



Innovative Applications of O.R.

## Cost efficiency in municipal solid waste service delivery. Alternative management forms in relation to local population size



Gemma Pérez-López<sup>a</sup>, Diego Prior<sup>b</sup>, José Luis Zafra-Gómez<sup>a,\*</sup>, Ana María Plata-Díaz<sup>a</sup>

<sup>a</sup> Faculty of Business and Finance, University of Granada, Spain

<sup>b</sup> Business Economics Department at Universitat Autònoma de Barcelona, Spain

### ARTICLE INFO

#### Article history:

Received 8 April 2015

Accepted 18 May 2016

Available online 4 June 2016

#### Keywords:

Local government

Delivery forms

Cost efficiency

Metafrontier

Municipal solid waste

### ABSTRACT

Considerable research has been devoted to the analysis of efficiency and of management forms for municipal waste collection, but widely varying results have been reported. In this paper, the metafrontier approach, by means of order- $m$  frontiers, is used to analyse the efficiency of different ways of managing waste collection services, in order to determine which form is more appropriate. We compare the results obtained with this approach against those of previous theories. The advantage of applying this methodology is that unlike traditional nonparametric frontier analysis, we can compare the efficiency of different groups of municipalities according to their population size and to the management form adopted to supply the service. The results obtained suggest that, in general, cooperation formulas are the most suitable for the waste collection service. Thus, intermunicipal cooperation performs best in smaller municipalities (up to 20,000 inhabitants). However, we find that contracting out the service is associated with higher levels of efficiency in municipalities with more than 20,000 inhabitants.

© 2016 Elsevier B.V. All rights reserved.

### 1. Introduction

The search for greater efficiency is a key element in evaluating performance in the provision of public services (Nogueira & Jorge, 2015). However, these services may be provided in different ways, which influence the level of efficiency obtained. In this context, understanding the relationship between efficiency and service delivery forms for the provision of local public services is a question of vital importance for the public manager, because the control of these services is viewed as a fundamental issue in local government (Geys & Moesen, 2009).

Among the great variety of services offered by local authorities, that of municipal solid waste (MSW) collection and disposal is one of the most widely studied, due to the complexity of its provision, the significant cost involved and increasing environmental concerns in this respect (Bel, Fageda, Dijkgraaf, & Gradus, 2010; Benito-López, Moreno-Enguix, & Solana-Ibañez, 2011; De Jaeger & Rogge, 2013; Jacobsen, Buysse, & Gellynck, 2013; Simões & Marques, 2012a; Zafra-Gómez, Prior, Plata-Díaz, & López-Hernández, 2013).

Recent studies on the question of MSW services have focused on determining which form of service delivery – public or pri-

– might achieve the highest levels of efficiency and cost savings (Bel & Fageda, 2010; Bel, Fageda, & Mur, 2014; Bel & Mur, 2009; Dijkgraaf & Gradus, 2013; Simões, Cruz, & Marques, 2012; Simões & Marques, 2012a; Zafra-Gómez et al., 2013; Mañez et al., 2016; Zafra-Gómez et al., 2016). Further empirical evidence would be useful to determine whether the public provision of this service achieves higher levels of cost efficiency than contracting out, or vice versa. In view of this background, it seems clear that research that only takes into account whether management of the service is public or private is insufficiently specific, and that the different service delivery alternatives for the MSW service must be defined. Within the wide range of possible forms of provision, those of municipal direct (MUD), municipal under contract (MUC), intermunicipal cooperation (IC) and private production with cooperation (PPC) are among the alternatives most commonly used in managing MSW services (Plata-Díaz, Zafra-Gómez, Pérez-López, & López-Hernández, 2014).

In short, the aim of the present study is to contribute to the literature on the analysis of cost efficiency in the provision of the MSW service, by analysing the differences that arise in cost efficiency from different ways of managing this service among Spanish local authorities, and thus to identify which service delivery form is best suited to its provision. To address this goal, we have examined a database composed of 771 Spanish municipalities, each with a population of 1000–50,000 inhabitants, for the period 2007–2010. For this study, the issue was addressed using a methodol-

\* Corresponding author. Tel.: +34 958246227; fax: +34 958246249.

E-mail addresses: [gemmaapl@ugr.es](mailto:gemmaapl@ugr.es) (G. Pérez-López), [diego.prior@uab.es](mailto:diego.prior@uab.es) (D. Prior), [jlzafra@ugr.es](mailto:jlzafra@ugr.es) (J.L. Zafra-Gómez), [amplata@ugr.e](mailto:amplata@ugr.e) (A.M. Plata-Díaz).

ogy that distinguishes the different technological processes provided by each service delivery form and reflects their impact on efficiency, taking into account all the units concerned. In this respect, we use the term metafrontier – frontier separation – developed by Battese and Rao (2002) and Battese, Rao, and O'Donnell (2004). Additionally, to determine the cost efficiency of the MSW service for each of the municipalities in the sample, we propose the use of partial nonparametric frontiers, applying order- $m$  frontiers (Cazals, Florens, & Simar, 2002; Daouia & Simar, 2007). As an alternative to DEA (data envelopment analysis), (Larrán-Jorge & García-Correas, 2015) partial nonparametric frontiers are robust to the presence of outliers and extreme values, and are unaffected by problems of dimensionality (Balaguer-Coll, Prior, & Tortosa-Ausina, 2013; Simões, Carvalho, & Marques, 2012).

The metafrontier concept facilitates the comparison of municipalities that present similar characteristics but deliver the service by different formulas. This methodology evaluates each municipality twice: in relation to the best practice for the form of service delivery adopted and also to the overall best practice among all the different forms of service delivery (De Witte & Marques, 2009). If efficiency values were computed without distinguishing the delivery form of the MSW service, taking municipalities as a whole, this would mean that two municipalities with similar characteristics that applied different forms of MSW service delivery could not be compared in terms of efficiency, since, for example, one town may present lower levels of efficiency than the other but be among the most efficient within its own form of service delivery. In such a context, the first-named municipality could improve its efficiency only by changing its form of service delivery to one that is more appropriate. For these reasons, the present study seeks to determine which service delivery form is most efficient for the MSW service, by making municipalities comparable in terms of efficiency through the metafrontier concept.

The results obtained suggest that cooperative forms achieve the highest levels of cost savings in the MSW service. However, the evidence suggests there are differences in cost efficiency between different service delivery forms according to the population size of the municipality. Specifically, in municipalities with a larger population the use of contracted-out management forms would be more appropriate.

The rest of this paper is organised as follows. In the second section, we present a theoretical review of the question of cost efficiency in MSW service delivery. The third section introduces the concept of metafrontier, the methodology applied in this study. In the fourth section, we present the data used in the analysis and the results obtained. Finally, the fifth section summarises the key findings and acknowledges the limitations of the study conducted.

## 2. Size, delivery forms and cost efficiency in the provision of MSW services

The debate over public or private management and its relationship to the cost of the MSW service has been widely discussed (Bel & Fageda, 2010; Bel et al., 2014; Bel & Mur, 2009; Bel & Warner, 2008, 2010; Benito, Solana, & Moreno, 2014; Jacobsen, Buysse, & Gellynck, 2013; Ohlsson, 2003; Simões, Cruz, et al., 2012; Stevens, 1978; Zafra-Gómez et al., 2013). This question is of great current interest due to the need to know which form of local service provision is most efficient (Bel et al., 2014), among the wide variety of service delivery forms possible (Jacobsen et al., 2013).

Diverse theoretical arguments have been proposed regarding the use of private firms to deliver public services, including public choice theory, property rights, organisational theory and the application of economies of scale (Bel & Fageda, 2006, 2008; Simões, Cruz, et al., 2012; Zafra-Gómez et al., 2013). The advantages obtained from the contracting out of public services mainly

result from the introduction of competition into municipal service provision (Warner, 2012); in particular, cost savings are facilitated by the fact that the private sector often presents lower production costs than is the case of the public sector (Bel & Fageda, 2006; Wassenaar, Dijkgraaf, & Gradus, 2010). In addition, if the service is contracted out, the private operator may have the possibility of providing the same service in different municipalities, which enables fixed costs to be shared among the different locations in which it operates, thus obtaining economies of scale and service cost reductions (Donahue, 1989). Accordingly, contracting out has been proposed as a means of reducing the costs of local service provision and of achieving higher levels of efficiency (Bel & Fageda, 2008).

However, the empirical evidence in this respect is unclear (Bel & Warner, 2008). Some studies have reported no significant differences in service costs between public and private production (Bel & Fageda, 2010; Bel & Mur, 2009; Dijkgraaf & Gradus, 2003); others have reported the existence of such cost differences, but published results vary widely. Thus, some studies find that contracting out reduces costs (Benito et al., 2014; Reeves & Barrow, 2000; Simões, Cruz, et al., 2012) while others conclude that private management is associated with higher costs (Ohlsson, 2003; Stevens, 1978; Zafra-Gómez et al., 2013).

This disparity in results may be due to the fact that in the provision of public services there continues to be, in many cases, a lack of competition or an inadequate regulatory model (Simões, De Witte, & Marques, 2010). The market structure is different between countries, ranging from the absence of regulation in the United States (Warner & Bel, 2008), to the legal obligation to provide a MSW service, but with freedom to adopt the management form preferred, in the Netherlands and Spain (Bel et al., 2010) and the strict regulatory system in Portugal (Simões & Marques, 2012b). The inconsistent results might also be justified by reference to the theory of incomplete contracts and to the presence of transaction costs that affect the negotiation of contracts (Bel & Fageda, 2006; Girth, Hefetz, Johnston, & Warner, 2012; Hefetz & Warner, 2012; Warner, 2012). For these reasons, it has been concluded that private participation in the MSW service requires appropriate regulation and a suitable market structure (Bel & Warner, 2008; Cruz, Simões, & Marques, 2013). Another factor which may obscure the relationship between cost efficiency and contracting out is that the size of the municipality may not be sufficient for economies of scale to be achieved. Simões et al. (2010) and Carvalho and Marques (2014) reported economies of size for utilities in Portuguese MSW services and in the recycling sector, respectively. According to Bel and Fageda (2009) and González-Gómez, Picazo-Tadeo, and Guardiola (2011), the factors that decide municipal managers to contract out certain local public services vary with the size of the municipality, and so cost efficiency can also vary in this respect.

There is evidence that smaller municipalities can obtain better results from other formulas than contracting out the MSW service (Bel et al., 2014; Benito, Guillamón, & Bastida, 2015). Private operators may be unable to obtain economies of scale in these smaller municipalities (Bel & Fageda, 2006; Warner & Hebdon, 2001; Warner & Hefetz, 2003), for two main reasons. First, small and medium-sized municipalities may not be large enough to reduce the unit cost of the service (Bel & Fageda, 2006, 2008; Mohr, Deller, & Halstead, 2010; Zafra-Gómez et al., 2013). Second, they may also lack the negotiating power to conclude beneficial contracts with private operators (Warner & Hefetz, 2003). Accordingly, in such municipalities, joint management has been considered as an alternative to contracting out (Bel & Fageda, 2006, 2008; Mohr et al., 2010; Warner & Hebdon, 2001; Warner & Hefetz, 2003; Zafra-Gómez et al., 2013).

Therefore, intermunicipal cooperation may be introduced, to jointly organise the service and thus exploit latent economies of

Download English Version:

<https://daneshyari.com/en/article/479209>

Download Persian Version:

<https://daneshyari.com/article/479209>

[Daneshyari.com](https://daneshyari.com)