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Abstract

The aim of the present study is to evaluate two dimensions of municipal performance, which to date have been addressed as two separate elements, namely financial condition and cost efficiency. These concepts are analyzed in a sample addressing almost 1600 local authorities in Spain, each with less than 20,000 inhabitants, using a DEA model adapted for the particular characteristics of local environment. The empirical analysis carried out shows that the financial management and the productive efficiency of local authorities are two aspects that need to be understood in any assessment of their global economic behaviour. However, these values are not interrelated, and thus it is all the more necessary to achieve a precise evaluation of each of these aspects of local management. Moreover, our analysis of cost efficiency shows that in smaller municipalities there is a trade-off between the quantity and the quality of the services provided, which is not the case among the other authorities examined.

Keywords: financial management, productive efficiency, DEA

JEL classification: H72, C61, D24

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1. Introduction.

In recent decades there has been increasing interest in developed countries in evaluating the economic behaviour and performance of local authorities. The study of how the bodies responsible for providing public services actually manage their resources and finances has become a priority issue within the branch of economics known as New Public Management. The fundamental goals of this study are to detect and prevent inefficiency and/or waste, and at the same time to improve the quantity and quality of the results offered to society[1]. Local finance authorities have not been isolated from this situation; current trends in fiscal decentralization in developed countries are highlighting the role played by local authorities, in both qualitative and quantitative terms, within the overall structure of the public sector.

Spain presents a clear example of the application of new and varied powers by local government authorities. Since the approval of the modern Constitution in 1978, there has been a gradual, but constant increase in the responsibilities undertaken by municipal and regional finance authorities, fundamentally based on the theoretically greater proximity of local authorities to the preferences and needs of the local population. However, at the same time there has been growing debate, mainly in operative and practical terms, concerning the real economic effectiveness and efficiency of these bodies. This debate has yet to produce definitive conclusions.

The present study constitutes an original approach which seeks to contribute to greater understanding of the management capacity of local authorities. For this purpose, we combine two viewpoints that, to date, have been dealt with separately in the economic literature: on the one hand, measures of financial condition, and on the other, evaluating local authorities' efficiency in providing public services. Many publications and studies have been dedicated to one or the other standpoint regarding municipal economic performance. A priori, it is undoubtedly of interest to analyze whether there exists a reply to questions such as the following: are the most financially sound local authorities also the most efficient providers of public services, in terms of both quality and quantity? Or, on the contrary, is the extra effort made in

[1] See Lovell and Muñiz (2003) for a comprehensive review of the main studies on the economic evaluation of the provision of different public services.

producing a high level of services normally accompanied by a difficult financial situation? As a corollary, we examine questions such as whether the dimension or quality of the services provided are determinant factors in the municipal success enjoyed, in both their financial and productive implementation.

The methodology applied in the present study is that of Data Envelopment Analysis (DEA), a non-parametric model of mathematical programming that has been widely used in recent years, thanks to its positive aspects and straightforward applicability to the particular aspects of public sector production. Regarding the units utilized for evaluation in the empirical analysis, the sample consisted of 1592 local authorities throughout Spain, each with fewer than 20,000 inhabitants. This analysis, to date, is the largest of its kind in Spain, in terms of the numbers of authorities sampled; most previous studies in Spain have been restricted to local or regional contexts.

The structure of the present paper is as follows: the next section reviews the concept of financial condition and discusses the problems that arise in measuring this parameter; we then describe the methodology utilized and the initial results obtained from our evaluation of the financial condition of the Spanish municipalities included in the sample. In Section 3, we summarise the most significant studies made in the field of cost efficiency and local finance, and describe the empirical analysis made of the sample in question. Section 4 brings together the two viewpoints of economic performance taken by local governments, and tests a series of study hypotheses. Finally, the main findings are summarised and some conclusions drawn.

2. Financial condition.

2.1. Relevance and conceptual aspects.

Interest in the question of local authorities' financial condition and the context in which they exercise economic activities first arose in the USA in the 1970s and early 1980s. This concern extended throughout the 1990s, given the financial difficulties that affected cities such as Miami, Pittsburgh and Philadelphia, (Khola, 2005a) and has continued to the present day. In different areas and at different levels, proposals continue to be made for systems to detect and evaluate financial crises (Khola, 2005b). Work has also been done in other countries; thus, in Australia, local authorities are currently undergoing fiscal stress, as reported by Dollery et al. (2006), while in the United Kingdom, the Audit Commission's publication of February 2007 stated "The assessment focuses on the importance of having sound and strategic financial management to ensure that resources are available to support the council's priorities and improve services". In addition, there has been increased interest in recent years among ratings agencies concerning financial information on local authorities and their socioeconomic environment, in order to assess the solvency of municipal debt.

The growing significance of this type of information has led to the definition and publication of numerous 'early warning' concepts, such as fiscal crisis, fiscal stress, fiscal distress, fiscal emergency or financial condition. In this respect, Hodnable (2003) observed that there exist various terms for measuring the concept of *fiscal crisis*. In the state of Rhode Island, the expression is *crisis*, while in Ohio it is *fiscal emergency*, and for Michigan and Pennsylvania, alarm bells are rung by *fiscal distress*. Clearly, all these terms refer to situations of financial difficulties in local finance.

Given this multiplicity of approaches, it is necessary to establish a system for monitoring local authorities' financial condition and thus obtain a measure of their situation, to facilitate decision taking by officials, ratings agencies, managers and the community in general. Such an instrument would make it possible to react effectively when the financial situation is unfavourable or to reward good financial performance. In order to develop this instrument, the present paper examines a broader, more appropriate concept for evaluating the financial health of a local council: financial condition.

Seeking more universal applicability, for Greenberg and Hiller (1995) and CICA (1997), the situation of a council's internal finances can be measured through a series of indicators referring to sustainability, flexibility and vulnerability. Sustainability is defined as an organization's capacity to maintain, promote and preserve the social welfare of a population by the resources available to it. Flexibility is taken to be the organization's ability to respond to economic changes and financial circumstances, within the limits of its fiscal capacity, the latter depending on the degree to which it is capable of responding to such changes by varying tax rates, indebtedness or transfers. The concept of vulnerability is based on an organization's level of dependence with respect to external funding received via transfers and grants.

More recently, Groves et al. (2003) claimed that the concept of financial condition can be measured by means of four magnitudes. These are *cash solvency* (short-term liquidity and cash management, i.e. the organization's capacity to generate sufficient liquidity to pay its bills); *budgetary solvency* (its capacity to generate sufficient budgetary income to meet its budgetary obligations); *long-run solvency* (the capacity of government to meet all its long-term obligations – a concept that provides a long-term view of the organization's financial condition); and finally, *service level solvency* (the provision of the level and quality of services expected by the population).

As can seen, and despite the non-existence of a unanimously-accepted definition of financial condition, all the above proposals take into account the conjunction of various partial aspects of the latter, and the sum of these approaches, in one form or another, would provide a global view of the financial performance of local authorities. In the present study, we have chosen to take a joint view of the financial factors on which there is greatest agreement in the literature concerning their significance in this context.

2.2. Evaluating the financial condition of local authorities in Spain.

In order to carry out an analysis of financial condition with our sample of local councils, the information used was that supplied by the Directorate General for Financial Coordination with Local Organizations (Ministry of Economy and Finance) for 1999[2]. This study included a total of 1592 local councils, each with a population of more than 1000 and less than 20000, representing 57% of all Spanish authorities of this type. We excluded larger municipalities because the greater variety and scope of the services that such local authorities are legally bound to provide preclude the homogeneity among the units to be analyzed that is necessary for meaningful comparisons to be made.

[2] Data requirement for the study is very high. To evaluate cost efficiency it is necessary to get information related to outputs taken from the *Encuesta de Infraestructuras y Equipamientos Locales* (MAP). This survey is carried out every 5 years, but the 2005 wave was not available in the date this study was made. So, 2000 wave data were used. This fact leads to use financial indexes related to 2000. Finally, financial indexes related to 1999 were used, because there was not available information for 2000 year.

As described above, the financial condition of a local authority is determined by a set of indicators obtained from the economic, financial and budgetary information provided. For this study, we initially selected 13 such indicators, with the aim of addressing all the aspects described in the literature concerning the financial condition of local authorities. Given the large number of indicators, and the foreseeable correlation between many of them, a previous study was first performed to detect the cases with a strong correlation among indicators, and thus avoid the inclusion of redundant information. The results of this study led us to finally select a set of six indicators: the indices of income execution, current budget receipts, short-run solvency, self funding, weight of financial load and budgetary result[3]. These variables are not significantly correlated and, taken together, they provide a measure of the financial health of the local authority.

After describing the units to be evaluated and the variables employed in deriving a global measure of the financial condition of these councils, we must now set out the methodology that will be applied. Let us recall at this point that the ultimate goal of a study of this type is to obtain a single, global evaluation of the values reported by each council being assessed. This circumstance required us to calculate an aggregate measure obtained through multivariate techniques, of which a leading example is Data Envelopment Analysis (DEA). This instrument's flexibility and versatility in the use of multiple variables has led it to becoming increasingly applied by experts in the field of financial analysis. Examples of this use can be found in studies by Smith (1990), Fernández-Castro (1994) and Yeh (1996), who used DEA to obtain an aggregate measure of financial management. With respect to the public sector, Glass et al. (2009) studied the use of financial ratios to create a benchmark, in comparison with one created on the basis of profit efficiency.

DEA is a nonparametric method that was initially developed by Charnes et al. (1978). Its basic formulation has been the object of numerous extensions[4] some of which are utilized in the present study. By means of constrained linear programming, and on the basis of homogeneous sampling observations, the

[3] The latter three are stated as the inverse, see Annexe 1 for definition and descriptive statistics.
[4] Many publications explain the basis for calculation, and the principal extensions of this technique; for example, see Cooper et al. (2000) or Thanassoulis (2001).

method constructs an empirical frontier of production possibilities, thus creating an ‘envelope’ with the units considered to represent best practices.

Representing the primal of the optimization program on a sample consisting of K suppliers who produce s outputs, denoted by y, and using m inputs, represented by *x*, the valuation of the k_0-th municipality is given by the solution to the following restricted schedule:

$$
\begin{array}{llll}
h_{k_0} = & \text{Máx.} & \sum_{j=1}^{s} u_j y_{jk} & \\
 & \text{s.a.} & \sum_{i=1}^{m} v_i x_{ik_0} = 1 & i=1,\ldots,m \\
 & & \sum_{j=1}^{s} u_j y_{jk} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 & j=1,\ldots,s \\
 & & u_j \geq \varepsilon, \quad v_i \geq \varepsilon, & k = 1,\ldots,k_0,\ldots,K
\end{array} \qquad (1)
$$

Completing the notation, u_r and v_j denote the weights for inputs and outputs, respectively, which are generated by the optimization program, ε is a non-infinitesimal Archimedean, and h_{k_0} is the efficiency index or final evaluation of the k_0-th municipality. Clearly, the version contained in the above mathematical program corresponds to the approach of output maximization.

In essence, therefore, DEA constitutes an analysis of ratios whereby the weights remain free, such that the program can assign to each unit those that maximize the value of its own global index.

Let us recall that the goal established for this analysis consists in obtaining a single, global measure for each local body. Taking this goal into account, we applied two extensions of the standard DEA model that had been developed previously, in order to adapt the potential of this technique to the economic context now being studied. These extensions were the single-input model and the constrained-weight model.

The first extension involves an atypical analysis in this methodological field, given the absence of inputs, strictly speaking. Therefore, the six economic and financial indicators selected are taken as variables that are representative of the output, and one variable, with a constant value for all the units, is taken as the sole input to the process[5]. In this context, the indicator calculated by DEA is interpreted as a global index reflecting the capacity of Spanish local authorities to improve their financial condition, the latter being addressed from the overall viewpoint derived from the six partial approaches comprising the analysis.

With respect to the second model applied, the great flexibility afforded by DEA enables us to assign zero weightings to any of the outputs and, thus, to construct final global indicators that are based solely on one dimension of the financial condition, irrespective of the level achieved in the other five dimensions. However, this is a difficult position to maintain if, as we have argued, each of these dimensions is significant and they are all independent – as was confirmed in the previous study of correlations. To solve this problem, we have an extension of DEA which has been the object of much attention in recent years[6], namely the constrained-weight model. This technique consists in limiting the effects of excessive specialization by imposing minimum and/or maximum weights to several or all of the variables employed in the study. In the empirical case analyzed in the present study, the results of a DEA evaluation with no restrictions of the weighting applied to the selected local authorities revealed that for 35% of the units the final assessment was determined on the basis of just one indicator. Even more influential was the fact that 86% of the municipalities obtained a global evaluation in which over 80% of the weighting was applied to only one of the six financial indicators. These two findings suggest that the DEA model should indeed be used with weighting restrictions, so that all the indicators considered to be significant may play a part, to a greater or lesser degree, in this evaluation. Regarding the decision to be taken on the quantitative restriction to be specified in the present case, we finally selected the severest restriction among those tested (and which the software application was capable of resolving), in the form of a simultaneous lower bound of 4% for all the weightings.

[5] Lovell and Pastor (1999), who proposed this model, showed that, providing variable returns to scale are utilized, the results obtained from using a DEA without inputs are equivalent to those obtained with a DEA in which a single constant input is included.

[6] This extension to the DEA, initially proposed by Dyson and Thanassoulis (1988), has been used in many theoretical and applied studies (Roll et al., 1991 and Pedraja et al., 1997, among others), and currently enjoys a high level of acceptance among researchers in this field.

The results derived from the definitive model for measuring financial condition revealed an average index, for all municipalities, of 48.87%. In other words, on average each local authority may increase the value of all its financial indicators by over 50% if it improves its performance at the same rate as do the best-performing municipalities in the sample. This average value is striking, as it highlights the existence of large disparities among the body of local authorities evaluated, with respect to the greater or lesser degree of success achieved in managing their financial affairs. Accordingly, there is considerable margin for a very large number of municipalities to improve their financial results.

Comparison of the results of the definitive constrained-weight evaluation with those produced by the standard free-weighting DEA model underscores the need to apply this extension to the method. The mean value of the global index of financial condition is 37 points lower in the case of constrained evaluation (an average of 86.37% with standard DEA).

This could be the consequence of purely methodological factors, by having reduced the number of possible solutions achievable with the respective mathematical programs. Nevertheless, it is highly significant that such an alteration did in fact occur, and to a dramatic extent; in a classification of some 1600 municipal councils, the mean variation in positions between one DEA and the other was 445 positions, with individual cases providing very striking variations[7] .

Accordingly, it was considered informative to split the total sample into four population size categories and to analyze the mean values produced for each subset, in order to obtain an initial evaluation of the municipal financial condition by population sectors.

[7] For example, the municipality of *Limpias*, which in a standard DEA allowing specialization would have been classed as efficient and therefore would be at the top of the list, with the other 41 efficient municipalities, would be demoted to last position of the 1600 evaluated if the six financial indicators were considered; on the contrary, the municipality of *Torremejía* would rise from position 1481 with free weighting to position 72 in the definitive evaluation of its financial condition.

Table 1. Financial condition divided by population size.

	Local authorities	Mean index of financial condition		Standard deviation	
Population		DEA without constrained weighting	DEA with constrained weighting	DEA without constrained weighting	DEA with constrained weighting
1,000-5,000	981	87.88	52.42	9.63	14.31
5,000-10,000	367	83.29	45.11	9.46	10.71
10,000-15,000	156	85.68	47.07	6.65	11.73
15,000-20,000	88	86.28	46.27	5.82	13.37
Total	1592	86.36	48.87	8.45	13.10

The results of dividing the sample in this way are shown in Table 1; it can be seen that the number of inhabitants in each municipality could affect its financial condition (an aspect which is examined in more detail below) because, both in the DEA with unconstrained weighting and in the constrained-weight version, the smaller municipalities (with 1000-5000 inhabitants) obtain the best results.

3. Evaluating efficiency in municipal costs.

3.1. Background.

Local councils play a fundamental role today in shaping the provision of public services in Spain. They constitute a body of organizations which, over time, have expanded the range of powers they undertake in this field. This has led to an accumulation of functions and hence increased expenditure and a greater influence within the Spanish economy. Thus, the spending by local authorities in Spain as a proportion of total public expenditure rose from 9.7% in 1980 to 12.7% in 1999 and to almost 15% by late 2005. In all, over 50% of public expenditure in Spain is now decentralized (Gil-Ruiz and Iglesias, 2007).

A great many studies have been published seeking to analyze, fundamentally by means of DEA, the technical efficiency of the provision of a public service by a group of supplier units in a given geographic area, but practically all of these studies have focused on a single, specific service (waste collection, policing, the fire service, urban transport, water distribution, etc.[8]). This absence of a global analysis of the technical efficiency attained by a set of local councils is due to a problem that is, indeed, almost unanswerable: how to combine (both in outputs and in inputs) the physical units employed/obtained in relation to services which present such a high degree of heterogeneity in their goals and in the effort directed to these purposes[9].

Let us now focus on the evaluation of efficiency in municipal costs, which is a more suitable parameter than technical efficiency for the case in question, and will be the approach used subsequently. The services provided by each municipal body are taken as a start point, and the costs arising from these services are calculated (as, therefore, are the budgetary overruns with respect to the costs reported by “best practice” municipal bodies). In this case, we already have available for analysis the budgetary and monetary magnitudes, and so we avoid some of the problems encountered with technical efficiency in combining the variables related to the whole group of services, at least as regards the inputs. The study normally considered to be the groundbreaker in the evaluation of municipal cost efficiency is that by Vanden Eeckaut et al. (1993). As it is cost efficiency that must be measured, these authors identified the costs for each municipality, using only current or ordinary costs. Regarding the results variables, in order to overcome the problem of aggregating diverse services, the authors proposed a solution that, with more or fewer variations and in full awareness of its inherent limitations, has been followed by practically all subsequent studies measuring municipal cost efficiency. This proposal involves the use of proxy indicators, i.e. indirect approximations which reflect only the need for public services from the standpoint of demand (the clearest example of such a proxy indicator, for this purpose, is that of the variable

[8] For the case of Spain, in particular, see studies focusing on refuse collection (Bosh et al., 2000), policing (García-Sanchez, 2009) or water distribution (García-Valiñas and Muñiz, 2007; Picazo-Tadeo et al., 2007), among others.

[9] See De Borger et al. (1994), one of the most commonly cited attempts to evaluate overall municipal technical efficiency, where an ad hoc attempt is made to attenuate the problem of aggregating the inputs and outputs of different services provided. This is done by selecting indicators of quantity, which in the authors’ opinion reflect with greater representativity the diverse services provided by local government. These indicators include the number of primary schoolchildren, beneficiaries of income subsidies, and the number of kilometres of streets.

"population"). The route opened up by the latter study was later expanded by De Borger and Kerstens (1996a, 1996b). Subsequent publications describing applications of this methodology have appeared in various countries, including the USA (Moore et al., 2005), Portugal (Afonso and Fernandes, 2006), Korea (Sung, 2007) and Spain. With respect to studies in Spain with particular attention to municipal cost efficiency, the most important ones published have been the recent papers by Giménez and Prior (2003), Balaguer-Coll (2004), Balaguer-Coll et al. (2007a), Giménez and Prior (2007) and Balaguer-Coll and Prior (2007).

As may be inferred from the above, the central problem in measuring municipal cost efficiency lies in the selection of results indicators that span as broad a range as possible of the municipality's global activities. Seeking to highlight common features, we see that one of the output indicators most frequently utilized, in global terms, is that of population. As observed by Balaguer-Coll (2004), this is a measure that is "*indicative of the volume of services that should be provided by the local body*". Other factors often taken into account are based on the consideration of population sectors that benefit especially from certain municipal services; these include the elderly, the unemployed and other beneficiaries of social and educational services, or on the extension of the highway network, or the surface area of the municipality (seeking to account for services such as street lighting and cleaning, or public transport), as well as more specific indicators related to particular services (the tonnes of waste collected, the volume of water supplied or the number of street lamps). Regarding differences among countries, it is notable that there, unlike studies carried out in Spain, output indicators may include the beneficiaries of local educational services and those of unemployment benefit or minimum wage payments. In Spain, these services are mainly the responsibility of regional, not local government.

3.2. Evaluating the cost efficiency of local government in Spain.

With respect to the analysis made of cost efficiency evaluation, we use the same database as was employed for measuring financial condition, which involved 1592 municipalities in Spain with a population of less than 20,000. In selecting the relevant variables, the guidelines set out in the above-mentioned forerunner study were followed. Thus, and regarding the variables to be used as proxies for the services provided, Table 2 shows the five outputs selected as indicators of the minimum services evaluated. This information was obtained from the Spanish Survey of Municipal Resources and Infrastructure (2000).

Table 2. Minimum services to be provided by a municipality with a population of fewer than 20,000 inhabitants, together with the respective output indicators.

Service evaluated	Output
Street lighting	Number of street lamps
Cemetery	Total population
Waste collection	Tonnes of waste collected
Street cleaning	Length of the highways network
Access to clean drinking water	Total population and length of the highways network
Physical access to the town centre	Length of the highways network
Regulations regarding food and drink	Total population
Public parks	Surface area of public parks
Libraries	Total population
Markets	Total population

The analysis also applies a sixth variable, which is indicative of the quality of the services provided. This is applied using various measures of quality, according to the service in question (see Table 3), combining these into a single index, by means of the mean value weighted by the number of physical units of each service. These data, too, were obtained from the Spanish Survey of Municipal Resources and Infrastructure (2000).

Table 3. Indexes of quality, by services provided.

	Output	Quality index
Highway infrastructure	Surface area of highway infrastructure (M)	Condition of road or pavement surface, rated on a scale of: [1] poor quality; [2] moderate quality, [3] good quality. "Quality" measured according to the number of bumps, cracks and/or potholes in the road surface.
Surface area of public parks	Surface area in m^2 / No. of inhabitants	Condition of parks, rated on a scale of: [1] poor quality; [2] moderate quality, [3] good quality. "Quality" measured according to the number of elements in poor condition (grass, paths, installations)
Street lighting	Number of street lamps / Total length of road network (M)	Condition of street lamps, rated on a scale of: [1] poor quality; [2] moderate quality, [3] good quality. "Quality" measured according to the deterioration to elements (lamps, wiring, junction boxes, lighting elements), or the absence of nocturnal lighting, or continued illumination during the day.
Waste collection	Tonnes of waste collected (Tn)	Adequacy or otherwise of the service, rated on a scale of: [1] inadequate; [2] adequate. The service will be evaluated taking into account the following aspects: - Insufficient provision of waste bins - Cleanliness of waste bins - Regularity of waste collection - Condition of waste bins

Finally, and regarding the four inputs to be employed, the relation between these and the budgetary items are shown in Table 4; these data were obtained from the Directorate General for Financial Coordination with Local Organizations (Ministry of Economy and Finance, 1999). The descriptive statistics for all the above variables are shown in Annexe 2.

Table 4. Inputs used in evaluating cost efficiency.

Personnel costs (I1)	Chapter 1 in the expenditure budget
Expenditure on goods and services (I2)	Chapter 2 in the expenditure budget
Current transfers (I3)	Chapter 4 in the expenditure budget
Real investments (I4)	Chapters 6 and 7 in the expenditure budget

The analysis shows the mean efficiency index, for all local authorities, to be 66.45%; thus each municipality, on average, could reduce the cost of its activities by over 30%. However, and as mentioned above, local councils in Spain typically provide services taking into account the size of the population to be served, and thus the results for the average global efficiency could be complemented with the information derived from an analysis of local government performance adjusted for the number of inhabitants; the results by population size are shown in Table 5.

Table 5. Analysis of cost efficiency, by population size.

Population	No. of municipalities	Mean index of efficiency	Standard deviation
< 5,000	981	65.07	20.77
5,000 - 10,000	367	65.19	19.32
10,000 - 15,000	156	69.73	18.18
15,000 - 20,000	88	73.93	19.57
Total	1592	66.45	20.50

Table 5 shows that levels of efficiency rise with increasing population, which could be considered a first indication of the existence of increasing economies of scale in the provision of municipal services at the level considered in this study. This aspect is further analyzed in the following section.

4. The relation between financial condition, cost efficiency and the quality of services provided: hypothesis and its testing.

From the analyses performed thus far, we see it could be useful to investigate the relations existing among the measures obtained regarding municipal economic performance. For this purpose, we now examine a series of hypotheses, using non-parametric methodologies. To the best of our knowledge, in the area of local public administration, no studies have previously been made of the relation between efficiency in financial performance and cost efficiency. Regarding local administration, some studies have set out to identify the relation between cost efficiency and variables of an economic-financial nature, but these papers have always been based upon the use of partial indicators (using second-stage studies) rather than taking a global standpoint.

The economic-financial variables used in the above studies were, fundamentally, taxation, transfers, budget deficit and debt. In general, a negative relation has been found between these variables and the levels of cost efficiency (Silkman and Young, 1982; Davis and Hayes 1993; De Borger and Kersterns, 1996; De Mello, 2002[10]; Dijkgraff et al., 2003; Balaguer-Coll et al., 2007). To date, though, no such study has sought to measure these types of relationships in a global way, using different ratios regarding municipal financial sufficiency in relation to the types of revenues received, in order to test whether a local council that is cost efficient in its production is also efficient regarding its financial margins. With the aim of extending our understanding of these questions, we propose a set of hypotheses to be tested, including in each one a hypothesis related to the size of the municipality.

4.1. Hypotheses to be tested.

It might be supposed that local councils which minimize their costs of providing services would also present an excellent financial condition, having shown themselves capable of developing an ample margin between revenues received and costs incurred. In consequence, the distributions of financial condition efficiency and of cost efficiency would be expected to be similar. Another assumption, on the other hand, is that councils achieving greater cost efficiency might make less effort to obtain fresh revenues and accordingly might not be so efficient regarding their financial condition; in this case, the distributions in each case would be different. With these considerations in mind, we propose the following hypothesis:

H_1: The distribution function for financial condition efficiency is the same as that for cost efficiency, when the quality of the services provided is not taken into account.

In addition to this hypothesis, we suggest the possibility that the relation between financial condition efficiency and cost efficiency might be affected by the inclusion of the quality of the services provided. For this reason, we formulate the following hypothesis:

H_2: The distribution function for financial condition efficiency is the same as that for cost efficiency, when the quality of the services provided is taken into account.

[10] Although the study by De Mello (2002) is not conclusive regarding the sign of the relation between costs and financial variables, as the latter vary depending on the type of service being evaluated.

Furthermore, the municipalities that are more cost efficient might be so because they do not require a sufficient level of quality of the services provided. Therefore, we also examine whether, when the variable “quality” is included in the calculation of cost efficiency, there are significant differences between the distributions. If there were no such differences, this would suggest that service quality does not influence whether a local authority is efficient or not (or in other words, that those which are most efficient in terms of quantity are equally efficient in quality). On the other hand, if the two distributions varied, this might be indicative of the existence of such a trade-off between cost efficiency and service quality.

H_3: The distribution function for cost efficiency, when the quality of the services provided is taken into account, is the same as when this service quality is not considered.

In the following three hypotheses, we study the effects of hypotheses 1-3 when the distribution function with respect to the size of the municipality is removed. Many published studies have argued that there exist economies and diseconomies of scale in the production of goods and services. Thus, Boyne (1996) published a curve relating population and efficiency, in an analysis of the waste collection service provided by six local authorities in the United Kingdom. Analyses of the efficiency achieved by Spanish municipalities (Balaguer-Coll et al., 2007; Benito et al., 2008 and Balaguer-Coll and Prior, 2009) have shown there is a positive relation between efficiency and population size.

Regarding the relation between cost efficiency and service quality, when population size is taken into account, various views have been expressed. Niskanen (1971) held that large organizations tend to offer services at higher cost and provide lower levels of quality. It has also been argued, however, that smaller bodies, in order to meet the high costs they face, reduce levels of quality so as not to raise tax rates (Christoffersen and Larsen, 2003). With respect to financial condition, in principle it might be thought that local authorities providing higher levels of service could also run into greater financial difficulties. Thus, the study by Zafra-Gómez et al. (2009) showed that the financial condition is better among councils providing lower levels of services, i.e. those where the population is smaller.

With all these considerations in mind, it remains to be determined whether there are differences among the distribution functions for financial condition, cost efficiency and quality, with respect to varying population sizes among municipalities. Therefore, the following hypotheses are proposed:

H_4: The distribution function for financial condition efficiency is the same as that for cost efficiency, when the quality of the services provided to different population sizes is not taken into account.

H_5: The distribution function for financial condition efficiency is the same as that for cost efficiency, when the quality of the services provided to different population sizes is included.

H_6: The distribution function for cost efficiency when the quality of the services provided is included is the same as that for cost efficiency when the quality of the services provided to different population sizes is not included.

Let us now discuss the results obtained regarding the above hypotheses.

4.2. Methodology for testing the hypotheses, and discussion of the results obtained

The tests of the above hypotheses are based on the results of the various DEA models developed in the above sections. Specifically, if we assume that in each of the hypotheses two different distributions are to be tested, f(B) and g(Y), which correspond to two DEA models examined in this study, we can test whether they are significantly different, taking as a null hypothesis Ho: f(B) = g(Y) and as an alternative hypothesis Ho: f(B) ≠ g(Y).

Traditionally, in order to test whether two distributions are significantly different or not, the value used is either the t value for related parametric samples or the Wilcoxon value for non-related non-parametric samples. However, there does exists an alternative to the use of these tests based on mean values, one that refers to the notion of global distance, or closeness, between two densities f(x) and g(x), via their integrated square error (Pagan and Ullah, 1999). The methodology used to determine whether there exist significant differences, following Pastor and Tortosa-Ausini (2008), is based on Li's test (1996), which measures the distance between the two density functions using the integrated square error of these functions:

I(f,g) = $\int_x (f(x) - g(x))^2 dx$ (2)

where f and g are estimated using kernel methods, such that:

$$\hat{f}(x) = \frac{1}{nh}\sum_{j=1}^{J} k\left(\frac{x_j - x}{h}\right)$$ (3)

$$\hat{g}(x) = \frac{1}{nh}\sum_{j=1}^{J} k\left(\frac{y_j - y}{h}\right)$$

and therefore, the estimator of the distance between the two functions is expressed as:

$$\hat{I} = \frac{1}{n^2 h}\sum_{i=1}^{n}\sum_{\substack{j=1 \\ j\neq i}}^{J}\left[k\left(\frac{x_i - x_j}{h}\right)k\left(\frac{y_i - y_j}{h}\right) - k\left(\frac{y_i - x_j}{h}\right) - k\left(\frac{x_i - y_i}{h}\right)\right]$$ (4)

Taking into account that the integrated square error is obtained by

$$T = \frac{Rh^{1/2}\,\hat{I}}{\hat{\sigma}}$$ (5)

where

$$\hat{\sigma} = \frac{1}{R^2\,\pi^{1/2} h}\sum_{i=1}^{R}\sum_{j=1}^{R}\left[k\left(\frac{x_i - x_j}{h}\right)k\left(\frac{y_i - y_j}{h}\right) + 2k\left(\frac{x_i - y_i}{h}\right)\right]$$ (6)

However, as remarked by Simar and Zelenyuk (2006) it is necessary to adapt Li's test when efficiency measures are employed in DEA. This adaptation consists in the bootstrap application of the p values of Li's test (1996) by

$$\hat{p} = \frac{1}{B}\sum_{b=1}^{B} J\{\hat{I}^b > \hat{I}\}$$ (7)

where b=1, … B is the number of bootstrap repetitions. Now, by using Algorithm 2 proposed by Simar and Zelenyuk (2006), based on the calculation and bootstrapping of Li's statistic (1996), and using the estimates obtained by DEA in which they are made equal to one, the latter are smoothed, far from the frontier, by the addition of a small degree of noise (5% of the empirical DEA distribution, and ignoring the values equal to one, but with an order of magnitude smaller than the estimation noise). As observed by Simar and Zelenyuk (2006), the smoothing is described by:

$$\hat{E}_i = \begin{cases} \hat{E}_i + \varepsilon_i & \hat{E}_i = 1 \\ \hat{E}_i & otherwise \end{cases}$$ (8)

where $\varepsilon_i = Uniform\left(0, \min\left\{R^{-\frac{2}{M+P+1}}, a\right\}\right)$ and where *a* is the $\propto$ quantile of the empirical distribution of efficiency, ignoring values equal to one[11].

Moving on to discuss the results obtained, Annexe 3 shows the density functions obtained from the comparison of distributions. On comparing the distribution of financial condition efficiency and cost efficiency, taking quality into consideration or otherwise (H1 and H2), it is evident that the two options present different shapes. While for the financial condition functions (solid line), the concentration of the probability mass lies more towards the left, around the value of 40, the cost functions (dotted line) present a corresponding concentration around the values of 60, 75 and 100, and to a lesser degree, 30, indicative of a greater dispersion of the results. For the case of Hypothesis 3, which compares the cost efficiency values with (solid line) and without (dotted line) quality, we observe greater densities around efficiency levels of approximately 30, 50, 70 and 100. These results, even before obtaining those from Li's test (1996), show that it is necessary to evaluate both financial condition and productive efficiency if we wish to achieve a global evaluation of municipal performance. Moreover, they also show that the most efficient councils regarding costs present a lower degree of motivation towards achieving optimum financial management.

We see, also, that the probability concentrations for cost efficiency when the question of quality is disregarded (CE – dotted line) are more left-leaning than those that include this variable (QCE – solid line) (H3). Also noteworthy is the fact that the values for probability concentrations are higher in the model in which quality is included than when this variable is omitted. It can be concluded, hence, that there do not seem to be large differences between cost structures with and without the inclusion of quality, as regards municipalities in Spain, as has been reported by Balaguer-Coll and Prior (2009).

[11] See Simar and Zelenyuk (2006) for more details.

Table 6. Results of checks made using Li's test (Simar & Zelenyuk, 2006).

Hypothesis to be tested	Null Hypothesis (H_o)	T	p-value
H2: DEA FC and DEA QCE	$f(DEA\ FC) = g(DEA\ CEQ)$	141.0863	0.0000
H5: DEA FC and DEA QCE in POP<5000	$f(DEA\ FC^{POP<5000}) = g(DEA\ CEQ^{POP<5000})$	76.92332	0.0000
H5: DEA FC and DEA QCE in 5000>POP<10000	$f(DEA\ FC^{5000<POP<10000}) = g(DEA\ CEQ^{5000<POP<10000})$	32.39106	0.0000
H5: DEA FC and DEA QCE in 10000>POP<15000	$f(DEA\ FC^{10000<POP<15000}) = g(DEA\ CEQ^{10000<POP<15000})$	22.83072	0.0000
H5: DEA FC and DEA QCE in 15000>POP<20000	$f(DEA\ FC^{15000<POP<20000}) = g(DEA\ CEQ^{15000<POP<20000})$	31.31845	0.0000
H1: DEA FC and DEA CE	$f(DEA\ FC) = g(DEA\ CE)$	94.6675	0.0000
H4: DEA FC and DEA CE in POP<5000	$f(DEA\ FC^{POP<5000}) = g(DEA\ CE^{POP<5000})$	46.59409	0.0000
H4: DEA FC and DEA CE in 5000>POP<10000	$f(DEA\ FC^{5000<POP<10000}) = g(DEA\ CE^{5000<POP<10000})$	24.43008	0.0000
H4: DEA FC and DEA CE in 10000>POP<15000	$f(DEA\ FC^{10000<POP<15000}) = g(DEA\ CE^{10000<POP<15000})$	16.78272	0.0000
H4: DEA FC and DEA CE in 15000>POP<20000	$f(DEA\ FC^{15000<POP<20000}) = g(DEA\ CE^{15000<POP<20000})$	26.79889	0.0000
H3: DEA QCE and DEA CE	$f(DEA\ CEQ) = g(DEA\ CE)$	4.905081	4.669442e-07
H6: DEA QCE and DEA CE in POP<5000	$f(DEA\ CEQ^{POP<5000}) = g(DEA\ CE^{POP<5000})$	4.215087	1.248410e-05
H6: DEA QCE and DEA CE in 5000>POP<10000	$f(DEA\ CEQ^{5000<POP<10000}) = g(DEA\ CE^{5000<POP<10000})$	0.5168286	0.3026379
H6: DEA QCE and DEA CE in 10000>POP<15000	$f(DEA\ CEQ^{10000<POP<15000}) = g(DEA\ CE^{10000<POP<15000})$	0.4237376	0.3358786
H6: DEA QCE and DEA CE in 15000>POP<20000	$f(DEA\ CEQ^{15000<POP<20000}) = g(DEA\ CE^{15000<POP<20000})$	0.03191906	0.4872683

Similar conclusions can be drawn from the analyses by population size (H4, H5 and H6). On analyzing the density functions for Hypotheses 4 and 5, we observe that the FC-QCE and FC-CE distributions (solid and dotted lines, respectively) present differing accumulated probabilities regarding the efficiency values. For the population segment of 5,000-10,000 inhabitants, the density functions are more similar, but the differences between the two distributions increase with larger populations.

Regarding Hypothesis 6, which addresses the question of QCE-CE distributions, it can be concluded that the differences between the two are minimal, except in the case of municipalities with fewer than 5,000 inhabitants. For these smaller areas, the density functions are very similar to those obtained in Hypothesis 3, with important differences between the two distributions. This situation corroborates the argument presented in previous papers, according to which smaller municipalities sacrifice quality when costs are high, so as not to raise levels of taxation (Christoffersen and Larsen, 2003). In contrast, the results for the municipalities with more than 5,000 inhabitants are similar to those obtained by Balaguer and Prior (2009), who remarked that "in our sample of Spanish municipalities, the trade-off between productivity and quality is not an important issue", although their results were not tested with respect to population size.

The above conclusions are ratified by Li's test, with the modification suggested by Simar and Zelenyuk (2006), as shown in Table 6. This table shows all the distributions to be different, except when we compare the cost efficiency, including or omitting the quality variable, and with respect to municipalities with more than 5,000 inhabitants.

These results show, thus, that it is not sufficient to measure cost efficiency and the quality of the services provided; we must also determine the efficiency of the financial structures of the municipalities being evaluated, because a council might be efficient as regards costs and quality, but nevertheless not be making best use of its financial resources, and thus be suffering from inefficient financial management.

5. Conclusions

The study and evaluation of the financial management performed by local government is a highly topical issue, mainly because of the vigorous processes of decentralization currently taking place in many developed countries. This increase in the range of competences being assumed locally, theoretically justified by the greater proximity of these administrations to the needs and preferences of their populations, has been accompanied by an ongoing debate in the literature as to the operativity and real efficiency of these bodies as providers of public services. The present study combines, for the first time, two viewpoints of municipal financial performance – financial condition and cost efficiency.

The sample used included nearly 1,600 municipalities in Spain with fewer than 20,000 inhabitants. This represents the largest such sample ever employed in a study of this type in Spain, and required a high level of commitment to obtain and process the data involved. The use of such a wide-ranging sample ensures the conclusions drawn from the study are rigorous and consistent, despite the considerable complexity involved in obtaining accurate financial, productive and demographic data for all the municipalities evaluated. The methodology applied was based on the basic DEA model, adapted to suit the particular characteristics of each context examined. Thus, in the case of the evaluation of financial condition, we considered it appropriate to implement extensions with a constant input and constrained weighting.

After having reviewed the literature concerning financial condition and the measurement of municipal cost efficiency, we performed an analysis to evaluate the financial condition. The results of this analysis confirm the correctness of the decision to adopt two extensions to the basic DEA model, as the application of the standard model revealed a high level of specialization among the municipalities on the basis of just one or two of the six indicators selected for the evaluation, which would have biased the global approach we sought to achieve.

After performing a parallel evaluation of cost efficiency for the same sample of municipalities, following the methodological guidelines recommended in previous papers, we identified six hypotheses for testing, each supported in one way or another in the bibliography, related to the existence or otherwise of links between financial condition and cost efficiency, as well as the role of quality in the latter case. The results obtained, both from the study of density functions of the data compiled and from the application of Li's test (1996), with the modification proposed by Simar and Zelenyuk (2006), reveal the existence of differences between financial condition and cost efficiency density functions. This means that municipalities that are more efficient in terms of productive costs are not related to those presenting a more efficient financial structure, but are characterized by presenting a degree of relaxation in the search for better financial margins, precisely because they are more efficient as regards costs.

In addition, with respect to the relation between cost efficiency and the inclusion or otherwise of quality, the distributions were only found to be similar in the case of municipalities with a population exceeding 5,000 inhabitants. This supports the argument made in previous papers to the effect that smaller municipalities, when faced with higher costs in the provision of the required quantity of public services, prefer to reduce the quality of these services rather than raise taxation, thus revealing the existence of a trade-off between the quantity and quality of service in such cases. This is not the case among larger municipalities, where the most cost efficient continue to be so even when the quality of the service provided is taken into account.

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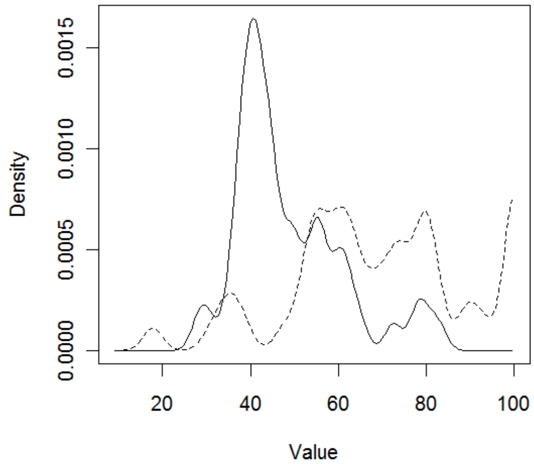
ANNEXE 1. Indicators of financial condition.

Elements		Indicators	Definition	Average	S.D.	Max.	Min.
Cash solvency		Index of short-run solvency	Liquid funds and net chargeables, divided by net payables	1.96	2.13	41.19	0.20
Budgetary solvency	Flexibility	Index of the weight of the financial load	Recognized receivables for current operations, divided by recognized obligations incurred as a consequence of interests and financial repayments	24.36	19.23	97.93	0.48
	Independence	Index of financial independence or self-funding	All recognized receivables, except those obtained from transfers or grants. divided by recognized obligations	0.51	0.20	1.54	0.09
	Sustainability	Index of non-financial budget result	Receivables divided by obligations (in both cases, derived from non-financial operations, and with financial assets)	1.02	0.17	3.16	0.43
		Index of income execution	Degree of success achieved in the managers' definitive forecasts, expressed as recognized receivables divided by definitive forecasts	0.83	0.16	1.68	0.22
		Index of current revenues received	Degree of effective receipt of recognized receivables. expressed as net revenues divided by net recognized receivables	0.85	0.10	1	0.27

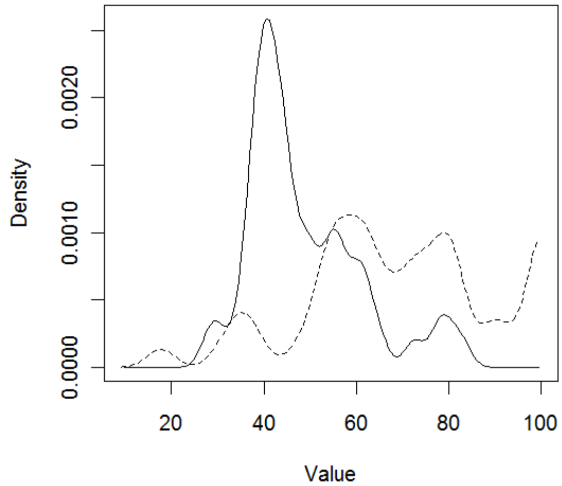
ANNEXE 2. Descriptive statistics of the variables employed in evaluating cost efficiency .

VARIABLE	AVERAGE	S.D.	MAX.	MIN.
PERSONNEL COSTS (I1)	160578413	173229371	1424772853	7796913
CURRENT COSTS: GOODS AND SERVICES (I2)	130902463	146982312	2057496780	8516490
CURRENT TRANSFER COSTS (I3)	32833167.8	57356378.5	1357880953	140750
INVESTMENT COSTS (I4)	153672503	173725519	2577928441	56905
WASTE COLLECTION (O1)	2808.75	5876.03	164105.1	1.679
LIGHTING (O2)	1087.29	1093.98	21376	2
STREETS (O3)	241916.07	221504.04	2761250	1428
PARKS (O4)	77552.59	854830.22	25019311	40
POPULATION (O5)	5267.84	4453.34	19977	1002
QUALITY (O6)	7.94	0.86	9.98	4.18

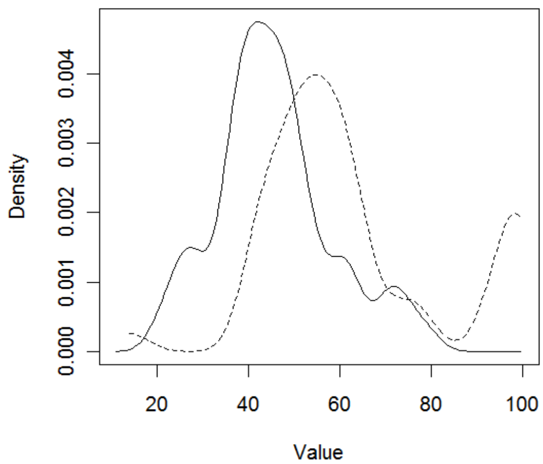
Annexe 3. Kernel density functions.



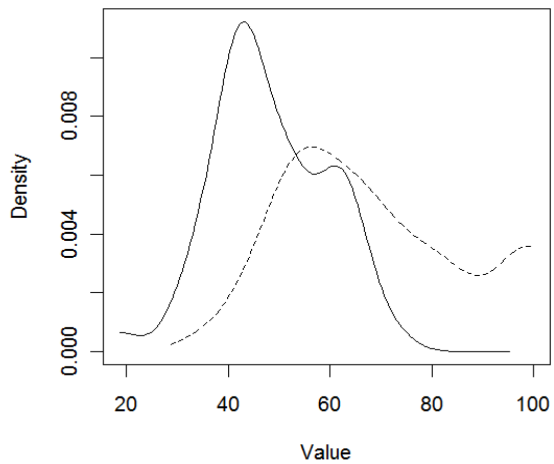
H2: DEA FC and DEA



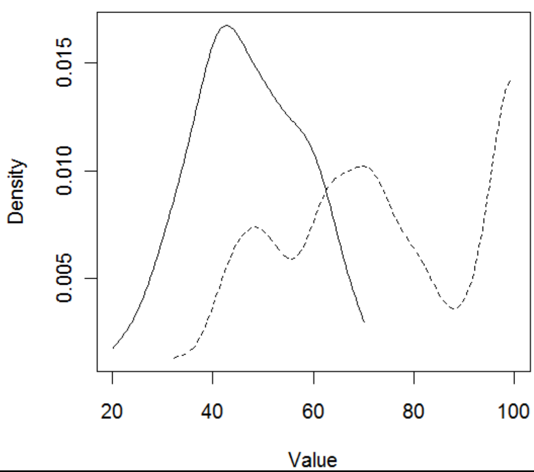
H5: DEA FC and DEA QCE in POP<5000



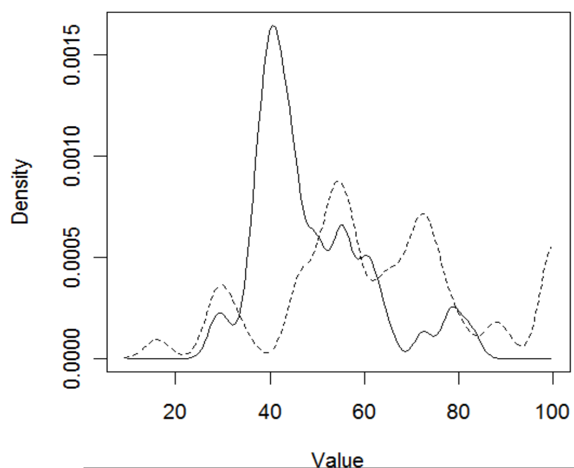
H5: DEA FC and DEA QCE in 5000>POP<10000



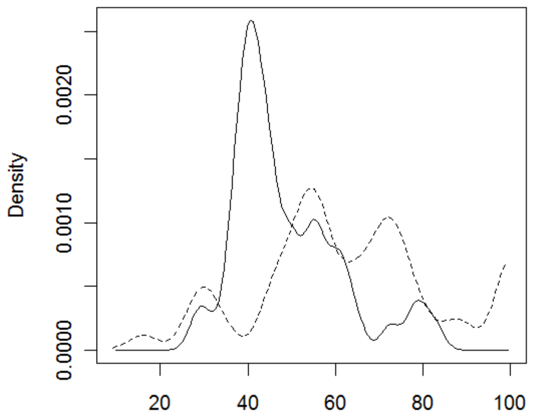
H5: DEA FC and DEA QCE in 10000>POP<15000



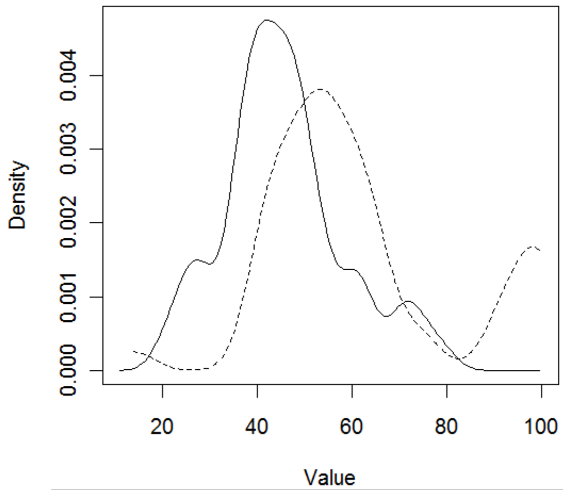
H5: DEA FC and DEA QCE in 15000>POP<20000



H1: DEA FC and DEA CE



H4: DEA FC and DEA CE in POP<5000



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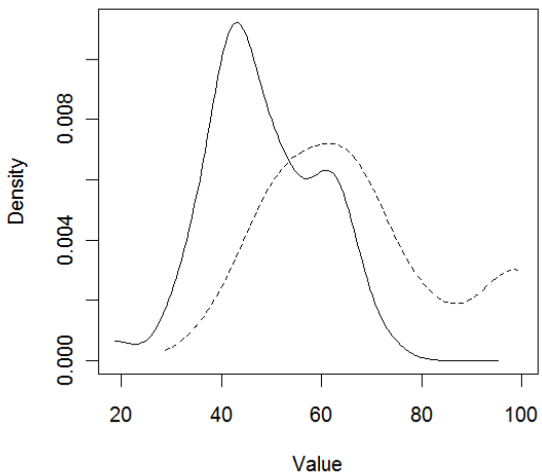

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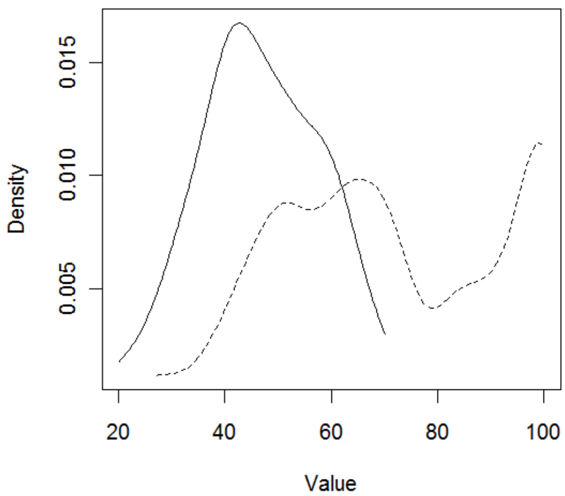

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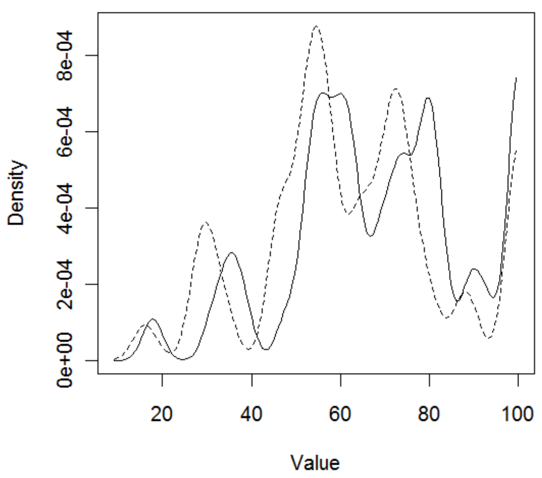
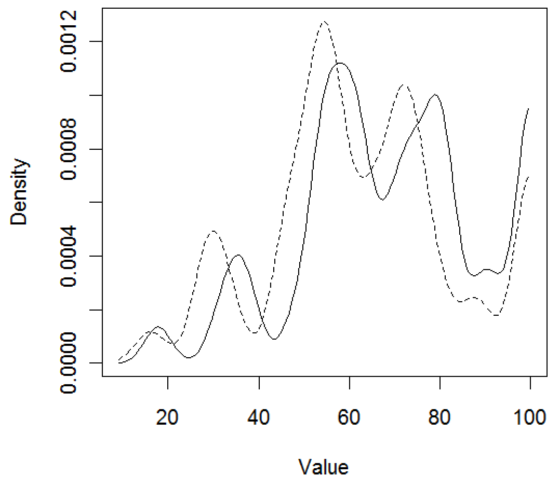
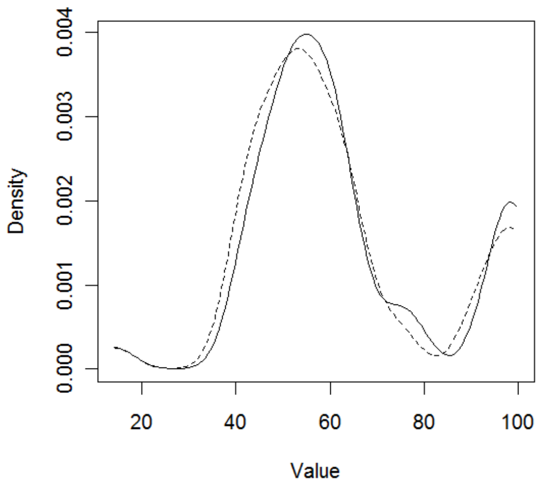


H3: DEA QCE and DEA CE



H6: DEA QCE and DEA CE in POP<5000



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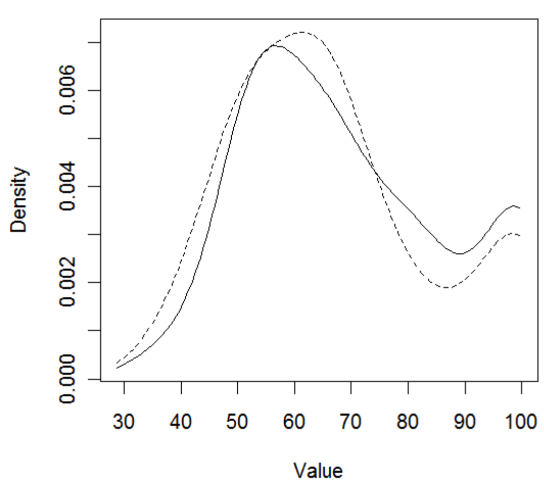
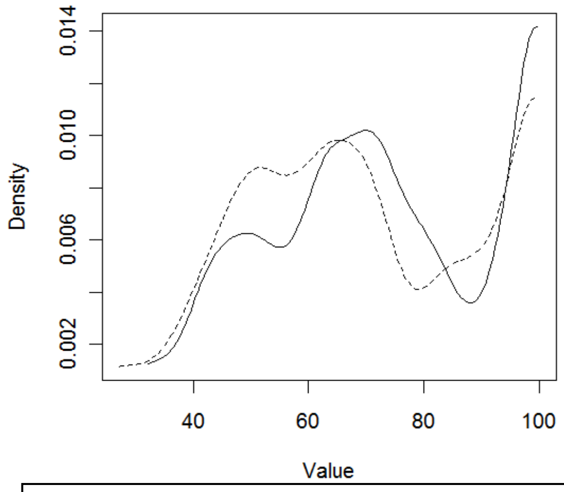


H6: DEA QCE and DEA CE in 10000>POP<15000



H6: DEA QCE and DEA CE in
15000>POP<20000

FC = Financial Condition; QCE = Quality-cost efficiency; CE = Cost efficiency

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