# Understanding the effect of contracting out on the delivery of local public services

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## Abstract

Contracting out is a mechanism through which the delivery of public services can be made more efficient. However, the process has yielded conflicting results. This paper presents a dynamic, mixed approach, incorporating an intertemporal frontier and a matching technique, to measure the short and long-term effects of the implementation of contracting out on the efficiency of local public service delivery. The study demonstrates the existence of temporary inefficiency arising from the change in service management when contracting out takes place, followed by an increase in efficiency among municipalities that contract out, with respect to comparable municipalities that do not do so.

## Introduction

Various theoretical arguments have been proposed in defence of contracting out local public services as a mechanism to improve efficiency (BRUDNEY et al., 2005; BROWN and POTOSKI, 2005). Most researchers in this context have focused on the relation between contracting out and the costs of local services, with the main aim of

determining whether contracting out is an appropriate service delivery form (BEL and WARNER, 2008; BAE, 2010). Nevertheless, empirical evidence is contradictory with respect to the reality of such cost savings (BRUDNEY et al., 2005), and in some cases higher costs have been reported (GIRTH et al., 2012), especially in individual cases (HODGE, 1996; SCLAR, 2000).

The question that remains to be answered is whether this contracting out achieves lasting cost savings or whether, to the contrary, it reduces cost efficiency. Clearly, this is a question of vital importance to the managers of local public services (BOARDMAN and HEWITT, 2004). Therefore, it is important to conduct an in-depth analysis of the results obtained from contracting out, to establish whether the cost efficiency of local public services improves after contracting out.

As observed by BEL and FAGEDA (2007), the time dimension in such an analysis is very important, because a change in the service management structure may, for some years, provoke inefficiency due to the effect of transaction costs; nevertheless, over time these costs will be assimilated and overcome, through learning efficiency (BOVAIRD, 2014), and management performance will be improved (RASHMAN et al., 2009; WARNER and HEFETZ, 2012). Organisational learning efficiency is an aspect of major importance in improving public service management and delivery (RASHMAN et al., 2009), and the experience gained over time is expected to enhance efficiency and cost control (ARGOTE, 1999).

The main objective of this study is to employ a mixed, dynamic methodology to examine the short and long-term effects of contracting out, to determine whether this delivery form leads to cost savings (greater efficiency), as held by advocates of the managerialist tradition, or to cost increases (less efficiency), as suggested under the

transaction cost theory. The dynamism of the study will allow us to study the effect produced over several years in comparison with the situation of municipalities where the service has not been contracted out, and thus reveal whether cost savings are produced.

To address these study goals, the following methodology was applied: first, the cost efficiency of each local government was calculated, by applying robust partial frontiers (DARAIO and SIMAR, 2007; DE WITTE and MARQUES, 2010) and the concept of intertemporal frontier (TULKENS and VANDEN EECKAUT, 1995), to quantify the year-on-year rate of change of cost efficiency for each local government. Second, the year variation in cost efficiency was analysed using matching techniques, as has been done in previous research in related areas (HECKMAN et al., 1997; MANJÓN et al, 2012; MÁÑEZ et al., 2013). In our specific context, this matching technique was applied by pairing observations for contracting out local governments with those for the control group (non-contracting-out municipalities with similar observed characteristics), and then estimating the effect of contracting out by subtracting the mean efficiency improvement of non-contracting municipalities from that achieved by contracting ones. The validity of this method was tested by reference to the waste collection services provided by a sample of 422 Spanish municipalities for the period 2002-2010.

The results obtained reveal the existence of a time lag between the implementation of contracting out and the materialisation of cost efficiency improvements. Short-term cost increases are incurred after contracting out the public service, apparently because local governments need to adapt to the peculiarities of contracted-out management and overcome initial transaction costs. However, cost efficiency is increased after three years' experience with this form of service delivery.

The rest of this paper is organised as follows. The first section reviews prior studies of contracting out, with respect to cost efficiency in municipal service delivery, and then introduces a new concept, that of learning efficiency, as part of the specific analysis of cost efficiency. The second and third sections present the methodology applied, the data used and the results obtained. Finally, the main conclusions drawn are summarised.

## Contracting out and cost efficiency in public service delivery. Dynamic – short and long term – effect on transaction cost inefficiency

Specific postulates that would favour the use of contracted out services have been proposed, such as economies of scale, market competition, specific assets, public choice and property rights. One of the main arguments, applicable to the majority of public services, is the presence of economies of scale (BEL and FAGEDA, 2006), which can be exploited by private operators to obtain cost savings by sharing the fixed costs of delivering a service to different local governments (DONAHUE, 1989; WASSENAAR et al., 2013). At the same time, different services are asset-specific, and so high levels of investment are required; for this reason, local governments often prefer to contract out the service and thus obtain cost savings (CARR et al., 2008).

Additionally, public choice theory (NISKANEN, 1971) and property rights theory (HART and MOORE, 1990) suggest that cost efficiency is enhanced when the service is contracted out. One reason for this is that under private management, staff have greater incentives to improve efficiency and will seek to reduce costs (BEL and WARNER, 2008). These arguments lead us to believe that contracting out may result in increased efficiency in the delivery and management of public services.

### *Contracting out and inefficiency: the short-term transaction cost theory*

However, there are also arguments against the idea that contracting out increases efficiency. In this respect, the transaction cost framework has been extensively studied (BEL and FAGEDA, 2006; BROWN and POTOSKI 2005; CARR et al., 2008; WASSENAAR et al., 2013). This theory suggests that contracting out costs are often underestimated because transaction costs are excluded from the analysis (SCLAR, 2000) and that these costs may reduce the cost efficiency obtained.

Transaction costs are those related to the administrative process of implementing and monitoring the contracting out process. They may originate from uncertainty, limited information and/or agents' opportunistic behaviour (COASE, 1937; WILLIAMSON, 1981) and are especially likely when the contract is weakly specified (BROWN and POTOSKI, 2005). Transaction costs are more likely to be incurred when the service presents characteristics such as asset specificity, absence of market competition and service complexity (BROWN and POTOSKI, 2005; BEL et al., 2010). Clearly, local governments may incur higher costs if private operators must be monitored, and the higher the transaction costs, the lower the cost efficiency gains to be obtained from contracting out (BEL and FAGEDA, 2008). In this context, transaction cost theory is often accepted as a solid framework with which to explain the limits of contracting out (BROWN and POTOSKI, 2005; DIJKGRAAF and GRADUS, 2013).

The question must then be addressed. In this situation, what does contracting out actually produce: cost savings or cost inefficiency? In fact, the answer is unclear, and indeed both options could be valid (PÉREZ-LÓPEZ et al., 2015), if the phenomenon is analysed not as an isolated effect at a particular point in time (BEL and FAGEDA, 2007), but as one taking place over time; thus, both a short and a long term effect may be produced (name deleted to maintain anonymity in the review process). Accordingly, when the change is first introduced the transaction costs may outweigh the cost saving

achieved by contracting out. Therefore, the following hypothesis is proposed.

*$H_1$: In the short term, the contracting out of public services will provoke cost inefficiency.*

***Long term effect of contracting out cost inefficiency***

As mentioned above, according to some theories contracting out increases efficiency, but the presence of transaction costs may counteract this benefit. This possible theoretical confrontation is corroborated by empirical observation, as there is no clear evidence of cost efficiency benefits obtained from this change (BEL et al., 2010).

On the other hand, there may be no such confrontation, but merely an absence of temporal perspective in the testing of each theoretical framework. Thus, theories in favour of contracting out and those referring to the existence of transaction costs may both be valid, but the effects referred to materialise at different points in time. The failure to distinguish this changing time perspective would account for the inconsistent results reported in the literature (BEL et al., 2010).

Therefore, the cost saving effect of contracting out may not be evident in the short term due to the existence of transaction costs; nevertheless, it will materialise in the long run. In consequence, a dynamic evaluation of the process must be conducted to verify the full effects, over a broad time horizon (BEL and FAGEDA, 2007; ZAFRA-GÓMEZ et al., 2014). In this respect, as indicated by (BEL et al. (2010: 570), most previous studies "did not measure the before and after effects of privatisation but rather changes over time across localities".

Thus, contracting out can be viewed as a dynamic process in which it is

important to consider the time effect (BEL and FAGEDA, 2007; GONZÁLEZ-GÓMEZ and GUARDIOLA, 2008). As observed by BROWN and POTOSKI (2003), contract management is efficient when it mitigates the specific problems that emerge in the contract process. Under the transaction costs theory, contracting out takes place within a principal-agent relation that may result in greater costs being incurred (FERNANDEZ, 2009). However, such cost increases may not be permanent and that, therefore, the local government may ultimately obtain cost efficiency gains in the long term. The dynamism of contracting out may mean that in the long term, either because the market itself produces a reduction in the cost of the service, or because new competitors emerge (WARNER, 2012), or even because organisations acquire new knowledge over time, cost savings are achieved. In relation to this latter concept, higher costs are incurred when a new management technique is implemented, but at the same time the organisation doing so can learn from experience of the new context. This learning effect could be translated into cost terms through the concept of learning efficiency, as the cost savings produced by acquired experience and know-how (BESANKO et al., 2009; BOVAIRD, 2014).

Thus, the second hypothesis of this paper is:

*$H_2$: In the long term, contracting out produces cost savings, outweighing the initial cost inefficiency derived from transaction costs.*

Appendix A includes a figure that illustrates the effects of transaction costs and of the learning curve when the service is contracted out. Starting from a municipality that has not outsourced its waste collection service (represented in the chart by the star), different situations can be identified, according to the theoretical framework in question.

According to market theories in services with high transaction costs, the average

cost is higher when the service is not contracted out. Accordingly, the average cost incurred by a contracting out municipality is expected to be lower, as shown in the figure. For this reason, a non-outsourcing municipality may decide to contract out the service at $t_1$. However, in the short term, this outsourcing can produce inefficiency, due to the generation of transaction costs, and the resulting cost to the municipality may rise and even exceed the cost prior to contracting out.

**Dynamic analysis of the implementation of contracting out**

To obtain empirical evidence to test the hypotheses presented in the previous section, a dynamic mixed methodology was applied, based on an intertemporal efficiency frontier and matching techniques (see Figure 1). This methodology consists of two phases: first, a measure of cost efficiency, comparable over time, is calculated; then, the matching technique is applied, in order to analyse the effect of a new policy. In this process, the individuals that have implemented the new policy are paired with those that have not but which have similar characteristics. The analyst then compares the results obtained by the two groups of individuals.

In the present case, the study is aimed to determine whether the contracting out of the service affects cost efficiency, and therefore the first requirement is to obtain a measure of changes in cost efficiency. Hence, before explaining the econometric model of the matching technique, let us examine the method used to obtain cost efficiency scores.

As the application of matching techniques requires a measure representing the inter-year variation in cost efficiency for each municipality in the sample, the concept of intertemporal frontier is applied (TULKENS and VANDEN EECKAUT 1995), which

facilitates temporal comparisons of the efficiency scores obtained under a single frontier, since it captures the overall efficiency change (AVKIRAN, 2009).

[Insert Figure 1]

An intertemporal frontier is constructed with all the observations contained in the panel data (TULKENS and VANDEN EECKAUT, 1995): constructing a single reference set for the whole period $[1, T]$, incorporating all the decision-making units (DMUs) in $Y\,(1, T)$. Hence, a simple production frontier that incorporates all local governments for the complete period considered in the analysis is considered, but in which subsamples of local governments can be differentiated for each year, and thus the change in cost efficiency can be calculated.

Additionally the intertemporal frontier is calculated by applying robust partial frontiers (DARAIO and SIMAR, 2007; DE WITTE and MARQUES, 2010). This approach computes the cost efficiency measure for each local government as a central value of repeated estimations of the cost efficiency scores with replacement obtained from the outputs of *m* subsamples (DARAIO and SIMAR, 2007). As this partial approach benchmarks a DMU within a subsample of *m* peers, its estimations are more robust than those of other estimators obtained through the application of nonparametric approaches such as data envelopment analysis (DEA) and the free disposal hull (FDH), which are extremely sensitive to outliers – because these approaches envelop all data points (DAOUIA and SIMAR, 2007). Furthermore, they are susceptible to measurement errors, because they assume the absence of statistical noise (DE WITTE and MARQUES, 2010). Robust partial frontiers overcome these limitations and allow the presence of superefficient units (observations beyond the estimated efficiency frontier), as this technique does not envelop all the data (SIMAR and WILSON, 2008).

The algorithm of the order-$m$ approach is explained in Appendix B. This methodology can be oriented toward inputs, outputs, costs or revenues. This paper opted for the cost orientation since in this specific context of local government outputs are either totally or partially determined externally and output prices are sometimes not available, and so it is more appropriate to seek to minimise the municipal cost (CHERCHYE et al., 2014). Considering the cost orientation and random replacement, the order-$m$ approach obtains efficiency scores beyond the efficiency frontier (superefficient units) when a DMU ($s$) reaches $\alpha_s^m > 1$.

The final step in phase one (Figure 1) is to obtain the change in cost efficiency, which is calculated as the difference between the cost efficiency scores of each local government for each year.

In the second phase (Figure 1), the actual variation in cost efficiency for new contractors would need to be compared with the cost efficiency variation that would have been presented by the same local governments if they had not contracted out the public service, to control for the direction of causality from contracting out to cost efficiency variation. The problem is that there is no information about the counterfactual situation, i.e., the variation in the cost efficiency of new contractors if they had never undertaken contracting out. Matching techniques provide a way to construct this counterfactual state.

More formally, $\Delta\alpha(c_{i(t+s)})$ denotes the change in cost efficiency between $(t+s-1)$ and $(t+s), s \geq 0$ for local government $i$ classified as a new contractor in $t$ ($c_{it}$) and $\Delta\alpha(nc_{i(t+s)})$ represents the change in cost efficiency that local government $i$ would have had if it had not contracted out the service ($nc_{it}$). Using this notation, the causal

effect of contracting out, in terms of change in cost efficiency from period $(t+s-1)$ to $(t+s)$ for local government $i$ that starts contracting out in $t$, can be defined as:

$$\Delta\alpha(c_{i(t+s)}) - \Delta\alpha(nc_{i(t+s)}) \quad (3)$$

In accordance with previous literature on policy/treatment evaluation, the average causal effect on local governments of starting to contract out, in $t$, is defined as (HECKMAN et al., 1997):

$$E\left(\Delta\alpha(c_{i(t+s)}) - \Delta\alpha(nc_{i(t+s)})\middle|c_{it}\right) = E\left(\Delta\alpha(c_{i(t+s)})\middle|c_{it}\right) - E\left(\Delta\alpha(nc_{i(t+s)})\middle|c_{it}\right) \quad (4)$$

However, in using this formulation (4) to make a causal inference, it arises the problem that in observational studies the counterfactual for a new contractor $(\Delta\alpha(nc_{i(t+s)}))$ is not observed and, therefore, must be generated[i]. This problem is overcome by using matching techniques to identify among the pool of non-contractors in $t$ those local governments with a distribution of observable variables $(X\ in\ t-1)$ affecting cost efficiency change and a probability of contracting out that is as similar as possible to the corresponding aspects of new contractors. In this sense, it is assumed that based on $X$, local governments with the same characteristics are randomly exposed to the contracting/not-contracting decision. Thus, expression (4) can be rewritten as follows:

$$E\left(\Delta\alpha(c_{i(t+s)})\middle|X_{it-1}, c_{it}\right) - E\left(\Delta\alpha(nc_{i(t+s)})\middle|X_{it-1}, nc_{it}\right) \quad (5)$$

However, there is a limitation, since there are several observable variables that may potentially affect a local government's probability of contracting out and the resulting change in cost efficiency. Therefore, it is necessary to determine the appropriate variable to match the municipalities, and if more than one variable is used, to determine the appropriate weights. Furthermore, in order to guarantee that the second term in (5) is a good counterfactual for the final term in (4), it is necessary to assume

that all relevant differences between new contractors and the control group of non-contractors are properly captured by the vector of observables $X$. This is the conditional independence assumption (CIA), which also means that the potential change in cost efficiency for local authorities that do not contract out is independent of the treatment assignment between being a new-contractor or a non-contractor, in accordance with $X$.

ROSENBAUM and RUBIN (1985) proposed using the propensity score technique to deal with this limitation. This method makes it possible to combine the complete information from a vector of variables, specifically driving the probability of initiating contracting out into a scalar that is the predicted probability of becoming a new contractor. A further benefit is that the propensity score method preserves the same properties as when the vector of variables is matched directly: thus, municipalities with the same probability of becoming a new contractor are randomly exposed to contracting out. Thus, local governments will be matched on the basis of their probability of contracting out for the first time.

As Figure 1 shows, before performing the matching analysis, the probability of a local government becoming a new contractor is determined (i.e., the propensity score) in terms of the predicted probability, using a probit model.

$$y_i = \mathrm{F}(x'_i\beta) + u_i \quad \text{[ii]}$$

$$i = 1, \ldots, \mathrm{n}$$

Propensity score matching includes different estimators (algorithms), which vary according to how the control group of individuals is defined and according to the weights assigned to the different individuals (STUART, 2010). The main matching methods are nearest neighbour, caliper and radius matching, subclassification

(stratification and interval matching) and weighting adjustments matching (CALIENDO and KOPEINIG, 2008; STUART, 2010). Previous studies have obtained robust results by applying different methods (MÁÑEZ et al., 2013). However, there is no single methodology that is valid for all situations, and so the choice of estimator depends on the specific circumstances of the study (STUART, 2010).

This study opted for the nearest neighbours method in order to construct the counterfactual (BECKER and ICHINO, 2002), this being one of the most common and understandable methods (RUBIN, 1973) as well as being the most effective approach when the researchers' goal is to select individuals for follow-up (STUART, 2010). This method matches the contracting municipality with the non-contracting ones that have the closest propensity score. This approach is applied by grouping the four closest non-contracting municipalities. Since the propensity scores had been previously estimated, the usual procedure would be to calculate the *p*-values corresponding to the extra-efficiency growth (EEG, hereafter) of new contractors using bootstrapping techniques. However, ABADIE and IMBENS (2008) showed that due to the extreme non-smoothness of nearest neighbours matching, the standard conditions for bootstrapping are not met, and so the bootstrap variance diverges from the actual variance. Subsampling was applied to overcome this problem (POLITIS et al., 1999), together with the Stata *nnmatch* command (ABADIE et al., 2004).

## Application of the method to the waste collection service

### *Data description*

To address the main study hypotheses, this paper analysed a database of 422 Spanish local governments with populations between 1,000 and 50,000 inhabitants for the period 2002-2010. The sample was restricted to municipalities within this

population range due to the lack of relevant information for those with smaller or larger populations. 20.44% of Spanish municipalities lie within the population range represented by the sample. This mixed, dynamic methodology was applied to evaluate the waste collection service, which is one of those most often studied in analyses of contracting out (ABRATE et al., 2014; BEL et al., 2010; ZAFRA-GÓMEZ et al., 2013, 2015; PLATA- DÍAZ et al., 2014)[iii].

Firstly, the Appendix C presents the variables used in the computation of the local governments' cost efficiency score, for which robust partial frontiers were applied via the order-*m* approach with a cost orientation (Table C.1) and their descriptive statistics (Table C.2).

In order to apply the matching techniques, municipalities were classified into two groups: contractors and non-contractors (counterfactual group). Contracting municipalities are those that began contracting out refuse collection service delivery at any point during the period 2003-2010 and non-contractors are the municipalities that did not contract out the service during the whole period considered (2002-2010). To create this classification, a variable was constructed, taking the value 1 if the municipality contracted out the refuse collection service and maintained this delivery form the moment of contracting out until the end of the period, and 0 otherwise.

Appendix D presents a summary of the contracting out variable. Table D.1 shows both the number of municipalities that contract out each year and the percentage they represent with respect to the non-contracting municipalities in the previous year. As can be seen, by the end of the sample period (year 2010), 95 municipalities (22.51%) had contracted out the refuse collection service. This table also shows that the current economic crisis accelerated the contracting out process; whereas the average contracting

out rate before the beginning of the crisis (2003-2007) was 1.97%, this ratio subsequently rose to 5.05%. Finally, Table D.2 in Appendix D contains the descriptive statistics for the change in cost efficiency for the contracting and non-contracting municipalities.

**Results**

This section presents the principal results used in our evaluation of the hypotheses proposed, following the method outlined in the previous section (Figure 1), based on matching techniques. The analysis first compared the cost efficiency distribution of contracting and non-contracting municipalities, both at the start and the end of the study period, and then examined whether those which contracted out during the study period presented lower initial levels of cost efficiency than those which did not.

***Test 1. Contracting out and changes in cost efficiency: an initial approach***

The main goal of this paper is to analyse the effect of contracting out on the change in cost efficiency of the service. To obtain an overview of the contracting out-efficiency relation, the study compared, for the first and last years of the sample, the cost efficiency distribution of the local governments that had not contracted out this service (non-contractors) with that of those which had done so during the study period (contractors).

For this purpose, the Kolmogorov-Smirnov (KS) one-and-two-sided tests of stochastic dominance is used as follows:

$$F_t(cost\ efficiency)\ vs.\ G_t(cost\ efficiency) \qquad t = 2002{,}2010$$

where $F$ is the distribution function of the contractors' cost efficiency and $G$ is

the corresponding distribution function for the non-contractors.

As can be seen in Table 1, the results for the first year of the study period (2002) suggest that there are no differences between the cost efficiency distributions of the non-contractors and of the future contractors, and so the null hypothesis of equality of cost efficiency distributions of the two-sided KS test is not rejected at any conventional level of significance. However, for the last year of the sample (2010), the cost efficiency distribution of the contractors exceeded that of the non-contractors, and so the null hypothesis of equality of the distributions is rejected but not the null hypothesis of favourable differences for contractors. This outcome implies that the contracting municipalities achieve higher rates of cost efficiency than do the non-contracting ones.

[Insert table 1]

This preliminary analysis suggests that contracting out increases cost efficiency, but it cannot be yet confirmed this as a causal link, because in order to establish a causal relation between contracting out and cost efficiency, it is necessary to compare the change in cost efficiency among municipalities after contracting out the waste collection service with the change in cost efficiency that would have been achieved by the contractors if they had not contracted out the service.

***Test 2. Ex-ante differences between contracting and non-contracting municipalities***

Considering that one of the factors favouring the decision to adopt contracting out is the expectation of obtaining cost savings (BRUDNEY et al., 2005), the following step is to test whether prior to contracting out the service, the cost efficiency of the municipalities in question was lower than that of the municipalities that did not contract out, by examining the cost efficiency presented before contracting out was implemented by newly-contracting municipalities and the corresponding cost efficiency of the non-

contracting municipalities.

Table 2 shows the results of the KS tests of stochastic dominance for the whole sample period that was performed jointly for the whole study period[iv] as follows:

$$F_{NEW}(cost\ efficiency)\ vs.\ F_{NON}(cost\ efficiency)$$

where $F_{NEW}$ is the cost efficiency distribution in year $t-1$ of the eight cohorts of new-contractors (for $t = 2003-2010$), and $F_{NON}$ is the yearly average cost efficiency distribution over the period 2003-2008 for non-contractors, which are re-defined as municipalities that did not contract out the waste collection service during the whole study period.

[Insert table 2]

Regarding the results of the formal KS tests of stochastic dominance, the null hypothesis of equality of the cost efficiency distributions of contracting and non-contracting municipalities is rejected, but not the null hypothesis of favourable differences to non-contractors. Therefore, before any contracting out took place, the cost efficiency for non-contracting municipalities was higher than that of the new-contracting ones, suggesting that one of the main reasons for the latter's decision to contract out was to increase cost efficiency.

***Results obtained by the nearest matching technique***

As explained in the method section, it is required to calculate the probability of a municipality becoming a new contractor (the propensity score), which is obtained in terms of predicted probability. For this purpose, a probit model is created, in which the dependent variable is a dummy variable representing the contracting out of the waste collection service. Appendix E summarises the specification of the probit model, the

description and descriptive statistics of the variables included as well as the results obtained in the probit analysis.

After performing the above tests, the final step was to apply the matching techniques, to compare the change in cost efficiency between new contractors and matched non-contractors for the periods $(t-1)$ to $t$, $t$ to $(t+1)$, $(t+1)$ to $(t+2)$ and $(t+2)$ to $(t+3)$. The choice of the period $(t-1)$ to $(t+3)$ is a compromise between allowing a sufficient length of time for possible learning effects to emerge and observing a reasonable number of new contractors[v]. In applying the matching technique, the specific year in which municipalities contracted out the waste collection service is taken into account. Thus, it is obtained information for the period $(t-1)$ to $t$ for all 95 municipalities that contracted out the waste collection service during the study period, but the information for the following periods to $(t+1)$, $(t+1)$ to $(t+2)$ and $(t+2)$ to $(t+3)$ depends on the year in which the service was contracted out[vi].

Table 3 presents the results of this comparison[vii]. As explained in the methodology section, nearest neighbours matching was used to construct the counterfactual (BECKER and ICHINO, 2002). Appendix F presents the balance of the observable variables within the matched samples and discusses the quality of the matching obtained.

[Insert table 3]

The number of contracting municipalities varies each year (Table D.1, Appendix D); thus, there were 95 municipalities to assess in the first year in which contracting out took place; however, in 2010 the waste collection service was contracted out by 17 municipalities (see Table D.1), and therefore it is possible to assess 78 municipalities in the second year, since the absence of data beyond the year 2010 meant that no

information was available for the second year of contracting out for the 17 municipalities in question. This situation was repeated year after year. Table 3 presents the analysis of the variations in efficiency over four years, once the waste collection service had been contracted out.

To test the first of the hypotheses proposed, the study examined whether the change in the form of service delivery worsened cost efficiency due to the presence of transaction costs. From the results obtained, it can be seen that the improvement in cost efficiency among new contractors is 1.4% lower than that achieved by matched non-contractors, and that the estimated EEG of new contractors is negative and significant in the short term. It is important to highlight the robustness of the results, which are practically identical with both of the methods used to calculate standard error. Thus, our results suggest the existence of inefficiency derived from contracted-out management. These results confirm Hypothesis 1, i.e., that in the short term, municipalities that do not contract out the service are more cost efficient than those which do contract out. As the municipalities compared have similar characteristics, except that some contract out the waste collection service and others do not, our results confirm that in the short term, the change to the contracting out delivery form introduces inefficiency costs.

The objective of testing Hypothesis 2, is to know what happened in subsequent years, to obtain a long-term perspective. As shown in Table 3, the fact that the EEG estimates for new contractors with respect to matched non-contractors are non-significant for the periods $t/t+1$, $t+1/t+2$ suggests that local governments overcome the initial transition costs after one year operating the contracted out waste collection service, but also that contracting out does not result in higher rates of cost efficiency during periods $t/t+1$and $t+1/t+2$. Therefore, our analysis of the effects

produced after discounting short-term effects shows there are no significant differences between similar municipalities that do not contract out and those that do.

Finally, for the period $t+2/t+3$, the study finds evidence of a positive EEG for new contractors, to 3.2% above the corresponding figure for matched non-contractors. This result could be interpreted as evidence of learning efficiency, which lasts no less than three years: thus, municipalities that contract out the waste collection service should allow at least three years before expecting to achieve increased cost efficiency. In summary, in the long term, contracting out produces higher levels of efficiency, and so Hypothesis 2 is confirmed.

**Conclusions and Discussion**

Various studies proposing a theoretical framework for market-oriented forms of service delivery have considered the contracting out of local public services and its relation to cost savings (BEL and WARNER 2008; BAE, 2010). However, such contracting out does not guarantee that cost efficiency will improve (BEL and WARNER, 2008), and prior empirical evidence in this respect has produced conflicting results (BEL and WARNER, 2008; BEL et al., 2010).

These results highlight the need to explore further the phenomenon of contracting out and its implementation in the provision of public services. Specifically, as pointed by BEL and FAGEDA (2007) the true nature of the phenomenon should be analysed from a dynamic standpoint, from the time of implantation, through development, until consolidation.

In this context, this paper describes the application of a mixed, dynamic approach to analyse the effects of contracting out on cost efficiency in the provision of

local public services, and determine its short and long-term impact.

The mixed, dynamic method described is divided into two stages: in the first of these, cost efficiency scores are estimated by means of an intertemporal frontier analysis and the application of robust partial frontiers. This approach assures the comparability of the levels of efficiency observed at different moments. In the second stage of the process, matching techniques are applied to determine whether contracting out increases or decreases cost efficiency over time. In implementing this model, the short and long-term effects of contracting out on efficiency are measured and compared.

The theoretical argument in favour of a dynamic study is that the real effects of contracting out may not appear in the short term, because adapting management patterns to the new contract could provoke temporary inefficiency. The benefits obtained from contracting out public services and making use of market mechanisms are only materialised in the long term, when the initial transaction cost inefficiency has been exceeded.

Application of the above method to the waste collection services provided by Spanish municipalities suggests that inefficiency is indeed heightened, in the short-term, by the implementation of contracting out, as a result of transaction costs (SCLAR, 2000). However, analysis of the years following the implementation of contracting out reveals that this decrease in cost efficiency is counteracted over time. The results highlight the existence of a long-term learning effect produced by the contracting out process, which may eventually produce better contract management and overcome the initial cost efficiency decrease.

The conclusions to be drawn from the results obtained and from the application of our methodology, with respect to the development of public policies, are that changes

in the provision of public services should be evaluated over a broad time horizon, especially for services where there is an intensive presence of specific assets and high service complexity, a situation that tends to produce high transaction costs and in which most new contracts are long term.

The method described is especially suitable for the development of public policies involving a management change from public to private provision of the service. However, public managers should be aware that to evaluate the effectiveness of such a change (i.e., toward contracting out), an extensive time horizon should be considered and the possible presence of initial transaction costs assessed; moreover, it is necessary to determine whether these costs decrease during the life of the contract. Therefore, in future research, contracting out should be analysed as a long-term process, taking into account the duration of the contract and the stage of implementation (which may influence the effects observed).

It must not be forgotten that any discussion of the results obtained must be focused on two broad concerns, as the relation between cost efficiency and contracting out depends on the service that is contracted out, on the length and form of the contract and on the flexibility and characteristics of the contracts created in each country.

Easily measurable services with lower levels of specialisation are characterised by lower control and transaction costs (BROWN and POTOSKI, 2005) and therefore cost efficiency is unlikely to decrease in the short term. In consequence, the relationship analysed in the present study may be quite different; therefore, further research is necessary to analyse the contracting of other types of services with lower transaction costs.

Finally, there are several factors that could explain the existence of a long term reduction in transaction costs. On the one hand, efficiency can be improved by contracting out, with the introduction of competition into the service (WARNER, 2012). In Spain, the management of waste collection services is normally contracted out through a concession procedure, and this tends to promote competition between operators in the auction process. On the other hand, this paper has previously argued that efficiency gains may be explained in terms of increased learning efficiency. A contract in which the terms are strictly specified, and which has a long duration, will not contribute to learning efficiency being achieved until the contract ends and is renewed[viii]. Therefore, further studies are needed, focused on other countries in which the length and the flexibility of the contracts is different, in order to measure learning efficiency as an explanatory factor of a possible long term reduction in transaction costs.

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**Table 1. Comparison of the cost efficiency distributions of contracting and non-contracting municipalities**

| Year | Number of observations | | Cost efficiency differences[a] | Equality of distributions | | Favourable differences to contracting municipalities | |
|---|---|---|---|---|---|---|---|
| | Contracting | Non-contracting | | Statistic | *P*-value | Statistic | *P*-value |
| 2002 | 95 | 327 | 0.000 | 0.634 | 0.111 | 1.153 | 0.070 |
| 2010 | 95 | 327 | 0.001 | 1.301 | 0.051 | 0.745 | 0.329 |

[a] Cost efficiency differences (between the two groups of municipalities) are calculated at the median of the distributions.

**Table 2: Comparison of previous cost efficiency of new-contractors and non-contractors**

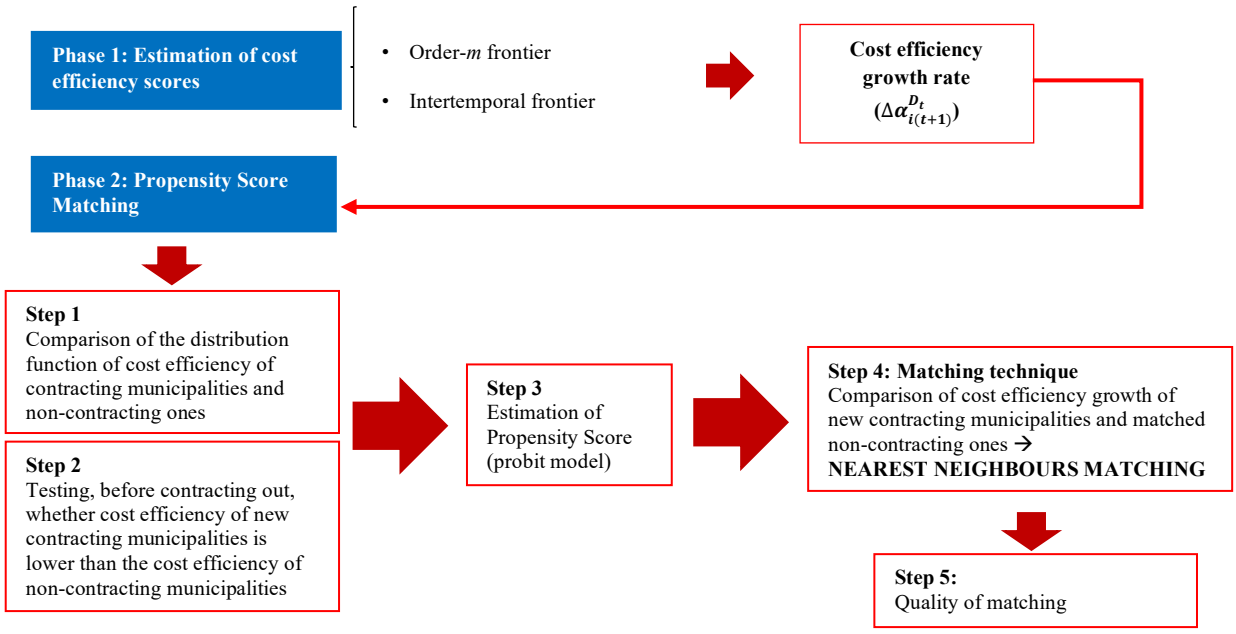
| Number of observations | | Equality of distributions | | Favourable differences to non-contractors | |
|---|---|---|---|---|---|
| New contractors | Non-contractors | Statistic | *P*-value | Statistic | *P*-value |
| 95 | 327 | 1.715 | 0.004 | 0.347 | 0.785 |

**Table 3. Estimates of extra-efficiency growth for contracting municipalities**

| Period | Nearest Neighbours | Observations | EEG | SE |
|---|---|---|---|---|
| *t* -1/*t* | SS | 95 (2616) | -0.014* | 0.008 |
| | A&I | | -0.014* | 0.008 |
| *t* /*t* +1 | SS | 78 (2616) | 0.004 | 0.009 |
| | A&I | | 0.004 | 0.007 |
| *t* + 1/*t* + 2 | SS | 55 (2616) | -0.002 | 0.010 |
| | A&I | | -0.002 | 0.011 |
| *t* + 2/*t* + 3 | SS | 40 (2616) | 0.032* | 0.017 |
| | A&I | | 0.032** | 0.016 |

EEG: Extra-efficiency growth of contractors with respect to non-contractors.
A&I: Standard errors were calculated using the ABADIE and IMBENS (2008) correction.
SS: Following POLITIS et al. (1999), standard errors were calculated by sub-sampling (2000 data extractions).
Observations show the number of contracting municipalities, with the number of control observations in parentheses, imposing common support. Contractors are the municipalities that contracted out the waste collection service during the study period. Non-contractors are municipalities that did not contract out in any year during the study period.
SE: Standard error
*, ** and *** indicate significance at 10%, 5% and 1%, respectively.

**Figure 1. Research methodology: phases and steps**




*Source: The author*

[i] Notes to the text are included in the Appendix G.