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Abstract

We investigate the effect of a local territorial reform, which reduced the number of parishes, on municipality spending efficiency in the period 2011-2016. We build a composite output indicator and use Data Envelopment Analysis (DEA) to compute efficiency scores, which we then analyze through a second stage regression with socio-demographic, economic factors and the reform. We find efficiency gains for around 10% of municipalities overall. In Alentejo and in Centro, more than 50% of the municipalities improved efficiency. The second stage results show that the reform did not improve local spending efficiency in Mainland Portugal, particularly in the Norte region.

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

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1. Introduction

Improving the efficiency and effectiveness of public services and at same time reducing public spending has become an important concern in the public sector. Undoubtedly, local governments could benefit from adhering to these objectives. Decentralization has transferred to the local government a considerable amount of government spending and decision-making. Yet, the resources to fulfill the demand for more and better local public services are scarce. Therefore, reforms that reduce local public spending and improve efficiency are very relevant. Most reforms have focused on two main areas: merging administrative regions or decentralizing the administrative and fiscal responsibilities. In this study, we will focus on the first type of reform.

Previous studies have evaluated the optimal size of municipalities (Doumpos and Cohen, 2014) and assessed the effect size, in terms of population, on municipality efficiency. Most studies find that efficiency scores are higher for larger municipalities (Balaguer-Coll, Prior and Tortosa-Ausina, 2007; Doumpos and Cohen, 2014) because of increasing economies of scale. Indeed, there is reasonable agreement that the smaller municipalities have higher costs (or compromised service quality) for all public services. For example, research of small local governments in Swiss Cantons suggests that costs and quality are severely compromised below a population of 500 (Ladner et al. 2003).

This paper contributes to this literature by assessing the changes on municipal efficiency stemming from a structural reform that reduced the number of administrative and local government units. Our example took place in 2013 when Portugal decreased (by around 29%) the number of parishes. Portugal provides an excellent case study to analyze the impact of this reform on municipality efficiency for three reasons. First, between 2011 and 2016, a municipality in Portugal spent on average 26 million Euros and municipality transfers to parishes accounted for approximately 4.3 percent of those expenditures. Although local governments have fiscal and

administrative autonomy, they rely heavily on funds from central government. On average, transferences from central government accounted for 42 percent of the total revenues. With this reform, the government intended to reduce the municipality spending and the amount of transfers to parishes, together with the assumption of fostering scale economies. Second, municipalities have to comply with the same rules and legislation but local politicians have some discretionary power on how to implement their policies and to use their resources. Finally, the local territory reform resulted from the memorandum of understanding signed between the Portuguese government, the EU and with the International Monetary Fund. Therefore, the need to reduce public expenditure in the local government made measuring their efficiency even more pressuring.

Hence, this study uses a two-stage methodology to measure the impact of the reform on the municipality efficiency. In the first stage, efficiency scores are measured using Data Envelopment Analysis (DEA) for the years 2011 (before the reform) and 2016 (after the reform). To compute the DEA 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. A second stage is proposed where the effect of the reform on the change of the efficiency scores obtained from the first stage is evaluated. We test our approach for the case of Portugal, both for the mainland and for the European Union Nomenclature of Territorial Units for Statistics (NUTS) regions.

Our results show that: i) between 2011 and 2016 there were efficiency gains for a small percentage of the municipalities, 10% and 6% respectively for the input and for the output oriented efficiency scores; ii) regionally, notably in Alentejo and in Centro, more than 50% of the municipalities improved efficiency; iii) the efficiency gains were negatively related to the territorial reform and to the reduction of parishes in mainland Portugal and particularly in Norte region.

The organization of the paper is as follows. Section 2 reviews the related literature. Section 3 reviews the Portuguese local government sector and Sector 4 presents the methodology. Section 5 reports and discusses the empirical results. Section 6 concludes.

2. Related Literature

Public finance theory argues that fiscal decentralization can increase the efficiency in the allocation of (public) resources. In other words, lower tiers of governments are closer to citizens and might provide informational advantages regarding their preferences (Ezcurra and Rodríguez-Pose, 2009). However, sometimes sub-national governments may not be able to make optimal resource allocation, since the central government usually commands more sophisticated technical resources. Therefore, the measurement of public sector efficiency and its determinants has been the subject of a growing literature.

Generally, this literature assesses technical efficiency (a concept stemming from Farrell, 1957) by using frontier analysis. Therefore, and to assess the efficiency of government spending, many studies usually estimate non-parametrically a production function frontier and derive efficiency scores based on the relative distances of inefficient observations from the frontier.[1] Efficiency is measured in an input-output perspective, in which the services provided (outputs) by the local or the central government are assessed against the resources employed (inputs). Formally, the higher the ratio of outputs to inputs, the more efficient the local or the central government is.

Previous studies have used frontier techniques (data envelopment analysis, free disposal hull, stochastic frontier analysis) to analyze the cost efficiency of public sector in different

[1] There are several parametric and non-parametric methodologies to compute technical efficiency. Parametric approaches include corrected ordinary least squares and stochastic frontier analysis (SFA). Among the non-parametric techniques data envelopment analysis (DEA) and free disposal hull (FDH) have been widely applied in the literature

countries or in a cross-country setup. The related literature follows broadly two streams: studies that evaluate the overall efficiency of the services provided by the (local) government, and studies that focus on a particular (municipal) public service.

Afonso et al. (2005, 2010) studied the overall public sector efficiency across several OCDE countries, taking into account the level of general government spending. On the other hand, several specific government functions such as education and health have been addressed by Afonso and St. Aubyn (2006, 2011). St. Aubyn et al. (2009) studied the case of Universities in the European Union. Overall, those studies show the existence of room for improvement regarding public spending efficiency. Although cross-country aggregated efficiency studies are very useful to compare the performance of different countries, efficiency analyses of individual countries take into account the institutional, cultural, political and economic setting providing more insights for the policy makers (Mandl, Dierx and Ilzkovitz, 2008).

Conversely, public spending efficiency studies covering the aggregated performance of local governments have been done for several countries. For instance, Van den Eeckaut, Tulkens and Jamar (1993), De Borger et al. (1994) and De Borger and Kerstens (1996, 2000) for Belgium; Athanassopoulos and Triantis (1998) and Doumpos and Cohen (2014) for Greece; Worthington (2000) for Australia; Prieto and Zofio (2001), Balaguer-Coll, Prior-Jiménez and Vela-Bargues (2002) and Benito, Bastida and Garcia (2010) for Spain; Afonso and Scaglioni (2007) and Storto (2015) for Italy; Waldo (2001) for Sweden; and Sampaio and Stosic (2005) for Brazil. In Portugal, we highlight the studies of Afonso and Fernandes (2006, 2008), Cruz and Marques (2014) and Afonso and Venâncio (2016).[2] Other stream of research includes studies that evaluate the efficiency of a specific municipality service, such as Bouckaert (1992) for the fire service; Lozano, Villa and

[2] See Kalb, Geys and Heinemann (2012) for a review of the literature.

Adenso-Dias (2004) for recycling operations and Rogge and De Jaeger (2013) for solid waste collection. Once again, the results of these two strands of the literature point to the fact that governments can attain efficiency gains at the municipal level as well.

Finally, research efforts have been also devoted to understand the major determinants of local government efficiency. Particularly, researchers have investigated the impact on municipality efficiency of a number of socio-demographic and economic characteristics, financial resources, environmental issues not controlled by the decision-makers, economies of scale and scope.

Our study aims to contribute to the local public spending literature by evaluating a specific reform, which merged several parishes in the belief that the aggregation of smaller administration entities would reduce public expenditure, and improve efficiency because of increasing economies of scale (Fox & Gurley, 2006; Warner, 2012). There are several examples where the pooling of resources, notably for water supply, sewage provision, primary education, increase efficiency notably by cost reduction. Interestingly, such pooling of resources could be dependent on the percentage of parishes, within a municipality.

3. Portuguese local government sector

To better frame the empirical results, we review some stylized facts about the Portuguese local government sector and the 2013 territorial organizational reform.

According to the Portuguese Constitution, local administration includes administrative regions, municipalities and civil parishes.[3] As the administrative regions have not yet been

[3] Portugal's administrative regions are organized into three tiers: districts and two autonomous regions of Azores and Madeira, municipalities and civil parishes. For statistical purposes, the European Union (EU) redefined the Portuguese territory into Nomenclature of Territorial Units for Statistics (NUTS) regions. The NUTS system subdivides the country into three levels: NUTS I (Portugal mainland and 2 autonomous regions of Azores and Madeira), NUTS II (7 regions) and NUTS III (30 sub-regions). These latter classifications were developed for the purpose of delivering structural funds for less favored regions and sub-regions.

established, the authorities responsible for delivering local public services are municipalities and parishes. At the end of 2012, there were 308 municipalities subdivided into 4,260 parishes. Of the total, 278 municipalities and 4,050 sections of municipalities, parishes, were located in mainland Portugal and the remaining 30 municipalities and 210 parishes were located in Azores and Madeira islands. In this study, we will focus on mainland municipalities and parishes because the islands have a different institutional and economic context.

The mainland municipalities are very heterogeneous in terms of population, geographical size, purchasing power and support received from the central government. Table 1 presents the socio-demographic, economic and political characteristics of the municipalities for the year 2011.

[Table 1]

The size of municipalities varies considerably. The median was 15,700 inhabitants, and the mean was 36,143 inhabitants. Almost 45 percent of the population lives in 23 municipalities with more than 100,000 inhabitants (8 percent of all municipalities). In terms of population density, the average and median was 311 and 70 inhabitants per squared kilometers, respectively. Municipalities are also economically different. There are a few very rich municipalities. In fact, only 34 municipalities have a purchase power higher than 100.

Local governments are territorially based organizations with administrative and fiscal autonomy. They have their own employees, patrimony and fiscal independence and its activity satisfies the local needs of their citizens. While municipalities have a major role on delivering local public services to citizens, parish competences are limited to a few public services (e.g. road and park maintenance; social facilities for children and the elderly and residence permits). Nonetheless, parishes establish an important link between municipalities and citizen needs. Municipalities

provide a plethora of traditional local government services:[4] development and maintenance of local infrastructures (e.g. sport, leisure and basic school facilities), supply of public goods such as drinking water, waste and sewage collection, education, childcare support, urban transportation, urban planning, health services, housing, cultural activities and events, and civil protection.[5] To provide these local public services, municipalities can freely choose their governance structures (direct, indirect, public, private or mix). In terms of revenues, municipalities are funded with transfers from the central government, transfers from the European Union, local taxes and sales and other revenues. Nonetheless, transferences from central government account, on average, for 42 percent of the total revenues. Municipalities obtain 46 percent of their revenues by self-generated revenues and taxes account on average for 39 percent of their own revenuers. Note that municipalities cannot set their own taxes and, the rates have to be defined within a range defined centrally.[6] Under the local finances legal framework, municipalities have their own budgets, and are subject to restrictive expenditure control mechanisms. They have to comply with strict budget rules and debt limits. Hence, their financial autonomy is rather limited in terms of revenues and borrowing.

In 2011, due to the sovereign debt crisis, Portugal applied for a bailout program with the International Monetary Fund, the European Central Bank and the European Commission. The memorandum of understanding signed in May 2011 entailed several clauses concerning the local government, namely: increase decentralization, reduce transfers from the central government,

[4] Some essential services are provided by the central government or private sector. Education is a competence of the central governement. Electricity, natural gas, postal services, broadband and telecomincations are provided by private companies.

[5] See Law 159/99 and Law 2/2007.

[6] The central government sets the tax base of all the local taxes, and the tax rate on transfers of real estate (IMT – *Imposto Municipal sobre as Transmissões Onerosas de Imóveis*). In the remaining local taxes, the municipalities set the tax rates within a range defined at the national level. For municipal corporate income tax (*Derrama*) and personal income tax, municipalities cannot charge more than the maximum threshold, and for property tax (IMI – *Imposto Municipal sobre Imóveis*), they have to set tax rate within a minimum and maximum threshold.

enhance reporting on budget execution and improve efficiency of local administration. In September 2011, the Green Paper on the reform of the local administration was published and it set the following goals: accomplish effective decentralization of local services, rationalize local government structures, envisage higher proximity and efficiency of local public services and reduce the number of parishes. This reform intended to create efficiencies and reduce public spending. At the same time, it affected the territorial geography and the political management of municipalities and parishes. These changes were implemented before the local government elections of 2013. Besides reducing the number of representatives in the local boards, the reform also increased, reduced or merged various parishes within municipalities, changed the territorial limits of the parishes within municipalities, and transferred parishes from one municipality to another.[7] Table A.1 of Appendix A presents the type of changes that occurred on each municipality. In addition, it is possible to observe that between 2009 and 2012, the number of parishes was 4,050. After 2013, the number of parishes reduced to 2,882, corresponding to a decrease of 29%. Of the total number of parishes, 50% merged with other parishes within the municipality (2022 parishes), 49% did not experience any change and the remaining 1% had their territorial limits changed.

Before 2013, a municipality included on average 15 parishes (see Table 2). Barcelos was the municipality with the most parishes (89 before 2013 and 61 after 2013). Four municipalities, Alpiarça, Barrancos, São Brás de Alportel and São João da Madeira, included a single parish. After 2013, Castanheira de Pera was also included to the list of municipalities with just one parish.

[Table 2]

[7] There were two transferences of parishes between municipalities. Pombalinho parish moved from Santarém municipality to Golegã municipaliy. Parque das Nações parish was created including parts of the Loures municipality and Lisbon municipality.

As a complementary exercise, we report in Table 3 the determinants that have contributed to the adoption of the reform. The dependent variable is a binary variable that assumes one for the municipalities that reduced the number of parishes and zero otherwise. The variable definition and sources in Appendix Table B.1. Interestingly, the likelihood of implementing the reform and reduced the number of parishes increases notably with the size of the municipality (population) and the level of per capita spending, and decreases with the level of purchasing power. The reform targeted less rich municipalities and those with larger transfers to parishes. In terms of political variables, municipalities whose mayor was from the same political party as the central government were less likely to implement the reform and reduce the number of parishes.

[Table 3]

4. Methodology

DEA is a non-parametric frontier methodology, which draws from Farrell's (1957) seminal work and was further developed by Charnes, Cooper and Rhodes (1978). Non-parametric techniques do not require the definition of the production functions and demand fewer requirements from the data. Frontier methodologies compare all observations with the "best practices". The production frontier in the DEA approach uses linear programming methods and computes the relative efficiency of a group of Decision Management Units (DMUs) that consume identical inputs and produce identical outputs.[8] For each municipality *i*, we consider is the following function:

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

[8] Coelli et al. (2002) and Thanassoulis (2001) offer introductions to DEA.

where Y_i is the composite output measure for municipality i and X_i is the per capita municipal expenditures registered on municipal accounts for the each year (2011 and 2016) as a measure of the municipal resources used in local services' provision input in municipality *i.*

If $Y_i < f(X_i)$, it is said that municipality *i* exhibits inefficiency. For the observed input levels, the actual output is smaller than the best attainable one and inefficiency is measured by computing the distance to the theoretical efficiency frontier.

Adopting an input orientation, for explanation purposes, and assuming the presence of variable-returns to scale (VRS), the efficient scores are computed through the following linear programming problem: [9]

$$\begin{aligned} &Max_{\delta,\lambda}\theta \\ &\text{s. to} \quad -\theta y_i + Y\lambda \geq 0 \\ &\qquad x_i - X\lambda \geq 0 \\ &\qquad n1'\lambda = 1 \\ &\qquad \lambda \geq 0 \end{aligned} \quad . \qquad (2)$$

In this formulation, there are *k* inputs used to produce *m* outputs for *n* DMUs. For the i-th DMU, x_i is the column vector of the inputs and y_i is the column vector of the outputs. We can also define *X* as the ($k \times n$) input matrix and *Y* as the ($m \times n$) output matrix.

In (3), θ is a scalar (that satisfies $1/\theta \leq 1$), and specifically is the efficiency score that measures technical efficiency, the distance between a municipality and the efficiency frontier, defined as a linear combination of the best practice observations. With $1/\theta < 1$, the municipality is inside the frontier (i.e. it is inefficient), while $\theta = 1$ implies that the municipality is on the frontier (i.e. it is efficient).

[9] 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.

The vector λ is a $(n \times 1)$ vector of constants that measures the weights used to compute the location of an inefficient DMU if it were to become efficient, and $n1$ is an n-dimensional vector of ones. The inefficient DMU can theoretically be on the production frontier as a linear combination of those weights, related to the peers of the inefficient DMU. The peers are other DMUs that are more efficient, and used as references for the inefficient DMU. The restriction $n1'\lambda = 1$ imposes convexity of the frontier, accounting for VRS. Dropping this restriction would amount to admit that returns to scale were constant.

Problem (3) is solved for each of the n DMUs in order to obtain the n efficiency scores. The VRS scores represent the pure technical efficiencies (PTE) and take into account that fact that DMUs might not operate at the optimal scale. In contrast, scores obtained through constant return to scale (CRS) represent technical efficiency (TE) and assumes that all DMUs are operating at the optimal scale.

5. Empirical Analysis

5.1. Data and variables

The data sample used in this analysis includes 278 municipalities for two periods: 2011, before the reform and 2016, after the reform (see Table 2). Between 2011 and 2016, the Portuguese economy was influenced by several economic events, such as the financial bailout, the outbreak of the economic crisis that spanned from 2008 until 2014 and the economic recovery from 2014 onwards.

To build the DEA efficiency scores for 2011 and 2016, we construct an output composite indicator, Local Government Output Indicator (LGOI) as suggested by Afonso and Venâncio (2015). This composite is a single measure of municipal performance evaluated in terms of social

services, Y1 (local inhabitants above 65 years old as a percentage of resident population); basic education Y2 (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, Y21; and 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, Y22); cultural services, Y3 (number of museums, zoos, botanical gardens and aquariums as a percentage of resident population, Y31; and number of art facilities as percentage of resident population, Y32); sanitation, Y4 (water supply per resident population, Y41; and urban waste collection per resident population, Y42); territorial organization, Y5 (building permits issued by local administration per resident population). To obtain the composite output indicator all values of each previous sub-indicator were normalised by setting the average equal to one. To compile the indicator from the various sub-indicators, we give equal weight to each of them. Our input measure includes municipal spending per resident population. Table B.2 in the Appendix B summarizes the definitions of our input and output variables and its sources.

5.2. DEA efficiency scores

Table 4 provides a summary of the DEA results that we have obtained for 2011 and 2016. The purpose of an input-oriented assessment is to study by how much one can proportionally reduce input quantities without changing the output quantities produced. Alternatively, and by computing output-oriented measures, one can assess how much output quantities can be proportionally increased without changing the input quantities used. In the case of the efficiency scores for 2011, we can see from Table 4 that input efficiency scores range between 0.514 for the Mainland and 0.674 in Algarve and in the Lisboa and Vale do Tejo (LTV) regions, implying that inputs could be theoretically lower by around 33%-49%, keeping the same level of output. On the

other hand, output efficiency scores range between 0.293 for the Mainland and 0.670 the Norte region, which means that one might envisage and output increase of around 37%-71% with the same level of inputs.

[Table 4]

Turning to the results obtained for 2016, also in Table 4, we find that the input efficiency scores range between 0.425 for the Mainland and 0.655 in Alentejo and in the Centro regions, implying that inputs could be theoretically lower by around 34%-56%, keeping the same level of output. In terms of the output efficiency scores, these range between 0.217 for the Mainland and the Alentejo region, and 0.646 for the Algarve region, implying that theoretically output could increase around 35%-78% with the same level of inputs.

Table 5 compares with more detail the changes in the efficiency scores between 2011 and 2016 for the overall Mainland. One can notice that between 2011 and 2016 there were efficiency gains for a small percentage of the municipalities, 10% and 6% respectively for the input and for the output oriented efficiency scores. In addition, Table 6 provides a similar exercise per region. In this case, the regions where there was a higher percentage of municipalities that increased their respective efficiency scores were the Alentejo (input) and Centro (input and output) regions with more than 50% of the municipalities improving efficiency.

[Table 5]

[Table 6]

5.3. Explaining efficiency

Since several exogenous factors are necessarily responsible for the existence of inefficiencies, we can then assess how the change of the efficiency scores relates to such determinants. As examples of such causes, we can consider the local territorial reform under

analysis, and factors proposed in the literature on local government efficiency, namely municipality characteristics not controlled by the mayor, changes in municipality characteristics and local governments' discretion behavior. For that purpose, we compare the DEA input efficiency scores before and after the reform using the following equation:

$$\Delta\theta_i = \beta_0 + \beta_1 \Delta Parish_i + Z_i'\beta_2 + \varepsilon_i \qquad (3)$$

where i denotes inland municipality.

Our dependent variable in Equation (3), $\Delta\theta_i$, is the difference between the DEA input scores before and after reform computed in the previous section.

Our variable of interest is $\Delta Parish_i$, defined as the change in the number of parishes within a municipality, computed as the difference between the logarithm of the number of parishes after and before the reform. Alternatively, we consider a binary variable $Reform_i$, which equals one if a municipality reduced the number of parishes, and zero otherwise. In these analyzes, we exclude one municipality which increased its number of parishes due to the reform. Our results do not change when we compute the effect of the reform in all mainland municipalities.

Local performance may be influenced by municipality characteristics and changes in the municipality characteristics. Therefore, we include a vector, Z_i to control for changes on sociodemographic and economic characteristics of the municipality. First, we include a binary variables **coastal** that equals one for municipality located near the sea and zero otherwise. This variable allow us to control for factors not influenced by the mayor namely, the existence of natural resources (beaches) and the type of geography of the municipality.

In addition, we consider the **change in size** of the municipality as the difference between the logarithm of local residents in 2016 and 2011. According to Grossman et al. (1999), the monitoring costs to mitigate local government's discretional behavior increase with geographic 'scarcity of

municipalities'. Hence, there might be scale economies regarding local public services provision. In addition, richer local residents usually impose higher pressure for more efficient services,[10] we therefore include the **change in income/wealth** measured as the change in the purchasing power in 2016 and 2011.

To control for the change on financial characteristics of the municipality, we include the **change on spending per capita,** measured as the change of the total public expenses per inhabitants in 2016 and 2011; the **change on financial independence**, measured as the change in the ratio of own revenues (taxes, sales and other revenues) to total revenues in 2016 and 2011; and the **change on tax revenues to own revenues ratio** in 2016 and 2011. Overreliance on central government funds is related to inefficiencies in municipalities (De Borger et al., 1993). The change on tax revenues to own revenues ratio is employed to take into account the change on the level of municipalities on tax collection. As taxes do not correspond to a specific array of services, contrary to revenues from services provisions, municipalities that increase their share could be characterized as less successful on providing chargeable services.

To capture local governments tendency to pursue their self-interests and their political agenda (Niskanen, 1975; Migué and Bélanger, 1974), we include three political variables: first, we use the Herfindahl index to assess the **political concentration** in the council of each municipality, measured based on the number of seats that different parties have according to the municipal elections of 2009 and 2013. A decrease (an increase) in political concentration from 2009 to 2013 suggests that the concentration of political power is getting weaker (stronger) and the opposition party is getting stronger (weaker), which may have a negative efficiency impact. The greater the variety of viewpoints the more intense the decision-making process. A stronger political leadership

may have more power in internal bargain and may find it more likely to resist the pressure to accommodate low efficiency and lower outputs (Borge, 2008). We also introduce a dummy variable, **re-elect**, that equals one in cases where the mayor has been re-elected in the last municipal elections and zero otherwise. Re-elected mayors for a second-term may be less motivated to implement policies towards improving the quantity and quality of services provided to citizens. The change on **voter turnout** is computed as the change in the abstention rate in municipal elections. The definition and sources of the explanatory variables are presented in Table B.3 of Appendix B.

The results from Table 7 show that several determinants contribute to explain the efficiency scores in the case of the full Mainland sample. The reform itself, taken as binary determinant, shows that reducing the number of parishes within a municipality actually contributes to a decrease in the input efficiency score (see Column 3 in Table 7). In addition, using the actual changes in the number of parishes (Columns 1 and 2 in Table 7), the results display an input efficiency reduction effect. A 10% reduction on the number of parishes implies a decrease of 0.01 in efficiency. In terms of control variables, the increase of population and of government expenditure, diminish efficiency as well. In contrast, an increase on own revenues ratio and tax revenues ratio is associated with efficiency increases. In terms of political variables, a reduction on voter turnout, increases efficiency as well.

[Table 7]

Form a regional perspective, we find (see Table 8) that the overall results for the Mainland case essentially hold. This is specially the case of Norte region. However, in the Alentejo and Algarve region (panel D in Table 8), the reduction in the number of parishes (accounting for control variables) does increase the input efficiency scores. This result yet does not hold, when we use a dummy variable for reform.

[Table 8]

Our results are no too different, although less robust, when the analysis is performed in terms of output efficiency scores. In addition, we used different estimation methods – Tobit and a double bootstrap procedure. These estimation models show similar results as the OLS regressions. Additionally, we controlled for several external factors (i.e. tourism index, area, population density, automobile fuel consumption, energy consumption, mayor, left and right wing) that might affect efficiency. Nonetheless, we removed the non-significant variables and those that presented Variance Inflation Factors (VIF) over 10. All these results available upon on request.

5. Conclusion

To evaluate if a territorial reform had a positive effect on the change on the efficient scores between 2011 and 2016 in Portugal, we used DEA approach. We computed the DEA efficiency scores using a composite output indicator of municipal services' provision, and we use municipal expenditure per inhabitant, in 2011 and in 2016 as the input. Afterwards, we assessed through a second stage regression whether socio-demographic and economic factors and the reform explained the change on efficiency.

Our results can be summarized as follows: i) overall, there are input and output efficiency gains for around 10% and 6% of municipalities, respectively; ii) regionally, notably in Alentejo and in Centro, more than 50% of the municipalities improved efficiency; iii) nevertheless, the second stage results show that the territorial reform did not improve local spending efficiency in mainland Portugal and particularly in the Norte region; The results are similar for the case of the output efficiency scores.

From a policy perspective, it is then less obvious that such reform, which implied a reduction of the number of parishes, has enhanced the efficiency of government spending across the board for the municipalities. Indeed, efficiency increases only in some regions, and policy makers need to account for such specific characteristics. Importantly, reforms like the one evaluated in this study require efforts between the central and local governments. Central government initiatives for improving local service efficiency and public spending can only be effective if local governments are willing participants in those reforms. In fact, local governments have to be motivated to implement those reforms on their own because they know more closely the needs of their citizens and how to improve the services provided.

The current study has its limitation. First, there is the issue of selecting inputs and outputs to compute the efficiency score and the selection of the control variables for the second-stage analysis. Even though the choice relied on the services provided by the local government defined in the legal framework, other authors could have chosen different variables, naturally also limited to data availability. The same applies to the control variables in the second-stage estimation. Finally, this study draws on data from the local government of one country naturally raising questions about the generalizability of these findings to another geographic context. While we make no claims that our findings are perfectly generalizable to other countries, the theoretical underpinnings of our model provide a framework for exploring these phenomena in other geographic locations.

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Table 1: Municipalities socio-demographic and economic characteristics (2011)

	Obs.	Average	Median	St dev	Min	Max
Area	278	320	229	284	8	1,721
Parishes	278	15	11	13	1	89
Population	278	36,143	15,700	58,222	1,834	547,733
Population density	278	311	70	864	5	7,389
Purchase power	278	78	72	21	50	217
Public spending per capita	278	1,094	932	525	397	3,031
Percentage of own revenues	278	0.46	0.42	0.19	0.13	0.92
Tax revenues to own revenues	278	0.39	0.38	0.16	0.05	0.78
Capital investments to total spending	278	0.26	0.26	0.11	0.03	0.54

Table 2: Some stylized facts for the municipalities

	2011	2016	2016-2011
Number of parishes	**4,050**	**2,882**	**-28.84%**
Number of municipalities	**278**	**278**	**0.00%**
Reduce parishes		230	
Maintain parishes		47	
Increase parishes		1	
Resident population	**10,047,621**	**9,809,414**	**-2.37%**
Reduce parishes	9,481,635	9,250,040	-2.44%
Maintain parishes	560,521	553,866	-1.19%
Increase parishes	5,465	5,508	0.79%
Average population per km^2	**311**	**303**	**-2.52%**
Reduce parishes	341	332	-2.74%
Maintain parishes	169	169	-0.38%
Increase parishes	71	65	-7.90%
Average purchasing power	**78.0**	**80.8**	**3.62%**
Reduce parishes	77.7	80.5	3.62%
Maintain parishes	79.7	82.5	3.54%
Increase parishes	78.4	83.3	6.27%
Average spending per capita	**1,094**	**1,055**	**-3.59%**
Reduce parishes	1,041	1,005	-3.51%
Maintain parishes	1,351	1,296	-4.00%
Increase parishes	1,154	1,172	1.59%
Average share of transfers to parishes	**2.79%**	**3.32%**	**0.53%**
Reduce parishes	3.13%	3.70%	0.58%
Maintain parishes	1.11%	1.44%	0.32%
Increase parishes	0.03%	2.67%	2.63%

Note: The table reports some stylized facts for the local government sector for the years 2011 and 2016 by municipalities that reduced, maintained or increased the number of parishes. Column "2016-2011" reports the percentage change between those years.

Table 3: Reform Adoption

	(1)	(2)
lPopulation	0.432***	0.432***
	(0.0510)	(0.0537)
Population density	-0.0833***	-0.0820***
	(0.0272)	(0.0287)
Income	-0.00712***	-0.00687***
	(0.00196)	(0.00199)
Education	-0.0466	-0.0447
	(0.0442)	(0.0499)
lSpending per capita	0.354**	0.357**
	(0.139)	(0.153)
Parish transfers	4.483***	4.187***
	(1.418)	(1.511)
Mayor	-0.120**	-0.119***
	(0.0474)	(0.0450)
Observations	183	183
Log pseudolikelihood	-51.41	-51.59
Pseudo R2	0.496	0.495

Note: Columns (1) and (2) report the marginal coefficients using probit and logit models, respectively. The dependent variable is a dummy variable equalling one if a municipality experienced a reduction in the number of parishes. The definition and sources of the independent variables are presented in Table B.1 of Appendix B. Districts dummies are included but not reported. Standard errors clustered at the district level are in parentheses. *** denotes statistical significance at 1%, ** significance at 5%, * significance at 10%.

Table 4: DEA Efficiency Results

		2011				2016			
		Efficient DMUs		**Average efficiency scores**		**Efficient DMUs**		**Average efficiency scores**	
Region	**N. of DMUs**	**N. of DMUs (municipality)**	**% of DMUs in the region**	**Input oriented**	**Output oriented**	**N. of DMUs (municipality)**	**% of DMUs in the region**	**Input oriented**	**Output oriented**
Alentejo	47	3 (Beja, Elvas, Sines)	6.38%	0.622	0.596	3 (Beja, Santiago do Cacém, Sines)	6.38%	0.655	0.217
Algarve	16	4 (Alcoutim, Faro, Olhão, Tavira)	25.00%	0.674	0.628	3 (Alcoutim, Olhão, Tavira)	18.75%	0.611	0.646
Centro	78	4 (Anadia, Vila do Rei, Gouveia, Leiria)	5.13%	0.636	0.603	3 (Vila do Rei, Gouveia, Leiria)	3.85%	0.655	0.629
LVT	51	3 (Caldas da Rainha,Almada, Tomar)	5.88%	0.674	0.452	2 (Sintra, Tomar)	3.92%	0.615	0.386
Norte	86	5 (Macedo de Cavaleiros, Vila Flor, Valongo, Vila Nova de Gaia, Alijó)	5.81%	0.618	0.670	4 (Barcelos, Macedo de Cavaleiros, Vila Flor, Valongo)	4.65%	0.600	0.666
Mainland	278	2 (Tomar, Valongo)	0.72%	0.514	0.293	3 (Monchique,Tomar, Valongo)	1.08%	0.425	0.217

Note: The table reports the DEA efficiency scores using 2011 and 2016 data. The column "Efficient DMUs" reports the number and name of efficient DMUs and the percentage of efficient municipalities in a region. DMUs is Decision Management Units.

Table 5: DEA Country Efficiency Scores Comparisons (VRS)

				Input				Output				2016-2011	
		DMUs	Efficient DMUs	Average	Max	Min	Stdev	Average	Max	Min	Stdev	Input	Output
1	**Country, 2011 DEA**	**278**	**2**	**0.514**	**1.000**	**0.185**	**0.197**	**0.293**	**1.000**	**0.140**	**0.115**		
2	Country, Reduce Parishes	230	1	0.509	1.000	0.185	0.197	0.291	0.922	0.140	0.109		
3	Country, Maintain Parishes	47	1	0.544	1.000	0.198	0.194	0.297	1.000	0.177	0.128		
4	Country, Increase Parishes	1	0	0.223	0.223	0.223	0.000	0.684	0.684	0.684	0.000		
5	**Country, 2016 DEA**	**278**	**3**	**0.425**	**1.000**	**0.065**	**0.181**	**0.217**	**1.000**	**0.112**	**0.093**	10.07%	6.12%
6	Country, Reduce Parishes	230	1	0.416	1.000	0.065	0.177	0.210	0.595	0.112	0.065	10.00%	5.65%
7	Country, Maintain Parishes	47	2	0.474	1.000	0.213	0.185	0.248	1.000	0.127	0.171	10.64%	8.51%
8	Country, Increase Parishes	1	0	0.128	0.128	0.128	0.000	0.254	0.254	0.254	0.000	0.00%	0.00%

Note: The table reports the input and output DEA efficiency scores for the mainland Portugal for the years 2011, Rows (1) to (4), and 2016, Rows (5) to (8). Rows (1) and (5) report the scores for the 278 municipalities, Rows (2) and (6) report the scores for the municipalities that reduced the number of parishes, Rows (3) and (7) report the scores for the municipalities that maintained the number of parishes, and the remaining rows report the scores for the municipalities that increased the number of parishes. The column "Efficient DMUs" reports the number of efficient DMUs and the column "2016-2011" reports the percentage of cases (municipalities) where there is a gain in efficiency, by comparing the 2011 efficiency score of the municipalities and the 2016 efficiency score.
DMUs is Decision Management Units. Max is maximum, Min is minimum and Stdev is standard deviation.

Table 6: DEA Regional Efficiency Scores Comparisons (VRS)

				Input				Output				2016-2011	
		DMUs	Efficient DMUs	Average	Max	Min	Stdev	Average	Max	Min	Stdev	Input	Output
1	**Norte, 2011 DEA**	**86**	**5**	**0.618**	**1.000**	**0.215**	**0.198**	**0.670**	**1.000**	**0.393**	**0.154**		
2	Norte, Reduce Parishes	71	4	0.613	1.000	0.215	0.194	0.664	1.000	0.393	0.151		
3	Norte, Maintain Parishes	15	1	0.643	1.000	0.301	0.215	0.697	1.000	0.426	0.164		
5	**Norte 2016 DEA**	**86**	**4**	**0.600**	**1.000**	**0.136**	**0.195**	**0.666**	**1.000**	**0.403**	**0.151**	43.02%	40.70%
6	Norte, Reduce Parishes	71	2	0.596	1.000	0.136	0.188	0.661	1.000	0.403	0.146	42.25%	40.85%
7	Norte, Maintain Parishes	15	2	0.617	1.000	0.316	0.222	0.689	1.000	0.451	0.175	46.67%	40.00%

				Input				Output				2016-2011	
		DMUs	Efficient DMUs	Average	Max	Min	Stdev	Average	Max	Min	Stdev	Input	Output
1	**Centro 2011 DEA**	**78**	**4**	**0.636**	**1.000**	**0.223**	**0.201**	**0.603**	**1.000**	**0.187**	**0.172**		
2	Centro, Reduce Parishes	63	4	0.636	1.000	0.223	0.210	0.601	1.000	0.187	0.183		
3	Centro, Maintain Parishes	15	0	0.637	0.850	0.267	0.157	0.614	0.862	0.445	0.112		
5	**Centro, 2016 DEA**	**78**	**3**	**0.655**	**1.000**	**0.175**	**0.183**	**0.629**	**1.000**	**0.187**	**0.171**	53.85%	56.41%
6	Centro, Reduce Parishes	63	3	0.646	1.000	0.175	0.192	0.620	1.000	0.187	0.181	52.38%	52.38%
7	Centro, Maintain Parishes	15	0	0.691	0.917	0.463	0.133	0.667	0.872	0.461	0.116	60.00%	73.33%

				Input				Output				2016-2011	
		DMUs	Efficient DMUs	Average	Max	Min	Stdev	Average	Max	Min	Stdev	Input	Output
1	**LVT 2011 DEA**	**51**	**3**	**0.674**	**1.000**	**0.343**	**0.193**	**0.452**	**1.000**	**0.237**	**0.155**		
2	LVT, Reduce Parishes	41	2	0.669	1.000	0.354	0.199	0.444	0.939	0.237	0.145		
3	LVT, Maintain Parishes	10	1	0.693	1.000	0.343	0.165	0.483	1.000	0.263	0.186		
5	**LVT, 2016 DEA**	**51**	**2**	**0.615**	**1.000**	**0.281**	**0.170**	**0.386**	**1.000**	**0.195**	**0.166**	39.22%	0.00%
6	LVT, Reduce Parishes	41	1	0.608	1.000	0.281	0.175	0.377	0.801	0.195	0.150	41.46%	0.00%
7	LVT, Maintain Parishes	10	1	0.644	1.000	0.454	0.145	0.421	1.000	0.202	0.217	30.00%	0.00%

				Input				Output				2016-2011	
		DMUs	Efficient DMUs	Average	Max	Min	Stdev	Average	Max	Min	Stdev	Input	Output
1	**Alentejo, 2011 DEA**	**47**	**3**	**0.622**	**1.000**	**0.343**	**0.166**	**0.596**	**1.000**	**0.279**	**0.182**		
2	Alentejo, Reduce Parishes	41	2	0.619	1.000	0.343	0.156	0.592	1.000	0.279	0.171		
3	Alentejo, Maintain Parishes	6	1	0.642	1.000	0.424	0.224	0.620	1.000	0.334	0.238		
5	**Alentejo, 2016 DEA**	**47**	**3**	**0.655**	**1.000**	**0.192**	**0.170**	**0.530**	**1.000**	**0.279**	**0.171**	61.70%	14.89%
6	Alentejo, Reduce Parishes	41	2	0.650	1.000	0.192	0.168	0.536	1.000	0.279	0.176	63.41%	17.07%
7	Alentejo, Maintain Parishes	6	1	0.687	1.000	0.556	0.180	0.484	0.592	0.291	0.116	50.00%	0.00%

				Input				Output				2016-2011	
		DMUs	Efficient DMUs	Average	Max	Min	Stdev	Average	Max	Min	Stdev	Input	Output
1	**Algarve, 2011 DEA**	**16**	**4**	**0.674**	**1.000**	**0.437**	**0.213**	**0.628**	**1.000**	**0.377**	**0.201**		
2	Algarve, Reduce Parishes	14	3	0.664	1.000	0.437	0.204	0.607	1.000	0.377	0.189		
3	Algarve, Maintain Parishes	1	0	0.487	0.487	0.487	0.000	0.549	0.549	0.549	0.000		
4	Algarve, Increase Parishes	1	1	1.000	1.000	1.000	0.000	1.000	1.000	1.000	0.000		
5	**Algarve, 2016 DEA**	**16**	**3**	**0.611**	**1.000**	**0.374**	**0.243**	**0.646**	**1.000**	**0.367**	**0.218**	6.25%	31.25%
6	Algarve, Reduce Parishes	14	2	0.599	1.000	0.374	0.230	0.629	1.000	0.367	0.210	7.14%	35.71%
7	Algarve, Maintain Parishes	1	0	0.400	0.400	0.400	0.000	0.532	0.532	0.532	0.000	0.00%	0.00%
8	Algarve, Increase Parishes	1	1	1.000	1.000	1.000	0.000	1.000	1.000	1.000	0.000	0.00%	0.00%

Note: The tables report the input and output DEA efficiency scores for the Norte, Centro, Lisboa and Vale do Tejo, Alentejo and Algarve region for the years 2011, Rows (1) to (4), and 2016, Rows (5) to (8). Rows (1) and (5) report the scores for the total number of municipalities within a region, Rows (2) and (6) report the scores for the municipalities that reduced the number of parishes, Rows (3) and (7) report the scores for the municipalities that maintained the number of parishes, and the remaining rows report the scores for the municipalities that increased the number of parishes. The column "Efficient DMUs" reports the number of efficient DMUs and the column "2016-2011" reports the percentage of cases (municipalities) where there is a gain in efficiency, by comparing the 2011 efficiency score of the municipalities and the 2016 efficiency score. DMUs is Decision Management Units. Max is maximum, Min is minimum and Stdev is standard deviation.

Table 7: Regression Model for the Change on Municipality Efficiency Scores

	(1)	(2)	(3)	(4)
Change parishes	0.157***	0.084**		
	(0.032)	(0.034)		
Reform			-0.043***	-0.032
			(0.013)	(0.020)
Coastal		0.009		0.007
		(0.007)		(0.007)
Change population		-0.330**		-0.284*
		(0.153)		(0.164)
Change income		0.210		0.246*
		(0.132)		(0.146)
Change expenditure		-0.354***		-0.359***
		(0.041)		(0.042)
Change own revenues		0.172**		0.175**
		(0.085)		(0.085)
Change tax revenues		0.102**		0.103**
		(0.044)		(0.047)
Political concentration		0.015		0.021
		(0.060)		(0.060)
Re-elect		0.008		0.008
		(0.012)		(0.011)
Change voter turnout		-0.002**		-0.003***
		(0.001)		(0.001)
Constant	-0.015	-0.085***	-0.025**	-0.079***
	(0.009)	(0.014)	(0.011)	(0.019)
District dummies	Yes	Yes	Yes	Yes
Observations	277	277	277	277
Sigma	0.096***	0.067***	0.098***	0.067***
	(0.010)	(0.015)	(0.010)	(0.015)
Log likelihood	255.0	357.4	249.8	356.5

Note: The table reports the estimated coefficients for Equation (3) using tobit regression model. The dependent variable is the change in DEA input scores between 2016 and 2011. The definition and sources of the independent variables are presented in Table B.3 of Appendix B. Standard errors clustered at the district level are in parentheses. *** denotes statistical significance at 1%, ** significance at 5%, * significance at 10%.

Table 8: Regression Results for the Change on Regional Municipality Efficiency Scores

	(1)	(2)	(3)	(4)
Panel A: Norte Region				
Change parishes	0.157*	-0.039		
	(0.087)	(0.056)		
Reform			-0.008***	-0.044***
			(0.000)	(0.015)
Sigma	0.107***	0.038***	0.108***	0.038***
	(0.009)	(0.005)	(0.009)	(0.006)
Log likelihood	70.12	159.1	69.08	159.2
Panel B: Centro Region				
Change parishes	0.020	0.076		
	(0.076)	(0.048)		
Reform			0.016	0.006
			(0.034)	(0.022)
Sigma	0.106***	0.045***	0.106***	0.046***
	(0.017)	(0.004)	(0.017)	(0.004)
Log likelihood	64.67	131.8	64.74	130.0
Panel C: LVT Region				
Change parishes	0.125	0.053		
	(0.092)	(0.049)		
Reform			0.029	0.020
			(0.036)	(0.031)
Sigma	0.088***	0.043***	0.091***	0.043***
	(0.009)	(0.004)	(0.012)	(0.004)
Log likelihood	50.58	86.18	49.06	85.81
Panel D: Alentejo e Algarve Regions				
Change parishes	0.029	-0.124***		
	(0.074)	(0.030)		
Reform			-0.017	-0.040***
			(0.014)	(0.010)
Sigma	0.104***	0.042***	0.104***	0.042***
	(0.015)	(0.004)	(0.016)	(0.004)
Log likelihood	53.08	110.3	53.20	109.9

Note: The table reports the estimated coefficients for Equation (3) using tobit regression model. The dependent variable is the change in DEA regional input scores between 2016 and 2011. Panel A, B, C and D present the coefficients results separately for Norte, Centro, Lisbon and Vale do Tejo and Alentejp and Algarve regions, respectively. The number of observations for Panel A, B, C and D equals 86, 78, 50 and 63, respectively. Columns (1) and (3) do not include control variables and Columns (2) and (4) add control variables. The definition and sources of the independent variables are presented in Table B.3 of Appendix B. All models include district dummies fixed effects. Standard errors clustered at the district level are in parentheses. *** denotes statistical significance at 1%, ** significance at 5%, * significance at 10%.

Appendix

Appendix A – 2013 Territorial Reform

Table A.1: Type of changes

	Parishes 2011							Parishes 2016
Municipality	No change	Merged	Changed limits	Transferred	Eliminated	New	Total	Total
Abrantes	8	11					19	13
Águeda	4	16					20	11
Aguiar da Beira	7	6					13	10
Alandroal	3	3					6	4
Albergaria-a-Velha	4	4					8	6
Albufeira	3	2					5	4
Alcácer do Sal	3	3					6	4
Alcanena	5	5					10	7
Alcobaça	9	9					18	13
Alcochete	3						3	3
Alcoutim	3	2					5	4
Alenquer	6	10					16	11
Alfândega da Fé	6	14					20	12
Alijó	10	9					19	14
Aljezur	4						4	4
Aljustrel	3	2					5	4
Almada	1	10					11	5
Almeida	9	20					29	16
Almeirim	4						4	4
Almodôvar	4	4					8	6
Alpiarça	1						1	1
Alter do Chão	4						4	4
Alvaiázere	3	4					7	5
Alvito	2						2	2
Amadora			11				11	6
Amarante	18	22					40	26
Amares	11	13					24	16
Anadia	7	8					15	10
Ansião	5	3					8	6
Arcos de Valdevez	23	28					51	36
Arganil	10	8					18	14
Armamar	10	9					19	14
Arouca	12	8					20	16
Arraiolos	3	4					7	5
Arronches	3						3	3
Arruda dos Vinhos	4						4	4
Aveiro	7	7					14	10
Avis	4	4					8	6
Azambuja	6	3					9	7
Baião	8	12					20	14
Barcelos	43	46					89	61
Barrancos	1						1	1
Barreiro	1	7					8	4
Batalha	4						4	4

	Parishes 2011							Parishes 2016
Municipality	No change	Merged	Changed limits	Transferred	Eliminated	New	Total	Total
Beja	6	12					18	12
Belmonte	3	2					5	4
Benavente	4						4	4
Bombarral	3	2					5	4
Borba	4						4	4
Boticas	5	11					16	10
Braga	18	44					62	37
Bragança	31	18					49	39
Cabeceiras de Basto	8	9					17	12
Cadaval	4	6					10	7
Caldas da Rainha	8	2	6				16	12
Caminha	9	11					20	14
Campo Maior	3						3	3
Cantanhede	9	10					19	14
Carrazeda de Ansiães	10	9					19	14
Carregal do Sal	4	3					7	5
Cartaxo	4	4					8	6
Cascais	2	4					6	4
Castanheira de Pêra		2					2	1
Castelo Branco	13	12					25	19
Castelo de Paiva	4	5					9	6
Castelo de Vide	4						4	4
Castro Daire	11	11					22	16
Castro Marim	4						4	4
Castro Verde	3	2					5	4
Celorico da Beira	12	10					22	16
Celorico de Basto	10	12					22	15
Chamusca	3	4					7	5
Chaves	29	19	3				51	39
Cinfães	13	4					17	14
Coimbra	8	23					31	18
Condeixa-a-Nova	4	6					10	7
Constância	3						3	3
Coruche	5	3					8	6
Covilhã	14	17					31	21
Crato	3	3					6	4
Cuba	4						4	4
Elvas	3	8					11	7
Entroncamento	2						2	2
Espinho	3	2					5	4
Esposende	4	11					15	9
Estarreja	3	4					7	5
Estremoz	5	8					13	9
Évora	6	13					19	12
Fafe	17	19					36	25
Faro	2	4					6	4
Felgueiras	12	20					32	20
Ferreira do Alentejo	2	4					6	4
Ferreira do Zêzere	3	2	4				9	7
Figueira da Foz	7	4	7				18	14
Figueira de Castelo Rodrigo	5	12					17	10

	Parishes 2011							Parishes 2016
Municipality	No change	Merged	Changed limits	Transferred	Eliminated	New	Total	Total
Figueiró dos Vinhos	3	2					5	4
Fornos de Algodres	9	7					16	12
Freixo de Espada à Cinta	2	4					6	4
Fronteira	3						3	3
Fundão	18	13					31	23
Gavião	3	2					5	4
Góis	3	2					5	4
Golegã	2			1			3	3
Gondomar	3	9					12	7
Gouveia	10	12					22	16
Grândola	3	2					5	4
Guarda	33	22					55	43
Guimarães	31	38					69	48
Idanha-a-Nova	9	8					17	13
Ílhavo			4				4	4
Lagoa	2	4					6	4
Lagos	2	4					6	4
Lamego	14	10					24	18
Leiria	9	20					29	18
Lisboa		43	10			1	53	24
Loulé	8	3					11	9
Loures	4	14					18	10
Lourinhã	5	6					11	8
Lousã	2	4					6	4
Lousada	9	16					25	15
Mação	5	3					8	6
Macedo de Cavaleiros	24	14					38	30
Mafra	6	11					17	11
Maia	7	10					17	10
Mangualde	8	10					18	12
Manteigas	4						4	4
Marco de Canaveses	6	25					31	16
Marinha Grande	3						3	3
Marvão	4						4	4
Matosinhos		10					10	4
Mealhada	5	3					8	6
Mêda	8	8					16	11
Melgaço	8	10					18	13
Mértola	6	3					9	7
Mesão Frio	4	3					7	5
Mira	4						4	4
Miranda do Corvo	3	2					5	4
Miranda do Douro	9	8					17	13
Mirandela	25	12					37	30
Mogadouro	17	11					28	21
Moimenta da Beira	13	7					20	16
Moita	2	4					6	4
Monção	17	16					33	24
Monchique	3						3	3
Mondim de Basto	4		4				8	6
Monforte	4						4	4
Montalegre	17	18					35	25

	Parishes 2011							Parishes 2016
Municipality	No change	Merged	Changed limits	Transferred	Eliminated	New	Total	Total
Montemor-o-Novo	5	5					10	7
Montemor-o-Velho	9	5					14	11
Montijo	2	6					8	5
Mora	4						4	4
Mortágua	6	4					10	7
Moura	3	5					8	5
Mourão	3						3	3
Murça	5	4					9	7
Murtosa	4						4	4
Nazaré	3						3	3
Nelas	5	4					9	7
Nisa	5	5					10	7
Óbidos	6	3					9	7
Odemira	8	6	2		1		17	13
Odivelas	1	6					7	4
Oeiras	2	8					10	5
Oleiros	8	4					12	10
Olhão	3	2					5	4
Oliveira de Azeméis	9	10					19	12
Oliveira de Frades	5	7					12	8
Oliveira do Bairro	3	3					6	4
Oliveira do Hospital	11	10					21	16
Ourém	9	9					18	13
Ourique	2	4					6	4
Ovar	4	4					8	5
Paços de Ferreira	9	7					16	12
Palmela	3	2					5	4
Pampilhosa da Serra	6	4					10	8
Paredes	17	7					24	18
Paredes de Coura	11	10					21	16
Pedrógão Grande	3						3	3
Penacova	5	6					11	8
Penafiel	23	15					38	28
Penalva do Castelo	9	4					13	11
Penamacor	7	5					12	9
Penedono	5	4					9	7
Penela	3	3					6	4
Peniche	3	3					6	4
Peso da Régua	4	8					12	8
Pinhel	10	17					27	18
Pombal	11	6					17	13
Ponte da Barca	12	13					25	17
Ponte de Lima	30	21					51	39
Ponte de Sor	4	3					7	5
Portalegre	4	6					10	7
Portel	4	4					8	6
Portimão	3						3	3
Porto	4	11					15	7
Porto de Mós	7	6					13	10
Póvoa de Lanhoso	16	13					29	22
Póvoa de Varzim	4	8					12	7
Proença-a-Nova	2	4					6	4

	Parishes 2011							Parishes 2016
Municipality	No change	Merged	Changed limits	Transferred	Eliminated	New	Total	Total
Redondo	2						2	2
Reguengos de Monsaraz	3	2					5	4
Resende	7	8					15	11
Ribeira de Pena	3	4					7	5
Rio Maior	6	8					14	10
Sabrosa	10	5					15	12
Sabugal	23	17					40	30
Salvaterra de Magos	2	4					6	4
Santa Comba Dão	3	6					9	6
Santa Maria da Feira	16	15					31	21
Santa Marta de Penaguião	5	5					10	7
Santarém	12	15					27	18
Santiago do Cacém	6	5					11	8
Santo Tirso	9	15					24	14
São Brás de Alportel	1						1	1
São João da Madeira	1						1	1
São João da Pesqueira	8	6					14	11
São Pedro do Sul	10	9					19	14
Sardoal	4						4	4
Sátão	7	5					12	9
Seia	14	15					29	21
Seixal	3	3					6	4
Sernancelhe	9	8					17	13
Serpa	3	4					7	5
Sertã	7	7					14	10
Sesimbra	3						3	3
Setúbal	3	5					8	5
Sever do Vouga	5	4					9	7
Silves	4	4					8	6
Sines	2						2	2
Sintra	4	16					20	11
Sobral de Monte Agraço	3						3	3
Soure	8	4					12	10
Sousel	4						4	4
Tábua	7	8					15	11
Tabuaço	9	8					17	13
Tarouca	4	6					10	7
Tavira	3	6					9	6
Terras de Bouro	11	6					17	14
Tomar	6	10					16	11
Tondela	12	14					26	19
Torre de Moncorvo	9	8					17	13
Torres Novas	6	11					17	10
Torres Vedras	7	13					20	13
Trancoso	15	14					29	21
Trofa	2	6					8	5
Vagos	5	6					11	8
Vale de Cambra	6		3				9	7
Valença	7	9					16	11
Valongo	3	2					5	4
Valpaços	20	11					31	25
Vendas Novas	2						2	2

	Parishes 2011							Parishes 2016
Municipality	No change	Merged	Changed limits	Transferred	Eliminated	New	Total	Total
Viana do Alentejo	3						3	3
Viana do Castelo	19	21					40	27
Vidigueira	4						4	4
Vieira do Minho	11	10					21	16
Vila de Rei	3						3	3
Vila do Bispo	3	2					5	4
Vila do Conde	14	16					30	21
Vila Flor	9	10					19	14
Vila Franca de Xira	2	9					11	6
Vila Nova da Barquinha	3	2					5	4
Vila Nova de Cerveira	7	8					15	11
Vila Nova de Famalicão	23	26					49	34
Vila Nova de Foz Côa	12	5					17	14
Vila Nova de Gaia	8	16					24	15
Vila Nova de Paiva	4	3					7	5
Vila Nova de Poiares	4						4	4
Vila Pouca de Aguiar	12	6					18	14
Vila Real	12	18					30	20
Vila Real de Santo António	3						3	3
Vila Velha de Ródão	4						4	4
Vila Verde	21	37					58	33
Vila Viçosa	3	2					5	4
Vimioso	7	7					14	10
Vinhais	18	17					35	26
Viseu	18	16					34	25
Vizela	3	4					7	5
Vouzela	6	6					12	9
Total	**1972**	**2022**	**54**	**1**	**1**		**4050**	**2882**

Appendix B – Variable definitions and sources

Table B.1: Definition of the Variables and Respective Sources for reform adoption

Variable	Definition	Source
Population	Logarithm of the local inhabitants, 2011	INE 2011, Recenseamento da População e Habitação, 2011
Population density	Logarithm of population per km^2, 2011	INE 2011, Recenseamento da População e Habitação, 2011
Income	Purchasing power, 2011. 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 2011
Education	Share of educated residents, 2011. Educated residents are individuals with high school diploma, bachelor, masters or doctoral degrees.	INE 2011,
Spending per capita	Logarithm of the spending per local inhabitants, 2011	Direcção-Geral das Autarquias Locais, Despesas municipais do ano de 2011 com trimestres e anual (http://www.portalautarquico.dgal.gov.p; INE
Parish transfers	Share of local spending allocated to parishes,2011	
Mayor	Dummy variable equaling one if a mayor is from the same political party as the government.	Results of municipal elections 29-09-2013 (http://eleicoes.cne.pt/)

Table B.2 – Definition of the Input (X) and Output Variables (Y) and Respective Sources

Variable	Input measure		Source
X	Total municipal expenditures per inhabitant, 2011 and 2016		Direcção-Geral das Autarquias Locais, Despesas municipais do ano de 2011 e 2016 com trimestres e anual (http://www.portalautarquico.dgal.gov.p; INE
Variable	**Output measures**	**Municipal results indicators**	**Source**
Y_1	Social services	Percentage of local inhabitants with ≥65 years old 2011 and 2016	INE 2012 and 2017, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2011 and 2016; INE.
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 (Y_{21}), 2011 and 2016. 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 (Y_{22}), 2001 and 2016.	INE 2012 and 2017, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2011 and 2016; INE.
Y_3	Cultural services	Number of museums, zoos, botanical gardens and aquariums per capita (Y_{31}), 2011 and 2016 Number of art facilities per capita (Y_{32}), 2011 and 2016	INE 2012 and 2017, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2011 and 2016; INE.
Y_4	Sanitation	Water supply per capita (Y_{41}), 2011 and 2016 Urban waste collection per capita (Y_{42}), 2011 and 2016	INE 2012 and 2017, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2011 and 2016; INE.
Y_5	Territory organization	Building permits issued by local administration per capita, 2011 and 2016	INE 2012 and 2017, Statistical Yearbook of Alentejo, Algarve, Centro, Lisboa and Norte Regions 2011 and 2016; INE.

Table B.3 – Definition of the Variables and Respective Sources for Second- Stage Regression

Variable	Definition	Source
Change parish	Difference between the logarithm of the number of parishes in 2016 and 2011 within a municipality	Lei n.º 11-A/2013, de 28 de janeiro, Reorganização Administrativa do Território das Freguesias; Declaração de Retificação n.º 19/2013, de 28 de março; Lei n.º 56/2012, de 8 de novembro - Reorganização Administrativa de Lisboa Direção Geral de Administração Interna (DGAI)
Reform	Dummy variable that equals one if a municipality reduced the number of parishes between 2016 and 2011, and zero otherwise	
Coastal	Dummy variable that equals one when the municipality is located near the sea, and zero otherwise.	
Change population	Difference between the logarithm of local residents in 2016 and 2011	INE
Change income	Difference between the purchasing power in 2016 and 2011. 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 2011 and 2016
Change expenditure	Difference between the logarithm of the spending per local inhabitants in 2016 and 2011,	Direcção-Geral das Autarquias Locais, Despesas municipais do ano de 2011 e 2016 com trimestres e anual (http://www.portalautarquico.dgal.gov.p; INE
Change own revenues	Difference between the ratio of own revenues (taxes, sales and other revenues) to total revenues in 2016 and 2011.	
Change tax revenues	Difference between the ratio of tax revenues to own revenues (taxes, sales and other revenues) in 2016 and 2011.	
Political concentration	Difference on the Herfindahl index, measured on the basis of the number of seats that different parties have according to the municipal elections of 2009 and 2013	Results of municipal elections 11-10-2009 and 29-09-2013 (http://eleicoes.cne.pt/)
Re-elect	Dummy variable that equals one in cases where the mayor has been re-elected in the last municipal elections and zero otherwise	
Change voter turnout	Difference between the abstention rate in municipal elections of 2009 and 2013	