PORTUGUESE LOCAL GOVERNMENT RELATIVE EFFICIENCY: A DEA APPROACH

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Abstract

It is widely accepted that performance measurement in the Public Sector is a difficult task, either in terms of efficiency or in terms of effectiveness. The most important reason for this relates to the lack of objective measures, given the market-aside operation of governmental activities. Therefore traditional methods of performance measurement, such as those based on the operating statement and the net income, tend fail. It is typical that public bodies' outputs are multiple and qualitative and consequently do not have the physical characteristic of being countable or divisible.

Portuguese Local Government has, in the last decade, undergone considerable management changes under the flag of efficiency improvement, namely additional competencies, supplementary and more diverse financial resources and a new accounting system.

In this context, this paper assesses the efficiency of Portuguese Continental municipalities, using year 2004 data and following a data envelopment analysis (DEA) methodology in order to provide a relative efficiency indicator. The analysis compares the ratio between resources as inputs ("undertaken commitments") and the activities accomplished as outputs, considering the functional classification used in municipalities' accounting and financial system.

This research adds to the knowledge of local authorities' performance the possibility of establishing a functioning ranking, nowadays increasingly important in what concerns financing issues. The preliminary results show that larger municipalities tend to be more efficient.

INTRODUCTION

In last decades one has witnessed a worldwide increasing interest in the issues of public sector efficiency. Problems of controlling public expenditure have led to a growing emphasis on the public sector output and productivity (Ganley and Cubbin, 1992). Within the EU context, growing attention has been given to the quality and efficiency of public spending, given the overall financial constraints faced by governments in most countries (EC, 2004). In what concerns local government, the debate over spending efficiency has been renewed with the implementation of decentralisation policies designed to refocus public decision-making from central to municipal levels of government (Afonso and Santos, 2003).

Regardless the level of government, the efficiency issue is central since it concerns making better use of the taxpayers' money by maximising the relationship between the available resources and the products or services provided.

Apart from the need to evaluating public expenditure efficiency for fiscal and deficit control reasons, there is an increasing interest in assessing Portuguese municipalities' creditworthiness (ratings), a purpose to which efficiency measurement seems to be important for.

The purpose of this paper is to evaluate Portuguese municipalities' relative efficiency, based on 2004 data of Continental Portugal, in order to rank their performance.

The methodology of data envelopment analysis (DEA) is applied, combining different indicators and considering "undertaken commitments" as inputs and accomplished activities as outputs. Since a cross-section comparison is made between each municipality and all the others, this allows obtaining a relative efficiency position. The objective is not showing which values that position should assume in order a municipality to be efficient ("best values"), but instead is reaching an efficiency frontier that limits Portuguese municipalities' efficiency perimeter, against which municipalities are positioned. This defines the maximum level of outputs that could have been produced by the most efficient municipalities with the resources available or the minimum level of inputs necessary to maintain the level of services offered.

Ranking municipalities' performance is important since it allows encouraging those farther from the efficiency frontier to make improvements as well as others situated over that line to try keeping their positions. Central government can also have a broad picture on how municipalities are performing with the available resources at the moment.

Furthermore, a few larger municipalities (e.g. Porto) are considering the possibility of diversifying financing sources are concerned about reaching credit ratings which efficiency relative positions are central for.

Although efficiency evaluation is simply a tool and not an aim itself, it allows enhancing weaker points regarding which improvements have to be made (Torres, 2002).

The paper makes a contribution by new evidence on municipalities' performance and adds to other important studies (e.g. Afonso and Fernandes, 2003 and 2005) the use of inputs measures that are not strictly cash-based – undertaken commitments instead of payments – as well as a different perspective of performance and efficiency analyses having in mind an investors' perspective.

The remainder of the paper is organised as follows. Section 1 offers an overview of Portuguese local government framework, namely addressing organisation, responsibilities, funding and the accounting system. In Section 2 issues concerning efficiency in the public sector are considered, such as measurement problems, reference values, measures suggested by international organisations and difficulties in establishing input and output indicators. Some relevant empirical analyses on local government efficiency are summarised in Section 4. Section 5 presents the empirical study addressing the data and methodology and discussing the results. The paper concludes with final considerations.

1. PORTUGUESE LOCAL GOVERNMENT FRAMEWORK

Unlike in most other Western European countries that have one or two intermediate tiers of government between central government and municipalities, Portugal has a three-tier public sector system that includes central government, municipalities and boroughs. The absence of intermediate tiers of government makes the link between central government and municipalities stronger (a positive credit factor) as it ensures tight central government controls on the one hand, and on the other, it allows direct negotiations between the two tiers of government (FitchRatings, 2005).

Municipalities are the local authorities assuming more importance, either referring to political decision power or to financial expression. Boroughs are small jurisdictions with few own competencies, performing tasks that are delegated from the respective municipalities (Bravo and Vasconcellos e Sá, 2000).

Portuguese municipalities' main responsibilities are set out in Decree by law 169/99, which was then amended by law 5A/2002 and includes:

- Urban and rural infrastructure (local road network, markets, cemeteries, parks and urban planning);
- Street lighting;
- Education – primary and nursery schools (including construction and maintenance school canteens and non-teachings staff salaries);
- Civil protection and the police (including fire fighters);
- Housing (financing low income housing);

- Environment (water supply and treatment, street cleaning and waste treatment);
- According to the latest information there are currently no plans to transfer further responsibilities were to be transferred, according to the Portuguese Constitution central government would have to grant adequate transfers to the municipalities as it did in the past.

Under the funding law approved in 1998, Portuguese municipalities benefit from central government mandatory transfers that reallocate 33% of the three main taxes – VAT, corporate tax and personal income tax – collected by central government two years previously.

In addition, Portuguese municipalities also received four taxes (municipal particular revenues) that are collected by the central government and then returned to the municipality (the property ownership tax, vehicle tax, the property sales tax and a surcharge on corporate income). Parliament retains legislative power to modify local taxes, while municipalities have some limited discretion on modifying tax rates. The last major national tax reform's occurred in 2002 and were related to two main taxes – the tax on property ownership and transfers.

Traditionally, the bulk of Portuguese municipalities' revenue (excluding new borrowing) is operating revenue, averaging 79% for the last five years, which is mainly composed of taxes; the remaining is capital revenue. Operating expenditure averaged 57% of total expenditure between 2000 and 2003, but declined to 50% in 2004. Consequently, capital expenditure has also been important for Portuguese municipalities (FitchRatings, 2005).

As to accounting, the current system of municipalities' accounting in Portugal consistently integrates three subsystems – budgetary, financial and cost accounting – and it presents the following mains features that represent significant improvements compared to the previous system (Carvalho *et al.*, 2006a, 2006b; Jorge *et al.*, 2006; Jorge, 2003):

- It facilitates verifying legal accomplishment, financial regularity and operations effectiveness (legal perspective), namely while establishing rules on the budget preparation and execution, as well as while defining supporting and reporting statements and requiring establishing and applying an Internal Control System;

- In a budgetary perspective, it registers the budget execution and determines budgetary results (deficit or surplus), using double-entry, creating specific account procedures to monitor each stage in expenditures and revenues execution and setting budgetary statements[1] to be disclosed in the annual accounts and logs;

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[1] Budgetary control statements for expenditures and revenues, cash flow statement and notes.

- In a financial perspective, it allows controlling and individually monitoring municipalities' budgetary and financial situation, as it requires classifying expenditures and revenues according both to their nature (economic classification) and per debtors and creditors;

- In a property perspective, it offers the possibility of preparing municipalities' Balance Sheets, enhancing their property composition, value and evolution, thus facilitating physical fixed assets to be kept updated and under control;

- It allows determining annual results, highlighting cost and, in some cases, revenues and results, per department, activity, good or service provided (economic and cost perspective);

- Using accrual basis (within the subsystems of financial and cost accounting) together with cash and commitments bases (in budgetary accounting), the new system allows recognising not only assumed obligations, rights, payments and receipts, but also assets and liabilities, calculating costs, revenues and economic results;

- It uses double-entry in the whole system (though optional for cost accounting), implying debits, credits and balances in the Plan of Accounts, improving accuracy and control of the accounting information;

- The three integrated subsystems allow controlling simultaneously the budget execution and the economic and financial management, using specific rules for inventorying and assessing of public property, namely for recognising and valuing fixed operational assets and public domain assets.

In summary, the system combines different perspectives to reach the following general objectives:

- Offering the needed information for municipalities to prepare the annual accounts as other statements to be disclosed for different users, namely the Court of Accounts and the Municipal Legislative Assembly;

- Providing the required information to compute de aggregated information for National Accounts, particularly concerning Local Administration;

- Offering enough financial and economic information to support decision-making both of political and management nature;

- Improving transparency in managing financial resources and the whole property that municipalities' manage or control.

Within the financial, budgetary and accounting system expenditures and revenues are compulsorily classified according to several categories. First of all, according to the specification principle, they follow a so-called economic classification, i.e., per nature.

Budgetary Framework Law additionally recommends expenditures to follow a departmental classification as well as a functional classification, each function corresponding to a broad category of municipal activities.

The functional classification is particularly important in assessing municipalities' efficiency, since output measures must relate to these categories. In fact, expenditures classification per functions allows understanding the financial effort municipalities carry out in several intervention areas following their responsibilities.

This classification comprises four broad categories (general functions[2], social functions[3], economic functions[4] and other[5]), detailed enough in order to consider all municipalities' responsibilities and allowing subsequent consolidated information at local, regional and national level[6].

Since when considered at macro level the functional classification aggregates total expenditure of all sectors of public administration, it embraces information concerning the resources applied amongst the whole of public administration activities.

In assessing efficiency, Cost Accounting is fundamental. Cost Accounting in the Public Administration is a consequence of new informational needs within the context of the *New Public Management*, namely because it provides information that, together with planning and control systems, allow analysing how each governmental unit contributes to economy, efficiency and effectiveness while using public resources (Torres, 2002).

As addressed above, a Cost Accounting subsystem is comprised within the Portuguese municipalities' accounting new system. Nevertheless, the great majority of municipalities have not implemented it yet (Carvalho *et al.*, 2006b). Therefore Portuguese municipalities' efficiency so far might be assessed not in terms of resources consumed or expenses (cost – accruals perspective), but in terms of undertaken commitments (expenditures) or merely in terms of money spent (payments – cash perspective). On the other hand, although the reform of municipalities' financial and accounting system have intended to improve efficiency evaluation, there is still no national framework, namely a set of performance indicators, to be followed by governmental entities. Actually, in their management reports municipalities just present

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[2] General administrative services; and security and public order.
[3] Education; health; social security; housing and collective services; and cultural, leisure and religious services.
[4] Agriculture, farming, hunting and fishery; industry and energy; transports and communication; commerce and tourism; other economic functions.
[5] Municipal debt; transfers between administrations; and other non-specified.
[6] Moreover, since functional categories are adopted from the International Monetary Fund and OECD classification, Carvalho *et al.* (2006c) support that cross-country comparisons are possible as well as consolidated information at supranational level.

budgetary and financial ratios and there is a great diversity amongst the measures presented compromising comparisons (Carvalho *et al.*, 2005; Fernandes, 2004).

As to control and supervision, municipalities' level of reporting to the central government's Court of Accounts (auditors), which was already high, increased further in 2000. Since then they have to present, on an annual basis, a four-year investment programme and an annual provisional budget. Municipalities also need to present, on an annual basis, balance sheets, fund balances and profit and loss accounts merged into two documents: Annual Accounts and Management Report. As explained, financial statements are presented on an accruals basis while budgetary statements are cash-based. The Court of Accounts, together with several sub-agencies of the Ministry of Finance, oversees the activities of municipalities. This close monitoring of municipalities' finances might be favourable to credit rating (FitchRatings, 2005).

2. EFFICIENCY IN THE PUBLIC SECTOR

Efficiency is defined as the relationship between used inputs and results obtained in the process of creation of value within an entity. As Bac (1994) highlights, efficiency criteria are based in business management and presume a positive balance in the relationship output/input, i.e., maintaining quality standards, which imply consumption rationality, eliminating waste.

Nevertheless, given that public sector entities, except governmental enterprises, are not profit oriented, efficiency criteria used in the private sector cannot be directly applied to the public sector, where the services provided are market-aside and difficult to valuate. Still, efficiency in the public sector is frequently defined as the relationship between goods and services provided and resources applied, emphasising output maximisation given a certain input or input minimization given a certain quantity and quality of output (Torres, 2002).

INTOSAI (1995) enlarges the definition, highlighting that efficiency is intimately related to the concept of "productivity"[7] and it needs a reference board to be adequately evaluated, either through benchmarking or establishing best-practice standards.

As a consequence of the difficulties in setting maximums and minimums levels of inputs and outputs, Torres (2002: 60) defines efficiency as "the most adequate relationship between outputs and the necessary resources to obtain them". It means reaching the objectives established minimising the resources used or given the resources available, maximising the objectives. From this point of view, efficiency and effectiveness are two alternative though interrelated issues, not necessary hierarchic.

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[7] Rosen (1993: 4) explains about public productivity that, in general terms, it is and efficiency measure – it tells how well resources have been used. "The more produced with a given set of resources, the higher productivity. (…) A productive organisation,…, is one that turns out a high level of good quality product with its resources. Public productivity focuses on the efficiency of governmental (…) administrative agencies and their subunits."

Evaluating public sector outputs and results, although not without difficulties, is less problematic than evaluating programmes general impacts. In this case it is necessary to determine up to what extent the effects are attributed to the programme and not to other factors, which demands for analysing causal relationships, identifying and controlling all external factors that might somehow affect that relationship (Ballart, 1992).

On the other hand, Simon (1994) highlights an additional problem derived from existing different measurement units for inputs and outputs, which brings difficulties for comparisons and implies that efficiency should be evaluated in relative terms. Therefore, he emphasises the need to enlarge the efficiency concept to include all factors implied in the process of creating value within an entity that are not susceptible of monetary measurement. This would allow determining whether a governmental entity is or is not efficient without necessarily following exclusively monetary criteria (AECA, 1997).

One of the most common techniques in efficiency evaluation is using management indicators. Their analysis helps to detect those programmes or services that deserve special attention, since do not reach the standard or average levels of effectiveness, efficiency, economy and quality. Management indicators also allow comparisons between similar entities and across time within the same entity, identifying trends.

Fernandes (2004) summarises that management indicators within governmental entities are management instruments supporting accountability as well as decision-making oriented towards reducing public deficit and increasing value-for-money. They allow evaluating those activities contributing for creating value and therefore understanding the relationship between resources applied, activities developed and obtained results, displaying information both to internal and external users.

Accordingly, management indicators, frequently used in private companies, play a twofold role in the public administration (Fernandes, 2004): internal (supporting the establishment of public policies, controlling their implementation and evaluate final results); and external (offering information to assess entities' performance and account for public managers responsibilities).

In terms of information requirements, management indicators must facilitate information on efficiency, effectiveness and economy of public sector entities following the qualitative characteristics generally required and accepted for financial reporting information, namely reliability, relevance, comparability and opportunity. As to methodological issues, the establishment of indicators requires taking into account the information to be facilitated by each one as well as how to get the data. Therefore, it is recommendable, while evaluating governmental entities activities, the use of several combined indicators that offer a global

vision. There are, however, problems in selecting indicators to represent the most significant issues amongst entities' activities, justifying the lack of reference frameworks (Torres, 2002).

Developing and classifying management indicators in public sector entities, is rather flexible, depending on what is intended to evaluate. Consequently there are several categories and criteria for classification (Torres, 1991). Many authors have addressed the subject, proposing alternative classifications for public management indicators. AECA (1997) and Torres (1991) offer a classification as follows in Table 1.

Table 1 – Classification of Public Sector Management Indicators

Classification Criteria	Categories
According to their nature	Economy
	Effectiveness
	Efficiency
	Equity
	Excellence
According to the object to be measured	Result
	Process
	Structure
	Strategy
According to the information offered	Budgetary
	Accounting (Financial Statements)
	Organisational
	Social
	Envelopment and Impact
According to their scope	Internal
	External

The above categories are somehow related to a dual-fold classification into input (means) and output (results or realisations) indicators, central for assessing efficiency.

Inputs indicators are measures that allow knowing the nature and quantity of the factors used directly or indirectly by entities in order to carry out their activities. They are the basis to evaluate economy and efficiency in managing public services. Most information to compute these measures comes from cost accounting. Input measures comprise the main resources used by governmental entities, namely human, material and financial resources. Problems may arise concerning the exact resource consumption.

As to output measures, they allow assessing the level of services provided, therefore requiring a detailed knowledge of the whole of entities' activities. Considering the complexity in finding a single indicator of output or results (given that objectives and outcomes are difficult to measure), it might be possible to combine several indicators – multidimensional series (Torres, 2002).

Relating to the above mentioned problems in finding a set of indicators that would offer the best representation of the main activities within the entity, Fernandes (2004) refers to the scarce use of management indicators in practice, justifying the prevalence of traditional financial measures. Since financial ratios merely measure and highlight specific aspects concerning financial income (namely those that might be quantifies in financial terms), these are not adequate decision-making support instruments in the presented public sector management context. In fact, a performance analysis focused on financial issues might have dysfunctional consequences for both the entities management and the accomplishment of their main objectives.

According to Afonso and Santos (2005: 2), "the proper measurement of public sector performance, particularly in what concerns service provision is a delicate empirical issue and the related literature, principally when it comes to aggregate data, is still limited". But the development and analysis of performance indicators is no more than a first step in the task of measuring the efficiency of public sector. The use of statistical analysis, such as regression analysis, can be seen as a significant improvement but not yet the ideal methodology (Barrow and Wagstaff). The third, and more satisfactory, phase is the evaluation using a group of methods based on the concept of frontier, the reason why they are called frontier methods. The idea is to identify and evaluate those organizations operating on the cost or production frontier (efficient organizations) and those operating below that frontier (inefficient organizations). The so-called data envelopment analysis (DEA) is probably the most commonly used frontier analysis technique, namely in the case of applications to measuring public sector efficiency.

3. DEA AND THE EMPIRICAL ANALYSES OF LOCAL GOVERNMENT EFFICIENCY

Data envelopment analysis is performance measurement technique and is used to evaluate the relative efficiency of a group of producers or units of an organization. These are commonly designated as decision-making units (DMUs). The emphasis on relative efficiency needs to be made, since DEA is a poor technique in estimating absolute efficiency. Simply put, DEA tells us how well a given DMU is doing compared to the others but not compared to a theoretical maximum.

While a typical statistical analysis is based on a central tendency approach, DEA is an extreme point method. In the first case, comparisons are made to the average. In an extreme point method, comparisons are made with the best producers or units. This is based on the idea that if a given unit A is capable of producing Y(A) units of output with X(A) inputs, then the other units should also be able to do the same if they are operating efficiently. Moreover, the units can be combined to form a composite unit with composite inputs and composite outputs. This is a virtual unit, since this composite unit does not necessarily exist. The main goal of DEA is to

find the best virtual unit for each real DMU. The efficiency frontier defined the maximum combinations of outputs that can be produced for a given set of inputs. If the virtual unit is capable of making the same output with less input or the making more output with less input, the real DMU is considered inefficient. On the contrary, if the virtual unit is alike the real DMU (lies in the frontier line), it is declared to be efficient. In technical terms, this virtual unit is formulated as linear program. This is the real why DEA is linear programming technique.

The analysis has to make several options regarding the way concrete problems are formulated. The first is opting between an input-oriented and an output-oriented analysis. An input-oriented analysis quantifies the reduction in the inputs that is necessary to become efficient holding the outputs constant. On the contrary, an output oriented analysis quantifies the necessary output expansion holding the inputs constant. A non-oriented analysis quantifies the improvements when both inputs and outputs can be improved simultaneously.

Another important issue is how to deal with differences sizes of the DMU. It is well known that efficiency may increase or decrease with size, that is, returns to scale. If a constant return to scale constraint is imposed, it means that no efficiency gains can be obtained with size. Usually, a variable returns to scale formulation is admitted in concrete problems relating to efficiency in the public sector.

The number of studies performing DEA in the public sector setting is too large enough to be reviewed here. Therefore, we concentrate on studies that consider local governments or municipalities as DMUs.

Bruno de Borger and Kristiaan Kerstens (1996) compare three approaches to evaluate the cost efficiency of Belgian local governments: Free Disposal Hull (FDH), DEA, and econometric approaches. The advantage of this study is the ability to compare the different parametric and non-parametric approaches and to evaluate their sensitivity with respect to the rankings of municipalities (589 in this case).

Two more recent studies of the Finish municipalities also deserve mention, both by Heikki Loikkanen and Ilkka Susiluoto (2004, 2006). The 2004 study compares DEA and econometric (Tobit) methods and its main virtue is the fact that uses a panel (1994-2002) of 353 municipalities. As usual, they estimate efficiency scores and found considerable differences. Namely, a group of peripheral municipalities clearly tend to perform worst. On the other hand, the efficiency scores tend to remain fairly stable over time. The 2006 study basically corroborates the previous study, finding the small municipalities as the most efficient.

António Afonso and Sónia Fernandes (2003; 2005) study the Portuguese case. The 2005 paper extends the DEA to the entire group mainland municipalities.[8] They perform a 1input to 1output

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[8] The 2003 analysis refers to the Lisbon region only.

analysis. The input is the per capita budgetary spending while the output is a composite measure. The Local Government Output Indicator (LGOI) is a normalized measure giving equal weight to a set performance indicators taken directly from the local government activities. In addition they perform the analysis by region: Algarve, Alentejo, Lisbon region, Center, and North. They found that the southern regions of Alentejo and Algarve perform more efficiently than the remaining country.

4. EMPIRICAL STUDY

In our analysis of local government efficiency, we also use DEA but we choose a different menu of inputs and outputs. This is due to the use of own collected data rather than official data that is always on a cash basis.

We collect data from the 2004 municipal annual accounts, either from the archives of the Supreme Audit Office of the Court of Accounts or, wherever necessary, from the municipalities themselves. Of the 278 mainland municipalities, only three were excluded due to unavailability of data. So our DEA includes 275 DMUs.

As we explained in the first section, the reform of the local government accounting towards a double-entry system makes it possible the presentation and use of different types of financial information. Financial statements are presented on an accruals basis while budgetary statements are cash-based. Our input measures are not strictly cash-based (payments) but undertaken commitments. Given the widely recognized problems relating to the use of cash information, this is clearly a better way to represent the use of resources. Regarding inputs we use two model specifications. The first with only one input and the second with three inputs, see Table 2.

Table 2 – List of Municipal Inputs

Model	Variable	Indicator
M1	Xt	Total expenditure
M2	X1	Personnel expenditure
	X2	Expenditure with goods and services
	X3	Capital expenditures

With respect to outputs, instead of a composite measure we use seven indicators as separate outputs. This avoids the measurement problems related to the construction of the composite measure itself. According to the legal framework, the municipal spending functions are the following: rural and urban equipment; energy, transport and communications; education,

patrimony, culture and science; sports and leisure; healthcare and social services; housing and civil protection; environment and basic sanitation; consumer protection, social and economic development; territory organization and external cooperation. In this sense, the municipal indicators are surrogate measures of municipal services demand. The idea is that we should expect similar performance from those municipalities with similar demand for services (Afonso and Fernandes 2005). Of course, the selection of output indicators was also determined by the availability of published data, in this case by the National Statistics Institute. Table 3 shows the seven selected output indicators.

Table 3 – List of Municipal Outputs

Variable	Indicator
Y1	Local inhabitants with 15 or less years old.
Y2	Local inhabitants with 65 or more years old.
Y3	Number of basic or elementary schools.
Y4	Number of students enrolled in the elementary schools.
Y5	Water consumption.
Y6	Number of building permits issued in the year.
Y7	Social development indicator, according to the Local Finance Law and officially published.

We use an input-oriented approach since the public sector focus has been more on controlling expenditure than on the increasing of outputs. In fact, the EU context of overall financial constraints faced by governments imposes an attention oriented towards expenditure reduction, not output expansion. Regarding returns to scale, we follow the standard procedure of adopting the more flexible option of variable returns to scale.

Model 1 (Table 4 of the Appendix) presents the results of the 1 input (total expenditure) analysis while Model 2 (Table 5 of the Appendix) relates to the 3 input (partial expenditure) analysis. Since DEA produces relative efficiency scores, more important than the computed score is the rank order of the municipality. The rankings are also presented in the table. The two models do not differ very much. The main difference is the number of municipalities declared to be efficient. As expected the number of efficient municipalities is higher in the second model. It is known that the higher the number of factors included in the analysis, the higher the number of DMU´s declared efficient.

Regarding substantive results, the main differences are observed with regard to size, here measured in terms of population. Since resident population is one of the factors used to determine intergovernmental grants (Local Finance Law 42/98), we group municipalities according to population size as follows:

- Small – ≤20,000 residents;
- Medium – 20,000-100,000 residents;
- Large – ≥ 100,000 residents.

Table 6 shows the average efficient scores when the three groups of municipalities based on size are considered. The results strongly suggest that larger municipalities tend to be more efficient.

Table 6 – Average Efficiency Scores by Size

Group	Model 1	Model 2
Small Size	70,65%	74,68%
Medium Size	75,66%	81,29%
Large Size	92,14%	93,29%

CONCLUSION

The reasons for this strong effect with respect to size may lie in the qualification of their human resources. The lack of municipal human capabilities is well known in Portugal, namely with respect to the smaller municipalities.

While simple and exploratory, given the nature of the data used, the results presented in this paper are a first step toward ranking Portuguese municipalities according to their efficiency. This also integrated the larger project of analysing the effects of the reform of the municipal accounting system. Knowing whether this new system makes them more efficient is very important, given that the main objectives of the reforms were precisely a better use of public resources.

An exploratory study leaves large room for future improvements. One is the replication of these results using other parametric and non-parametric techniques. This step also allows the check of robustness of the present results. Given the well known sensitivity of the frontier techniques, this is a fundamental task.

A second future avenue could be the explanation of the differences of efficiency among municipalities, for example, whether or not a higher level of conformity with the new accounting system (Jorge et al 2005; 2006) has a positive effect on the efficient score. Since an endogeneity problem is certainly present here, it would have to be taken into account separately.

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Appendix

Table 4 – Data Envelopment Analysis Results (1 input; 7 outputs)

Municipality	Efficiency Score	Rank	Municipality	Efficiency Score	Rank
Abrantes	65,11%	182	Mogadouro	50,65%	245
Águeda	100,00%	1	Moimenta da Beira	68,78%	164
Aguiar da Beira	66,22%	176	Moita	87,65%	79
Alandroal	44,24%	265	Monção	74,08%	130
Albergaria-a-Velha	78,41%	114	Monchique	37,50%	272
Albufeira	66,17%	177	Mondim de Basto	98,27%	55
Alcácer do Sal	92,84%	64	Monforte	50,89%	242
Alcanena	74,27%	128	Montalegre	42,99%	266
Alcobaça	62,85%	191	Montemor-o-Novo	81,91%	96
Alcochete	72,62%	137	Montemor-o-Velho	61,74%	197
Alcoutim	49,42%	249	Montijo	71,16%	145
Alenquer	100,00%	1	Mora	73,22%	134
Alfândega da Fé	52,88%	238	Mortágua	100,00%	1
Alijó	78,88%	107	Moura	46,15%	260
Aljezur	76,49%	120	Mourão	45,17%	263
Aljustrel	70,07%	158	Murça	74,85%	126
Almada	100,00%	1	Murtosa	71,66%	142
Almeida	52,27%	239	Nazaré	47,89%	252
Almeirim	82,54%	94	Nelas	88,21%	74
Almodôvar	57,05%	226	Nisa	50,76%	243
Alpiarça	64,30%	187	Óbidos	41,85%	268
Alter do Chão	73,19%	135	Odemira	59,15%	211
Alvaiázere	86,61%	83	Odivelas	96,91%	57
Alvito	100,00%	1	Oeiras	74,52%	127
Amadora	83,83%	90	Oleiros	65,55%	179
Amarante	85,80%	86	Olhão	78,80%	108
Amares	96,48%	58	Oliveira de Azeméis	87,42%	81
Anadia	91,53%	67	Oliveira de Frades	83,80%	91
Ansião	54,11%	235	Oliveira do Bairro	62,63%	192
Arcos de Valdevez	68,10%	166	Oliveira do Hospital	87,13%	82
Arganil	78,45%	113	Ourém	73,87%	131
Armamar	69,21%	160	Ourique	45,27%	262
Arouca	95,28%	59	Ovar	64,50%	185
Arraiolos	67,64%	168	Paços de Ferreira	100,00%	1
Arronches	75,24%	121	Palmela	71,00%	149
Arruda dos Vinhos	58,54%	217	Pampilhosa da Serra	61,91%	195
Aveiro	56,68%	229	Paredes	100,00%	1
Avis	71,55%	143	Paredes de Coura	50,61%	246
Azambuja	71,35%	144	Pedrógão Grande	77,59%	118
Baião	90,31%	69	Penacova	99,84%	52
Barcelos	100,00%	1	Penafiel	78,27%	115
Barrancos	100,00%	1	Penalva do Castelo	70,24%	156
Barreiro	88,17%	75	Penamacor	42,83%	267
Batalha	100,00%	1	Penedono	100,00%	1
Beja	57,15%	225	Penela	67,46%	169
Belmonte	68,90%	161	Peniche	100,00%	1
Benavente	72,18%	140	Peso da Régua	79,61%	105
Bombarral	70,12%	157	Pinhel	70,80%	150
Borba	70,59%	151	Pombal	100,00%	1
Boticas	66,41%	175	Ponte da Barca	61,37%	199

Braga	100,00%	1	Ponte de Lima	100,00%	1
Bragança	59,88%	203	Ponte de Sor	67,10%	172
Cabeceiras de Basto	100,00%	1	Portalegre	39,03%	269
Cadaval	87,56%	80	Portel	88,08%	76
Caldas da Rainha	100,00%	1	Porto	78,58%	110
Caminha	67,37%	170	Porto de Mós	89,52%	72
Campo Maior	90,28%	70	Póvoa de Lanhoso	100,00%	1
Cantanhede	79,90%	104	Póvoa de Varzim	59,41%	207
Carrazeda de Ansiães	89,69%	71	Proença-a-Nova	67,74%	167
Carregal do Sal	100,00%	1	Redondo	88,87%	73
Cartaxo	58,03%	223	Reguengos de Monsaraz	50,54%	247
Cascais	100,00%	1	Resende	58,86%	214
Castanheira de Pêra	38,66%	270	Ribeira de Pena	59,29%	209
Castelo Branco	73,82%	132	Rio Maior	53,57%	237
Castelo de Paiva	59,23%	210	Sabrosa	71,01%	147
Castelo de Vide	68,89%	163	Sabugal	75,08%	123
Castro Daire	100,00%	1	Salvaterra de Magos	100,00%	1
Castro Marim	66,87%	173	Santa Comba Dão	67,22%	171
Castro Verde	62,60%	193	Santa Maria da Feira	92,97%	62
Celorico da Beira	58,37%	219	Santa Marta de Penaguião	80,46%	102
Celorico de Basto	92,67%	65	Santarém	59,38%	208
Chamusca	56,85%	227	Santiago do Cacém	56,84%	228
Chaves	59,12%	212	Santo Tirso	80,78%	101
Cinfães	100,00%	1	São Brás de Alportel	85,20%	87
Coimbra	97,52%	56	São João da Madeira	100,00%	1
Condeixa-a-Nova	70,44%	152	São João da Pesqueira	100,00%	1
Constância	74,97%	125	São Pedro do Sul	52,11%	240
Coruche	55,47%	232	Sardoal	47,52%	254
Covilhã	46,86%	257	Sátão	68,14%	165
Crato	78,71%	109	Seia	47,51%	255
Cuba	72,59%	138	Seixal	100,00%	1
Elvas	50,98%	241	Sernancelhe	93,30%	61
Entroncamento	100,00%	1	Serpa	65,21%	181
Espinho	83,24%	93	Sertã	59,98%	202
Esposende	100,00%	1	Sesimbra	78,51%	112
Estarreja	64,83%	184	Setúbal	54,09%	236
Estremoz	59,41%	206	Sever do Vouga	85,98%	85
Évora	58,35%	220	Silves	48,75%	250
Fafe	77,04%	119	Sines	25,47%	275
Faro	46,66%	259	Sintra	100,00%	1
Felgueiras	70,35%	153	Sobral de Monte Agraço	81,07%	99
Ferreira do Alentejo	58,64%	216	Soure	90,71%	68
Ferreira do Zêzere	59,41%	205	Sousel	66,78%	174
Figueira da Foz	61,29%	200	Tábua	81,70%	97
Figueira de Castelo Rodrigo	78,52%	111	Tabuaço	71,01%	148
Figueiró dos Vinhos	60,74%	201	Tarouca	49,88%	248
Fornos de Algodres	54,12%	234	Terras de Bouro	79,60%	106
Freixo de Espada à Cinta	81,37%	98	Tomar	54,84%	233
Fronteira	58,78%	215	Tondela	65,37%	180
Fundão	31,80%	274	Torre de Moncorvo	46,81%	258
Gavião	85,16%	89	Torres Novas	59,72%	204
Góis	72,57%	139	Torres Vedras	92,93%	63
Golegã	87,96%	77	Trancoso	55,64%	230
Gondomar	100,00%	1	Trofa	63,19%	190

Gouveia	72,80%	136	Vagos	100,00%	1
Grândola	55,64%	231	Vale de Cambra	77,90%	117
Guarda	48,16%	251	Valença	74,09%	129
Guimarães	100,00%	1	Valongo	68,90%	162
Idanha-a-Nova	70,25%	155	Valpaços	70,34%	154
Ílhavo	92,52%	66	Vendas Novas	99,41%	53
Lagoa (Algarve)	73,42%	133	Viana do Alentejo	100,00%	1
Lagos	61,54%	198	Viana do Castelo	100,00%	1
Lamego	58,53%	218	Vidigueira	66,13%	178
Leiria	100,00%	1	Vieira do Minho	100,00%	1
Lisboa	100,00%	1	Vila de Rei	87,75%	78
Loulé	47,20%	256	Vila do Bispo	100,00%	1
Loures	100,00%	1	Vila do Conde	50,76%	244
Lourinhã	100,00%	1	Vila Flor	85,19%	88
Lousã	82,32%	95	Vila Franca de Xira	98,88%	54
Lousada	94,35%	60	Vila Nova da Barquinha	100,00%	1
Mação	61,77%	196	Vila Nova de Cerveira	64,19%	188
Macedo de Cavaleiros	61,92%	194	Vila Nova de Famalicão	100,00%	1
Mafra	100,00%	1	Vila Nova de Foz Côa	86,02%	84
Maia	58,31%	221	Vila Nova de Gaia	100,00%	1
Mangualde	58,08%	222	Vila Nova de Paiva	57,15%	224
Manteigas	100,00%	1	Vila Nova de Poiares	44,43%	264
Marco de Canaveses	37,82%	271	Vila Pouca de Aguiar	71,11%	146
Marinha Grande	100,00%	1	Vila Real	100,00%	1
Marvão	78,14%	116	Vila Real de Santo António	45,92%	261
Matosinhos	83,60%	92	Vila Velha de Ródão	75,12%	122
Meda	65,04%	183	Vila Verde	100,00%	1
Melgaço	59,03%	213	Vila Viçosa	71,66%	141
Mértola	35,28%	273	Vimioso	63,26%	189
Mesão Frio	64,33%	186	Vinhais	80,85%	100
Mira	99,86%	51	Viseu	100,00%	1
Miranda do Corvo	75,00%	124	Vizela	100,00%	1
Miranda do Douro	47,65%	253	Vouzela	80,37%	103
Mirandela	69,26%	159	Average	74,20%	

Table 5 – Data Envelopment Analysis Results (3 inputs; 7 outputs)

Municipality	Efficiency Score	Rank	Municipality	Efficiency Score	Rank
Abrantes	71,20%	174	Mogadouro	51,99%	252
Águeda	100,00%	1	Moimenta da Beira	78,45%	149
Aguiar da Beira	75,10%	162	Moita	92,70%	82
Alandroal	47,09%	265	Monção	87,39%	100
Albergaria-a-Velha	82,98%	124	Monchique	46,24%	266
Albufeira	58,79%	231	Mondim de Basto	99,97%	70
Alcácer do Sal	89,88%	89	Monforte	51,49%	254
Alcanena	82,98%	125	Montalegre	45,17%	269
Alcobaça	77,21%	155	Montemor-o-Novo	87,76%	99
Alcochete	83,15%	123	Montemor-o-Velho	70,12%	181
Alcoutim	55,63%	240	Montijo	78,90%	147
Alenquer	100,00%	1	Mora	100,00%	1
Alfândega da Fé	59,34%	225	Mortágua	100,00%	1
Alijó	91,87%	84	Moura	42,31%	273
Aljezur	86,76%	102	Mourão	48,63%	262
Aljustrel	65,70%	199	Murça	89,52%	92
Almada	100,00%	1	Murtosa	69,52%	184
Almeida	55,63%	241	Nazaré	43,97%	271
Almeirim	84,54%	109	Nelas	88,96%	95
Almodôvar	63,57%	209	Nisa	50,81%	257
Alpiarça	57,58%	233	Óbidos	45,23%	268
Alter do Chão	86,02%	105	Odemira	58,69%	232
Alvaiázere	96,73%	74	Odivelas	100,00%	1
Alvito	100,00%	1	Oeiras	73,53%	165
Amadora	80,79%	135	Oleiros	71,06%	176
Amarante	92,99%	81	Olhão	89,44%	93
Amares	100,00%	1	Oliveira de Azeméis	84,23%	110
Anadia	100,00%	1	Oliveira de Frades	83,52%	118
Ansião	60,65%	221	Oliveira do Bairro	68,17%	188
Arcos de Valdevez	100,00%	1	Oliveira do Hospital	94,16%	80
Arganil	81,86%	131	Ourém	100,00%	1
Armamar	77,49%	153	Ourique	48,44%	263
Arouca	91,23%	85	Ovar	67,50%	191
Arraiolos	69,42%	185	Paços de Ferreira	100,00%	1
Arronches	79,43%	143	Palmela	84,07%	113
Arruda dos Vinhos	56,24%	239	Pampilhosa da Serra	62,71%	214
Aveiro	79,57%	141	Paredes	97,36%	73
Avis	79,98%	139	Paredes de Coura	64,37%	203
Azambuja	75,12%	161	Pedrógão Grande	82,41%	128
Baião	90,07%	88	Penacova	100,00%	1
Barcelos	100,00%	1	Penafiel	88,26%	97
Barrancos	100,00%	1	Penalva do Castelo	84,20%	111
Barreiro	100,00%	1	Penamacor	52,90%	250
Batalha	100,00%	1	Penedono	100,00%	1
Beja	63,92%	204	Penela	72,04%	170
Belmonte	79,16%	145	Peniche	100,00%	1
Benavente	70,14%	180	Peso da Régua	77,03%	156
Bombarral	68,77%	187	Pinhel	66,74%	194
Borba	80,57%	137	Pombal	100,00%	1
Boticas	65,88%	198	Ponte da Barca	67,66%	189
Braga	100,00%	1	Ponte de Lima	100,00%	1
Bragança	63,61%	208	Ponte de Sor	63,33%	211

Cabeceiras de Basto	100,00%	1	Portalegre	44,79%	270
Cadaval	83,15%	122	Portel	89,82%	90
Caldas da Rainha	100,00%	1	Porto	100,00%	1
Caminha	63,40%	210	Porto de Mós	100,00%	1
Campo Maior	100,00%	1	Póvoa de Lanhoso	95,04%	79
Cantanhede	100,00%	1	Póvoa de Varzim	54,76%	246
Carrazeda de Ansiães	100,00%	1	Proença-a-Nova	66,22%	197
Carregal do Sal	100,00%	1	Redondo	83,30%	120
Cartaxo	60,46%	223	Reguengos de Monsaraz	58,79%	230
Cascais	100,00%	1	Resende	63,62%	207
Castanheira de Pêra	49,35%	260	Ribeira de Pena	56,75%	237
Castelo Branco	100,00%	1	Rio Maior	55,50%	242
Castelo de Paiva	58,80%	229	Sabrosa	84,15%	112
Castelo de Vide	83,63%	115	Sabugal	83,17%	121
Castro Daire	100,00%	1	Salvaterra de Magos	100,00%	1
Castro Marim	71,33%	172	Santa Comba Dão	66,92%	193
Castro Verde	60,58%	222	Santa Maria da Feira	100,00%	1
Celorico da Beira	55,06%	244	Santa Marta de Penaguião	86,45%	104
Celorico de Basto	100,00%	1	Santarém	69,08%	186
Chamusca	57,57%	234	Santiago do Cacém	56,44%	238
Chaves	71,12%	175	Santo Tirso	84,88%	108
Cinfães	100,00%	1	São Brás de Alportel	78,28%	150
Coimbra	82,06%	130	São João da Madeira	100,00%	1
Condeixa-a-Nova	70,57%	178	São João da Pesqueira	100,00%	1
Constância	81,13%	133	São Pedro do Sul	51,51%	253
Coruche	59,00%	228	Sardoal	51,11%	256
Covilhã	89,06%	94	Sátão	84,88%	107
Crato	80,80%	134	Seia	54,25%	248
Cuba	83,65%	114	Seixal	100,00%	1
Elvas	50,70%	258	Sernancelhe	95,68%	78
Entroncamento	100,00%	1	Serpa	61,10%	219
Espinho	88,02%	98	Sertã	62,41%	215
Esposende	100,00%	1	Sesimbra	77,29%	154
Estarreja	62,76%	213	Setúbal	61,89%	218
Estremoz	57,50%	235	Sever do Vouga	87,29%	101
Évora	67,44%	192	Silves	51,15%	255
Fafe	89,63%	91	Sines	24,43%	275
Faro	54,19%	249	Sintra	100,00%	1
Felgueiras	71,29%	173	Sobral de Monte Agraço	76,83%	157
Ferreira do Alentejo	59,21%	226	Soure	96,42%	76
Ferreira do Zêzere	63,68%	206	Sousel	66,37%	195
Figueira da Foz	64,39%	202	Tábua	78,94%	146
Figueira de Castelo Rodrigo	86,71%	103	Tabuaço	72,09%	169
Figueiró dos Vinhos	60,69%	220	Tarouca	55,29%	243
Fornos de Algodres	52,86%	251	Terras de Bouro	82,29%	129
Freixo de Espada à Cinta	96,37%	77	Tomar	73,34%	166
Fronteira	72,79%	168	Tondela	77,79%	151
Fundão	56,87%	236	Torre de Moncorvo	54,33%	247
Gavião	81,58%	132	Torres Novas	67,58%	190
Góis	79,95%	140	Torres Vedras	100,00%	1
Golegã	90,91%	86	Trancoso	72,94%	167
Gondomar	100,00%	1	Trofa	66,28%	196
Gouveia	83,42%	119	Vagos	99,19%	71
Grândola	62,04%	216	Vale de Cambra	82,55%	127

Guarda	75,70%	158		Valença	69,87%	182
Guimarães	100,00%	1		Valongo	64,57%	201
Idanha-a-Nova	75,43%	160		Valpaços	100,00%	1
Ílhavo	100,00%	1		Vendas Novas	96,60%	75
Lagoa (Algarve)	80,20%	138		Viana do Alentejo	100,00%	1
Lagos	63,90%	205		Viana do Castelo	100,00%	1
Lamego	63,24%	212		Vidigueira	77,77%	152
Leiria	100,00%	1		Vieira do Minho	100,00%	1
Lisboa	100,00%	1		Vila de Rei	92,26%	83
Loulé	43,30%	272		Vila do Bispo	100,00%	1
Loures	100,00%	1		Vila do Conde	47,39%	264
Lourinhã	100,00%	1		Vila Flor	85,61%	106
Lousã	83,61%	117		Vila Franca de Xira	100,00%	1
Lousada	100,00%	1		Vila Nova da Barquinha	100,00%	1
Mação	60,12%	224		Vila Nova de Cerveira	70,54%	179
Macedo de Cavaleiros	65,35%	200		Vila Nova de Famalicão	100,00%	1
Mafra	100,00%	1		Vila Nova de Foz Côa	100,00%	1
Maia	59,18%	227		Vila Nova de Gaia	100,00%	1
Mangualde	54,80%	245		Vila Nova de Paiva	62,03%	217
Manteigas	100,00%	1		Vila Nova de Poiares	45,86%	267
Marco de Canaveses	75,69%	159		Vila Pouca de Aguiar	82,83%	126
Marinha Grande	98,09%	72		Vila Real	100,00%	1
Marvão	79,21%	144		Vila Real de Santo António	49,28%	261
Matosinhos	88,32%	96		Vila Velha de Ródão	75,09%	163
Meda	69,74%	183		Vila Verde	100,00%	1
Melgaço	78,57%	148		Vila Viçosa	73,69%	164
Mértola	38,58%	274		Vimioso	90,08%	87
Mesão Frio	79,53%	142		Vinhais	83,63%	116
Mira	100,00%	1		Viseu	100,00%	1
Miranda do Corvo	72,04%	171		Vizela	100,00%	1
Miranda do Douro	50,62%	259		Vouzela	80,71%	136
Mirandela	70,67%	177		Average	78,55%	