, since they are ad-hoc companies that only provide the service for the parent LG.

Eventually, low significance places our results in line with previous literature, where lack of consensus is the outstanding note.

5.4. Political sign

The political sign does not have an influence on efficiency, according to results depicted in table 11. In particular, aside from the shortage of significance, the efficiency is evenly distributed, i.e., in police, sports and refuse collection, progressive parties reach greater efficiency, whereas in the remaining three services, greater efficiency is achieved by conservative parties. This feature confirms the work of Vanden Eeckaut *et al.* (1993).

(Insert Table 11)

5.5. Fiscal effort, indebtedness and financial situation

There are some works assessing the incidence of financial variables in Spanish LG; for example, Benito and Bastida (2004) find that non-financial surplus/deficit, financial independence, capital expenditures, and capital revenues are the variables that best explain the level of indebtedness in this type of entities; and Monasterio and Suárez-Pandiello (2002) and Cabasés *et al*. (2007) study the effectiveness of institutional borrowing restrictions in Spanish municipalities.

Our data show that tax burden imposed to citizens, measured by *taxburdrev*, is connected to a greater efficiency in services in general, although significance

(***0.002) only appears in water supply (table 12). This result confirms works of De Borger and Kerstens (1996), Spann (1977) and Davis and Hayes (1993).

(Insert Table 12)

Regarding the debt position of the LG, Worthington (2000) argues that greater debt service (*lrdebtpc*) results in shorter resources for services provision and thus efficiency decreases. Nevertheless, our results indicate that all correlations are positive except one, and although they are not significant, show a clear tendency. Maybe the explanation in this case is that greater indebtedness is the result of past capital investments that allow now a greater efficiency.

Short term financial situation of the LG, measured by its working capital (*wcapitalpc*), presents ambiguous relations with services efficiency. For this reason our data cannot confirm the work of Dijkgraaf *et al.* (2003), who argue that financial stress forces municipal managers to improve efficiency of the services as a way to obtain cost savings.

6. Conclusions, limitations and further research

This paper investigates the relative efficiency of a list of 6 services in the municipalities of the Region of Murcia (Spain), by means of DEA methodology: police, culture, sports, green areas, refuse collection and water supply. In a second phase, efficiency indicators obtained have been related to other municipal variables of control, evaluating in this way the determinants of the public efficiency.

With respect to the economic level of the LG, we do not find significant relationships. Nevertheless, it is worth to emphasize that most of correlations (70.83%) are positive, which gives idea of some relationship between economic level and efficiency. Regarding tourist level, in four out of the six services (66.67%), correlation is positive, although no statistical significance is found.

The size (population) of the LG reveals, in general, positive correlations with efficiency ratios. Only in police and refuse collection correlations are negative,

although with an extremely reduced significance. The only one significant correlation takes place with water supply, revealing the existence of economies of scale in this service. With respect to extension of the LG (km^2), in general correlations are also positive, except in culture and green areas, but significance is low.

Population density is correlated positive, but weakly, with efficiency. The only significance appears in green areas, since the greater population dispersion hinders the maintenance of green areas

In water supply, highly significant results demonstrate public management through a company controlled by the LG is more efficient than private management. However, according to our results, private vs. public and in-house vs. out-house management comparisons, which have become very fashionable due to New Public Management reforms, are not clear.

Political sign does not influence efficiency. In particular, aside from the lack of significance, efficiency is evenly distributed, i.e., in three services progressive parties reach greater efficiency, and in the remaining three, the opposite pattern takes place. This result supports the so-called "convergence" school of thought, which argues that industrialised societies of the twentieth century have become increasingly similar, facing the same kind of problems and thus using the same kind of solutions. Consequently, political, institutional and cultural differences do not matter much when it comes to explain variations in policy outputs (Skinner 1976; Thomas 1980).

Fiscal effort from the tax payers is connected with a greater efficiency in the services in general, although significance only appears in water supply. This is good news for citizens, who have the right to demand *value for money* to the managers of their taxes. On the other hand, short term financial health of the LG, measured by its working capital, shows ambiguous relations with services efficiency.

Regarding indebtedness, the correlations are positive, except in a service (refuse collection), and although they are not significant, indicate a clear trend. Perhaps the

explanation in this case is that greater indebtedness in the last years financed investments that allow now a greater efficiency.

Our work has the limitation of having focused on a Spanish Region and thus the sample is not very large. Nevertheless, on the one hand, the response rate is very high 69%. On the other, inputs and outputs have been thoroughly selected and provide extremely accurate data. Direct interviews were carried out with the participants to check the data in detail. This meticulousness is hard to achieve if a large and disperse sample of LG is considered.

Further research is needed to broaden the scope of services analysed. Besides, repeating the survey year after year would enhance comparisons and allow investigating the evolution of LG efficiency. Finally, further input and output indicators should be developed and tested.

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References

Abizadeh, S. and Gray, J. (1993) Provincial Government Spending in Canada: An Empirical Analysis, *International Review of Applied Economics*, **7**, 69-90.

Asociación Española de Contabilidad y Administración de Empresas (AECA) (1997) *Indicadores de Gestión para las Entidades Públicas* (Management Indicators for Public Organizations). Madrid: AECA.

Asociación Española de Contabilidad y Administración de Empresas (AECA) (2004) *Un Sistema de Indicadores de Gestión para los Ayuntamientos*. Madrid: AECA.

Balaguer, M. T. (2004) La eficiencia en las administraciones locales ante diferentes especificaciones del output, *Hacienda Pública Española*, **170 (3),** 37-58.

Balaguer, M.T.; Prior, D. and Tortosa, E. (2007) On the determinants of local government performance: A two-stage nonparametric approach, *European Economic Review*, **51**, 425-451.

Bel, G. (2006) Un análisis de los gastos municipales por el servicio de residuos sólidos urbanos, *Revista de Economía Aplicada*, **14 (41)**, 5-32.

Benito, B. and Bastida, F. (2004) The determinants of the municipal debt policy in Spain, *Journal of Public Budgeting, Accounting and Financial Management*, **16 (4)**, 525-558.

Bosch, N.; Pedraja, F. and Suárez-Pandiello, J. (2000) Measuring the efficiency of Spanish municipal refuse collection services, *Local Government Studies*, **26 (3)**, 71–90.

Cabasés, F.; Pascual, P. and Vallés, J. (2007) The effectiveness of institutional borrowing restrictions: Empirical evidence from Spanish municipalities, *Public Choice*, **131 (3-4)**, 293-313.

Callan, S. J. and Thomas, J. M. (2001) Economies of scale and scope: A cost analysis of municipal solid waste services, *Land Economics*, **77 (4)**, 548-60.

Cameron, S. (1989) Police cost function estimates for England and Wales, *Applied Economics*, **21**, 1279-1289.

Carr-Hill, R.A. and Stern, N.H. (1979) *Crime, the Police and criminal statistics*. London: Academic Press.

Consejo Económico y Social de la Región de Murcia -CES- (2000) *La renta familiar disponible bruta y el índice de bienestar de los municipios de la Región de Murcia durante el periodo 1995-2000: estimación y análisis*, Estudio 12.

Charnes, A.; Cooper, W.W. and Rhodes, E. (1978) Measuring the Efficiency of Decision Making Units, *European Journal of Operational Research,* **2 (6)**, 429-444.

Cusack, T.R. (1997) Partisan politics and public finance: Changes in public spending in the industrialized democracies 1955-1989, *Public Choice,* **91 (3-4)**, 375-395.

Darrough, M.N. and Heineke, J.M. (1979) Law enforcement agencies as multi-product firms: an econometric investigation of production cost, *Public Finance*, **34 (2)**, 176-195.

Davis, M. and Hayes, K. (1993) The demand for good government, *Review of Economics and Statistics*, **75**, 148-152.

De Borger, B.; Kerstens, K.; Moesen, W. and Vanneste, J. (1994) Explaining differences in productive efficiency: an application to Belgian municipalities, *Public Choice*, **80 (3-4)**, 339-358.

De Borger, B. and Kerstens, K. (1996) Cost efficiency of Belgian local governments: A comparative analysis of FDH, DEA, and econometric approaches, *Regional Science and Urban Economics*, **26 (2)**, 145-170.

De Grauwe, P. (1985) *The growth of the public sector under center-right and center-left governments*, CES Research Paper, Catholic University of Leuven.

Díez-Ticio, A.; Mancebón, Mª. J. and Mar-Molinero, C. (2000) The Efficiency of the Spanish Police Service: An Application of the Multiactivity DEA Model. Paper presented to *International Conference on Accounting, Auditing & Management in Public Sector Reforms, EIASM*, Zaragoza, 169-186.

Díez-Ticio, A. and Mancebón, Mª. J. (2003) Análisis de la eficiencia de las instituciones encargadas de la seguridad ciudadana, *Papeles de Economía Española*, **95**, 306-319.

Dijkgraaf, E. and Gradus, R. H. (2005) Collusion in the Dutch waste collection market, *Industrial Organization* 0502006, Economics Working Paper.

Dijkgraaf, E.; Gradus, R. H. and Melenberg, B. (2003) Contracting out refuse collection, *Empirical Economics*, **28 (3)**, 553-570.

Dubin, J. A. and Navarro, P. (1988) How markets for impure public goods organize: The case of household refuse collection, *Journal of Law, Economics and Organization*, **4 (2)**, 217-241.

Fountain, J. and Roob, M. (1994) Service Efforts and Accomplishments Measures, *Public Management*, **76 (3)**, 6-12.

García, F.; Marcuello, C.; Serrano, D. and Urbina, O. (1999) Evaluation of Efficiency in Primary Health Care Centres: An Application of Data Envelopment Analysis, *Financial Accountability and Management*, **15 (1)**, 67-83.

García-Valiñas, M.A. and Muñiz, M.A. (2007) Is DEA useful in the regulation of water utilities? A dynamic efficiency evaluation (a dynamic efficiency evaluation of water utilities), *Applied Economics*, **39 (2)**, 245-252.

Giménez, V.M. and Prior, D. (2007) Long- and short-term cost efficiency frontier evaluation: Evidence from Spanish local governments, *Fiscal Studies*, **28 (1)**, 121-139.

Giménez, V.M. and Prior, D. (2000) Frontier Evaluation and Cost Efficiency Decomposition. An application to the councils of Catalonia. Paper presented to *42 International Conference of the Operational Research Society*, Swansea.

Giménez, V.M. and Prior, D. (2003) Evaluación frontera de la eficiencia en costes. Aplicación a los municipios de Cataluña, *Papeles de Economía Española*, **95**, 113-124.

Governmental Accounting Standards Board (GASB) (1990) *Service Effort Accomplishments Reporting: Its Time Has Come*, Research Report. Norwalk, Connecticut, USA.

Governmental Accounting Standards Board (GASB) (1994) *Service Efforts and Accomplishments Reporting*, Concepts Statement 2. Norwalk, Connecticut, USA.

Gyimah-Brempong, K. (1987) Elasticity for factor substitution in police agencies, *Journal of Business and Economics Statistics*, **5 (2)**, 257-265.

Gyimah-Brempong, K. (1989) Production of public safety: are socioeconomic characteristics of local communities important factors?, *Journal of Applied Econometrics*, **4 (1)**, 57-71.

Hagen, T.P. & Vabo, S.I. (2005) Political characteristics, institutional procedures and fiscal performance: Panel data analyses of Norwegian local governments, 1991–1998, *European Journal of Political Research,* **44 (1)**, 43-64.

Hollingsworth, B., Harris, A. and Gospodarevskaya, E. (2002) The efficiency of immunization of infants by local government, *Applied Economics*, **34 (18)**, 2341-2345.

Intervención General de la Administración del Estado (IGAE) (1997) *El establecimiento de objetivos y la medición de resultados en el ámbito público*, Madrid.

Joumard, I.; Per Mathis Kongsrud, P.M., Nam, Y. and Price, R. (2004) Enhancing the effectiveness of public spending: experience in OECD countries, OECD Economics Department Working Paper no. 380 (available online at: http://www.olis.oecd.org/olis/2004doc.nsf/linkto/eco-wkp(2004)3, on June 8, 2007).

Kitchen, H.M. (1976) A statistical estimation of an operating cost function for municipal refuse collection, *Public Finance Quarterly*, **4 (1)**, 43-72.

La Caixa (2004) Anuario Económico de España 2004, Barcelona.

Loikkanen, H. A. and Susiluoto, I. (2005) Cost efficiency of Finnish municipalities in basic service provision 1994-2002, *Urban Public Economics Review*, **4**, 39-64.

Lovell, C.A. and Muñiz, M.A. (2003) Eficiencia y productividad en el sector público. Temas dominantes en la literatura, *Papeles de Economía Española*, **95**, 47-65.

Mathieson, D. and Passell, P., (1976) Homicide and Robbery in New York city: an economic model, *Journal of Legal Studies*, **6**, 83-98.

Monasterio, C. and Suárez-Pandiello, J. (2002) Local government financing and borrowing: Spain, in B. Dafflon (ed.), *Local Public finance in europe: Balancing the budget and controlling debt* (231–255). Cheltenham, UK: Edward Elgar.

Navarro, A. (1998) *El control económico de la gestión municipal. Un modelo basado en indicadores*. Valencia: Sindicatura de Comptes.

Ortiz, D. (2003) *Los indicadores como instrumentos para la evaluación de la gestión pública. Una investigación empírica en el ámbito municipal*. University of Granada (Spain): Doctoral Thesis.

Pina, V. and Torres, L. (1992) Evaluating the Efficiency of Nonprofit Organizations: An Application of Data Envelopment Analysis to the Public Health Service, *Financial Accountability and Management*, **8 (3)**, 213-224.

Prieto, A.M. and Zofio, J. L. (2001) Evaluating effectiveness in public provision of infrastructure and equipment: The case of Spanish municipalities, *Journal of Production Analysis*, **15 (1)**, 41-58.

Sampaio de Sousa, M. C. and Stosic, B. (2005) Technical efficiency of the Brazilian municipalities: correcting nonparametric frontier measurements for outliers, *Journal of Productivity Analysis*, **24 (2)**, 157-181.

Silkman, R. and Young, D.R. (1982) X-Efficiency and state formula grants, *National Tax Journal*, **35 (3)**, 383-397.

Skinner, R.J. (1976) Technological Determinism: A Critique of Convergence Theory, *Comparative Studies in Society and History*, **18 (1)**, 2-27.

Spann, R. (1977), Public versus private provision of governmental services, in T. Borcherding (ed.), *Budgets and bureaucrats: The sources of government growth*, 71-89, Durham: Duke University Press.

Stevens, B. J. (1978) Scale, market structure, and the cost of refuse collection, *Review of Economics and Statistics*, **60 (3)**, 438-448.

Tang, K. (1997) Efficiency of the private sector: a critical review of empirical evidence from public services, *International Review of Administrative Sciences,* **63 (3)**, 459-474.

Taïrou, A.A. (2000) Does inefficency explain financial vulnerability of French municipalities?. Paper presented to *International Conference on Accounting, Auditing and Management in Public Sector Reforms*, EIASM, Zaragoza, 589-599.

Thomas, J.C. (1980) Policy Convergence Among Political Parties and Societies in Developed Nations: A Synthesis and Partial Testing of Two Theories, *Western Political Quarterly*, **33 (2)**, 233-246.

Vanden Eeckaut, P., Tulkens, H. and Jamar, M. (1993) Cost efficiency in Belgian municipalities, in H. Fried, C.A.K. Lovell and S. Schmidt (eds.), *The measurement of productive efficiency: Techniques and applications* (300-334), Oxford: Oxford University Press.

Vilardell, I. (1998) *El control de l´eficiència en la gestió de les administracions municipals*. Universitat Autónoma of Barcelona (Spain): Doctoral Thesis.

Waldo, S. (2001) *Municipalities as Educational Producers-An Efficiency Approach*, Working Paper, University of Lund, Sweden.

Worthington, A.C. (2000) Cost efficiency in Australian local government: a comparative analysis of mathematical programming and econometric approaches, *Financial Accountability and Management*, **16 (3)**, 201-223.

Table 1. Description of inputs and outputs used in the survey

Service	Indicators	
Police	INPUTS	Costs of personnel Current consumptions
	OUTPUTS	Number of interventions made Number of detentions made
Culture	INPUTS	Costs of personnel Current consumptions
	OUTPUTS	Number of visits to municipal museums Number of volumes in public libraries
Sports	INPUTS	Costs of personnel Current consumptions
	OUTPUTS	Number of m^2 of covered sport facilities Number of m^2 supplied of discovered sport facilities Number of users registered in municipal sport activities
Green areas	INPUTS	Costs of personnel Current consumptions Current transfers
	OUTPUTS	Number of m^2 of green areas Number of total hours of maintenance and conservation
Refuse collection	INPUTS	Costs of personnel Current consumptions Current transfers
	OUTPUTS	Number of tons of domestic refusal collected Number of tons of industrial or commercial refusal collected Number of industries, commercial establishments and houses in which refuse is collected daily
Water supply	INPUTS	Costs of personnel Current consumptions
	OUTPUTS	Number of m^3 of water supplied Number of new connections to potable water network conducted

Table 2. Descriptive statistics of variables

variable	Description	N	Minimum	Maximum	Sum	Mean	St. dev.
econlevel	economic level 2002	31	2.00	5.00	111.00	3.58	0.77
iecon_00	CES[8] study 12, table 3.3 economic index	31	2.00	5.00	103.00	3.32	0.75
isbie_00	CES study 12, table 3.3. synthetic index of well-being	31	2.00	5.00	104.00	3.35	1.05
rfdpc_00	CES study 12, table 2.2. familiar available gross income per capita (thousand euros)	31	6.99	9.07	245.15	7.91	0.57
tourindex	tourist index: 0 no tourism; 592 maximum	31	0.00	592.00	1,228.00	39.61	116.56
population	total population 31.12.2002	31	5841	377,888	1,118,283	36,073.65	71,939.32
sqkmext	extension of the LG, km^2	31	10.00	1,675.00	9,297.00	299.90	374.48
density	population density: total population 31.12.2002/km^2	31	9.01	2,187.31	9,382.77	302.67	444.24
polsign	political sign of municipal government: 0_left wing; 1_right wing	31	0.00	1.00	19.00	0.61	0.50
taxburdrev	Tax burden over revenues (taxes/total revenues 2002)	30	0.14	0.60	13.00	0.43	0.11
lrdebtpc	long run debt per capita 31.12.2001 (thousand pesetas; 1 = 166.386 pesetas)	31	11.20	105.85	1369.47	44.18	22.29
wcapitalpc	Working capital per capita 31.12.2001 (thousand pesetas)	31	-120.41	26.72	-147.34	-4.75	26.03

[8] CES: Economic and Social Council of Region of Murcia.

Table 3. Economic and tourist level[9]

		Economic level				Tourism
		econlevel	iecon_00	isbie_00	rfdpc_00	tourindex
Police	Corr. coeff.	-0.04	0.15	0.05	0.04	0.04
	Sig.	0.80	0.35	0.75	0.76	0.76
Culture	Corr. coeff.	-0.03	0.08	-0.03	0.03	-0.02
	Sig.	0.86	0.67	0.89	0.83	0.91
Sports	Corr. coeff.	0.26	0.27	0.23	0.25	0.15
	Sig.	0.17	0.16	0.22	0.13	0.38
Green areas	Corr. coeff.	0.02	-0.08	0.15	0.00	0.01
	Sig.	0.91	0.62	0.38	0.98	0.96
Refuse collection	Corr. coeff.	-0.08	-0.01	-0.06	0.04	-0.04
	Sig.	0.68	0.94	0.74	0.81	0.83
Water supply	Corr. coeff.	0.24	0.10	0.25	0.10	0.09
	Sig.	0.18	0.58	0.15	0.54	0.56
Tau_b de Kendall. Bilateral significance: * 10%, ** 5%, *** 1%.						

[9] We must note the limitation stemming from variables *iecon_00*, *isbie_00* and *rfdpc_00*, which refer to year 2000, being the latest available data.

Table 4. Size of the LG

		lnpopulation	sqkmext	density
Police	Corr. coeff.	-0.05	0.05	0.06
	Sig.	0.73	0.73	0.70
Culture	Corr. coeff.	0.15	-0.01	0.09
	Sig.	0.33	0.94	0.59
Sports	Corr. coeff.	0.25	0.01	0.24
	Sig.	0.13	0.95	0.15
Green areas	Corr. coeff.	0.03	-0.20	0.27
	Sig.	0.85	0.19	* 0.08
Refuse collection	Corr. coeff.	-0.01	0.25	-0.14
	Sig.	0.97	0.14	0.42
Water supply	Corr. coeff.	** 0.35	0.14	0.14
	Sig.	0.03	0.38	0.40
Tau_b of Kendall significance: * 10%, ** 5%, *** 1%.				

Table 5. Culture: management forms

Culture		Efficiency			
Form of management	N	Minimum	Maximum	Mean	St. dev.
Direct management (own LG)	19	0.33	1.00	0.75	0.24
Autonomous public agency	2	0.63	1.00	0.82	0.26
Public company 100% controlled by LG	1	0.55	0.55	0.55	.
Significance ANOVA (* 10%, ** 5%, *** 1%): 0.661.					

Table 6. Sports: management forms

Sports		Efficiency			
Form of management	N	Minimum	Maximum	Mean	St. dev.
Direct management (own LG)	16	0.22	1.00	0.87	0.26
Autonomous public agency	7	0.29	1.00	0.79	0.29
Significance Mann-Whitney (* 10%, ** 5%, *** 1%): 0.389.					

Table 7. Green areas: management forms

Green areas		Efficiency			
Form of management	N	Minimum	Maximum	Mean	St. dev.
Direct management (own LG)	16	0.01	1.00	0.32	0.35
Public company 51% controlled by LG	3	0.42	0.69	0.57	0.14
Private company	4	0.05	0.17	0.11	0.05
Significance ANOVA (* 10%, ** 5%, *** 1%): 0.182.					

Table 8. Refuse collection: management forms

Refuse collection		Efficiency			
Form of management	N	Minimum	Maximum	Mean	St. dev.
Direct management (own LG)	4	0.63	1.00	0.89	0.18
Public company 51% controlled by LG	2	0.57	0.99	0.78	0.30
Private company 10% controlled by LG	1	0.45	0.45	0.45	.
Private company	12	0.33	1.00	0.65	0.24
Significance ANOVA (* 10%, ** 5%, *** 1%): 0.271.					

Table 9. Water supply: management forms

Water supply		Efficiency			
Form of management	N	Minimum	Maximum	Mean	St. dev.
Public company 51% controlled by LG	4	0.71	1.00	0.90	0.14
Private company	16	0.12	1.00	0.44	0.25
Significance Mann-Whitney (* 10%, ** 5%, *** 1%): 0.014 **					

Table 10. In-house/out-house and public/private management

	Way of management (efficiency mean)			
Service	In house	Out house	Public	Private
Culture	0.75	0.80	0.76	.
Sports	0.87	0.79	0.84	.
Green areas	0.32	0.31	0.35	0.11
Refuse collection	* 0.89	* 0.66	* 0.85	* 0.64
Water supply	.	0.52	* 0.90	* 0.44

In-house: Direct management by the own LG.

Out-house: Public entities and all types of companies.

Public: LG, Public entity, public company controlled more than 50% by LG.

Private: Private companies and those companies participated by City council below 51%.

Significance Mann-Whitney: * 10%, ** 5%, *** 1%.

Table 11. Political sign

	Progressive			Conservative		
	N	Mean	St. dev.	N	Mean	St. dev.
Police	11	0.72	0.31	16	0.61	0.33
Culture	10	0.74	0.28	13	0.77	0.20
Sports	9	0.89	0.25	14	0.82	0.28
Green areas	8	0.26	0.32	15	0.34	0.33
Refuse collection	5	0.79	0.25	14	0.68	0.24
Water supply	9	0.51	0.21	12	0.54	0.35

Significance Mann-Whitney: * 10%, ** 5%, *** 1%.

Table 12. Budget and financial variables

		taxburdrev	lrdebtpc	wcapitalpc
Police	Corr. coeff.	0.00	0.01	0.06
	Sig.	1.00	0.93	0.67
Culture	Corr. coeff.	-0.15	0.16	0.28
	Sig.	0.33	0.30	* 0.07
Sports	Corr. coeff.	0.16	0.11	0.12
	Sig.	0.33	0.51	0.47
Green areas	Corr. coeff.	0.04	0.14	-0.14
	Sig.	0.77	0.36	0.36
Refuse collection	Corr. coeff.	0.03	-0.08	-0.05
	Sig.	0.86	0.65	0.75
Water supply	Corr. coeff.	*** 0.50	0.20	-0.09
	Sig.	0.00	0.20	0.59
Significance Tau_b de Kendall: * 10%, ** 5%, *** 1%.				