Shiva's Dance: Crisis, Local Institutions and Private Firms

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Abstract

The uneven spatial distribution of start-ups and their respective survival may reflect comparative advantages resulting from the local institutional background. For the first time, we explore this idea using Data Envelopment Analysis (DEA) to assess the relative efficiency of Portuguese municipalities in this specific context. We depart from the related literature where expenditure is perceived as a desirable input by choosing measures of fiscal responsibility and infrastructural variables in the first stage. Using a Malmquist Index to compare results for 2006 and 2010, we find that mean performance decreased substantially with the effects of the Global Financial Crisis. A second stage is then performed employing a double-bootstrap procedure to evaluate how the regional context outside the control of local authorities (e.g. demographic characteristics and political preferences) impacts on efficiency. Our findings suggest that no exogenous factors can drive firm creation and retention at municipal level during a major financial crisis.

Keywords: Entrepreneurship, Efficiency, Portuguese local governments, Accountability, Financial Crisis

JEL: H70, L26, R11, C61,C67.

1. Introduction

The Global Financial Crisis deteriorated citizen's confidence in policymakers and weakened individual future prospects. On the one hand, reforms intended at enhancing the efficiency of all levels of government have been increasingly gaining

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importance. In this context, local public services are especially under scrutiny as more decentralized policies are being designed and monitoring costs for voters are lower (Devas and Delay, 2006). On the other, high unemployment rates have called for the resurgence of entrepreneurship as a viable career option. The continual process of creation and destruction (Shiva's Dance in the Hindu culture) is, once again, perceived as vital to society's dynamics. This paradigm shift, however, is not blind to recognize that benefits of newcomers come at a cost of some incumbents.

This paper attempts to provide a systematic investigation on the role of municipalities in creating the conditions to encourage private firm establishment and development. We use a linear frontier technique Data Envelopment Analysis (henceforth, DEA) to assess, in the first stage, relative performance in this context.

Providing incentives for greater transparency and enhanced competition among municipalities is especially important as this exercise can be subject to some misgivings and misinterpretations. Indeed, oftentimes, not all the appropriate variables are taken into consideration, which might end in biased results. The current work addresses these concerns in two particular ways: 1. Exploring a comprehensive set of variables based on- but not critically accepting- the related literature, as well as on the specific features of portuguese municipalities; 2. Computing, in the second stage, the double approach proposed by Simar and Wilson (2007), to evaluate the determinants of relative performance.

As we want to unveil how the regional context changed with the crisis, we selected data from two post local (and national) election years (2006 and 2010) to comment on the evolution before and during the turmoil. This option is encouraged by evidence gathered by Veiga and Veiga (2006) and Aidt *et al.* (2011) on the presence of rational political business cycles (PBC) at the municipal level. In line with the Rogoff (1990) model, bureaucrats ended up distorting expenditures and taxes to signal greater competency in the two years before election.[1]

Portugal is a particularly interesting case study for this purpose. Firstly, the titanic effects of the economic crisis provide a good testing ground for possible changes in relevance between factors. For instance, the unemployment rate increase from 7.6% in 2006 to 10.8% in 2010. Secondly, our dataset is based on a single country rather than a combination of several states with diverse policy instruments. Thirdly, representatives are chosen in highly partisan elections. Lastly, mainland municipalities are all subject to the same rules (including coincident election dates).

[1]The theory of PBC was popularized by Nordhaus (1975). Empirical investigations of rational PBC include Alesina and Roubini (1992), Alesina *et al.* (1993) and, for Portugal, Baleiras and Costa (2004).

One should note that this investigation does not focus on capturing factors which may impact on birth and death rates on a national level but are unlikely to diverge across municipalities such as the minimum efficient scale in different sectors or macroeconomic fluctuations. We are primarily concerned with what may govern regional dissimilarities, comparing their evolution before and during the financial crisis.
This study is organized as follows: in section two, a short tour on the entrepreneurship and local governance is provided while, in three, some stylized facts about Portuguese local governments are presented. In section four, the empirical strategy is addressed. Regarding the first stage, five clarifies which inputs and outputs are selected, and section six discusses the results. In section seven we assess the change in efficiency measured by the Malmquist Index. For the second stage, eight reports the non-discretionary factors considered, whereas nine explains the results. Finally, section ten concludes.

2. Entrepreneurship and local governance

Our intent in this section is twofold as we will survey both the literature on the regional determinants of firm creation and destruction, and the methodological advances in assessing municipal efficiency.
Entrepreneurship, to begin with, is a topic of growing interest for academics and policy makers. Even if one does not believe either in a Marxian contradiction (capitalism cannot survive because of economic failure) or in a Schumpeterian paradox (capitalism is being destroyed because of its very creative success), the role of creative destruction is key (Elliott, 1980). The idea itself is a very old one. But it was only since Schumpeter (1934) that researchers have been pointing out a whole array of benefits produced by entrepreneurs ranging from employment (Blanchflower, 2000; and for Portugal, Baptista *et al.*, 2014) to production (Audretsch and Feldman, 1996) and innovation (Acs and Audretsch, 1988).
Concentration is not a new concept for economists since Marshall (1920) concluded that external economies of scale arise on a regional level. In recent times, more attention has been devoted to inspect the relevance of entrepreneurship for local growth and the causes of its regional variation. [2] In this regard, Armington and

[2]For good references on the importance of defining the concept of regional competitiveness as well as the theoretical, empirical and policy debate involved see Porter (2003) and Kitson *et al.* (2004). For a good recent survey see Fritsch (2008).

Acs (2002) describe regional externalities (or agglomeration effects), unemployment, entrepreneurial culture and industrial restructuring as the main topics to be considered.

In Portugal, Figueiredo *et al.* (2002) concluded that investors tend to locate in close proximity of their residence area. Nevertheless, firm births seem erratically distributed through the territory when controlling exclusively for population. This suggests that other dynamics associated to the local environment constrain entrepreneurial intensity. [3]

The literature on municipal efficiency can be divided into individual or global public services. While the former focuses on specific public goods that are provided by each municipality, the latter consists in a performance assessment of local authorities as a whole. For the second case, noteworthy contributions by Afonso and Fernandes (2008) and Cruz and Marques (2014) on Portuguese municipalities for the years of 2003 and 2009, respectively, should be highlighted. Both concluded that the large majority of municipalities could improve overall performance without necessarily increasing their spending items. In a nutshell, Table 1 summarizes the main findings.[4]

[3]For more details on Portuguese firms see Mata *et al.* (1995), Mata and Machado (1996) and Cabral and Mata (2003).

[4]A special focus is devoted to a plethora of papers exploring non-parametric techniques. For global public services, relevant empirical work was made for Belgium (De Borger *et al.*, 1994 and De Borger and Kerstens, 1996), Spain (Prieto and Zofio, 2001 and Balaguer-Coll *et al.*, 2007), Finland (Loikkanen and Susiluoto, 2005), Brazil (Sousa and Sótsic, 2005) and Germany (Bönisch *et al.*, 2011).

Table 1. Variables and Findings of the related literature (Source: own construction, adapted from Cruz and Marques (2014))

First Stage Inputs (I) and Outputs (O)	Second Stage Exogenous Factors	Innovations and Results
1) **De Borger et al. (1994)** using 589 Belgian municipalities. (I) No. of white collar workers; No. of blue collar workers; surface of buildings owned by the municipalities. (O) Surface of municipal roads; No. minimal subsistence grants; No. of students in local primary schools; Surface of public recreational facilities; Ratio of nonresidents to residents.	Population; No. of coalition parties; Dummies for the liberal and socialist parties; Per capita Income; Size of the block grants; Share of the adult population holding a degree of higher education.	Population and higher education rates have a positive efficiency effect. Block grants yield a negative influence; the presence of liberals and the average personal income also seem to affect performance.
2) **De Borger and Kerstens (1996)** using 589 Belgian municipalities. .(I) Municipal expenditures. (O) No. of beneficiaries of minimal subsistence grants; No. of students enrolled in local primary schools; Surface of public recreational facilities; Population; Fraction of the population older than 65	No. of coalition parties; Dummies for the liberal and socialist parties; Income per capita; Property tax rate; Size of the per capita block grants; Share of the adult population with just a primary education degree; Population density.	Property rate tax and population density seem to exhort a positive influence. Personal income, the size of the per capita block grants and the percentage of population with only primary education have a negative influence on efficiency.
3) **Prieto and Zofio (2001)** using 209 Spanish municipalities. I) Personnel expenditure; Other operational expenditure; Current transfers; Capital transfers; Capital expenditure. (O) Population; Number of lighting points; Urban waste collected; Street infrastructure area; Area of public parks; Quality.	Tax revenue; Size of block grants; Self-generated revenue; Financial liabilities; Financial deficit; Percentage of votes attained by the ruling party.	Block grants and high percentage of votes for the governing party have a negative influence; the remainder variables may also have a negative impact.
4) **Balaguer-Coll et al. (2007)** using 414 Spanish municipalities. (I) Expenditures on goods and services; Current transfers; Capital expenditure; wages and salaries. (O) Population; Tons of waste; Street infrastructure; Public parks; Quality	Taxes; Grants; Self-generated revenues; Financial liabilities; Deficit; Votes received by ruling party candidates	Empirical evidence towards the idea that resources may be better allocated by large municipalities.
5) **Loikkanen and Susiluoto (2005)** using 353 Finish municipalities. (I) Total expenditures. (O) No. of children daycare centres; No. of visits to basic health and dental care; Institutional care of the elderly and handicapped; Hours of teaching; Total loans in municipal libraries	Population; Earned income; Education level; Location and physical structure distance; Age of employees; Producer of services (% of all service) bought from other municipalities	The most efficient municipalities were rather small. Political variables and turnover in local elections did not explain efficiency while Peripheral location, high income, and high unemployment tend to reduce it.
6) **Sousa and Stósic (2005)** using 4796 Brazilian municipalities. (I) Total current expenditures; No. of teachers; No. of hospital and health centers; Rate of infant mortality. (O) Population; Literate population; School enrolment; School attendance; Promotions to the next grade; Students in the proper grade; Water coverage; Wastewater coverage; Waste coverage	Tourism; Scale	Touristic and very small municipalities tend to have lower efficiency scores.
7) **Bönisch et al., (2011)** using 203 German municipalities. (I) Labor; Capital; Resources and intermediate inputs. (O) Population; child care places; children in elementary school; traffic and recreational area; employees	Population density; Share of senior citizens; Relative population change; Type of municipality; Debt per capita; Relative equalizatio. Transfers; Unemployment rate	Centralized organizational forms displayed no efficiency advantage over local associations/municipalities.
8) **Afonso and Fernandes (2008)** using 278 mainland municipalities. (I) Total expenditures. (O) Local Government Output Indicator	Distance to the district capital; Population with secondary education; Population with tertiary education; Per capita purchasing power; Population density; Annual population growth.	Purchasing power and education have a positive influence. Distance to the capital of district may have a negative influence.
9) **Cruz and Marques (2014)** using 308 Portuguese municipalities. (I) No. Of staff; Capital expenditures; Other operational expenditures. (O) Population, Extension of municipal roads, urban waste collected; drinking water supplied; wastewater treated; No. of infrastructures	Tourism, Island, Topography, Illiteracy, Concentration, Purchasing power, Financial independence, Area, No. of parishes, Public housing, Net debt	One of the first papers to apply Simar and Wilson (2007) procedure.. Empirical evidence suggesting a clear difference between mainland and overseas municipalities.

3. Portuguese Institutional Framework: Local Government Sector

Sub-national governments in Portugal assume only two levels: the autonomous regions of Madeira and Azores, and administrative municipalities. The first municipal elections under democratic rule took place in 1976 and, since then, there has been an important widespread of local governments competencies. For instance, they are responsible for the promotion of education, health, transport, communication, culture and leisure. After joining the European Economic Community in 1986, municipalities funds increased considerably and, in 1999, there were new extensions of their activities to enhance, among other responsibilities, the attraction of private investment (Law 159/99).

Portuguese municipalities are governed by the Municipal Assembly and the Town Council. The top candidate from the most voted list becomes the president of the Town Council (mayor) and, at the end of each year, this executive body designs the local budget and the plan of activities for the next period. The process of implementing local policies requires the approval of the legislative body (Municipal Assembly) and is subject to both internal and external control mechanisms from central government agencies and the Court of Accounts. In this context, municipalities are responsible for the bulk of consolidated expenditures of the local tier of government and such item is divided into current and capital expenditures. The subcomponents of the first part include expenditures on goods and services, and compensation of employees while those associated to the second share comprise investment, financial assets and liabilities, and capital transfers to parishes.

As for revenues, despite the fact that local authorities are financially independent, their main sources of income still rely on transfers from national and European funds. Moreover, this redistributive nature is especially imperative for poor municipalities. On the other hand, the relative importance of real estate as a fiscal basis for local taxes has significantly increased in the past few years since municipalities have, within certain limits, the autonomy to set property tax rates (IMI and IMT). Remaining resources come from vehicle, property transfer and corporate income taxes, fees, fines and debt. [5]

[5]For a rigorous exploration on the country background see Blanchard (2006). For further details on Portuguese municipalities see Costa *et al.* (2013). Table A.1. provides a comparison among local governments in Europe.

4. Empirical Strategy

DEA is a non-parametric methodology (i.e., an estimate of an unobserved true frontier, conditional on data which is not required to fit a normal distribution) that does not try to answer how a certain quantity of output resulted from the political process. Nor does it represent welfare equilibrium from a benevolent social planner perspective. Instead, as an output-oriented strategy is followed, it just analyzes whether the maximum output is attained vis-a-vis the given quantity of inputs provided in the municipality. [6] The reason behind this choice is motivated by the fact that political agents may have an incentive not to use inputs optimally (Niskanen, 1975; Hayes *et al.*, 1998). Furthermore, as previously stated, Portuguese local governments areas of intervention are very broad, and their tasks are not restricted towards creating an appropriate environment for business formation.

To the best of our knowledge, this is the first time that DEA is used to study this phenomenon. We believe this is a suitable approach for several reasons. According to De Borger and Kerstens (1996, p. 167), to the extent that there are no a priori reasons to prefer one methodology over the others and as long as there is no solution to the problem of choosing the best reference technology (), it seems to be preferable to analyse public sector efficiency questions using a broad spectrum of different methods and to find out just how robust the results are. If we pursued, for example, an econometric cost or expenditure function approach, we would be assuming that the underlying production function was efficient. In this setting, the error term would therefore contain inseparable inefficiency and statistic misspecification components (Bönisch *et al.*, 2011). Moreover, parametric approaches such as the stochastic frontier analysis present the advantage of allowing deviations from the efficient frontier due to stochastic influences or measurement errors, they are usually not realistic when price data is not available. In fact, although the notion that the cost-inefficiency and statistical noise are uncorrelated may be reasonable with cost equation variables for competitive markets, it may be less convincing if there are producer-specific differences in the quality of the output created. [7] Prices in DEA are unknown but, given that all municipalities in Portugal have access to the same capital market and are constrained by the same collective wage agreement, they are assumed to be identical. In addition, DEA does not require an a priori assumption

[6] An input-oriented strategy evaluates how much input quantities can be proportionally reduced while keeping constant the quantity of outputs.

[7] For a good survey on the comparison between the different parametric and non-parametric methods see De Borgen and Kerstens (1996), Worthington and Dollery (2000).

of a particular functional form for public decision making units (henceforth, DMU). Finally, another important characteristic of DEA, in sharp contrast to other parametric methods that determine an idealized standard of performance, is that this technique seeks to examine the efficiency of a DMU (e.g., municipality) relative to its peers.

DEA was introduced in the economic literature by Charnes *et al.* (1978) based on the seminal contribution by Farrell (1957). One should note that efficiency is understood in this scheme as the ratio between a weighted sum of outputs and a weighted sum of inputs.[8] A convex hull is thus computed from data on a multiplicity of inputs and outputs by applying linear programming techniques not subject to statistical problems such as simultaneous equation bias (Afonso and Fernandes, 2008). To form a piecewise production possibilities frontier, the number of inputs and outputs should be low as they would otherwise be compared along more dimensions and, subsequently, the number of efficient DMU's would be larger. Scores are derived on the basis of relative distances of inefficient observations from the frontier. To do so, we solve the following problem for municipality j, having each one the outputs y_0 and the inputs x_0:

$$\begin{aligned} &\max_{\theta,\lambda} \theta_0 \\ &s.to: \\ &\theta_0 y_0 \leq \sum_{j=1}^{n} y_j \lambda_j \\ &x_0 \geq \sum_{j=1}^{n} x_j \lambda_j \\ &\sum_{j=1}^{n} \lambda_j = 1 \\ &\lambda_j \geq 0 \end{aligned} \tag{1}$$

[8]More information on DEA can be found in Cooper (2000) and Thanassoulis *et al.* (2008). In the economic literature, three main measures of efficiency are mentioned: technical, allocative and dynamic efficiency. Since we refer to the use of inputs in the most technologically efficient manner, technical efficiency considerations are therefore developed in this paper.

Where θ_0 is a scalar showing by how much the production of each DMU could increase and λ_0 are weighting factors defined optimally in the model for each municipality. Therefore, DEA gives the "benefit of the doubt" to each unit being evaluated by trying to make it look as efficient as possible in comparison with the others.
At this stage, two important remarks must be added. First, an efficient DMU (θ_0 =1) implies relative (not strictly or Pareto) efficiency. This means that these units represent the best existing but not necessarily the best possible operating units. Second, by adding the third constraint to the previous problem, we take into account the possibility that some DMUs might not be operating at the optimal scale. Hence, we are assuming variable returns to scale (VRS) outlined by Banker *et al.* (1984) rather than constant returns to scale (CRS). [9]
The criterion adopted to assess efficiency is straightforward. In the first stage, we decided to use inputs that are, at least to a certain degree, manageable by the municipality and the exogenous outputs of interest to our research question. A second stage is then required in order to explain how environmental factors that are not part of the production process (e.g. political preferences) constrain the choices of both inputs and outputs, and thus, impact on performance. In this part, several papers calculated a censored (tobit) regression given that the dependent variable the efficiency scores calculated in the first stage cannot take values lower than one. However, this raises a problem of paramount importance as the process that regulates the probability of censuring is the same process defining how the uncensored observations are restricted. Another concern is advanced by Simar and Wilson (2007). As inputs and outputs are correlated with the non-discretionary factors (otherwise it would not make sense to use them), the error term of the second stage is serially correlated with the efficiency scores. These scholars, using Monte Carlo experiments, developed a solution that will be implemented in section nine of this paper: first, by employing a truncated regression and, afterwards, by establishing inference on a bootstrap procedure in which the performance score is bias-corrected and serial correlation is considered. [10]

[9] Additionally, Hollingsworth and Smith (2003) defended that VRS are the correct design when one uses ratios instead of absolute numbers as inputs and outputs. A figure comparing CRS and VRS returns to scale can be seen in figure A1 in appendix

[10] An important alternative is to perform the second stage via non-parametric smoothing techniques as proposed by Balaguer-Coll *et al.* (2007).

5. First Stage: Dataset, Inputs and Outputs.

For the choice of inputs, its election is based on previous theoretical literature on entrepreneurship.[11] Even taking this strategy into consideration, our choices are not free from criticisms. Hence, we should hereafter explain each of the four institutional inputs under three different crucial vectors.[12]:

Infrastructural geographic planning. Through the synergies of exploring an integrated location with informational spillovers, we expect that Industrial areas increase the likelihood of firm formation. Audretsch *et al.* (2004) illustrate the expansion of industrial parks, science and technology incubators as the most effective start-up oriented policy. Furthermore, tourism is a strategic segment for the Portuguese economy and, for this reason, Tourism areas are also considered.

Governance responsibility. The differences in tax rates can greatly affect the regional variation in business activity (Gentry and Hubbard, 2000; Henrekson and Sanandaji, 2011). The sum of IMI (*Imposto Municipal sobre Imóveis*) and IMT (*Imposto Municipal sobre Transmissões Onerosas de Imóveis*) revenues, the two most relevant local taxes, per capita is thus included. However, since the impact of heavy business entry regulation is associated with a higher concentration of informal sector activity (Djankov *et al.*, 2002), more unemployment (Fonseca *et al.*, 2000) and reduced entry (Klapper *et al.*, 2006), we transform the previous input in a desirable one, PropTaxInv, by taking its inverse (Thanassoulis *et al.*, 2007).[13] IMT constitutes an important start-up cost to new firms as it is levied on the transfer of a real estate. On the other hand, IMI is computed every single year over the property tax value of urban and rural real estates located in the Portuguese territory. Moreover, a rational forward-looking entrepreneur will not take into account only the tax rates prevailing in a given year since she or he knows that more debt in the present will be reflected

[11] A detailed explanation of the inputs and output variables and data sources is offered in Table A.2. Additionally, Arouca (2013, p. 2) put emphasis on the importance of both the development of business-related infrastructures and the signals stemming from sound financial management.

[12] For comparability reasons, we confine our attention on the 278 mainland municipalities because those overseas are subject to vertical externalities from an extra layer of power and specific fiscal benefits.

[13] The effects of a substantive reform, prior to our dataset, that significantly speeds up firm registration procedures in Portugal were studied by Branstetter *et al.* (2014).

in a higher tax burden in the future. Variables related to spending (e.g., total or capital expenditures) are widely used in the literature (see Table 1). Nonetheless, more inputs (namely, financial resources) are not necessarily translated into more outputs in the presence of unbalanced budgets. This idea is in accordance with evidence collected by Borge *et al.* (2008) and Arouca (2013). We compute instead a measure of fiscal responsibility to ascertain the extent of interest payments in each municipality Primary expenditures/Total expenditures. This constitutes a proxy for quality of spending rather than for quantity in the sense that money used to pay interests is not directed to improve local governments competencies.

Licensing outline. Public administration construction items are typically highly visible and help form expectations at the level of prevailing bureaucracy in the municipality. Wagner and Sternberg (2004) stressed that the extensiveness of cumbersome regulatory requirements can discourage the creation of new ventures. We proxy these effects using a construction ratio, measured as the ratio between the predicted duration of construction works and their effective duration.

At the same time, we adopt two outputs with data drawn from *Quadros de Pessoal*, a yearly mandatory questionnaire on all companies with paid labour, to understand local entrepreneurial culture in Portugal.[14]:

Start-up attraction. We decided to use the number of new business units divided by the incumbent firms (in this case, $Entry_{inc}$) to properly reveal the effects of regional clusters and measure the entry of new capabilities, an essential element of the market process.[15] This approach relies on the idea that "for a meaningful comparison of regions or industries of different size or different economic potential,

[14]Accordingly, cases of self-employment or family workers are not contemplated in *Quadros de Pessoal*. At the same time, other organizations such as public entities, foundations, associations or cooperatives are exempted from our analysis due to their non-profit nature. Furthermore, given its longitudinal matched employer-employee character, this source connects workers to their corresponding establishments and companies/ headquarters, with only the latter being considered in our analysis.

[15]In a given year, a plant is identified as Entry (Exit) if it was absent in the files for the two preceding (following) years (Mata and Portugal, 1994). For other examples of past usage see Mata *et al.* (1995), Mata and Machado (1996), Cabral and Mata (2003), Holl (2004), Baptista and Mendonça (2010).

the number of start-ups has to be related to a measure of this economic potential" (Fritsch, 2008 p.5).

Firm survival. A similar strategy is followed as far as exits are concerned, but we transform this bad into a desirable output by taking its inverse ($Exit_{inc-inv}$) as recommended by Thanassoulis *et al.* (2007).

Descriptive statistics of all inputs and outputs used to compute the efficiency of Portuguese mainland municipalities are presented in Table 2 for 2006 and 2010.[16] To properly reflect the effects of the crisis, two further analyses are added: whereas Figure 2 highlights the uneven geographical pattern of private firms net entry ($Entry_{inc}$ and $Exit_{inc-inv}$), Figure 3 displays the sharp differences between $Entry_{inc}$ (higher in 2006) and $Exit_{inc-inv}$ (lower in 2006) distributions for both periods.

Table 2. Summary statistics for Inputs (I) and Outputs (O) in 2006, 2010 (Source: own construction)

Variables	Mean	Std. dev.	Min	Max	Obs
(I) Industrial area					
2006	0.014	0.023	0.0001	0.151	278
2010	0.014	0.023	0.0001	0.151	278
(I) Tourism area					
2006	0.003	0.012	0.0001	0.105	278
2010	0.004	0.012	0.0001	0.105	278
(I) Property Tax_inv					
2006	14.91	8.54	1.35	48.82	278
2010	12.23	6.41	1.50	37.58	278
(I) Primary expenditures/ Total Expenditures					
2006	0.981	0.015	0.888	1	278
2010	0.987	0.014	0.859	1	278
(I) Construction ratio					
2006	0.758	0.116	0.459	1.094	278
2010	0.756	0.111	0.459	1.094	278
(O) Entry_inc					
2006	0.011	0.0316	0.046	0.293	278
2010	0.078	0.0235	0.035	0.218	278
(O) Exit_inc_inv					
2006	11.263	2.332	2.332	6.357	278
2010	9.671	3.598	4	39	278

[16] We cope with zeros in data by replacing them by 0.0001 as suggested by Bessent and Bessent (1979).

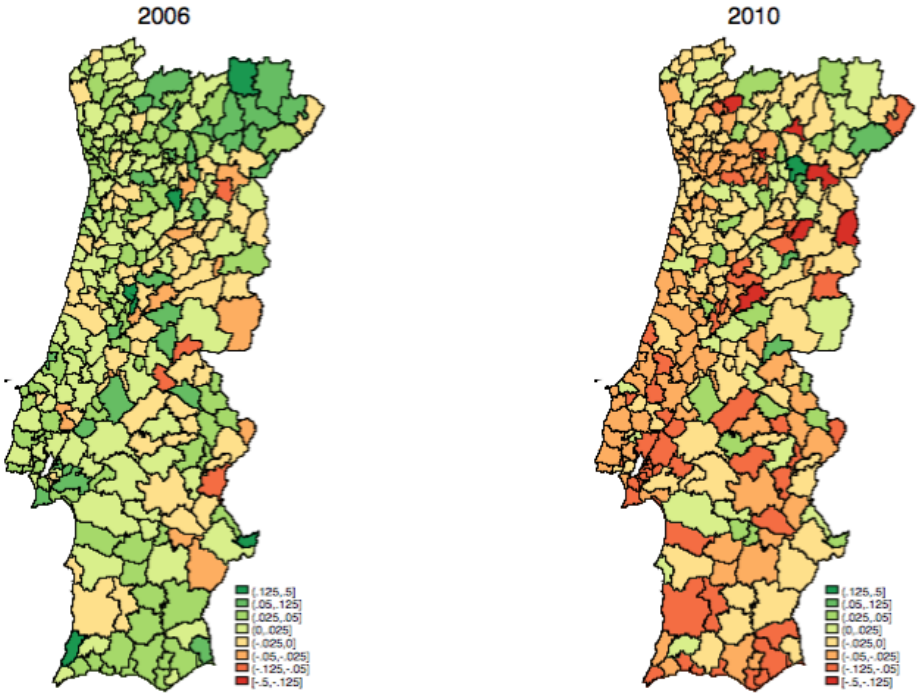

Figure 1. Municipal Net $Entry_{inc}$ in 2006 and 2010, respectively.

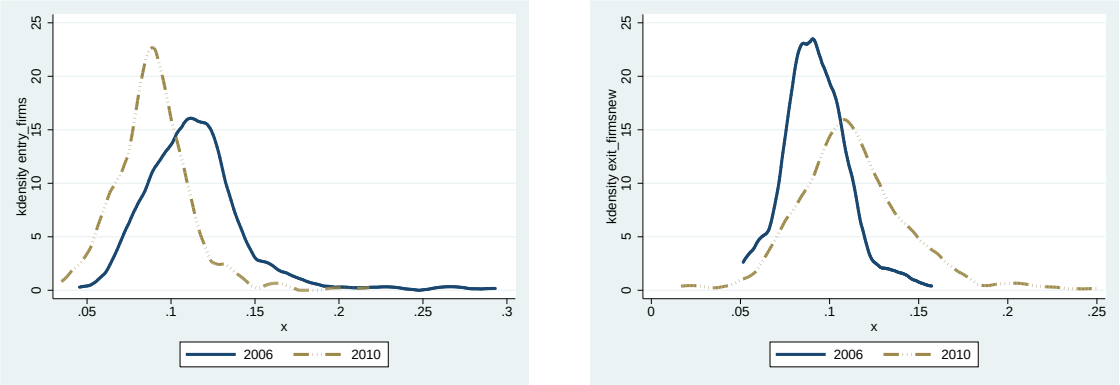

Figure 2. $Entry_{inc}$ and $Exit_{inc}$ densities, respectively, for 2006 and 2010

6. Assessing efficiency results and brief discussion

The results of the VRS output-oriented DEA calculations for mainland local authorities can be found in Figure 4. To properly interpret them, one should recall that the higher the value of θ_j, the less efficient is the DMU given the referred inputs and outputs. In this framework, one can clearly observe the rampant effects coincident with the eruption of the Global Financial Crisis on municipal performance in Portugal. From one period to the other, scores deteriorated sharply as the mean relative inefficiency increased from 1,524 in 2006 to 1,929 in 2010. These results can be read in the following way: net private firm entry divided by incumbents could be, on average and given the local inputs, more than 52% higher in 2006 and almost 93% higher four years later. Moreover, these results are persistent if we cluster for all NUTS 2 regions in Table 3.

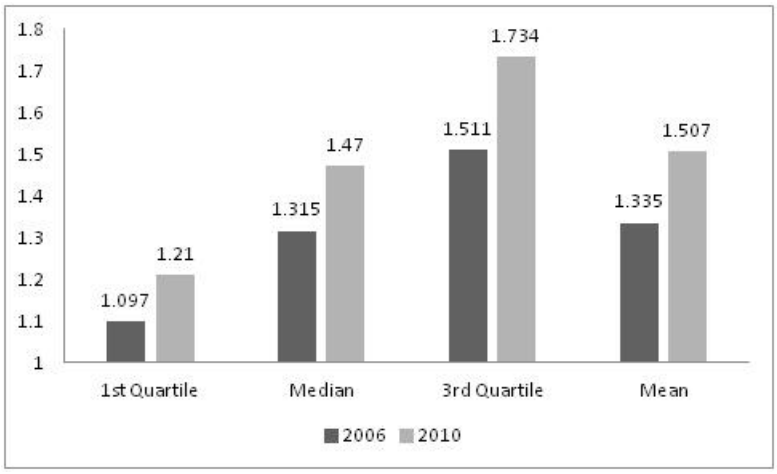

Figure 3. Average relative inefficiency scores (Source: own construction)

Table 3. Average inefficiency scores per NUTS2 regions (Source: own construction)

Year	Mainland Portugal	Norte	Centro	Lisboa	Alentejo	Algarve
2006	1.34	1.35	1.39	1.22	1.06	1.39
2010	1.51	1.47	1.69	1.26	1.22	1.69

7. Productivity change

Caves, Christiansen and Diewert (1981) developed a measure of productivity change across time, the Malmquist Index, whose formula is given by:

$$MI(x_t; y_t; x_{t+1}; y_{t+1}) = \frac{(D^t(x^t, y^t)}{D^t(x^{t-1}, y^{t-1})} \tag{2}$$

Although when written under this form the Malmquist Index takes the technology in period t as the reference one against which the DMU'S in the two periods must be compared. To avoid such a restrictive assumption, the Malmquist Index can be rewritten as a geometric average of two Malmquist Indexes which consider the two years as reference technologies:

$$MI(x_t; y_t; x_{t+1}; y_{t+1}) = (\frac{(D^t(x^t, y^t)}{D^t(x^{t-1}, y^{t-1})} \cdot \frac{(D^{t-1}(x^t, y^t)}{D^{t-1}(x^{t-1}, y^{t-1})})^{1/2} \tag{3}$$

Building on this specification we may rearrange the terms in the previous expression and get the final form of the index given as:

$$MI(x_t; y_t; x_{t+1}; y_{t+1}) = \frac{(D^t(x^t, y^t)}{D^{t-1}(x^{t-1}, y^{t-1})} \cdot [\frac{(D^{t-1}(x^t, y^t)}{D^t(x^t, y^t)} \cdot \frac{(D^{t-1}(x^{t-1}, y^{t-1})}{D^t(x^{t-1}, y^{t-1})}]^{1/2} \tag{4}$$

Under this specification the Malmquist index can be read as the product of two different blocks which provide insightful information on how efficiency has changed from one period to the other. The first term, outside the square brackets, is simply the ratio of the efficiency scores in each year evaluated in relation to the respective technology. This term can be read as a catch up factor (CU), meaning if from one period to the other we witness a general movement of the inefficient DMU's in relation to the efficient frontier.
Inside the square brackets we observe a frontier shift factor (FI). This component reflects if between the two periods with the same inputs we witness or not an higher capacity of the DMU to achieve a higher output.
For both components and for the own Malmquist index, values higher than one correspond to positive evolutions and values lower than one represent a deterioration from one period to the other. Also to note that the original Malmquist Index is computed under Constant Returns to Scale (CRS), contrary to case presented here which is given under Variable Returns to Scale (VRS). The scale impact on the final

Malmquist Index results has been subject to attention in the literature in works such as Grifell-Tatj and Lovell (1995). Like Berg *et al.* (1993), Portela and Thanassoulis (2010) and Portela *et al.* (2012) we derive a Malmquist index under VRS technology.[17]

The Malmquist index has been a widespread measure for evaluating productivity evolution in works such as Före *et al.* (1994) on the productivity change of several countries using capita capital and Labour as inputs, Portela (2012), Adang and Borm (2007) on the change of efficiency in public health care or Zhou *et al.* on the performance in carbon emissions. Although the Malmquist Index has not been used in evaluating the efficiency of political institutions, such as municipalities as it is the case. This measure may provide particular insights on how elected bodies may change their efficiency not just between electoral periods, but during periods of economic difficulties. With this purpose we have perused the calculation of a Malmquist index for each one of the Portuguese municipalities and evaluated how their efficiency in firm attraction has changed before and after the burst of a financial crisis, between the years of 2006 and 2010.

As in the previous section, to make the reading of the results more tractable, the results on the Malmquist index are aggregated by NUTS 2:

Table 4. Malmquist index results per NUTS2 regions (Source: own construction)

Year	**Mainland Portugal**	**Norte**	**Centro**	**Lisboa**	**Alentejo**	**Algarve**
MI (Malmquist index)	0.87	0.87	0.89	0.77	0.66	0.93
CU (Catch-up factor)	0.92	0.95	0.87	0.97	0.91	0.98
FS (Frontier Shift factor)	0.95	0.93	1.03	0.79	0.74	0.96

Observing the results on the Malmquist index and in its two components we can get a wider picture about how the efficiency of Portuguese municipalities in attracting and keeping firms has changed from 2006 to 2010. For the total aggregate, given by Mainland Portugal, we observe an average negative evolution in the catch up component, which matches the evolution of the efficiency scores already observed in table 4.

[17]As stated by Portela and Thanassoulis (2010), assuming VRS we exploit the useful information from a frontier which do not assume the constancy in the returns to scale and we derive a productivity measure net of the changes that may arise from the scale effect from one period to the other

This negative results seem to be confirmed by the negative evolution in the frontier shift factor, meaning a deterioration of the capacity of each municipality to generate a higher output with the resources at its dispose. Putting together the evolution of the two components of the Malmquist index we denote that between 2006 and 2010 the efficiency of the Portuguese municipalities worsened in two aspects. 1) By one side the inefficient municipalities got further from the efficient frontier (which we infer by the negative catch up factor), 2) The own efficient frontier had a negative regression, denoting a structural lower ability of the municipalities to attract new business.
When the results showed in table 4 are desegregated by quartiles the negative evolution showed becomes even more evident, since is observable that for the whole country more than 75% of the municipalities present a Malmquist index lower than one between 2006 and 2010. [18] The evolution previous described for the Mainland seems to be confirmed across the different regions of the country, showing that the deterioration in the firm attractions by municipalities was not an isolated circumstance.

8. Assessing efficiency results and brief discussion

The inefficiency found in the previous section may not be exclusively attributable to poor municipal management. As Afonso and Fernandes (2008, p. 1985) put it, "one has to assume that some municipalities are unable to achieve the "best-practice" due to a relative harsh environment". The following non-discretionary factors (i.e. outside the mayors control, at least in the short-run) are thus taken into account to evaluate which of them drive the ability of local authorities to generate higher performance levels.[19]

Demography. Given that local governments are closer to citizens, decentralization presents several informational benefits for voters accountability. For instance, one could refer the Tieboutean hypothesis (1956) regarding the analogy between competing regional governments and private firms or Oates theory (1972) stating that better matching arises when local preferences are heterogeneous. Despite all these advantages, decentralization may also contribute to higher administrative costs and

[18] The table with the quartile analysis of the Malmquist index and its components can be seen in Appendix, Table A3

[19] A detailed explanation of all environmental variables and data sources is offered in Table A.4.

to negative externalities originated by a lack of coordination and risk sharing. Therefore, it is unclear whether high Population Density is detrimental (Geys, 2006) or helpful (Geys *et al.*, 2010) to efficiency. Moreover, to account for the population age-structure, a high Dependency ratio is expected to have a negative influence on the capacity to attract investment and hence on municipal competitiveness (Bönte *et al.*);

Political preferences. Firstly, to test Cox and McCubbin's (1986) hypothesis that the central government may favour his supporters in the allocation of funds, we introduce a dummy variable that takes the value of one when the prime-minister and the mayor belong to the same political party ,SamePolParty, as suggested by Veiga (2011). Secondly, to control for the effects of distinct political ideologies and agendas, we use the fraction of Leftist Mandates in each jurisdiction. In this regard, since Reynolds *et al.* (1994) argued that right-wing conservatism tends to be related with a resilient entrepreneurial culture, a negative coefficient is expected. Thirdly, it is not clear whether the effects of strong majorities regarding efficiency are positive (Borge *et al.*, 2008) or negative (Kalb *et al.*, 2012). Consequently, a Majority dummy is added. Fourthly, as the electoral engagement fosters civic awareness (Geys *et al.*, 2010), Abstention in local elections is also considered and a negative coefficient is anticipated. Lastly, the length of the current Mayors tenure in office may also have an impact on efficiency (Kaplan *et al.*, 2011). Assuming that mayors have a higher probability of being reelected if they are efficient (Grossman *et al.*, 1999), a positive sign is expected;

Human Capital. We include micro level data regarding the percentage of graduates in each municipality for two reasons. Hamilton (1983), on the one hand, defended that the ability to monitor local efficiency depends on the educational level of residents. On the other, Baptista and Mendonça (2010) found that regional access to knowledge and an educated workforce significantly influences firm location in specific sectors;

Accessibility. We account for the possibility that new motorways increase the attractiveness of locations close to, at least, one of these infrastructures (Holl, 2004) using a Highway dummy;

Table 5 Definition of environmental variables in the baseline specification for 2006 and 2010 (Source: own construction. adapted from Arouca. 2013)

Variables	Mean	Std. dev.	Min	Max	Obs	Hypothesis
Population Density						
2006	0.313	0.854	0.006	7.338	278	?
2010	0.310	0.833	0.005	7.125	278	
Age Dependency ratio						
2006	0.589	0.123	0.400	1.087	278	-
2010	0.594	0.120	0.386	1.085	278	
Same Political Party dummy						
2006	0.363	0.482	0	1	278	?
2010	0.432	0.496	0	1	278	
Leftist Mandates (%)						
2006	54.570	0.2501	0	100	278	-
2010	57.112	0.2585	0	100	278	
Majority dummy						
2006	0.903	0.297	0	1	278	?
2010	0.907	0.292	0	1	278	
Abstention in local election years (%)						
2006	34.097	7.522	17.7	53.7	278	-
2010	36.381	7.582	18.9	55.9	278	
Mayor's tenure						
2006	8.493	7.072	1	30	278	+
2010	9.043	7.614	1	34	278	
Graduates (%)						
2006	6.062	0.029	1.487	26.562	278	+
2010	7.520	0.032	2.564	28.706	278	
Highway dummy						
2006	0.540	0.499	0	1	278	?
2010	0.554	0.498	0	1	278	

9. Evaluating Efficiency Results and Policy Implications

In this section we use Simar and Wilson's double-bootstrap technique (2007) to test how exogenous variables affect the relative efficiency found in section six. This procedure relies on a coherent data generating process to produce a pseudo-frontier which takes into account the sampling distribution of the bias term. In this study we compute Algorithm 2 where 100 replications were used to generate bias-corrected estimates of a previous truncated (rather than censored) regression. Afterwards, 2000 replications were employed to calculate confidence intervals at 95%. At this phase, one should bear in mind that since the dependent variable in the previous method is an inefficiency estimate, a positive (negative) value for a given coefficient corresponds to a negative (positive) relationship between the respective environmental variable and municipal performance.

At the 0,05 level, β is only statistically significantly different from zero when both the lower and the upper bounds of the confidence interval have the same signal.[20]

Table 6 Simar and Wilson (2007) double bootstrap results in the baseline specification for 2006 (Source: own construction)

2006				
		Confidence interval (95%)		
	Coef	Lower Bound	Upper Bound	Effect
Popdensity	-0.01	-0.10	0.06	
Dependencyratio	0.75	0.33	1.15	-
Samepoolparty	0.01	-0.09	0.11	
Leftistmandates	0.01	-0.22	0.25	
Majority	-0.01	-0.14	0.13	
Abstentionrate	-0.44	-1.17	0.27	
Mayortenure	0.00	0.00	0.00	
Highways	0.11	0.02	0.2	-
Graduates	-2.15	-4.03	-0.26	+
Constant	1.26	0.78	1.75	
Sigma	0.29	0.25	0.31	
Regions Dummies	Yes	-	-	

Table 7 Simar and Wilson (2007) double bootstrap results in the baseline specification for 2010 (Source: own construction)

2010				
		Confidence interval (95%)		
	Coef	Lower Bound	Upper Bound	Effect
Popdensity	-0.05	-0.26	0.11	
Dependencyratio	0.69	-0.12	1.48	
Samepoolparty	0.22	-0.02	0.45	
Leftistmandates	-0.29	-0.83	0.47	
Majority	0.11	-0.19	0.45	
Abstentionrate	-1.26	-2.00	0.19	
Mayortenure	0.00	-0.02	0.00	
Highways	0.06	-0.13	0.25	
Graduates	-3.25	-6.9	0.25	
Constant	1.71	0.79	2.67	
Sigma	0.56	0.47	0.62	
Regions Dummies	Yes	-	-	

In 2006, three items were found statistically significant in our analysis. First, the Age dependency ratio seems to be the main driver of inefficiency in the period, which may be explained by a significant ageing problem faced by the country. This result

[20]For more details on Simar and Wilson's double-bootstrap (2007) see the Technical Appendix.

is consistent with evidence gathered by Bönte *et al.* who found "an inverse U-shaped relationship between age and the decision to start a business".
On the political variables, we should underline how none of the chosen indicators seem to impact on the efficiency levels. The variables related to education and road infrastructures, however, seem to play an important role. In this regard, our results suggest that the percentage of Graduates creates a proper environment for a more efficient municipality in what concerns private firm attraction and retention. A well-educated population are hypothesized to be better in monitoring the activities of politicians and ultimately sanction incompetence and inefficiency. But higher education levels are also likely to imply better trained (and hence more efficient) civil servants. On the contrary, the negative impact on performance scores due to the existence of a highway infrastructure might seem difficult to understand at first sight. In fact, Portugal was bottom of the European league in terms of roads and safety just a few decades ago. A series of ambitious programs changed this scenario through public-private partnerships, used to shift payment on to future taxpayers. If this has helped cut average journey times, highways are also evidence of ill-advised public spending. Since 1986, Portugal has enlarged its motorway network from about 300km to 3,000km. In relative terms, the country has 60 per cent more kilometres of motorway per inhabitant than Germany and four times more than the United Kingdom. EU funding contributed to the glut of motorways. For more than 30 years Portugal has received 96bn in structural and cohesion funds to help it catch up with other member states to which the central government has put forward a further 86bn. In other words, around 25 per cent of regional development funds have been invested in roads. All in all highways increased the magnetism of particular municipalities (and thus their inefficiency) as better accessibilities facilitate transport connections. This concentration, on the other hand, came at cost of other (and more numerous) municipalities with less pronounced resources.
In contrast, we are not able to identify one single driver of local performance for 2010. This outcome gives per se a clear idea of the strong impact of the Global Financial crisis on Portuguese municipalities. We conclude how under a global financial crisis, the non discretionary factors that may explain municipal efficiency disappear. In a policy evaluation perspective, despite this result may indicate a low power of the local political institutions to engage in counter cyclical policies, it may constitute evidence that these kind of policies have to be targeted at a broader national level.

10. Final Remarks

The current work aims to examine the institutional role of municipalities in creating the conditions to encourage private initiative, opportunity recognition and willingness to take risks. We contribute to the literature in three major issues. To begin with, we study, for the first time, the previous research question using Data Envelopment Analysis (DEA) to assess efficiency and a demanding double-bootstrap to evaluate its determinants. Second, we compare the effects after and during the Global Financial Crisis by selecting two post local (and national) election years (2006 and 2010). Furthermore, we depart from the related literature where the most widely used input variables are measures of spending size rather than fiscal responsibility. Lastly, we use both desirable and undesirable outputs in the first and an extensive range of environmental traits in the second stage.

In the first stage we present additional evidence that the effects of the crisis were particularly damaging for regional development as performance scores deteriorated sharply from 2006 to 2010. These results are confirmed when a Malmquist Index approach is adopted. This index indicates that from 2006 to 2010 the inefficient municipalities, meaning the ones which are below the efficient frontier, become even more inefficient. We conclude as well on a negative frontier shift effect, which reveals that under the same inputs the ability to achieve a higher output decreased.

A second stage was then computed to understand which non discretionary factors may impact on efficiency levels in both years. For the first period we found that an old demographic population structure and the existence of at least one highway had a negative effect whereas a more educated working force had the opposite result. Moreover, we should highlight that none of the five political variables used had a statistically significant impact. For the second period, however, no exogenous factor seemed to influence firm creation and retention at municipal level during a major financial crisis.

This study has also its limitations. Besides the classical problem of choosing all the relevant variables to assess effciency, exacerbated by a strong opposition against implementing performance evaluation models in Portuguese municipalities, one should bear in mind that some of them may be strongly constrained in their movements towards the production function.

In the future, with increasingly detailed available data, it may be possible to extend our investigation with new institutional variables (e.g., average days until payment, transparency and fiscal stability indices) or across economic sectors. For instance, the differences between the consequences of entrepreneurship due to pecuniary or knowledge externalities should be explored. To conclude, new avenues of research

may unlock efficiency as well as effectiveness from the point of view of three distinct concerns: sustainability, accountability and quality of life.

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13. Appendix

Table A.1 International comparisons on local governments (Source: own construction with data from EU Subnational Governments: 201 Key Figures. 2011/2012 Edition)

Country	No. of municipalities (2010)	Average number of inhabitants	Total public expenditure (% GDP)	No. of municipalities (1950)
Austria	2357	3.56	8,2%	3999
Belgium	589	18.48	7,1%	2669
Denmark	98	5.59	37,6%	1387
Finland	336	15.96	22,5%	547
France	36697	1.77	11,8%	38814
Germany	11533	7.08	8,0%	24772
Greece	325	34.78	2,8%	5959
Italy	8094	7.47	15,7%	7781
Netherlands	418	39.74	17,2%	1015
PORTUGAL	308	34.38	7,2%	303
Spain	8116	5.68	24,3%	9214
Sweden	290	32.34	25,5%	2281
United Kingdom	406	152.68	14,0%	2028

Figure A1 Comparison between Efficient frontiers under CRS and VRS)

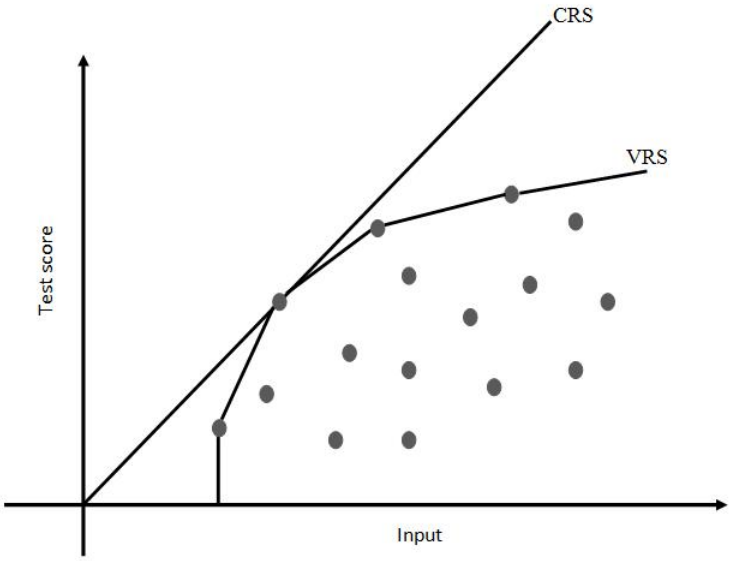

Table A.2. Definition of Inputs (I) and Outputs (O) in the baseline specification for 2006 and 2010 (Source: own construction, adapted from Arouca, 2013)

Variable	**Operational Description**	**Data source**
(I) Industrial area	Percentage of municipal area allocated for industrial usage according to the official PMOT: Municipal Spatial and Land use Plan	*DGOTDU*
(I) Tourism area	Percentage of municipal area allocated for industrial usage according to the official PMOT: Municipal Spatial and Land use Plan	*DGOTDU*
(I) Primary expenditures/ Total Expenditures	Total annual expenditure of municipalities minus annual interest payments divided by total annual expenditures	*INE a)*
(I) Property taxes$_{percapitainv}$	The inverse of total annual IMI and IMT revenues of municipalities divided by total population	*INE a)*
(I) Construction ratio	Ratio between predicted duration of construction works and effective duration of construction works (in months)	*INE b)*
(O) Entry_inc	Number of firms attracted to each municipality divided by the number of firms functioning in the same area	*Quadros de Pessoal*
(O) Exit_inc_inv	Inverse of the number of firms leaving the municipality divided by the number of firms still functioning in the same area	*Quadros de Pessoal*

Notes: Acronyms for sources of annual raw data correspondence: DGOTDU (Office for Spatial Planning and Urbanism), INE a) (Statistics Portugal Regional Statistical Yearbooks), INE b) (Statistics Portugal- Inquérito aos Projectos de Obras de Edificao e de Demolio de Edifícios and Estatísticas das Obras concluídas). Remaining doubts are answered by the author upon request.

Table A.3. Definition of environmental variables in the baseline specification for 2006 and 2010 (Source: own construction, adapted from Arouca, 2013)

Variable	**Operational Description**	**Data source**
Population Density	Ratio of resident population per squared kilometre of municipal territory (k inhabitants per km2)	*INE a)*
Age Dependency ratio	Ratio of individuals typically not in the labor force (aged 0-14 and 65+) and active population (aged 15-64)	*INE a)*
Same Political Party dummy	Coincidence between the prime minister and mayor's political party (in those cases, the dummy variable is equal to one)	*DGAI*
Leftist Mandates (%)	Percentage of mandates in the municipal local authority assigned to parties or coalitions ideologically leftist (PS (Socialist Party), CDU (Communist Party) and BE (Left Bloc)	*DGAI*
Majority dummy	Existence of a majority governing the Municipal Assembly (in those cases, the dummy variable is equal to one)	*DGAI*
Abstention in local election years (%)	Percentage of voters in the municipality who refrained or abstained from voting in local elections years (2005 and 2009)	*DGAI; INE a)*
Mayor's tenure	Number of consecutive years in office	*DGAI; INE a)*
Graduates (%)	Percentage of employees working in the municipality who hold a university degree (tertiary level of education)	*Quadros de Pessoal*
Highway dummy	Existence of at least one highway passing through the municipality (in those cases, the dummy variable is equal to one)	*INE a)*

Notes: Acronyms for sources of annual raw data correspondence: DGAI (Office for Internal Affairs), INE a) (Statistics Portugal-Regional Statistical Yearbooks), Remaining doubts are answered by the author upon request.

Table A4. Malmquist index and its components (quartile analysis)

Year	**1st quartile**	**Median**	**3rd quartile**	**Mean**
MI (Malmquist index)	0.73	0.85	0.98	0.87
CU (Catch-up factor)	0.76	0.93	1.02	0.93
FS (Frontier Shift factor)	0.83	0.93	1.06	0.95

Technical Appendix

Simar and Wilson Bootstrap algorithm

1) Estimation of $\widehat{\theta_i}$ for all DMU's considering the original data.

2) Using the maximum likelihood method obtain the estimate $\widehat{\beta}$ of β and the estimate $\widehat{\sigma_\epsilon}$ of σ_ϵ in the truncated regression of $\widehat{\theta_i}$ in z_i using the $m \leq n$ when $\widehat{\theta_i} \geq 1$

3) Loop over the next three steps for L1 bootstraps in order to get a set of estimates B_i=$(\widehat{\theta^*_{ib}})_{b=1}^{L}$:

3.1 For each i=1,...,m DMU's draw ϵ_i from $\mathcal{N}[0, \widehat{\sigma_\epsilon}]$ distributed with left truncation at $1 - z_i\widehat{\beta}$.

3.2 Compute θ^*_i=$z_i\widehat{\beta} + \mu_j$.

3.3 Set $x^* = x_i$; $y^* = y_i.\frac{\theta_i}{\theta^*_i}$

3.4 Compute $\theta^*_i = \theta(x_i, y_i|\wp^*)\forall_i = 1, ..., n$, where $\wp^*$ is obtained by replacing Y, X in the DEA linear programming problem with $Y^* = [y^*_1, ..., y^*_n]$ and $X^* = [x^*_1, ..., x^*_n]$

4) For each $i = 1, ..., n$ compute a bias corrected estimator $\widehat{\widehat{\theta_i}}$ using the bootstrap estimates B_i and the original estimate $\widehat{\theta_i}$

5) Using again the method of maximum likelihood to estimate the truncated regression of $\widehat{\widehat{\theta_i}}$ in z_i, getting estimates $(\widehat{\widehat{\beta}}; \widehat{\widehat{\sigma}})$

6)Loop over the next three steps for L2 bootstraps estimates:

3.1 For each i DMU's draw μ_j from $\mathcal{N}[0, \widehat{\widehat{\sigma_\epsilon}}]$ distributed with left truncation at $1 - z_j\widehat{\widehat{\beta}}$.

3.2 Compute θ^{**}_j=$z_j\widehat{\widehat{\beta}} + \mu_i$.

3.3 Come back to the maximum likelihood truncated regression to estimate by truncated regression θ^{**}_j=$f(z_i; \mu_{ij})$ obtaining $(\widehat{\widehat{\beta}^*}; \widehat{\sigma_\epsilon}^*)$

7) Use the bootstrap estimates and the original $\widehat{\widehat{\beta}}$ and $\widehat{\widehat{\sigma_\epsilon}}$ to construct confidence intervals for β and σ_ϵ.

Note: In the present case L1 correspond to 100 replications and L2 to 2000.