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Local Property Tax Reform and Municipality Spending Efficiency

Abstract

We investigate the effect on municipality spending efficiency of a local property tax reform, which reduced in 2008 the upper limit of the property tax. We compute municipality efficiency scores via data Envelopment Analysis (DEA) from 2005 to 2011, and then we rely in a panel data set to estimate how the tax reform affected the efficiency scores. Results of the analysis show that average input efficiency scores declined from 0.575 before the tax reform to 0.488 after the tax reform. This change was transversal to municipalities that reduced the municipal property tax (IMI) and to the ones that maintained the tax rate. In addition, the IMI reform is linked to higher efficiency scores. In other words, the reduction in efficiency ends up being smaller for the municipalities that decreased the IMI tax rate.

JEL-Codes: C140, C230, H110, H210, H500.

Keywords: public spending efficiency, local government, data envelopment analysis (DEA), local property tax reform.

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1. Introduction

The efficient provision of public goods by local governments is a key issue in public finance. Local governments provide a plethora of services. Yet, the resources to fulfill the demand for more and better local public services are scarce. Among the self-generated revenues, taxation is by far the most important source of municipal funding.

This paper contributes to the literature by assessing the changes on municipal efficiency stemming from a property tax reform that in 2008 reduced the maximum threshold for this tax rate for Portuguese municipalities. This reform limited the amount of own revenues for specific municipalities, restraining their ability to gather the required financial resources to respond to the service needs of the local population. However, did the reform oblige the local governments to become more efficient? Our goal is to evaluate if there were improvements in local government spending efficiency for the treated municipalities, those that were forced to reduce their property tax revenues, in comparison to those that did not have to change their property tax rate.

For that purpose, we start by computing the efficiency scores using Data Envelopment Analysis (DEA) for the period between 2005 and 2011. To compute the DEA input efficiency scores, we use a composite indicator of municipal services' provisions (outputs), as in Afonso and Venâncio (2016), and we use local government spending as the input. Then, we evaluate the impact of reform on the efficiency scores obtained from the first stage in a panel set up.

Our results show a decrease in the input-oriented efficiency scores, both for the municipalities that were forced to decreased the tax rate and for the ones that did not, during the period of our analysis, but the 2008 property tax reform improved the municipality performance, particularly for the municipalities that were for forced to reduce the property tax rate on reassessed urban properties (IMI) tax rate. Although efficiency scores declined for all municipalities, such reduction ends up being smaller for the municipalities that were forced to decrease the IMI tax rate.

The organization of the paper is as follows. Section 2 reviews the related literature. Section 3 reviews the Portuguese local government sector and property tax reform. Section 4 presents the data and the methodology to compute the municipality efficiency scores. Section 5 reports and discusses the empirical results. Section 6 concludes.

2. Related Literature

Taxation and expenditure limits are constitutional or statutory limitations on government entity's fiscal behavior (Mullins & Wallins, 2004). These restrictions imposed on governments limit their ability to collect and spend revenues. In general, three types of property tax limits exist (Mullins &Wallin, 2004; Stallmann et al., 2017): i) assessment limits, which control how much the assessed value of a property can rise; ii) levy limits, which constrain the total revenue a government can raise from property taxes, regardless of the property tax rate; and iii) tax rate limits, which limit the tax rate for all local governments (Mullins & Joyce, 1996; Walczak, 2018). The most common form of taxation limits, which we evaluate in this study, is a limit on the overall property tax, setting a maximum rate that a government can charge a property owner (Walczak, 2018).

Taxation usually has a significant political cost as it reduces the mayor's popularity and re-election odds (Niskannen, 1975; Geys, 2010). Previous studies on tax and expenditure limitations have focused on reasons for voter support, projected effects and their actual impacts (Peterson, 1981; Bails, 1982). Voters support tax limitations for self-interest reasons. In a way, they desire to lower the price but maintain the same level of existing public services, and consequently make governments more efficient (Mullins and Joyce, 1996). The combination of high tax revenues and low service satisfaction has led residents to believe that governments were inefficient (Lowery & Silgelman, 1981). Other reasons for supporting tax limitations include the growth in property evictions and home liens due to property value increases and the desire to stimulate economic growth and development (Lowery & Sigelman, 1981).[1]

In terms of their actual impacts, these type of reforms usually force local governments to implement budget cuts as local revenues decline and spending slows down (Shadbegian, 2003). It also prevents local governments from increasing the number of public sector employees (Poterba & Rueben, 1995). On the other hand, some authors argue that the initial reduction of government spending that comes from tax reforms disappears overtime as governments find other ways to finance themselves. Local governments shift their reliance towards non-tax revenues (fees and charges, state transfers and debt) for financing local public services and create a vertical shift of power and responsibility to the state, associated with poorer educational performance and poorer quality municipal services (Mullins & Joyce, 1996). Alternatively, local governments might also

[1] A business environment with low tax rates spurs economic growth and entrepreneurial activity (Venâncio et al., 2020; Ferreira et al., 2019).

create new revenue streams (Jung & Bae, 2011). In contrast, others argue that tax reforms might not really have a relevant impact in terms of government spending (see, for instance, Courant and Rubinfeld, 1987, for the Tax Reform Act of 1986 in the US). Therefore, one could question the tax and spend proposition, which has been assessed notably in a single country set-up.[2]

In this study, we evaluate the impact of taxation and expenditure limits on municipalities' technical efficiency. Efficiency is measured by comparing the inputs of production units with their outputs. Local governments are constantly under pressure to achieve efficiency gains by improving the local public services while reducing local public spending. Although efficiency has been widely used in the literature to assess local government performance,[3] its application to taxation limits is rather limited. This lack of attention is striking considering the relevance of taxation for a country's public spending efficiency (Afonso et al., 2021a; 2021b). Therefore in our study, we evaluate the local government efficiency improvements originating from property tax reform, after controlling for municipality characteristics. The tax-and-spend hypothesis (see, for instance, von Fursternberg et al., 1986) could be underlying notably the possibility that lower tax rates might be linked to lower spending, and higher efficiency (keeping the same level of offered public services).

3. Portuguese local government sector and property tax reform

To better frame the empirical results, we review some relevant facts of the Portuguese local government sector and of the 2008 local property tax reform.

Portugal's local government system is organized into three tiers: districts and two autonomous regions of Azores and Madeira, municipalities, and civil parishes. There are 308 municipalities in Portugal, of those 278 are in mainland Portugal and the remaining 30 are located in Azores and Madeira islands. Municipalities are the main organizational entities responsible for providing local public services., namely: development and maintenance of local infrastructures (e.g., sport, leisure and basic school facilities), supply of public goods (e.g., drinking water, waste and sewage collection, education, childcare support, urban transportation, urban planning, health

[2] See, for instance, von Fursternberg et al. (1986), Chang et al. (2002), Payne (2004), and Kollias and Paleologou (2006).

[3] For example, local municipality efficiency has been assessed in Belgium (Eeckhaut, Tulkens, and Jamar, 1993; De Borger et al., 1994; De Borger and Kerstens, 1996), Italy (Afonso and Scaglioni, 2007), Germany (Geys, Heinemann, and Kalb, 2010), Greece (Athanassopoulos and Triantis, 1998; Doumpos and Cohen, 2014) and Spain (Benito, Bastida, and Garcia, 2010). For Portugal, we highlight the studies of Afonso and Fernandes (2006, 2008) and Afonso and Venâncio (2016, 2020).

services, housing, cultural activities and events), and civil protection (see Laws 159/99 and 2/2007).

Although municipalities are able to control their spending, subject to expenditure control mechanisms, their revenue autonomy is rather limited (OECD, 1999). The reason for the reduced autonomy is twofold: high reliance on transfers from the central government and reduced freedom to set their local tax rates. Typically, municipalities are funded with transfers from the central government (on average 49.3 percent for the period 2005-2011), transfers from the European Union, local taxes and sales and other revenues. On average, own revenues account for around 33.6 percent of the total municipal revenues, and out of those, taxes account for approximately 53 percent for the period 2005-2011. Table 1 summarizes the main sources of funding for a municipality for the period 2005-2011.

[Table 1]

The main local taxes are the municipal property tax (*Imposto Municipal sobre Imóveis*, IMI and *Contribuicão Autárquica*, CA); the local tax on real estate transfer (*Imposto Municipal sobre as Transmissões Onerosas de Imóveis*, IMT); a municipal surcharge on corporate income tax (*Derrama*); and a variable tax share of the central government personal income tax (*Imposto sobre o Rendimento de Pessoas Singulares*, IRS). Figure 1 illustrates the main taxes and the related level of government.

[Figure 1]

The revenues of the property tax (IMI and CA) are by far the main source of own revenues, accounting approximately 22 percent for the period 2005-2011. Municipalities cannot set their own taxes, but they can define the tax rates within a range previously defined by the central government. For example, for the local property tax, municipalities must set the tax rate within a lower and upper bound, for municipal corporate income tax and personal income tax, municipalities cannot charge more than a maximum threshold tax. For IMT, the central government directly defines the local tax rate.

The local property tax (IMI) was introduced in 2003 after a general reform of the Portuguese tax system, which replaced the previous property tax, *Contribuicão Autárquica*, (CA) implemented in 1989. The reform was accompanied by a revaluation of urban property for tax purposes and its implementation spanned several years. Nonetheless, three different property tax rates co-existed in each municipality: rural property tax, urban property tax whose fiscal value was re-assessed (IMI), and urban property whose tax value was not reassessed (CA). The non-reassessed properties had a ten-year transition period, during which every urban real estate had to be re-assed.

On July 2, 2008, the Portuguese central government announced a decrease in the upper bound of the local property tax rate, from 0.5% to 0.4% for the reassessed properties (IMI) and from 0.8% to 0.7% for the non-reassessed urban properties (CA). The rural properties tax did not change. Before 2008, on average a municipality charged 0.4% and 0.71% of IMI and CA taxes, respectively. After 2008, these property tax rates decreased to 0.35% and 0.65% respectively for IMI and CA.

[Table 2]

Table 2 displays the lower and upper limits for the three co-existing property tax rates before and after the reform: reassessed urban properties (IMI), non-reassessed urban properties (CA) and rural properties. Therefore, we divide municipalities into four groups: municipalities who had to both reduce the IMI and CA tax rates (82 municipalities); municipalities who had to decrease the IMI (12 municipalities); municipalities who had reduce the CA (63 municipalities); and municipalities that did not change the tax rate (121 municipalities). In total, 157 municipalities reduced their property tax revenues. Figure 2 presents the spatial distribution of these four groups. One can notice that many municipalities around the metropolitan areas of Lisbon and Porto (the two biggest cities), in the coastline and in the south, were obliged to decrease the IMI tax rate in 2008. On the other hand, more inland municipalities did not have to reduce the property tax rate.

[Figure 2]

This reform provides a good opportunity to study the effects of reducing municipality revenues on public spending efficiency because it focusses on a single country where local

governments operate under the same institutional background. In fact, Portuguese local governments have tax and administrative autonomy, but they rely also significantly on financing from the central government. Because of the reform, municipalities saw their own property tax revenues per capita reduced from 90 EUR in 2007 to 75 EUR in 2008 (see Table 1). Although local politicians have some discretionary power on how to implement their policies and to use their resources, their revenue autonomy is very limited.

4. Data and Municipality Efficiency Scores

4.1. Data

Our dataset includes 278 mainland Portuguese municipalities evaluated during the period between 2005 (3 years before the tax reform) and 2011 (3 years after the tax reform).[4] We exclude the municipalities located in the Portuguese Islands because they have different instutional and economic context.

We gather data from several sources. Information on municipal socio-demographic and economic characteristics was retrieved from Statistics Portugal (INE). Data on local expenditures was obtained from the General Directorate for Local Authority's (*Direcção-Geral das Autarquias Locais*, DGAL) website and the set of political characteristics and electoral results was constructed based on data obtained from the General Directorate for Internal Affairs' (*Direcção-Geral da Administração Interna*, DGAI).

4.2. Municipality Efficiency Scores

Our key dependent variable is the municipality efficiency, which we compute using the data envelopment analysis (DEA). DEA is a non-parametric frontier methodology, drawing from Farrell's (1957) seminal work further developed by Charnes et al. (1978), which computes the relative efficiency of a group of observations.[5] Besides comparing each observation with an optimal outcome, this approach does not impose an underlying production function, it allows deviations

[4] We do not consider the years after 2011 to minimize the effects of the Global Financial Crisis and the Portuguese financial crisis, which started in 2011 and only began to fade away in 2014. From May 2011 to May 2014 Portugal implemented an Economic Adjustment Programme, which was consigned in a Memorandum of understanding on financial assistance, signed between the Portuguese government, the EC, the ECB and the IMF.
[5] Coelli et al. (2002) and Thanassoulis (2001) offer introductions to DEA.

from the efficient frontier, and it examines the efficiency of a country relative to its peers. Formally, for each municipality $\boldsymbol{i}$, we consider is the following function:

$$Y_i = f(X_i),\ i = 1, \ldots, 278 \qquad (1)$$

where Y is the composite output measure (Local Government Output Indicator, LGOI) and X is the per capita municipal expenditures.

As suggested by Afonso and Venâncio (2016, 2020), we use a set of metrics to construct the composite **Local Government Output Indicator** (LGOI). This indicator reflects local government performance in four areas: social services, basic education, cultural services, sanitation and territorial planning. LGOI is the simple average of these four indicators computed yearly for the period 2005-2011. Accordingly, each indicator results from the average of several sub-indicators. To measure **social services**, we use the ratio of local inhabitants above 65 years old to total resident population. For the **basic education** sub-indicator, we compiled data on school buildings per capita (number of nursery and primary school buildings in percent of the total number of corresponding school-age inhabitants), and gross primary enrolment ratio (number of enrolled students in nursery and primary education in percent of the total number of corresponding school age inhabitants). To measure the **cultural services**, we used the number of museums, zoos, botanical gardens, and aquariums as a percentage of resident population and the number of art facilities as a percentage of resident population. The **sanitation** sub-indicator includes the water supply per resident population and the urban waste collection per resident population. The **territorial planning** sub-indicator is measured by the number of building permits issued by local administration per resident population. To ensure a convenient benchmark, each sub-indicator measure is first normalized by dividing the value of a specific municipality by the average of that measure for all the municipalities in the sample.

Our input measure, municipal spending per resident population is lagged one year, therefore is computed for the period between 2004 and 2010. Table A1 in Appendix A provides additional information on the data sources and variable construction. Afonso and Venâncio (2016, 2020) provide further explanation on the variables' construction.

We adopt an input-oriented approach,[6] to measure the proportional reduction in inputs while holding output constant and assume variable-returns to scale (VRS), to account for the fact that countries might not operate at the optimal scale**.** More specifically, to compute the efficient scores, we use the following linear programming problem: [7]

$$\begin{aligned} &\min_{\theta,\lambda} \theta \\ s.t. \quad &-y_i + Y\lambda \geq 0 \\ &\theta x_i - X\lambda \geq 0 \\ &I1'\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \tag{2}$$

where y_i is a column vector of outputs, x_i is a column vector of inputs, θ is the efficient scores, λ is a vector of constants, $I1'$ is a vector of ones, X is the input matrix and Y is the output matrix. To impose convexity of the frontier and account VRS , we include the restriction $I1'\lambda = 1$. Dropping this restriction, would imply considering the constant returns to scale assumption.

In Equation (2), θ is a scalar (that satisfies $0 \leq \theta \leq 1$) and measures the technical efficiency, the distance between a municipality and the efficiency frontier, defined as a linear combination of the best practice observations. With $\theta < 1$, the municipality is inside the frontier, it is inefficient, while $\theta = 1$ implies that the municipality is on the frontier and it is efficient, representing the best existing municipality (but not necessarily the best possible). The vector λ measures the weights used to compute the location of an inefficient municipality if it were to become efficient, hence, maximizes productivity.

Table 3 provides a summary of the DEA results for the period 2005-2011, before and after the property tax reform using input-oriented approach. The results obtained in each year are illustrated on Tables B.1 of online Appendix B, and the number of efficient municipalities each year ranges from two to five. Table 3 shows that the average input efficiency scores declined from 0.575 before the tax reform to 0.488 after the tax reform. This change was transversal to municipalities that were obliged to reduce the IMI tax and to the ones that maintained the tax rate,

[6] Conversely, we could have adopted an output orientation. In this case we would measure the proportion increase in outputs holding inputs constant.

[7] This is the equivalent envelopment form, derived by Charnes et al. (1978), using the duality property of the multiplier form of the original programming model.

although the reduction in efficiency ends up being smaller for the municipalities that decreased the IMI and the CA tax rate. In addition, Figure 3 presents the treated and control municipalities, which are fairly dispersed through Portugal.

[Table 3]

[Figure 3]

5. Empirical Methodology and Results

To evaluate the impact the property tax reform on local government efficiency (θ_{it}), we estimate the following difference-in-difference specification for municipality i and year t, for the period 2005-2011:

$$\theta_{it} = \beta_t + \beta_i + \beta_1 Treated_i \; x \; Post\ Period_y + Z'_{it-1}\beta_2 + \varepsilon_{it}. \qquad (3)$$

Our dependent variable, θ_{it}, is the DEA input efficient score, computed in the previous sub-section. The input-oriented scores are more suitable for this analysis because they ensure that a given municipality's efficiency is determined by its ability to minimize municipality's per capita spending to keep providing a fixed level of (public) services.

$Post\ Period$ is a dummy variable equaling one for the years after the property tax reform, from year 2008 to 2011, and zero otherwise. $Treated$ is a binary variable that equals one if the municipality experienced a reduction on either CA or IMI taxes, and zero if a municipality was not forced to reduce the upper bound of the property tax.

Z is a vector of sociodemographic, macroeconomic, and institutional controls that may affect municipality's performance. This latter vector is lagged one year to minimize reverse causality concerns and it includes: i) municipality size and density, defined as the logarithm of domestic residents to control for the monitoring costs of government's discretional behavior (Grossman et al., 1999) and population density; ii) municipal income, measured by the unemployment rate, measured as the ratio of resident population aged between 15 and 65 years old who is enrolled as unemployed in the Portuguese Institute of Employment and Professional Training (*IEFP*), the logarithm of consumption of electricity per capita and the purchasing power; iii) municipality socio-demographic characteristics, measured by the share of female population,

the share of population with university degree and the share of immigrant population; iv) several political variables, namely: a dummy variable equaling one if the mayor and the Prime-Minister belong to the same political party, another dummy variable equaling one if the mayor has holds a majority in the municipal council and dummy variable equaling one if the mayor is female; the fraction of leftist mandates in the municipal council to control for distinct political ideologies and v) socio-demographic characteristics of the mayor, such as gender (dummy variable equaling one if the mayor is female and zero otherwise), age and education (dummy variable equaling one if the mayor has a bachelor degree). β_m denotes municipality fixed effects to control for geography-specific time invariant and unobserved characteristics and β_t denotes time (year) fixed effects to control for the macro-economic context and common time trends. The standard errors for this and all subsequent estimations are clustered at the municipality level (Bertrand et al., 2004). The definition and sources of the explanatory variables are presented in Table A.2 in the Appendix A, and Table 4 presents the descriptive statistics.

[Table 4]

There are three main challenges when assessing the causal impact of tax reforms on municipality efficiency. First, exogenous and non-discretionary inputs, such as municipality socio-economic characteristics and mayor discretionary behavior can contribute to explain municipality's efficiency scores. Nonetheless, many characteristics of the municipality and mayors are unobserved. To mitigate this issue, we control for the municipal-level characteristics. Second, unique features of the tax system may be endogenous to municipality performance, which could lead to reverse causality. We circumvent these concerns by taking advantage of a quasi-natural experiment. Finally, to measure the impact of the property tax reform, we need a counterfactual hypothesis of what efficiency would have been like in the treated municipalities if the property tax reform had not occurred. To this end, we select a set of control municipalities which we expect would be a viable representation of the performance of the treated municipalities if there had been no tax reform. More specifically, we assume that the property tax reform was not introduced in a way that correlates with unobserved trends in the dependent variable. To investigate this concern, we analyze the determinants of the property tax reform adoption.

Table 5 presents the probit results for the period 2005-2007 (before the tax reform). As time-varying economic variables, we include all the variables included vector Z. Larger municipalities were significantly more likely to be eligible for the property tax reform, notably the IMI reform. For the case of the IMI tax reform, this one is also more likely when a majority municipality government is in place.

[Table 5]

Table 6 presents the estimated coefficients for municipality efficiency using a difference-in-difference model for specification Equation (3). From the results, the IMI reform is linked to higher efficiency scores (see columns (3) and (4)). In other words, even if efficiency were to decline, such reduction ends up being smaller for the municipalities that decreased the IMI tax rate.

[Table 6]

The identification strategy of our results relies on two assumptions: i) the municipality characteristics must be balanced in the treatment and control groups, and ii) the municipalities must show similar parallel trends in the pre-treatment period. With respect to the first requirement, we try to tackle it by including several municipality socio-economic variables. Except for population, the remaining characteristics of the municipalities are not different in the treated and control group. Regarding the second assumption, we performed two exercises. First, we compare the evolution of municipality efficiency in treated and control municipalities during the pre-treatment and treatment periods (Angrist and Pischke, 2009). Figure 3 does not provide evidence of distinct pre-treatment trends between treatment and control municipalities which could undermine our identification strategy. Second, we perform a falsification (placebo) test by restricting the period of analysis to 2005-2007. The treatment and control groups remain the same, however the Post Period variable equals one for the years 2006 and 2007. The results are presented in Columns (1) and (2) of Table 7. This exercise displays no statistically significant effects regarding the relevance of the tax reform.

[Figure 3]

[Table 7]

Additionally, we performed several robustness checks. Our first robustness exercise modifies Equation 3 to encompass an interaction with the imposed decrease of the property tax rate. The treatment intensity effects are obtained by substituting $Treated_i$ by $Intensity_i$, a non-binary indicator of how much the municipality was forced to decrease the property tax rate. The results, displayed in Columns (3) and (4) of Table 7, yield very similar conclusions to our baseline. We also present results for a subsample of Portuguese mainland municipalities. We exclude 22 municipalities with very low IMI in 2007, bellow 0.3% and 19 municipalities with very low CA in 2007, bellow 0.6%. Our results maintain the same. Furthermore, we drop 2008, the year when the reform was announced and implemented. We remove the most severe crisis year from our sample (i.e., 2011) when Portugal implemented the Economic Adjustment Programme, which was consigned in a Memorandum of Understanding on financial assistance, signed between the Portuguese government, the EC, the ECB and the IMF. The goal is to dismiss concerns that our result is being driven by this event. In fact, the ensuing results further support our baseline specification analysis.

6. Conclusion

We have assessed the changes on municipal efficiency stemming from a property tax reform that in 2008 reduced the maximum threshold for this tax rate for Portuguese municipalities. Several municipalities around the metropolitan areas of Lisbon and Porto (the two biggest cities), and in the coastline and in the south, were forced to decrease the IMI and the CA tax rate. On the other hand, more inland municipalities did not reduce the property tax rate.

Hence, we have evaluated if there were improvements in local government spending efficiency for the municipalities that reduced their property tax revenues, in comparison to those that did not have to change their property tax. For that purpose, we computed efficiency scores using DEA for the period between 2005 and 2011 and then we use a panel data set to estimate how the tax reform affected the efficiency scores.

Our results show that the average input efficiency scores declined from 0.575 before the tax reform to 0.488 after the tax reform. This change was transversal to municipalities that were obliged to reduce the IMI tax and to the ones that maintained the tax rate. In addition, the IMI

reform is linked to higher efficiency scores. In other words, even if efficiency were to decline, the reduction on efficiency ends up being smaller for the municipalities that decreased the IMI tax rate.

Hence, a policy implication to draw form the analysis is that somewhat lower tax rates, in this case, property tax rates, can be spending efficiency enhancing. This can be viewed through the lenses of the tax-and-spend hypothesis.

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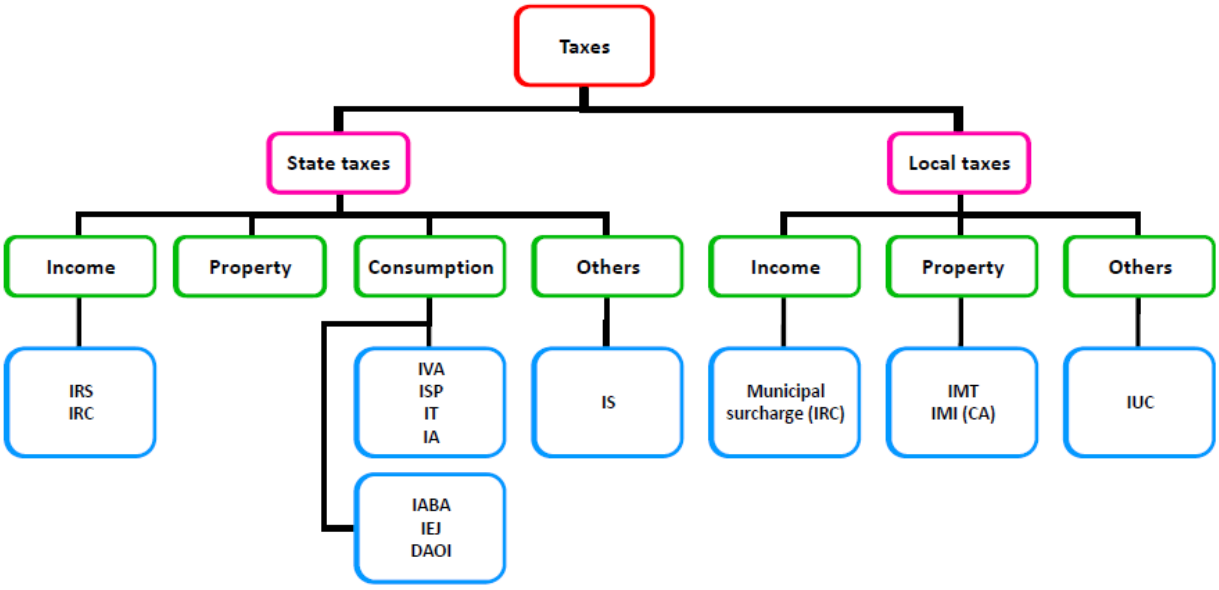
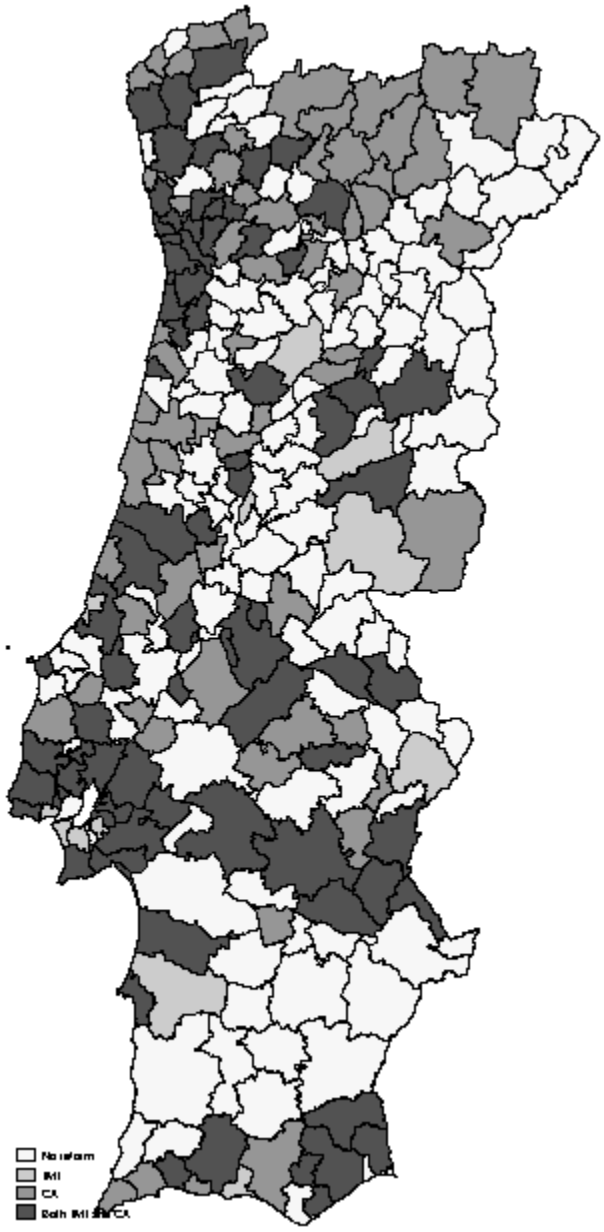
Figure 1 – Taxes in Portugal



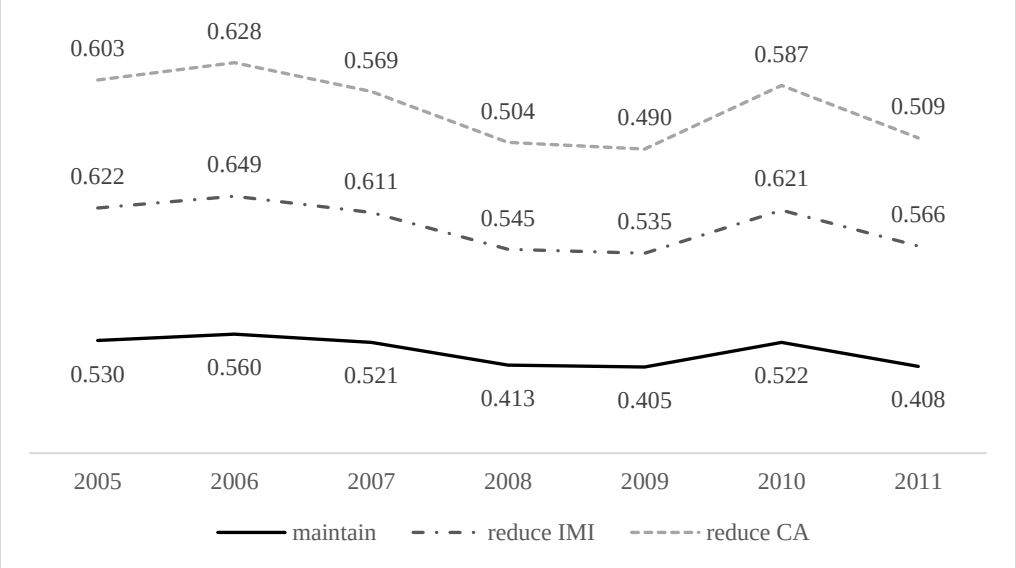
Note: Personal income tax (IRS); Corporate income tax (IRC); Value added tax (IVA); Excise tax on petroleum and energy products (ISP); Excise tax on tobacco (IT); Vehicle Tax (IA); Excise tax on alcohol and alcoholic beverages (IABA); Tax on gambling inspections and checks or Special excise tax on gambling and gaming activities (IEJ); Customs Duties and Other Charges (DAOI); Stamp tax/duty (IS); Municipal tax on real estate transfer (IMT); *Contribuição Autárquica* (CA); Municipal local property tax (IMI); Road tax (traffic and haulage) (IUC).

Figure 2 – Treated and Control Municipalities



Note: The figure plots the municipalities that were forced to both reduce the IMI and the CA tax rate (dark grey), the municipalities that were forced to decrease the IMI tax rate (grey); the municipalities that were forced to the CA tax rate (light grey) and the municipalities that were not forced to reduce the property tax rate (white).

Figure 3 – Average Efficiency Score by Type of Municipality



Note: The figure plots the average efficiency scores for the municipalities that were obliged to reduce the upper limit of the property tax rate on reassessed urban properties (IMI); for the municipalities that were obliged to reduce the upper limit of the property tax rate on non-reassessed urban properties (CA); and for the municipalities that were not obliged to change the property tax rate.

Table 1 – Municipality Main Sources of Funding

	2005	2006	2007	*2008*	2009	2010	2011	**Average**
Total revenues share								
Transfers from central government/total revenues (%)	50.0%	50.6%	47.5%	*47.8%*	50.7%	50.6%	48.1%	**49.3%**
Own revenues/total revenues (%)	32.2%	34.1%	36.5%	*35.2%*	31.7%	32.7%	32.7%	**33.6%**
Own revenues share								
Taxes/own revenues (%)	52.1%	53.7%	54.3%	*53.1%*	52.0%	51.9%	52.6%	**52.8%**
Property taxes/own revenues (%)	17.4%	20.0%	19.6%	*21.7%*	22.6%	23.6%	25.2%	**21.5%**
IMT/own revenues (%)	12.9%	13.6%	16.7%	*15.1%*	12.7%	11.8%	10.6%	**13.3%**
Indirect taxes and others/own revenues (%)	10.2%	7.0%	9.5%	*8.8%*	7.8%	8.3%	7.7%	**8.5%**
Municipal surcharge/own revenues (%)	3.6%	3.3%	3.1%	*2.7%*	3.3%	2.5%	3.5%	**3.2%**
Property tax rate								
IMI	0.41%	0.40%	0.39%	*0.40%*	0.35%	0.35%	0.35%	0.35%
CA	0.70%	0.71%	0.70%	*0.71%*	0.65%	0.65%	0.65%	0.65%
Property tax per capita (EUR)	65	61	90	*75*	74	76	81	**75**

Table 2 – Property Tax Reform: Minimum and Maximum Tax Rate Values

Year	Reassessed (IMI)		Non-Reassessed (CA)		Rural
	Min	Max	Min	Max	
2003-2007	0.20%	0.50%	0.40%	0.80%	0.80%
2008-2011	0.20%	**0.40%**	0.40%	**0.70%**	0.80%

Note: In this study, we focus on the reassessed urban properties (IMI) and non-reassessed urban properties (CA) tax rate reform. Source: Portuguese Tax Authority.

Table 3 – DEA Efficiency Results

		Before tax reform					After tax reform				After - Before	
		DMUs	**Average**	**Max**	**Min**	**Stdev**	**Average**	**Max**	**Min**	**Stdev**	**Percentage of municipalities with eff gains 1/**	**Growth**
1	**Municipality, DEA**	**278**	**0.575**	**1.000**	**0.245**	**0.177**	**0.488**	**0.943**	**0.158**	**0.172**	12.23%	-15.1%
2	Municipality, Reduce IMI tax	94	0.628	0.969	0.245	0.192	0.567	0.969	0.245	0.182	20.21%	-9.7%
3	Municipality, Reduce CA tax	145	0.600	0.969	0.245	0.184	0.523	0.943	0.158	0.178	14.48%	-12.9%
4	Municipality, Maintain taxes	121	0.537	1.000	0.254	0.161	0.437	0.919	0.187	0.151	9.09%	-18.6%

Note: The table reports the input DEA efficiency scores for Portuguese mainland municipalities for the years before the tax reform (2005-2007) and after the tax reform (2008-2011). Row (1) report the scores for the 278 municipalities; Rows (2) report the scores for the municipalities that were obliged to reduce the upper limit of the property tax rate on reassessed urban properties (IMI); Rows (3) report the scores for the municipalities that were obliged to reduce the upper limit of the property tax rate on non-reassessed urban properties (CA); Rows (4) report the scores for the municipalities that were obliged to reduce both the upper limit of the property tax rate on reassessed (IMI) and non-reassessed (CA) Rows (5) report the scores for the municipalities that were not obliged to change the property tax rate. The first column "After- Before", "Percentage", reports the percentage of municipalities where there is a gain in efficiency, by comparing the average efficiency score after and before the property tax reform. The second column "After- Before" reports the growth rate of the average efficiency scores after and before the property tax reform. Number is the number of municipalities. Max is maximum, Min is minimum and Stdev is standard deviation. 1/ percentage of municipalities where there is a gain in efficiency, by comparing the average efficiency score after and before the property tax reform.

Table 4 – Descriptive statistics

Variable	Obs	Mean	Std. Dev.
Efficiency score	1946	0.53	0.20
Tax reform	1946	0.56	0.50
IMI reform	1946	0.34	0.47
CA reform	1946	0.52	0.50
Population	1946	36,095	57,884
Population density	1946	0.31	0.85
Unemployment rate	1946	6.34	2.25
Electricity per capita	1946	0.37	0.76
Purchasing power	1946	75.41	24.30
Share female	1946	0.35	0.07
Share tertiary degree	1946	0.06	0.03
Share immigrants	1946	0.07	0.05
Same political party	1946	0.90	0.31
Majority	1946	0.40	0.49
Share leftist mandates	1946	0.55	0.25
Female mayor	1946	0.06	0.24
Mayor age	1946	52.24	8.08
Mayor education	1946	0.82	0.38

Table 5 – Property tax reform adoption in eligible municipalities (2005-2007)

	Tax reform (1)	IMI reform (2)	CA reform (3)
ln(Population)	0.603*	0.866***	0.512*
	(0.309)	(0.312)	(0.305)
Population density	-0.067	0.118	-0.079
	(0.171)	(0.173)	(0.169)
Unemployment rate	0.048	-0.007	0.037
	(0.044)	(0.044)	(0.043)
ln(Electricity per capita)	0.090	0.382	0.151
	(0.273)	(0.264)	(0.271)
Purchasing power	-0.005	0.002	-0.001
	(0.008)	(0.008)	(0.008)
Share female	-1.092	-0.269	-0.753
	(1.527)	(1.710)	(1.507)
Share tertiary degree	1.836	-5.954	-2.034
	(5.494)	(5.834)	(5.310)
Share immigrants	1.205	3.858	-0.405
	(2.626)	(2.827)	(2.564)
Same political party	0.104	0.039	0.141
	(0.106)	(0.097)	(0.108)
Majority	0.363	0.581*	0.173
	(0.257)	(0.298)	(0.248)
Share leftist mandates	0.455	0.726	0.313
	(0.434)	(0.456)	(0.424)
Female mayor	0.114	0.091	0.243
	(0.415)	(0.408)	(0.425)
ln(Mayor age)	0.190	0.736	0.177
	(0.629)	(0.653)	(0.614)
Mayor education	0.074	-0.234	0.446
	(0.284)	(0.283)	(0.296)
Constant	-6.605*	-11.898***	-5.813*
	(3.503)	(3.485)	(3.355)
Observations	834	834	834
Pseudo R-square	0.101	0.182	0.0679

Note: The table reports the estimated coefficients for the tax reform adoption using a probit model for the period 2005-2007. Year fixed effects omitted. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively.

Table 6 – DEA Efficiency Scores

	(1)	(2)	(3)	(4)
Tax reform x Post period	0.023**	0.010		
	(0.012)	(0.017)		
IMI reform x Post period			0.039***	0.043*
			(0.013)	(0.022)
CA reform x Post period			0.001	-0.012
			(0.012)	(0.016)
ln(Population)		0.648***		0.525**
		(0.219)		(0.227)
Population density		-0.103*		-0.101**
		(0.060)		(0.051)
Unemployment Rate		0.004		0.004
		(0.004)		(0.004)
ln(Electricity per capita)		-0.011		-0.007
		(0.051)		(0.050)
Purchasing power		-0.001		-0.001
		(0.001)		(0.001)
Share female		0.021		0.037
		(0.176)		(0.175)
Share tertiary degree		-1.133**		-1.102**
		(0.512)		(0.494)
Share immigrants		-0.491**		-0.545**
		(0.245)		(0.253)
Same political party		-0.000		-0.001
		(0.007)		(0.007)
Majority		-0.012		-0.012
		(0.016)		(0.015)
Share leftist mandates		0.013		0.007
		(0.044)		(0.043)
Female mayor		0.105*		0.094*
		(0.055)		(0.052)
ln(Mayor age)		0.049		0.048
		(0.047)		(0.046)
Mayor education		-0.011		-0.011
		(0.016)		(0.016)
Constant	0.552***	-5.823***	0.552***	-4.611**
	(0.005)	(2.053)	(0.005)	(2.129)
Observations	1,946	1,946	1,946	1,946
R-squared	0.305	0.397	0.310	0.403
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: The table reports the estimated coefficients from Equation (3) using a fixed effect model. The dependent variable is the DEA input scores computed between the period 2005 and 2011. The definition and sources of the independent variables are presented in Table A.2 of Appendix A. Municipality and year fixed effects omitted. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively.

Table 7 – Robustness Check

	Placebo		Intensity				Subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tax reform x Post period	-0.013		0.508***	0.409			0.024*	0.007		
	(0.015)		(0.124)	(0.251)			(0.013)	(0.019)		
IMI reform x Post period		-0.019			0.517***	0.433*			0.041***	0.046**
		(0.017)			(0.129)	(0.253)			(0.013)	(0.022)
CA reform x Post period		-0.003			-0.016	-0.049			0.000	-0.018
		(0.015)			(0.087)	(0.123)			(0.013)	(0.018)
ln(Population)	0.667***	0.646***		0.499**		0.501**		0.743***		0.598**
	(0.214)	(0.214)		(0.233)		(0.232)		(0.229)		(0.235)
Population density	-0.103*	-0.105*		-0.092*		-0.093*		-0.107*		-0.105**
	(0.061)	(0.059)		(0.049)		(0.049)		(0.063)		(0.052)
Unemployment rate	0.004	0.004		0.004		0.004		0.006		0.007
	(0.004)	(0.004)		(0.004)		(0.004)		(0.005)		(0.005)
ln(Electricity per capita)	-0.010	-0.007		-0.009		-0.010		-0.006		-0.001
	(0.050)	(0.050)		(0.052)		(0.052)		(0.051)		(0.051)
Purchasing power	-0.001	-0.001		-0.001		-0.001		-0.001		-0.001
	(0.001)	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Share female	0.027	0.027		0.040		0.043		-0.075		-0.055
	(0.175)	(0.176)		(0.172)		(0.174)		(0.203)		(0.203)
Share tertiary degree	-1.131**	-1.120**		-1.112**		-1.103**		-1.024		-0.989*
	(0.516)	(0.510)		(0.502)		(0.496)		(0.622)		(0.595)
Share immigrants	-0.481**	-0.501**		-0.547**		-0.550**		-0.515*		-0.574**
	(0.243)	(0.249)		(0.256)		(0.257)		(0.270)		(0.273)
Same political party	-0.011	-0.012		-0.012		-0.012		-0.008		-0.008
	(0.016)	(0.016)		(0.015)		(0.015)		(0.016)		(0.016)
Majority	-0.000	-0.000		-0.001		-0.001		-0.001		-0.001
	(0.007)	(0.007)		(0.007)		(0.007)		(0.008)		(0.008)
Share leftist mandates	0.012	0.011		0.010		0.009		0.041		0.030
	(0.044)	(0.043)		(0.043)		(0.043)		(0.050)		(0.049)
Female mayor	0.106**	0.106**		0.100*		0.100*		0.096*		0.084*
	(0.052)	(0.049)		(0.052)		(0.052)		(0.052)		(0.049)
ln(Mayor age)	0.054	0.053		0.047		0.048		0.043		0.038
	(0.047)	(0.047)		(0.046)		(0.046)		(0.047)		(0.045)
Mayor education	-0.011	-0.011		-0.011		-0.011		-0.006		-0.007
	(0.016)	(0.016)		(0.016)		(0.016)		(0.017)		(0.017)
Constant	-6.029***	-5.822***	0.454***	-4.363**	0.455***	-4.386**	0.562***	-6.787***	0.562***	-5.334**
	(2.004)	(1.997)	(0.006)	(2.175)	(0.008)	(2.174)	(0.005)	(2.183)	(0.005)	(2.234)
Observations	1,022	1,022	1,946	1,946	1,946	1,946	1,757	1,757	1,757	1,757
R-squared	0.397	0.398	0.313	0.402	0.313	0.402	0.297	0.392	0.303	0.400

***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively.

Table 7 – Robustness Check (continued)

	Drop 2008				Drop 2011			
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Tax reform x Post period	0.023*	0.007			0.017	0.010		
	(0.012)	(0.017)			(0.012)	(0.018)		
IMI reform x Post period			0.040***	0.053**			0.029**	0.045**
			(0.014)	(0.024)			(0.013)	(0.022)
CA reform x Post period			-0.002	-0.023			0.002	-0.013
			(0.013)	(0.018)			(0.012)	(0.017)
ln(Population)		0.610***		0.471**		0.596**		0.455*
		(0.216)		(0.221)		(0.258)		(0.260)
Population density		-0.076		-0.076		-0.132**		-0.129**
		(0.069)		(0.056)		(0.058)		(0.051)
Unemployment rate		0.008*		0.008*		0.005		0.005
		(0.004)		(0.004)		(0.005)		(0.005)
ln(Electricity per capita)		-0.020		-0.016		0.044		0.051
		(0.055)		(0.055)		(0.062)		(0.062)
Purchasing power		-0.001		-0.001		-0.001		-0.001
		(0.001)		(0.001)		(0.001)		(0.001)
Share female		0.060		0.072		0.002		0.023
		(0.199)		(0.199)		(0.203)		(0.202)
Share tertiary degree		-1.177**		-1.115**		-1.251**		-1.240**
		(0.484)		(0.459)		(0.543)		(0.514)
Share immigrants		-0.477*		-0.525*		-0.447		-0.510
		(0.286)		(0.289)		(0.314)		(0.325)
Same political party		-0.011		-0.012		-0.011		-0.011
		(0.015)		(0.014)		(0.018)		(0.018)
Majority		-0.001		-0.002		-0.002		-0.003
		(0.007)		(0.007)		(0.008)		(0.008)
Share leftist mandates		0.025		0.017		0.007		-0.003
		(0.044)		(0.043)		(0.051)		(0.050)
Female mayor		0.072		0.058		0.141		0.131
		(0.048)		(0.042)		(0.087)		(0.083)
ln(Mayor age)		0.040		0.038		0.051		0.049
		(0.046)		(0.043)		(0.048)		(0.048)
Mayor education		-0.018		-0.018		-0.001		-0.002
		(0.017)		(0.016)		(0.022)		(0.022)
Constant	0.456***	-5.471***	0.457***	-4.104*	0.553***	-5.232**	0.551***	-3.839
	(0.009)	(2.034)	(0.008)	(2.084)	(0.009)	(2.449)	(0.009)	(2.465)
Observations	1,668	1,668	1,668	1,668	1,668	1,668	1,668	1,668
R-squared	0.297	0.403	0.302	0.412	0.307	0.378	0.310	0.385

***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively.

Appendix A

Table A.1 – Definition of the Input (X) and Output Variables (Y) and Respective Sources

Variable	Input measure		Source
X	Total municipal expenditures per inhabitant, 2004-2010		Direcção-Geral das Autarquias Locais, Despesas municipais com trimestres e anual;2004-2010; (http://www.dados.gov.pt); INE
Variable	**Output measures**	**Municipal results indicators**	**Source**
Y_1	Social services	Percentage of local inhabitants with ≥65 years old, 2005-2011	INE, 2005-2011.
Y_2	Basic education	School buildings per capita measured by the number of nursery and primary school buildings in percent of the total number of corresponding school-age inhabitants, 2005-2011. Gross primary enrolment ratio, the number of enrolled students in nursery and primary education in percent of the total number of corresponding school-age inhabitants, 2005-2011.	INE 2006-2012, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2005-2011; INE.
Y_3	Cultural services	Number of museums, zoos, botanical gardens and aquariums per capita, 2005-2011 Number of art facilities per capita, 2005-2011	INE 2006-2012, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2005-2011; INE.
Y_4	Sanitation	Water supply per capita, 2005-2011. Urban waste collection per capita, 2005-2011.	INE 2006-2012, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2005-2011; INE.
Y_5	Territory organization	Building permits issued by local administration per capita, 2005-2011.	INE 2006-2012, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2005-2011; INE.

Table A.2 – Definition of the Explanatory Variables and Respective Sources

Variable	Definition	Source
ln(Population)	Logarithm of the local inhabitants	INE, Estimativas anuais da população residente
Population density	Logarithm of population per km^2	
Unemployment rate	Ratio of resident population aged between 15 and 65 years old who is enrolled as unemployed in the Portuguese Institute of Employment and Professional Training (IEFP)	Portuguese Institute of Employment and Professional Training
ln(Electricity per capita)	Logarithm of consumption of electricity per capita	Direção-Geral de Energia e Geologia, Estatísticas do carvão, petróleo, energia elétrica e gás natural
Purchasing power	Purchasing power is an index constructed by the Statistics Portugal to evaluate the income and wealth of local residents.	INE, Estudo sobre o Poder de Compra Concelho
Share female	Share of female population.	INE, Estimativas anuais da população residente
Share tertiary degree	Share of population with university degree.	
Share immigrants	Share of immigrant's population.	
Same political party	Dummy variable equaling one if the mayor and the Prime-Minister belong to the same political party, and zero otherwise.	Direção-Geral da Administração Interna, Results of municipal elections
Majority	dummy variable equaling one if the mayor holds a majority in the municipal council and zero otherwise	
Share leftist mandates	Fraction of leftist mandates in the municipal council.	
Female mayor	Dummy variable equaling one if the mayor is female and zero otherwise.	
ln(Mayor age)	Logarithm of mayor age.	
Mayor education	Dummy variable equaling one if the mayor has a bachelor degree and zero otherwise.	

Appendix B (online)

Table B.1: Input-oriented DEA VRS Efficiency Scores

Code	Municipality	2005	2006	2007	2008	2009	2010	2011
101	Águeda	**1.000**	0.991	0.804	0.765	0.667	0.675	0.705
102	Albergaria-a-Velha	0.738	0.715	0.616	0.670	0.704	0.615	0.552
103	Anadia	0.861	0.891	**1.000**	0.669	0.579	0.860	0.785
104	Arouca	0.607	0.649	0.538	0.497	0.587	0.544	0.539
105	Aveiro	0.729	0.717	0.651	0.443	0.601	0.706	0.707
106	Castelo de Paiva	0.778	0.738	0.671	0.691	0.433	0.762	0.505
107	Espinho	0.490	0.518	0.513	0.510	0.490	0.563	0.498
108	Estarreja	0.621	0.612	0.559	0.500	0.528	0.467	0.617
109	Santa Maria da Feira	0.989	0.933	0.915	0.755	0.825	0.903	0.891
110	Ílhavo	0.610	0.630	0.606	0.611	0.491	0.506	0.546
111	Mealhada	0.710	0.705	0.598	0.466	0.519	0.575	0.611
112	Murtosa	0.570	0.671	0.573	0.547	0.428	0.712	0.461
113	Oliveira de Azeméis	0.837	0.837	0.816	0.401	0.859	0.895	0.847
114	Oliveira do Bairro	0.520	0.565	0.531	0.518	0.468	0.455	0.425
115	Ovar	0.851	0.897	0.883	0.796	0.735	0.694	0.642
116	São João da Madeira	0.485	0.354	0.426	0.387	0.421	0.567	0.456
117	Sever do Vouga	0.592	0.589	0.542	0.559	0.480	0.639	0.575
118	Vagos	0.805	0.680	0.582	0.562	0.603	0.818	0.704
119	Vale de Cambra	0.684	0.713	0.600	0.459	0.501	0.653	0.564
201	Aljustrel	0.481	0.553	0.363	0.399	0.360	0.487	0.456
202	Almodôvar	0.603	0.480	0.480	0.249	0.262	0.328	0.257
203	Alvito	0.459	0.414	0.380	0.214	0.226	0.288	0.169
204	Barrancos	0.311	0.357	0.242	0.163	0.156	0.268	0.299
205	Beja	0.520	0.659	0.603	0.487	0.578	0.669	0.623
206	Castro Verde	0.553	0.491	0.472	0.263	0.263	0.429	0.246
207	Cuba	0.480	0.461	1.000	0.349	0.401	0.390	0.409
208	Ferreira do Alentejo	0.376	0.457	0.382	0.323	0.308	0.353	0.343
209	Mértola	0.242	0.333	0.307	0.187	0.201	0.287	0.201
210	Moura	0.550	0.539	0.459	0.386	0.337	0.502	0.330
211	Odemira	0.419	0.491	0.405	0.315	0.352	0.459	0.365
212	Ourique	0.432	0.505	0.482	0.317	0.228	0.450	0.284
213	Serpa	0.638	0.617	0.563	0.354	0.354	0.325	0.280
214	Vidigueira	0.438	0.430	0.681	0.389	0.358	0.428	0.288
301	Amares	0.610	0.843	0.729	0.546	0.686	0.612	0.531
302	Barcelos	0.876	0.847	0.855	0.874	0.924	0.865	0.911
303	Braga	0.769	0.977	0.934	0.922	0.798	0.851	0.888
304	Cabeceiras de Basto	0.565	0.615	0.568	0.521	0.449	0.499	0.406
305	Celorico de Basto	0.553	0.716	0.588	0.536	0.547	0.430	0.313
306	Esposende	0.755	0.746	0.660	0.745	0.711	0.938	0.677
307	Fafe	0.824	0.769	0.657	0.608	0.591	0.615	0.612
308	Guimarães	0.888	0.938	0.970	0.914	0.757	0.732	0.600
309	Póvoa de Lanhoso	0.701	0.682	0.641	0.579	0.585	0.588	0.554
310	Terras de Bouro	0.416	0.317	0.290	0.338	0.285	0.342	0.319
311	Vieira do Minho	0.644	0.644	0.582	0.473	0.590	0.564	0.431
312	Vila Nova de Famalicão	0.740	0.895	0.889	0.785	0.759	0.688	0.722
313	Vila Verde	0.802	0.871	0.777	0.743	0.753	0.770	0.720
314	Vizela	0.786	0.766	0.643	0.768	0.709	0.763	0.676
401	Alfândega da Fé	0.287	0.349	0.241	0.216	0.179	0.162	0.276
402	Bragança	0.495	0.596	0.457	0.422	0.381	0.521	0.473
403	Carrazeda de Ansiães	0.432	0.393	0.520	0.353	0.287	0.445	0.284

Code	Municipality	2005	2006	2007	2008	2009	2010	2011
404	Freixo de Espada à Cinta	0.346	0.372	0.290	0.147	0.143	0.263	0.195
405	Macedo de Cavaleiros	0.505	0.462	0.408	0.405	0.314	0.505	0.437
406	Miranda do Douro	0.449	0.583	0.483	0.341	0.260	0.626	0.310
407	Mirandela	0.553	0.539	0.505	0.458	0.413	0.534	0.521
408	Mogadouro	0.352	0.347	0.319	0.319	0.290	0.347	0.221
409	Torre de Moncorvo	0.352	0.339	0.303	0.285	0.315	0.456	0.195
410	Vila Flor	0.446	0.453	0.345	0.267	0.353	0.541	0.294
411	Vimioso	0.319	0.350	0.327	0.199	0.259	0.313	0.228
412	Vinhais	0.465	0.376	0.358	0.294	0.310	0.360	0.270
501	Belmonte	0.487	0.681	0.774	0.463	0.423	0.725	0.477
502	Castelo Branco	0.666	0.699	0.589	0.357	0.509	0.614	0.552
503	Covilhã	0.637	0.692	0.592	0.477	0.692	0.665	0.627
504	Fundão	0.428	0.449	0.337	0.399	0.393	0.644	0.441
505	Idanha-a-Nova	0.501	0.501	0.453	0.231	0.242	0.554	0.289
506	Oleiros	**1.000**	**1.000**	1.000	0.276	**0.241**	1.000	0.242
507	Penamacor	0.333	0.353	0.354	0.263	0.246	0.432	0.264
508	Proença-a-Nova	0.374	0.423	0.454	0.298	0.289	0.432	0.320
509	Sertã	0.564	0.564	0.488	0.474	0.449	0.521	0.396
510	Vila de Rei	0.305	0.329	0.406	0.244	0.237	0.658	0.247
511	Vila Velha de Ródão	0.330	0.402	0.373	0.217	0.209	0.383	0.196
601	Arganil	0.590	0.446	0.656	0.417	0.423	0.467	0.378
602	Cantanhede	0.897	0.851	0.646	0.581	0.748	0.544	0.827
603	Coimbra	0.813	0.882	0.648	0.663	0.637	0.832	0.657
604	Condeixa-a-Nova	0.619	0.744	0.710	0.608	0.503	0.660	0.541
605	Fig. Castelo Rodrigo	0.682	0.713	0.687	0.752	0.594	0.993	0.391
606	Góis	0.330	0.397	0.408	0.264	0.305	0.425	0.252
607	Lousã	0.609	0.717	0.501	0.548	0.590	0.644	0.537
608	Mira	0.639	0.788	0.493	0.496	0.456	0.706	0.523
609	Miranda do Corvo	0.604	0.682	0.650	0.539	0.554	0.554	0.531
610	Montemor-o-Velho	0.710	0.901	0.697	0.687	0.386	0.449	0.555
611	Oliveira do Hospital	0.601	0.671	0.644	0.553	0.535	0.671	0.472
612	Pampilhosa da Serra	0.476	0.470	0.397	0.176	0.169	0.310	0.171
613	Penacova	0.647	0.765	0.653	0.604	0.507	0.563	0.570
614	Penela	0.614	0.615	0.568	0.372	0.358	0.562	0.316
615	Soure	0.658	0.676	0.604	0.647	0.553	0.643	0.515
616	Tábua	0.561	0.716	0.560	0.519	0.546	0.584	0.425
617	Vila Nova de Poiares	0.406	0.326	0.364	0.440	0.281	0.396	0.181
701	Alandroal	0.356	0.373	0.361	0.284	0.294	0.172	0.252
702	Arraiolos	0.389	0.384	0.310	0.229	0.301	0.508	0.339
703	Borba	0.662	0.590	0.596	0.230	0.301	0.686	0.480
704	Estremoz	0.583	0.703	0.550	0.476	0.504	0.447	0.426
705	Évora	0.663	0.694	0.529	0.594	0.458	0.645	0.639
706	Montemor-o-Novo	0.565	0.596	0.441	0.394	0.415	0.500	0.447
707	Mora	0.365	0.280	0.331	0.271	0.331	0.540	0.365
708	Mourão	0.248	0.268	0.227	0.227	0.134	0.451	0.292
709	Portel	0.268	0.398	0.335	0.257	0.242	0.327	0.275
710	Redondo	0.474	0.511	0.420	0.324	0.275	0.432	0.296
711	Reguengos de Monsaraz	0.391	0.361	0.383	0.325	0.318	0.468	0.322
712	Vendas Novas	0.386	0.500	0.480	0.483	0.481	0.517	0.551
713	Viana do Alentejo	0.332	0.444	0.391	0.416	0.298	0.317	0.338
714	Vila Viçosa	0.621	0.614	0.706	0.474	0.434	0.848	0.448
801	Albufeira	0.293	0.312	0.245	0.188	0.173	0.335	0.272
802	Alcoutim	0.207	0.402	0.209	0.118	0.150	0.210	0.156
803	Aljezur	0.629	0.641	0.519	0.194	0.269	1.000	0.344
804	Castro Marim	0.285	0.441	**0.265**	**1.000**	1.000	0.299	0.276

Code	Municipality	2005	2006	2007	2008	2009	2010	2011
805	Faro	0.608	0.673	0.724	0.674	0.637	1.000	0.655
806	Lagoa	0.283	0.343	0.254	0.228	0.322	0.368	0.319
807	Lagos	0.306	0.326	0.311	0.228	0.272	0.426	0.322
808	Loulé	0.329	0.329	0.266	0.248	0.224	0.338	0.304
809	Monchique	0.298	0.275	0.285	0.291	0.318	0.405	0.298
810	Olhão	0.759	0.732	0.380	0.621	0.546	0.666	0.655
811	Portimão	0.504	0.488	0.401	0.348	0.379	0.561	0.467
812	São Brás de Alportel	0.562	0.661	0.541	0.319	0.362	0.478	0.440
813	Silves	0.553	0.518	0.462	0.478	0.308	0.658	0.477
814	Tavira	0.408	0.435	0.362	0.320	0.328	0.476	0.566
815	Vila do Bispo	0.666	0.653	0.586	0.170	0.198	0.419	0.233
816	Vila Real de Santo António	0.326	0.389	0.268	0.193	0.269	0.187	0.299
901	Aguiar da Beira	0.321	0.318	0.427	0.326	0.326	0.532	0.304
902	Almeida	0.311	0.308	0.215	0.210	0.267	0.288	0.265
903	Celorico da Beira	0.599	0.674	0.595	0.326	0.401	0.392	0.404
904	Figueira da Foz	0.395	0.319	0.367	0.288	0.284	0.330	0.232
905	Fornos de Algodres	0.266	0.370	0.408	0.285	0.356	0.112	0.271
906	Gouveia	0.716	**1.000**	0.982	0.433	**0.593**	1.000	0.622
907	Guarda	0.564	0.626	0.594	0.495	0.387	0.648	0.549
908	Manteigas	0.217	0.252	0.292	0.219	0.216	0.288	0.282
909	Meda	0.451	0.541	0.452	0.276	0.198	0.455	0.275
910	Pinhel	0.429	0.390	0.365	0.322	0.370	0.427	0.325
911	Sabugal	0.578	0.507	0.464	0.314	0.291	0.481	0.337
912	Seia	0.558	0.561	0.783	0.503	0.494	0.728	0.186
913	Trancoso	0.477	0.461	0.397	0.433	0.409	0.468	0.355
914	Vila Nova de Foz Côa	0.466	0.559	0.510	0.319	0.333	0.519	0.283
1001	Alcobaça	0.605	0.669	0.710	0.664	0.662	0.821	0.774
1002	Alvaiázere	0.448	0.544	0.406	0.354	0.378	0.386	0.296
1003	Ansião	0.559	0.541	0.452	0.259	0.503	0.597	0.455
1004	Batalha	**1.000**	0.974	0.804	0.628	0.585	0.549	0.473
1005	Bombarral	0.683	0.549	0.476	0.595	0.598	0.850	0.547
1006	Caldas da Rainha	**0.966**	0.823	0.623	0.674	0.660	0.819	0.891
1007	Castanheira de Pêra	0.243	0.508	0.642	0.303	0.342	0.595	0.212
1008	Figueiró dos Vinhos	0.478	0.475	0.476	0.356	0.355	0.540	0.215
1009	Leiria	0.951	0.960	0.855	0.682	0.801	0.925	0.845
1010	Marinha Grande	0.809	0.827	0.755	0.661	0.680	0.764	0.658
1011	Nazaré	0.799	0.733	0.749	0.578	0.349	0.738	0.607
1012	Óbidos	0.385	0.427	0.328	0.292	0.246	0.312	0.292
1013	Pedrógão Grande	0.368	0.412	0.460	0.236	0.327	0.568	0.304
1014	Peniche	0.962	0.629	0.660	0.615	0.743	0.802	0.620
1015	Pombal	0.795	0.711	0.630	0.651	0.673	0.630	0.532
1016	Porto de Mós	0.767	0.787	0.629	0.620	0.546	0.576	0.462
1101	Alenquer	0.852	0.631	0.622	0.706	0.717	0.836	0.657
1102	Arruda dos Vinhos	0.438	0.418	0.426	0.415	0.441	0.547	0.534
1103	Azambuja	0.512	0.502	0.433	0.323	0.400	0.564	0.933
1104	Cadaval	0.799	0.666	0.656	0.594	0.591	0.796	0.486
1105	Cascais	0.535	0.599	0.561	0.539	0.447	0.548	0.547
1106	Lisboa	0.463	0.511	0.488	0.415	0.377	0.542	0.455
1107	Loures	0.857	0.729	0.726	0.623	0.596	0.729	0.762
1108	Lourinhã	0.729	0.746	0.571	0.512	0.358	0.547	0.473
1109	Mafra	0.549	0.635	0.569	0.526	0.561	0.582	0.582
1110	Oeiras	0.495	0.485	0.515	0.472	0.495	0.535	0.587
1111	Sintra	**1.000**	0.964	0.944	0.989	**1.000**	0.818	0.966
1112	Sobral de Monte Agraço	0.437	0.552	0.472	0.554	0.475	0.553	0.485
1113	Torres Vedras	0.736	0.710	0.650	0.603	0.608	0.749	0.649

Code	Municipality	2005	2006	2007	2008	2009	2010	2011
1114	Vila Franca de Xira	0.746	0.807	0.847	0.708	0.732	0.682	0.851
1115	Amadora	0.842	0.848	0.909	0.894	0.719	0.736	0.755
1116	Odivelas	0.986	**1.000**	0.905	0.906	0.867	0.859	0.933
1201	Alter do Chão	0.306	0.357	0.348	0.264	0.263	0.518	0.223
1202	Arronches	0.266	0.381	0.395	0.188	0.163	0.320	0.256
1203	Avis	0.489	0.501	0.481	0.246	0.266	0.445	0.269
1204	Campo Maior	0.682	0.732	0.609	0.411	0.427	0.565	0.460
1205	Castelo de Vide	0.353	0.428	0.351	0.266	0.281	0.354	0.301
1206	Crato	0.250	0.245	0.239	0.218	0.195	0.268	0.193
1207	Elvas	0.409	0.512	0.614	0.397	0.360	0.725	0.550
1208	Fronteira	0.306	0.299	0.294	0.225	0.287	0.298	0.222
1209	Gavião	0.355	0.328	0.302	0.180	0.260	0.326	0.245
1210	Marvão	0.627	0.658	0.623	0.323	0.367	0.674	0.334
1211	Monforte	0.506	0.588	0.658	0.233	0.211	0.574	0.318
1212	Nisa	0.305	0.336	0.419	0.206	0.235	0.400	0.280
1213	Ponte de Sôr	0.560	0.507	0.525	0.420	0.327	0.404	0.369
1214	Portalegre	0.387	0.432	0.394	0.252	0.475	0.659	0.487
1215	Sousel	0.409	0.292	0.353	0.308	0.301	0.406	0.282
1301	Amarante	0.740	0.881	0.792	0.713	0.736	0.754	0.740
1302	Baião	0.709	0.837	0.682	0.600	0.519	0.594	0.557
1303	Felgueiras	0.801	0.819	0.804	0.807	0.622	0.577	0.635
1304	Gondomar	0.984	0.769	**1.000**	0.853	0.760	0.884	0.772
1305	Lousada	0.813	0.804	0.652	0.752	0.678	0.534	0.541
1306	Maia	0.643	0.788	0.679	0.719	0.652	0.742	0.913
1307	Marco de Canaveses	0.879	**1.000**	0.937	0.712	0.885	0.988	0.920
1308	Matosinhos	0.675	0.699	0.745	0.649	0.660	0.629	0.563
1309	Paços de Ferreira	**1.000**	0.957	0.664	0.608	0.561	0.654	0.613
1310	Paredes	0.905	0.861	0.871	0.738	0.661	0.760	0.554
1311	Penafiel	0.819	0.741	0.773	0.742	0.772	0.844	0.722
1312	Porto	0.555	0.641	0.528	0.504	0.507	0.639	0.558
1313	Póvoa de Varzim	0.598	0.536	0.484	0.499	0.480	0.559	0.565
1314	Santo Tirso	0.682	0.868	0.812	0.851	0.671	0.648	0.577
1315	Valongo	0.923	0.862	0.943	**1.000**	0.800	0.836	0.993
1316	Vila do Conde	0.674	0.636	0.545	0.505	0.554	0.719	0.601
1317	Vila Nova de Gaia	0.885	0.897	0.700	0.834	0.906	**1.000**	**1.000**
1318	Trofa	0.755	0.819	0.619	0.753	0.736	0.817	0.790
1401	Abrantes	0.556	0.558	0.589	0.644	0.657	0.670	0.523
1402	Alcanena	0.485	0.518	0.496	0.542	0.436	0.958	0.359
1403	Almeirim	0.588	0.679	0.618	0.623	0.552	0.587	0.579
1404	Alpiarça	0.713	0.653	0.628	0.472	0.394	0.659	0.276
1405	Benavente	0.505	0.609	0.556	0.549	0.529	0.674	0.651
1406	Cartaxo	0.653	0.554	0.550	0.433	0.985	0.591	0.550
1407	Chamusca	0.484	0.524	0.392	0.357	0.342	0.460	0.407
1408	Constância	0.563	0.884	0.960	0.312	0.288	0.453	0.270
1409	Coruche	0.450	0.503	0.525	0.464	0.509	0.509	0.379
1410	Entroncamento	0.520	0.517	0.529	0.569	0.458	0.490	0.571
1411	Ferreira do Zêzere	0.375	0.363	0.406	0.481	0.408	0.421	0.328
1412	Golegã	0.860	0.868	0.756	0.396	0.350	0.574	0.356
1413	Mação	0.673	0.730	0.674	0.294	0.376	0.583	0.324
1414	Rio Maior	0.446	0.519	0.495	0.493	0.369	0.457	0.472
1415	Salvaterra de Magos	0.786	0.900	0.828	0.654	0.644	0.922	0.789
1416	Santarém	0.755	0.825	0.751	0.612	0.435	0.894	0.650
1417	Sardoal	0.463	0.613	0.680	0.332	0.270	0.500	0.318
1418	Tomar	0.730	0.764	**0.722**	**1.000**	1.000	**0.675**	**1.000**
1419	Torres Novas	0.664	0.614	0.566	0.527	0.399	0.673	0.515

Code	Municipality	2005	2006	2007	2008	2009	2010	2011
1420	Vila Nova da Barquinha	0.420	0.436	0.472	0.488	0.372	0.334	0.278
1421	Ourém	0.785	0.781	0.685	0.689	0.511	0.813	0.549
1501	Alcácer do Sal	0.468	0.485	0.337	0.291	0.316	0.376	0.284
1502	Alcochete	0.568	0.613	0.598	0.489	0.456	0.517	0.535
1503	Almada	0.829	0.856	0.848	0.761	0.633	0.862	0.894
1504	Barreiro	0.882	0.782	0.849	0.712	0.800	0.725	0.882
1505	Grândola	0.351	0.402	0.430	0.333	0.311	0.260	0.310
1506	Moita	0.736	0.785	0.856	0.742	0.930	0.787	0.856
1507	Montijo	0.577	0.601	0.577	0.588	0.685	0.564	0.783
1508	Palmela	0.502	0.584	0.582	0.509	0.429	0.589	0.639
1509	Santiago do Cacém	0.673	0.678	0.675	0.517	0.454	0.818	0.492
1510	Seixal	0.819	0.797	0.737	0.645	0.743	0.717	0.806
1511	Sesimbra	0.540	0.551	0.454	0.462	0.459	0.531	0.493
1512	Setúbal	0.768	0.811	0.758	0.701	0.774	0.824	0.778
1513	Sines	0.331	0.388	0.203	0.257	0.198	0.296	0.468
1601	Arcos de Valdevez	0.450	0.440	0.433	0.357	0.301	0.400	0.460
1602	Caminha	0.448	0.526	0.541	0.398	0.397	0.566	0.417
1603	Melgaço	0.429	0.487	0.261	0.248	0.233	0.416	0.256
1604	Monção	0.544	0.621	0.470	0.420	0.450	0.438	0.411
1605	Paredes de Coura	0.394	0.376	0.254	0.301	0.310	0.340	0.336
1606	Ponte da Barca	0.501	0.471	0.398	0.398	0.321	0.434	0.331
1607	Ponte de Lima	0.602	0.779	0.762	0.594	0.386	0.626	0.576
1608	Valença	0.455	0.535	0.415	0.376	0.334	0.433	0.371
1609	Viana do Castelo	0.939	0.867	0.729	0.694	0.641	0.721	0.670
1610	Vila Nova de Cerveira	0.502	0.571	0.419	0.297	0.262	0.392	0.269
1701	Alijó	0.855	0.785	0.676	0.394	0.284	0.683	0.459
1702	Boticas	0.484	0.518	0.480	0.277	0.244	0.495	0.229
1703	Chaves	0.585	0.614	0.550	0.456	0.547	0.616	0.583
1704	Mesão Frio	0.374	0.423	0.376	0.412	0.360	0.197	0.266
1705	Mondim de Basto	0.540	0.499	0.402	0.413	0.395	0.169	0.338
1706	Montalegre	0.284	0.302	0.278	0.261	0.242	0.331	0.236
1707	Murça	0.280	0.555	0.464	0.429	0.337	0.398	0.202
1708	Peso da Régua	0.566	0.630	0.524	0.489	0.472	0.405	0.379
1709	Ribeira de Pena	0.329	0.271	0.248	0.238	0.226	0.248	0.251
1710	Sabrosa	0.511	0.468	0.413	0.325	0.251	0.317	0.311
1711	Santa Marta de Penaguião	0.535	0.634	0.442	0.380	0.326	0.449	0.332
1712	Valpaços	0.489	0.590	0.511	0.488	0.403	0.485	0.370
1713	Vila Pouca de Aguiar	0.444	0.431	0.391	0.387	0.364	0.458	0.378
1714	Vila Real	0.826	0.926	0.861	0.808	0.729	0.895	0.651
1801	Armamar	0.479	0.560	0.453	0.299	0.340	0.419	0.294
1802	Carregal do Sal	0.617	0.715	0.769	0.524	0.503	0.707	0.553
1803	Castro Daire	0.523	0.530	0.487	0.451	0.464	0.528	0.372
1804	Cinfães	0.636	0.778	0.635	0.648	0.470	0.698	0.538
1805	Lamego	0.690	0.692	0.453	0.374	0.462	0.617	0.453
1806	Mangualde	0.549	0.583	0.494	0.531	0.450	0.609	0.488
1807	Moimenta da Beira	0.524	0.484	0.496	0.402	0.312	0.687	0.466
1808	Mortágua	0.609	0.689	0.654	0.528	0.314	0.425	0.486
1809	Nelas	0.593	0.662	0.572	0.559	0.477	0.374	0.515
1810	Oliveira de Frades	0.712	0.908	0.745	0.469	0.466	0.708	0.453
1811	Penalva do Castelo	0.507	0.667	0.539	0.452	0.465	0.627	0.476
1812	Penedono	0.321	0.374	0.418	0.249	0.262	0.412	0.215
1813	Resende	0.474	0.552	0.600	0.470	0.405	0.495	0.339
1814	Santa Comba Dão	0.641	0.732	0.522	0.522	0.351	0.642	0.528
1815	São João da Pesqueira	0.521	0.513	0.493	0.365	0.328	0.423	0.339
1816	São Pedro do Sul	0.490	0.620	0.498	0.294	0.459	0.485	0.503

Code	Municipality	2005	2006	2007	2008	2009	2010	2011
1817	Sátão	0.785	0.544	0.536	0.446	0.552	0.580	0.465
1818	Sernancelhe	0.399	0.445	0.531	0.286	0.380	0.356	0.279
1819	Tabuaço	0.437	0.469	0.393	0.275	0.310	0.206	0.238
1820	Tarouca	0.365	0.369	0.466	0.364	0.358	0.309	0.277
1821	Tondela	0.666	0.650	0.530	0.508	0.599	0.575	0.582
1822	Vila Nova de Paiva	0.423	0.503	0.446	0.331	0.371	0.562	0.325
1823	Viseu	0.759	1.000	0.888	0.757	0.680	0.743	0.719
1824	Vouzela	0.630	0.734	0.752	0.287	0.494	0.680	0.475
	Average	0.572	0.600	0.552	0.465	0.455	0.562	0.469
	Median	0.557	0.593	0.534	0.451	0.422	0.557	0.460
	Max	1	1	1	1	1	1	1
	Min	0.207	0.245	0.203	0.118	0.134	0.112	0.156
	Stdev	0.188	0.185	0.183	0.190	0.187	0.187	0.195
	# Efficient	5	5	4	3	3	5	2