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Some Determinants of Intermediate Local Governments' Spending Efficiency: The Case of French Départements

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Abstract

Efforts undertaken by France to restructure the allocation of governmental competencies increased the importance of subnational governments by transferring additional tasks. This paper analyzes the efficiency of public spending on an intermediate government level for a sample of 96 *départements* in metropolitan France in 2008. Spending efficiency is measured using Data Envelopment Analysis (DEA). Results indicate significant room for improvements and detect spending inefficiencies averaging between 10 and 22 percent, depending on model specification. To explain efficiency, a bootstrapped truncated regression, following Simar and Wilson (2007), is applied. The second-stage regression shows that efficiency is also determined by exogenous factors and identifies the distance to the national capital, inhabitants' income and the share of inhabitants of an age over 65 as significant determinants of efficiency.

JEL Codes: C14, H11, H72

Keywords: Intermediate Government Spending Efficiency, Nonparametric Efficiency Analysis, Bootstrapped Truncated Regression

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1 Introduction

In the course of the financial crisis starting in 2007, the sustainability of public finances was again put on the public agenda. However, the increasing pressure on public budgets is not new but is more pronounced and manifold than before.[2] The OECD (2010a) emphasizes the strong need for fiscal consolidation, whereby structural reforms remain an essential policy tool for its facilitation. Particularly those reforms targeting the increase in public sectors' productivity and efficiency would improve the fiscal positions of many countries (OECD, 2010a). Efficiency improvement potentials do not seem to be fully exploited, most notably at the sub-national government level (OECD, 2007, 2009a). Using 2008 data on the 96 European French *départements*, this paper evaluates the spending efficiency of this intermediate level of governance using non-parametric efficiency analysis. Further, it aims to discuss factors that might explain parts of the existing inefficiency by second-stage regression.

In general, the public sector comprises of those economic activities in which governments are engaged either in the production, the delivery or the allocation of public goods and services. These activities range from providing a legal system to purchasing goods and services, from government production to government redistribution of income. How public sector activities are pursued and its scope strongly differs among economies (Stiglitz, 2000). In many countries the public sector includes more than one level of government (Atkins and van den Noord, 2001) and notably contributes to the economic outcome. In 2008, the average share of general government expenditures[3] in gross domestic product (GDP) was about 41 % (OECD, 2010b) for OECD countries, emphasizing its economic relevance. Particularly in multilayer systems, two issues are relevant for fiscal sustainability and public sector performance: the allocation of responsibilities and the management of public spending (OECD, 2003). With respect to the former, Atkins and van den Noord (2001) note that decision-making authority is preferable where it can best be exercised.[4] With respect to the latter, exercising control over public spending is an important instrument strengthening the management of public spending (OECD, 2003, 2010a).

Benchmarking is the systematic comparison of the performance of one unit to other units (Bogetoft and Otto, 2011), thus making status quo evaluation and identification of areas that can be improved possible. Thus, it is a tool to exercise control over public expenditures, independently from the contributing level of government. Efficiency analysis provides benchmarking approaches that identify best practices (frontier) used in the transformation of inputs to outputs (technology). Relative to the determined best practice, unit-individual inefficiency then can be measured.[5] To define the frontier and

[2] The European Commission (2010, p. 66) mentions the falling share of working age people in the population, lower (potential) economic growth and higher costs associated with providing services for the aging population.

[3] These include expenditures by central, state and local government plus social security.

[4] This argumentation is in line with public choice theory (effectiveness and knowledge about needs), e.g. Mueller (2003), Balaguer-Coll et al. (2010).

[5] It is common consensus that the public sector production exhibits inefficiencies that arise from numerous sources, e.g., organizational settings and personnel, procurement and budgeting restrictions. Therefore, the private sector serves as the standard of comparison. Alternatively, inefficiencies can be identified by comparing economic activities of government bodies among a homogenous group.

measure the inefficiency of French *départements* we use Data Envelopment Analysis (DEA), which is a deterministic and nonparametric benchmarking method.[6] Compared to alternative parametric techniques, e.g., Stochastic Frontier Analysis (SFA), one distinguishing feature of DEA is that, except for convexity, it does not require any assumptions, such as a functional form, regarding the technology (Hjalmarsson et al., 1996). This is very useful since governmental activity, opposed to the example of firm activity, does not have a convenient, well-established equivalence in microeconomic theory. Thus, governmental behavior might not be adequately represented by a production function. Furthermore, DEA allows us to consider multiple outputs, representing different governmental duties.

Efficiency analysis is applied to numerous European countries, and although France is one of the biggest economies in the world and an important member of the European Union (EU), to our knowledge, it has not been individually studied.[7] In addition, such an analysis is worthwhile because the repeated failure of authorities to meet medium-term spending objectives reinforces the need to improve the capacity of decision makers to control public spending (OECD, 2003).

France possesses a unique organization of its public sector, which roughly consists of the central government, the sub-national governments, the social security funds, and large publicly owned enterprises (OECD, 2003). The country is a decentralized, unitary state meaning that the central state holds all legislative power and delegates responsibilities for public service provision to sub-national administrative bodies. According to OECD (2010b), the overall proportion of general government expenditures[8] to national GDP in France is the highest ratio among the OECD countries, about 53 % in 2008. These expenditures include those made by the central government (about 34 %), by the sub-national governments (about 21 %), and by the social security (about 45 %; OECD, 2009b).

The French Constitution entitles three levels of sub-national governments: the *régions*, the *départements*, and the *communes*; each with an elected council, autonomously financed, and possessing - to a limited extent - fiscal sovereignty (French Constitution, Art. 72, 72-2). While the *régions* contribute with 13 % to local governments' expenditures, the *secteur communal*[9] contributes with 55 % and the *départements* with 32 % (CLENCH, 2010).

We are particularly interested in analyzing *départements* for two reasons: First, they constitute the intermediate level of sub-national government for which a lack of analysis still exists and the potential for efficiency improvement does not seem to be exploited at this level yet. Second, *départements* hold an important role in the shifting of power from national to local authorities. France has a long history of decentralization, which can be interpreted as part of a broader effort by the French state to deal with the increasing complexity of its responsibilities and management (Cole, 2006). The power of the *départements* was already enhanced with the reforms of 1982-1983 that conceded larger budgets, more

[6] For a comparison and discussion of alternative efficiency analysis methods, see, among others, Coelli et al. (2005), and Hjalmarsson et al. (1996).

[7] France is included in cross-country analyses considering OECD countries, e.g., Afonso et al. (2005) and Maudos et al. (2003).

[8] This excludes expenditures contributed by the large publicly owned enterprises.

[9] The communal sector includes *communes* and *groupements*.

staff and more service-delivery responsibilities. The reforms of 2003-2004 intending to clarify the responsibilities shifted additional power toward sub-national levels to support better and more efficient governance. As a result the share of general government services delivered by them increased.

However, inefficiency can be influenced by factors over which the *départements* cannot fully exercise control. Thus, such exogenous factors explain some aspects of the inefficiency. Depending on the considered system, these variables can relate to, e.g., political, geographical or fiscal characteristics. The physical location of Paris, both as a leading global economic center and as the center of French political power, is important. *Départements* that are part of or are located closer to the Paris agglomeration may benefit from that location; whether due to the close proximity to policy makers, due to a pool of highly skilled labor force, and/or due to economic strength. In addition to other factors, this effect needs to be taken into account when discussing spending efficiency.

The paper is organized as follows: Section 2 gives an overview of the literature on public sector efficiency. Section 3 introduces the methodologies applied in this paper. In section 4, the model specifications and data are presented. The results are discussed in section 5 and section 6 concludes.

2 Literature Review

A broad literature on measuring public sector performance by means of frontier methods has evolved. Kalb (2010), Afonso and Fernandes (2008), De Borger and Kerstens (2000) and Worthington and Dollery (2000) provide comprehensive overviews of the empirical evidence derived from both, parametric and nonparametric methodologies. The existing literature concentrates on evaluating the performance of the public sector either in terms of publicly proved services or in terms of administrative units. For example, the work by Hauner and Kyobe (2010), Worthington (1999) and Gorman and Ruggiero (2008) all refer to particular services including the health sector, education, libraries and police work. However, our focus is on the performance of administrative units. Within this context, spending efficiency is understood to be a global measure of the administrative bodies' capability to provide and manage the tasks they are in charge of, with respect to the multiple inputs placed at their disposal.[10]

Concerning the representation of inputs, mainly financial rather than physical measures are used. While some authors, including this paper, Geys and Moesen (2009), de Sousa and Stosic (2005), Vanden Eeckhaut et al. (1993) and Arcelus et al. (2007), use one financial aggregate to describe the inputs, i.e. total or current expenditures, others further decompose these into capital related expenditures and labor cost (e.g. Balaguer-Coll et al., 2010) or FTE equivalents (Worthington, 2000). The advantage of using financial data is that all inputs are considered. However, it also implies that the administrative units face identical input factor prices if input factor prices and quantities cannot

[10] This approach is along the same lines as Stiglitz (2000) who refers to the governmental management as a public good itself where everybody benefits from a better, more efficient and responsive management.

accordingly be implemented in the estimation. Concerning the representation of outputs, i.e. the goods and services administrative units are providing, analyses predominantly rely on the tasks that are obligatory to the units due to the legal prescription. Although this approach excludes voluntary tasks, depending on the application, it covers the vast majority of costs and, thus, allows comparing the units. To measure these outputs, the literature provides a wide range of means. For example, educational service is measured as the number of lessons taught (Loikkanen and Susiluoto, 2006), pupils enrolled (Geys et al., 2010), pupil exam performance (Giordano and Tommasino, 2011), the number of schools, or even the population in the relevant age group (Kriese, 2008). Each measure contains information on education in general, but delivers different specific information. Following Bradford et al. (1969, p. 186), one could distinguish direct (D-) outputs, and outputs of primary interest to the citizen-consumer (C-output). For instance, while the number of lessons taught tries to assess directly the actual service provided, student exam attainment is an outcome that is also a result of other socio-economic factors, which are not under control of the local government. However, citizens may be more concerned about the final outcome, rather than the amount of services delivered (Afonso and Fernandes, 2006). The ongoing discussion on defining inputs and outputs underlines the general problems associated with representing the transformation process of administrative units. Among others, Balaguer-Coll et al. (2007) point out that the production process is complex and difficult to model and Afonso and Fernandes (2006) note that inputs and outputs are difficult to model. Furthermore, prices are hardly available (De Borger and Kerstens, 1996).

With respect to the character of administrative units, efficiency analyses are conducted at the different tiers of governmental organization. The country level, i.e. state level, is the level of highest aggregation. Work by Afonso et al. (2005), provides empirical evidence for cross-country comparisons. Much attention is on local governments for which tasks can be identified more precisely. Municipalities are analyzed for various countries, e.g., Belgium (e.g. Vanden Eeckhaut et al., 1993; De Borger et al., 1994), Spain (e.g. Benito et al., 2008; Balaguer-Coll et al., 2010), Germany (e.g. Kriese, 2008; Kalb, 2010), Japan (Tanaka, 2006), and Finland (Loikkanen and Susiluoto, 2006, Loikkanen et al., 2011). However, the empirical evidence for intermediate levels of government – to which the French *départements* belong to – is very limited. By nonparametric deterministic techniques, Hauner (2008) analyzes the spending efficiency for 89 Russian regions in terms of health care provision, education and social services. The author finds significant differences between the regions in all sectors. Likewise, Giordano and Tommasino (2011) find efficiency differences among the 103 Italian provinces that perform municipal, regional and national tasks. In addition, the authors identify rather low correlation of efficiency scores for different responsibilities. Applying a stochastic frontier approach, Kellermann (2007) evaluates the spending efficiency of the 26 Swiss Cantons between 1990 and 2002, finding fairly low inefficiency and increasing efficiencies over time.

Subsequent to the measurement of the performance rendered by particular public services and administrative units, the literature is also concerned with explaining (in)efficiency. The purpose of these analyses is to explain performance differences that are due to exogenous factors (determinants) that are not (fully) under the control of the decision-making units. Following Fried et al. (1999), a clearer understanding of the nature of inefficiency is important for designing policies that improve resource allocation. Such analyses are commonly conducted in a second stage, in which a set of explanatory factors are regressed on efficiency scores obtained by efficiency analysis techniques. Table 1gives an overview on second-stage analysis, outlines the approaches used, and summarizes the main findings.

The determinants can be contextually grouped into political, geographic, fiscal, and socio-economic factors. However, Table 1 shows that for some of them the evidence is inconsistent, e.g. population. While De Borger et al. (1994), Giménez and Prior (2007), and Balaguer-Coll et al. (2007) find a positive impact of population on efficiency, the results of Loikkanen and Susiluoto (2006) and Loikkanen et al. (2011) indicate a negative relationship between these factors. Similarly, population density is found to be positively related to efficiency in some studies (Geys et al., 2010; Loikkanen and Susiluoto, 2006), while other studies do not find significant effects (Afonso and Fernandes, 2008). Likewise, the results are ambiguous regarding the influence of inhabitants' economic situation (e.g. in terms of income or purchasing power): while some studies find significant negative impact (De Borger and Kerstens, 1996; Loikkanen and Susiluoto, 2006), other authors find significant positive influence (Giménez and Prior, 2007; Afonso and Fernandes, 2008). Concerning dependence on central government transfers, most studies find a negative relationship between central government grants and efficiency (De Borger and Kerstens, 1996; Balaguer-Coll et al., 2007). Similarly, a majority of studies find a negative impact of tourism and in-commuting on efficiency, which might be due to the additional costs of public goods provided to non-residents. In contrast, increasing urbanization and commercial activity (Loikkanen and Susiluoto, 2006; Balaguer-Coll et al., 2002; Giménez and Prior, 2007) and higher resident education levels (De Borger and Kerstens, 1994, Loikkanen and Susiluoto, 2006) are generally found to be positively related to efficiency. The latter are also used as indicator for citizen political participation, which is also found to positively influence efficiency (e.g. De Borger and Kerstens, 2000; Giordano and Tommasino, 2011).

Table 1: Overview of Second-stage Analyses on Government Efficiency[11]

Authors	Sample	Method	Main Finding: Positive Impact on Efficiency	Main Finding: Negative Impact on Efficiency
De Borger and Kerstens (1994)	589 Belgian municipalities	Tobit	• High local tax rates • Inhabitants education level	• Higher inhabitants income • Per capita block grants • Number of coalition parties
De Borger and Kerstens (1996)	589 Belgian municipalities	Tobit	• Higher property taxes • Inhabitants education level	• Block grants • High inhabitants income
Athanassopoulos and Triantis (1998)	172 Greek municipalities	Tobit	• High share of fees and charges in municipal income • High investment share in total expenditures	• Population density • Grants • Parties affiliated to the central government
Balaguer-Coll et al. (2002)	Spanish municipalities	Tobit	• Largest populations • Level of commercial activity	• Higher per capita tax revenue • Higher per capita grants
Loikkanen and Susiluoto (2006)	353 Finnish Municipalities 1994 – 2002	OLS	• Higher inhabitants education • Dense urban structure • Large share of municipal workers between 30 and 49	• Larger population • High inhabitants income • Peripheral location • Diverse service structure • Unemployment
Balaguer-Coll et al. (2007)	414 Valencian municipalities	Non-parametric smoothing	• Larger population	• Tax revenues • Self-generated revenues • Deficit • Grants
Giménez and Prior (2007)	258 Catalonian municipalities	Tobit	• Larger population • Inhabitants income • Commercial activity • Tourism	• Distance to the regions capital
Afonso, Fernandes (2008)	278 Portuguese municipalities	Tobit	• Inhabitants education • Inhabitants purchasing power	
Hauner (2008)	89 Russian regions	Truncated regression	• Inhabitants income • Good governance • Democratic control	• Federal grants • Higher spending
Loikkanen et al. (2011)	353 Finish Municipalities 1994 – 2002	OLS	• Dense urban structures • Higher inhabitants education • Large share of municipal workers between 30 and 49 • City managers' education • Co-operation	• High unemployment • Larger population • Peripherality

[11] This extends the overview in Afonso and Fernandes (2008).

Second-stage analysis predominantly employs regression techniques such as OLS and Tobit regression. While Tobit regression accounts for the limitation of efficiency scores at unity, it still imposes strong statistical assumptions and requires a correct model specification. Simar and Wilson (2007) show that this technique has several drawbacks and may lead to biased results. Recent analyses of government efficiency take this, to some extent, into account: Hauner (2008) uses a truncated rather than a censored regression model following the suggestion of Simar and Wilson (2007). Balaguer-Coll et al. (2007) try to overcome the problems with a nonparametric smoothing approach, which demands no functional specification and avoids assumption violations. This paper uses bootstrapped truncated regression, as proposed by Simar and Wilson (2007), which has, to the authors' knowledge, so far not been applied to analyze government efficiency.

3 Methodology

3.1 Performance Measurement with Data Envelopment Analysis

We use Data Envelopment Analysis (DEA) to measure the spending efficiency of French *départements*. Thereby, the *départements* can be considered as decision-making units (DMUs) transforming inputs to outputs. DEA determines the best practice technology (frontier) by piecewise linear programming whereby the frontier envelopes all observed input-output combinations. Thus, the frontier sets the benchmark against which each of the *départements* is compared to and any distance to the frontier is interpreted as inefficiency. Those *départements* lying on the frontier are considered to be relatively efficient and serve as peers for others. Hence, a *département* is fully efficient on the basis of available evidence if and only if the performance of other *départements* does not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs (Cooper et al., 2004, p. 3). More formally, we analyze a set of $I\,(i=1,...,I)$ *départements* that transform an input vector x_i collecting $n\,(n=1,...,N)$ inputs, into an output vector y_i collecting $m\,(m=1,...,M)$ outputs. According to Simar and Wilson (2008), the production set ψ can be understood as the set of physical available points (x,y), or in other words as a set of feasible input-output combinations, i.e.

$$\psi=\left\{(x,y)\,\varepsilon\mathbb{R}_{+}^{N+M}\,\middle|\,x\ \ can\ \ produce\ \ y\right\} \tag{1}$$

This production set constraints the production process. To describe the efficient boundary (frontier) of ψ we assume input-orientation meaning that we identify the minimum amount of inputs required to produce a given amount of outputs. Hence, for every *département*, we obtain the maximum potential reduction of inputs for its observed level of outputs, which is available in the feasible production set.

This is a reasonable assumption because the obligatory tasks of the French *départements* are determined by law and thus, choices related to outputs are limited. Furthermore, practical consolidation favors spending-based budget retrenchment (OECD, 2010) for which the input-oriented boundary of ψ provides useful information. For a *département* i with the input-output combination (x^0, y^0), the input-oriented efficiency measure θ is then defined by

$$\theta\left(x^0, y^0\right) = \min\{\theta \,\big|\, (\theta x^0, y^0) \in \psi\} \tag{2}$$

where $\theta(x^0, y^0)$ gives the radial, i.e. proportional, reduction of inputs a unit could undertake to become efficient (Simar and Wilson, 2008). By construction, θ is equal or less than unity, but cannot take values smaller than zero. For $\theta = 1$, the *département* is efficient and cannot reduce its input. For $\theta < 1$, the *département* can produce the same level of output with only using $1-\theta$ times its input; thus it could save θ percent of each input.

Based on the ideas of Farrell (1957), different linear programs have been developed to allow the technology, i.e. the frontier, to be of certain nature. Most frequently, the models proposed by Charnes et al. (1978) and Banker et al. (1984) are applied where the technology exhibits constant returns to scale (CCR model) and variable returns to scale (BCC model), respectively. We assume variable returns to scale (VRS), which assures that local governments are benchmarked against units of similar structure. An efficiency estimate $\hat{\theta}$ for an observation operating at level (x^0, y^0) is then derived by solving the following program

$$\hat{\theta}(x^0, y^0) = \min\left\{\theta \left|\; y^0 \le \sum_{i=1}^{I} \lambda_i y_i;\;\; \theta x^0 \ge \sum_{i=1}^{I} \lambda_i x_i;\;\; \theta > 0;\;\; \sum_{i=1}^{I} \lambda_i = 1,\;\; \lambda_i \ge 0;\;\; i = 1,\dots,I \right.\right\} \tag{3}$$

with λ_i being a vector of unit-individual weights for inputs and outputs that are used to construct the efficient linear combination. VRS assumption is introduced by the constraint $\sum_{i=1}^{I} \lambda_i = 1$.

Nonparametric deterministic frontiers, such as those constructed by DEA, are appealing since they rely on only few assumptions. However, when applying DEA, particularly two aspects must be carefully considered: the convergence rate of the DEA estimator and extreme values or outliers in the data. The convergence rate measures how fast an estimator converges to the true and unknown parameter subject to the number of observations. Compared to alternative parametric approaches, the DEA estimator exhibits a slow degree of convergence. Hence, the validity of DEA estimates strongly depends on the number of variables used, i.e. the dimensionality of the model specification, relative to the observations included. To obtain a reasonable discriminative power and meaningful estimation results, an appropriate ratio of variables and observations is necessary. We address this issue by restricting ourselves to a single input and the most relevant outputs, i.e. the mandatory tasks.

3.2 Outlier Detection

Furthermore, DEA frontiers are sensitive to extreme values and outliers (Simar, 2003). Extreme values and outliers can indicate either data errors, for which DEA cannot correct, or indicate observations that are outside the normal range but nevertheless valid. Because DEA relies on envelopment, extreme values and outliers belong to the attainable set with certainty. Thus, when identified as peers, they can directly influence the efficiency measures of other observations. To overcome this issue, we use two methodologies, first the super-efficiency analysis proposed by Banker and Gifford (1988) to detect outliers and then the efficiency stepladder (ESL) proposed by Edvardsen (2004) to test the frontier's robustness. The concept of super-efficiency constructs efficiency measures by avoiding that the evaluated unit can help span the frontier (Bogetoft and Otto, 2011). Consequently, super-efficient observations obtain efficiency scores larger than unity and can be subject to an individual inspection. We use the results of this analysis to identify observations with a super-efficiency score[12] greater than 1.2. These are further investigated using the ESL approach that indicates the sensitivity of the individual efficiency scores to measurement errors (Edvardsen, 2004). Thus, efficiency estimates can be investigated in terms of robustness. For every observation, the first step of this iterative approach is to identify its most influential peer, i.e. the peer whose exclusion leads to the greatest efficiency increase. The detected peer is removed and DEA is conducted again. This procedure is done repeatedly until the given observation becomes fully efficient. The changes of the measured efficiency occurring in these steps indicate the sensitivity of the measured efficiency scores against the other observations in the data set. This allows us to evaluate the influence of the elimination of those observations that are found to be potentially super-efficient.

3.3 Bootstrapped Truncated Second-Stage Regression

To investigate which and whether exogenous variables have explanatory power on inefficiency, we conduct the bootstrapped truncated regression proposed by Simar and Wilson (2007). This approach allows for valid inference in the second stage and is therefore superior to others. Previous studies on local government efficiency predominantly used OLS or Tobit regression. Tobit regression takes the censored nature of efficiency estimates into account (not larger than 1). However, Simar and Wilson (2007) note that due to serial correlation, Tobit regression yield inappropriate and biased estimation results. Basically, two sources of errors cause biases: on the one hand, the observations are empirically

[12] Based on Monte Carlo simulation, Banker and Chang (2006) propose to define observations as outliers that exceed an efficiency level of 1.2.

obtained and not independently distributed, but underlie serial correlation. On the other hand, since only a sample is used and the most efficient observations are not captured, the efficiency scores are likely to be biased upwards. Even though our sample covers the whole population of French *départements*, the true frontier remains unknown. Furthermore, inefficiencies may still exist for the efficient observations.

To evaluate the influence of exogenous factors on the spending efficiency of French *départements*, we investigate the following relationship

$$\theta_i = \alpha + \beta Z_i + \varepsilon_i , \qquad (4)$$

with θ_i representing the unknown true efficiency of the i-th observation, α being a constant term (intercept) and β being the vector of coefficients to be estimated. For each variable, β is the same for all observations and indicates the relationship between Z_i, a vector of exogenous factors, to the efficiency score. ε_i is the statistical noise term of the i-th observation, which is restricted by the condition $\varepsilon_i \leq 1 - \alpha - \beta Z_i$. Following Simar and Wilson (2007) this term is assumed to follow a truncated normal distribution with zero mean (before truncation), unknown variance and a truncation point determined by this condition. Since the true θ is unknown, it is replaced with the Farrell efficiency scores obtained in the first stage ($\widehat{\theta}_i$, bounded between zero and unity). The econometrical problem becomes

$$\widehat{\theta}_i = \alpha + \beta Z_i + \varepsilon_i \quad with \quad \varepsilon \sim N(0, \sigma^2) \qquad (5)$$

such that $\varepsilon_i \leq 1 - \alpha - \beta Z_i$, which has to be solved by Maximum-Likelihood-Estimation with respect to β and σ. By using bootstrapping methods with b replications, b estimates for these coefficients are calculated. Confidence intervals for those estimators can be constructed following Simar and Wilson (2000). A positive sign of the second-stage estimation coefficient indicates a positive relationship between spending efficiency and the respective explanatory variable.

4 Model Specification and Data

4.1 Specification of Inputs and Outputs

We consider the French *départements* as units that contribute expenditures (input) in order to provide a certain bundle of publicly provided services (outputs) without assuming a functional form of this process.

We use total expenditures (TOTEX) as a single input employed by the *départements* to provide public services for that they are in charge of. Using TOTEX as input measure, on the one hand, allows incorporating all relevant input information. On the other hand, it implicitly assumes that input factor prices are the same for all *départements*. This assumption appears to be reasonable in the case of France: With respect to labor it is justified since wages of civil servants are mainly regulated by the government. With respect to capital expenditures, De Borger and Kerstens (1996) argue that Belgian local governments have access to the same capital markets and thus face similar capital related inputs prices, which can also be assumed for the French *départements*. A further issue related to capital input is the issue of the dynamic character of investments. However, our data show that investment expenditures remain fairly steady over time.

To specify the outputs, we follow the work done by Vanden Eeckhaut et al. (1993) and De Borger et al. (1994) and concentrate on the *départements'* legal obligations (mandatory tasks) in the fields of social services (care for elderly and provision of minimum subsistence grants), secondary education, road construction and maintenance and general administration. Although, these outputs do not comprise the entire array of services provided, the restriction is rational. The selected outputs cover the most relevant competencies of the French *départements*, both, in terms of responsibility and in terms of the share in expenditures. Furthermore, it prevents us from having a poor ratio of variables to observations, which would deteriorate the meaning of our estimation results. We further refer to the one input, five output case as Model 1.

In order to further improve the dimensionality of our model specification we define a second model specification (further referred to M2) where we apply the output aggregation approach proposed by Afonso and Fernandes (2008). The output-indicator, i.e. the local government output indicator (LGOI) combines the specified output variables into one measure and is constructed for each *département* $i \; (i = 1, ..., 96)$ according to the following equation:

$$LGOI_i = \frac{1}{M} \sum_{m=1}^{M} \frac{OUTPUT_i^m}{\overline{OUTPUT}^m}, \tag{6}$$

where m denotes the m-th output $(m = 1, ..., M)$ and $\overline{OUTPUT}^m$ denotes the average value of output m. Before aggregating the output variables with equal weight, they are normalized to one.

Hence, the output measure LGOI, by construction, has a mean of 1 with higher values indicating more output. Besides reducing the dimensions, the LGOI offers another advantage: observations are not necessarily considered as relatively efficient by performing well in only one dimension.[13] The aggregation hopes to capture the overall performance. However, the equal weighting of all outputs may constitute a drawback and is worth discussing. Nevertheless, an alternative weighting scheme does not seem to be applicable nor improving, and weighting with cost shares is not possible due to data limitations.

4.2 Specification of Exogenous Variables

In the second stage, we aim to identify the impact of some selected exogenous variables on the spending efficiency. For this purpose a set of variables is regressed on the efficiency scores obtained from the DEA analysis in the first stage. The literature provides a wide range of possible variables. However, their exogeneity is neither always absolutely certain nor applicable in our context. For example, the dependence on grants as a fiscal variable influences the transformation process of the *départements* itself and thus, would introduce endogeneity to the estimation. As a result the obtained coefficients would be biased. Hence, political or fiscal variables are omitted in this analysis. We choose three geographical and two socio-economic factors that are assumed to have some impact on the spending efficiency of the French *départements*.

First, we test how efficiency is influenced by the *département* size (SIZE). The territorial size of the *départements* is predetermined and we hypothesize that larger *départements* face disadvantages due to the lack of positive agglomeration economies. The effort devoted to general coordination may be higher and provision of certain services (e.g. safety and fire fighters) might be relatively more costly. Thus, size may affect spending efficiency.

Second, we test the influence of the distance to Paris (DISTANCE). In the French context this variable is of particular interest, since it captures the peripheral character associated with centralized states. Being spatially closer to the economic and political capital seems to be advantageously to local governments. The *départements* further from Paris, for example, may experience greater migration of highly skilled workers and may have limitations in exercising political influence. We therefore expect a negative relationship between DISTANCE and spending efficiency.

Third, we test a variable that contains information on the coastal location (SEASIDE). Due to special circumstances, the *départements* could be forced to have additional expenditures, e.g. for flood control or road and port construction and maintenance. Thus, costal regions should have spending efficiency negatively affected.

Fourth, following De Borger and Kerstens (1996) we include the households' income (MED_INCOME) to the set of explanatory variables. The authors argue that the households' income

[13]Due to the linear programming algorithm, specialists in one dimension are considered as efficient independently from their performance in other dimensions.

may influence the efficiency in two ways. First, local governments' higher fiscal capacity may facilitate featherbedding and on-the-job-leisure. This is not necessarily the case for the French *départements*, since their tax revenues are mainly independent from income levels. Nevertheless, a negative relationship between income and monitoring of the government by the society may exist: due to higher opportunity costs households decide to spend less of their time on monitoring their government, which facilitates inefficiencies. Moreover, as Geys et al. (2010) argue that, income possibly influences the preferences of the inhabitants. Due to additional income, the demand for public goods of higher quality might increase.[14] Based on these arguments, we expect a negative relationship between median income and efficiency.

Lastly, we investigate what effect the population composition, especially the old-age dependency ratio (SHARE_ELDERLY), has. The structure of the population can significantly influence public sector efficiency and budgets as shown for example by Geys et al. (2007) and Seitz (2008). Even though the French population is expected to grow, ageing will significantly change the structure leading to a higher share of dependent elderly persons relative to total population, which will also lead to a change in the demand for public goods and services. Nevertheless, this demographic change is already present and leads to demand for additional public services for elderly, whereas at the moment especially rural counties are affected.

4.3 Data

Our sample consists of the 96 French *départements* exclusively located in Europe. For 2008 we gather monetary and physical data from the Institute for Research and Information in Health Economics (IRDES), the French Ministry of the Interior and the French National Institute of Statistics and Economic Studies (INSEE). Table 2 presents the main characteristics of our data. We restrict our analysis to 2008, since the *départements* obligations were extended considerably in the previous years: In 2004 and 2005, responsibilities in the social sector, concerning especially social welfare, care for elderly, as well as youth work, were extended. Similarly, in 2006 competences for the care of disabled were extended and responsibility for more than 17,000 km of roads was transferred from national to local governments. Finally, in 2007, the technical staff in secondary schools, in total more than 95,000 employees, was transferred to the local government. However, our output variables are not able to capture the additional competencies assigned to the *départements* during this decentralization process. Hence, the changes in technology, i.e. the additional responsibilities, prevent us from pooling data for more years. For the same reason, results from comparing the year considered to previous ones, give only very limited information on the dynamics of spending efficiency.

[14] Loikkanen et al. (2011) point out that resident income might also be an indicator of regional input price differentials. They argue that capital cost and especially land prices will be higher in areas with higher income.

Table 2: Descriptive Statistics for Inputs, Outputs and Exogenous Factors

Variable	Unit	Mean	Min	Max	SD
Input					
TOTEX	Million Euros	653.83	118.20	2,648.28	483.87
Outputs					
POP	No. of inhabitants	654,345	80,965	2,607,476	492,756
BENEF	No. of beneficiaries	10,471	727	71,813	12,003
NURSING	No. of beds	4,799	383	12,694	2,680
PUBPUPILS	No. of pupils	24,576	0	92,604	19,176
ROAD	Kilometers	3,931	0	7,762	1,540
LGOI	Indicator	1.00	0.20	3.68	0.60
Explanatory Variables					
DISTANCE	Kilometers	354	0	917	204
SIZE	Square kilometer	5,666	105	10,000	1,923
SEASIDE	Dummy	0.27	0.00	1.00	0.45
MED_INCOME	Euros	26,555	20,944	39,671	3,216
SHARE_ELDERLY	Ratio	0.18	0.11	0.37	0.04

Input is measured as total expenditure (TOTEX), which contains all operating expenditures, including personnel expenditures, interest payments, general expenditures and other expenditures, and all investment expenditures, including investment costs, debt amortization, and granted subsidies. The *départements'* outputs are represented by five output indicators: the number of beneficiaries of minimal subsistence grants (BENEF) and the number of beds in private and public retirement and nursing homes (NURSING)[15] are used to measure social services. The road network kilometer (ROAD) are used as an indicator for efforts undertaken concerning road construction and maintenance and the number of pupils on public schools (PUBPUPILS)[16] approximates education services provided. Finally, the total population (POP) is used as an indicator for general administrative services and other services.

The *départements* in our sample spent on average 654 million euro, with a minimum of 118 million and a maximum of 2.6 billion euro. This spread indicates the large variety between the government in terms of size and services provided. This is also reflected by the different output measures, which vary strongly. Subsequently, the local government output indicator signalizes significant output differences and spreads from 0.2 to 3.68. The zeros for education and road-related outputs concern Paris and the *départements* of Corsica, which have transferred the responsibilities to other institutions. Since these expenditures do not show up in the TOTEX measure, we set the corresponding output to zero. The indicators also represent other obligations, for instance is the variable PUBPUPILS also an indicator for other youth-related services. Likewise, POP is assumed to be an indicator for the services directed

[15]Contrary to the pure number of elderly, e.g. the population over 65, this variable contains more information on the number of dependent elderly.

[16] This variable is chosen to measure the services regarding the provision of education infrastructure. In our opinion, this is a more appropriate measure then the number of schools, since it also takes different school sizes into account.

to handicapped inhabitants, services for public safety and services concerning preventive medicine. TOTEX as input and the five output variables build our first model specification, further referred as Model 1. Because a better rate of dimensions to the number of observations would improve the efficiency estimation (cp. Simar and Wilson, 2008), our second model specification (further referred as M2) uses a Local Government Output Indicator as specified above.

Concerning out exogenous factors the following variables are chosen: distance to the capital (DISTANCE) is measured as linear distance between Paris and the capital of the considered *département*. The size of each *département* (SIZE) is measured as territory in square kilometers and ranges from 105 to 10,000 km² indicating the substantial differences between the jurisdictions concerning the service area. Coastal location is represented by a dummy, SEASIDE that equals one if the *département* has seashore. For 26 out of 96 *départements* in our sample this is the case. Inhabitants' income is measured as median household income in 2008 (MED_INCOME) and its wide spread (between about 21,000 and 40,000 €) shows that notable economic differences between the territorial units exist. Finally, the old-age dependency ratio (SHARE_ELDERLY) is the share of over 65 years old in the total population. This variable ranges from 11 to 37 percent and indicates that population composition varies significantly across *départements*.

5 Results

5.1 Identifying Outliers and Extreme Values

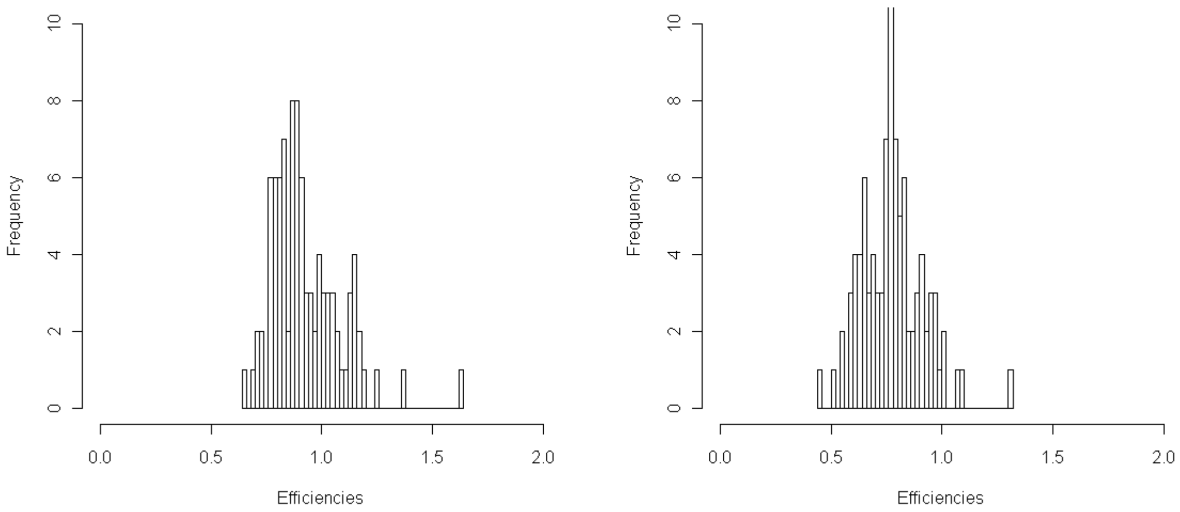
In order to obtain meaningful and robust efficiency estimates using DEA, we screen the data for outliers and extreme values. The histograms in Figure 1 show the frequency distribution of efficiency measures from super-efficiency analysis. Using model specification M1 (left graph), three observations, Lozère, Loire-Atlantique, and Yvelines, have efficiency scores that exceed the critical value of 1.2 proposed by Banker and Chang (2006). Thus, they are candidates to be excluded from the sample. Using model specification M2 only one observation, Lozère, attains an efficiency score that is notably larger than one. We assume that these results are not driven by data errors[17], and review the observations with respect to their characteristics. Lozère attains super-efficiency scores of about 1.4 and 1.3 in model specifications M1 and M2, respectively. It is the sample's smallest unit in terms of both input and output. Hence, we conclude that Lozère is an extreme, but still valid, observation outside the normal range. Loire-Atlantique receives a high efficiency score of about 1.6 in model specification M1, while it is not suspicious in M2. The same pattern is observed for Yvelines, which has an efficiency score slightly above 1.2 in M1, while inefficient in M2. One explanation for this finding could be that Loire-Atlantique and Yvelines are specialists in one of the dimensions (possibly

[17] However, one cannot rule out the possibility of measurement errors.

causing the results of M1). In order to decide which observation to exclude, we further test their impact on other *départements'* performance using ESL.

Figure 1: Histograms of Super-efficiency Analysis

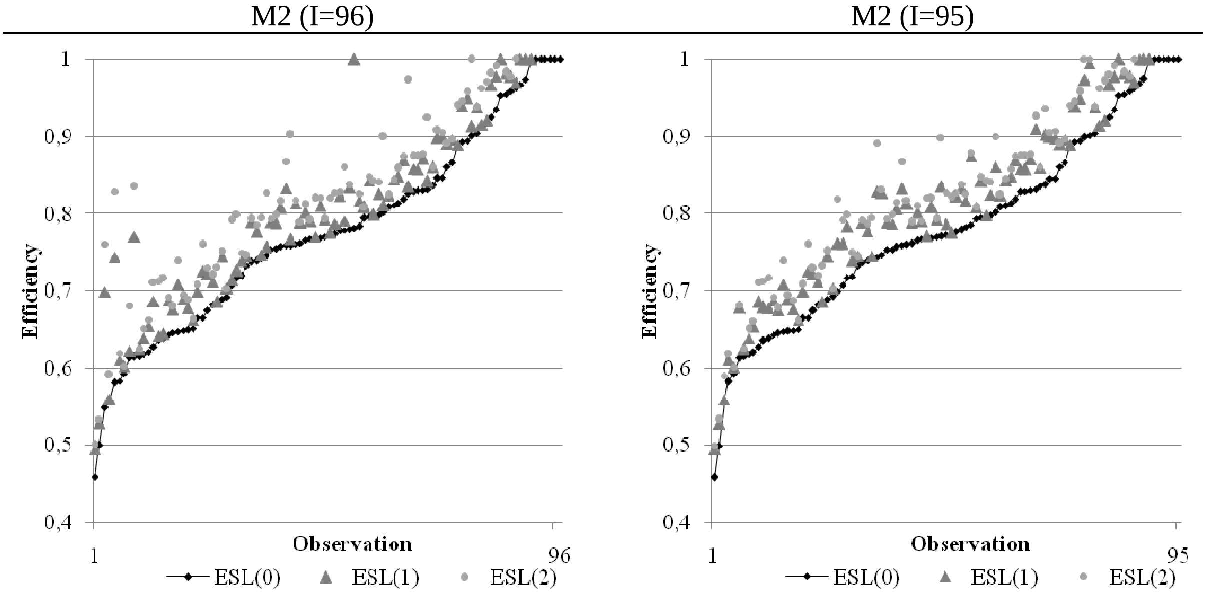
M1 (I=96)	M2 (I=96)



The conclusions, drawn from the ESL approach, are the same for both model specifications. For its visual representation we refer to model specification M2. The left graphic Figure 2 shows the first two steps of this approach, including all observations. Already the first step (ESL(1))notably increases the efficiency estimates of numerous observations. A closer look at the most influential peers excluded during the whole procedure reveals that among the super-efficient units Lozère's impact on the efficiency of the other observations is the greatest. Loire-Atlantique or Yvelines are rarely identified as the most influential peer. Hence, excluding Lozère leads to a strong increase of efficiency estimates for certain observations, while excluding Loire-Atlantique or Yvelines would have nearly no impact. Therefore, we first exclude Lozère and recalculated the super-efficiency scores and the ESL with the remaining 95 observations.

The recalculated super-efficiency analysis finds no new super-efficient observations indicating that Lozère has not masked any other outlier. Again, Loire-Atlantique and Yvelines are identified to be super-efficient in model specification M1 (about 1.6 and 1.2, respectively) and not in M2 (both about 0.9). The new ESL for M2 is shown in the right graphic of Figure 2. After excluding Lozère, the frontier is clearly less prone to outliers and appears to be robust against extreme data points. For the sample of the remaining 95 observations the first step increases the mean efficiency by less than 4 %. Note that these findings also apply for M1 in which Loire-Atlantique and Yvelines would be identified as additional outliers in the super-efficiency analysis. Nevertheless, since their impact on the frontier - and thus on the efficiency scores of the other observations - is found to be limited, we do not exclude additional observations and further analysis is conducted for the sample of 95 *départements*.

Figure 2: Efficiency Step Ladder for M2 Before and After Excluding Lozère



5.2 Spending Efficiency Measurement

The DEA estimation results for the 95 observations are summarized in Table 3. The mean spending efficiency of French *départements* is about 90 % in model specification M1 and 78 % in M2, respectively. This implies an average improvement potential of 10 % and 22 % meaning that the *départements* could save this amount of inputs while providing the observed level of output. In both models, the maximum value of spending efficiency is 1 by definition, while minimum values differ. The lowest efficiency score attained in M1 is 65 % and 46 % in M2. This finding is related to the lower dimensionality of model M2. Further, the lower dimensionality is the main reason why model M2 finds considerably fewer observations as fully efficient than model M1 does.

Table 3: Summary Statistics of Spending Efficiency Estimates (in %) for M1 and M2

Model Specification	Mean	Median	Min	Max	SD	Efficient unit
M1	0.897	0.896	0.653	1	0.093	28
M2	0.782	0.773	0.458	1	0.124	6

Note: The Spearman rank correlation coefficient for M1 and M2 is 81 %.

However, a Spearman rank correlation coefficient of 81 % indicates that the *départements* are judged similarly in terms of relative order.[18] A more detailed evaluation reveals that the observations considered as efficient in M2 are also found to be efficient in M1. Furthermore, they are mainly located in the North of France. Similarly, the *départements* with lower rankings are the same in both models and predominantly located in the South East of France.

[18]A high coefficient of the Spearman rank correlation allows to draw similar conclusion from the estimation although the magnitude of efficiency differs, see e.g., Hirschhausen et al. (2006).

Table 4 summarizes the spending efficiency scores of the *départements* grouped by regions and underlines the finding of existing regional differences. Two Northern regions host the most efficient *départements*, namely Nord-Pas-De-Calais, a densely populated region, and Basse-Normandie, a relatively sparsely populated one. In both regions, the *départements* are situated close to the frontier. Both Rhône-Alpes, which contains the second largest industrial cluster in Frances, and Corse, are located in southeastern France and contain poorly performing *départements*. For both regions, the analysis suggests that the current level of output could be achieved with 20 % less actual input. In general, the efficiency scores possess a slightly negative correlation with economic strength (in terms of per capita GDP). However, this might not only be caused by wasting resources but - to certain extent - also relates to higher quality public goods and services. Unfortunately, quality cannot be reflected by the data available.[19]

Table 4: Spending Efficiency of the *Départements* Grouped by Regions

Région [a]	No. of départ.[b]	M1				M2			
		Mean	Med.	Min	Max	Mean	Med.	Min	Max
Alsace	2	0.82	0.82	0.78	0.86	0.73	0.73	0.64	0.81
Aquitaine	5	0.87	0.84	0.78	1.00	0.78	0.75	0.68	1.00
Auvergne	4	0.93	0.94	0.85	1.00	0.85	0.82	0.79	0.97
Bourgogne	4	0.89	0.91	0.76	1.00	0.81	0.82	0.67	0.93
Bretagne	4	0.86	0.86	0.77	0.94	0.71	0.71	0.64	0.77
Centre	6	0.94	0.92	0.90	1.00	0.85	0.78	0.76	1.00
Champagne-Ardenne	4	0.97	0.99	0.90	1.00	0.82	0.87	0.63	0.90
Corse	2	0.78	0.78	0.78	0.79	0.72	0.72	0.70	0.74
Franche-Comté	4	0.87	0.84	0.78	1.00	0.74	0.67	0.62	1.00
Île-de-France	8	0.90	1.00	0.69	1.00	0.74	0.76	0.56	0.91
Languedoc-Roussillon	4	0.97	1.00	0.87	1.00	0.78	0.78	0.75	0.84
Limousin	3	0.87	0.89	0.71	1.00	0.80	0.77	0.65	1.00
Lorraine	4	0.92	0.93	0.84	1.00	0.80	0.76	0.72	0.96
Midi-Pyrénées	8	0.87	0.86	0.80	1.00	0.75	0.76	0.61	0.90
Nord-Pas-De-Calais	2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Basse-Normandie	3	0.98	1.00	0.95	1.00	0.94	0.95	0.90	0.97
Haute-Normandie	2	0.89	0.89	0.79	0.99	0.81	0.81	0.77	0.85
Pays de la Loire	6	0.93	0.98	0.78	1.00	0.79	0.76	0.58	0.95
Picardie	2	0.87	0.87	0.87	0.88	0.82	0.80	0.76	0.89
Poitou-Charentes	4	0.95	0.96	0.88	1.00	0.86	0.85	0.81	0.93
Provence-Alpes-Côte d'Azur	6	0.86	0.85	0.74	1.00	0.76	0.75	0.61	0.96
Rhône-Alpes	8	0.81	0.82	0.65	0.99	0.66	0.68	0.46	0.86

[a] The régions are the French NUTS-2 level [b] The number of *départements* is their number on the territory of a régions. Régions borders are also *département* borders; no *département* belongs to more than one region.

Regarding the different model specifications, the results emphasize the sensitivity of efficiency measures on output aggregation. For example the average *département* of the region Île-de-France, the

[19] Quality aspects are rarely covered in the literature. Examples can be found in Balaguer-Coll et al. (2002, 2007).

political and economic center of France, which includes Paris, is close to the overall mean efficiency in model M1 and achieves a score of about 0.9. In model M2 these *départements* fall behind and reach only an average efficiency of 0.74. This can mainly be explained by the definition of LGOI, the compound output indicator. The densely populated *départements* in that region reach high values in population-related output measures, but lower scores in the other fields. The resulting low scores in few output indicators results in a lower overall LGOI.

Although LGOI offers certain advantages, particularly with respect to the dimensionality, the imposed equal weighting of different government activities remains hard to defend while DEA determines these weights endogenously. Nevertheless, results from LGOI are comparable to those obtained with separate outputs. Therefore, the second-stage analysis relies only on the multiple output model specification of model M1.

5.3 Explaining Efficiency

In order to explain parts of the performance of the French *départements*, we conduct in a second stage a bootstrapped truncated regression following Simar and Wilson (2007). A set of exogenous factors is regressed on the efficiency scores obtained from the DEA program. Furthermore, due to the truncation at unity, the number of observations giving information about this relationship reduces from 95 to 67. The estimation results of the second-stage regression are summarized in Table 5.[20]

Table 5: Second-Stage Regression Results

	$\widehat{\beta}$		p-value	CI LB[c]	CI UB[d]
SIZE	0.0162		0.161	-0.0065	0.0389
DISTANCE	-0.2790	**	0.048	-0.0555	-0.0003
SEASIDE	0.0090		0.732	-0.0427	0.0607
MED_INCOME	-0.0190	***	0.002	-0.0307	-0.0072
SHARE_ELDERLY	-1.3247	**	0.020	-2.4385	-0.2108
Constant	1.6082	***	0.000	1.1160	2.1004
Sigma	0.0708	***	0	0.0548	0.0868
Log-likelihood	90.14				
n	67				

Note: ***, **, * indicate significance at 1 %, 5 %, at 10 % level. c) Lower bound of the confidence interval, d) upper bound. For better representation, data is corrected for the standard deviation.

For the variables SIZE and SEASIDE we find no significant impact on the French *départements'* spending efficiency. Concerning the first, modern communication technology possibly simplifies coordination and thus, reduces transaction costs. Concerning the latter, the effect of coastal location seems to be negligible when analyzing public sector efficiency for French *départements*.

[20] Note that regression results may vary when bootstrapping is applied. Nevertheless, our results show up to be robust.

Concerning the variable DISTANCE, we find a significant negative impact on the spending efficiency, meaning being located closer to Paris fosters performance.[21] This is in line with previous analyses on other European unitary states, such as Portugal (Afonso and Fernandes, 2008) and Finland (Loikkanen and Susiluoto, 2006, Loikkanen et al., 2011). Distance to policymakers might influence efficiency in several ways: first, remote *départements* might face migration of highly skilled workers to the capital. This is possibly even more relevant for France because of the exceptional economical and political position of Paris. The capital attracts an especially young and highly skilled population (French Census, 2006), which also improves the pool of candidates for the public sector. Moreover, this finding might be interpreted as the ability of local governments to exercise direct influence on national politics to their advantage. Since Paris hosts the major political institutions on national, regional and departmental level, closeness to the political decision-makers can be beneficial, e.g. when the redistribution of sub-national tasks during the process of decentralization are discussed. Regarding this point, further analysis of the influence of political variables would be beneficial as far as they can be represented by exogenous measures.

Similar to other studies, like De Borger and Kerstens (1996), our results show a significant negative relationship with spending efficiency and median income (MED_INCOME). As previously noted, there are two explanations for this finding: on the one hand, high-income households probably sacrifice less time monitoring their government due to higher opportunity costs, which facilitates inefficiency. On the other hand, demand for public goods of higher quality might increase in high income areas, driving up the costs for the local government. As long as no quality indicator is available, this question remains unanswered.

The coefficient of the share of elderly population (SHARE_ELDERLY) has a negative sign and is highly significant. Thus, demographic structure seems to impact spending efficiency. An explanation for this could be that costs of service provision are higher for the elderly segments of the population, as shown by Seitz (2008) for Germany. Since population projections for France forecast a significant increase in the elderly population, local government budgets will be especially affected at the *département* level due to the allocation of responsibilities among the layers of government. In light of this demographic challenge, analyzing and reducing public sector inefficiency becomes even more important.[22]

Overall, our results suggest that efficiency is partly driven by exogenous factors. Peripheral location and greater resident income are negatively related to efficiency. Likewise, a higher share of elderly population is found to negatively influence efficiency. Contrarily, *départements'* size and coastal location are not found to have significant influence. Future research on governments' efficiency should take this into account to derive more accurate efficiency estimates.

[21] We also test a variable that contains information on the topography, i.e. the highest elevation in the départements. Such a variable is highly correlated with DISTANCE. Therefore, our estimator might also include effects of the land-form on efficiency.

[22] A higher share of elderly population is also related to a rural structure of a *département*. Therefore our estimator might also include negative effects from this factor, e.g. by allowing for agglomeration and scale economies.

6 Conclusion

The French government has reallocated responsibilities for service deliveries in the first years of the 2000s. These changes increased the responsibilities of the French *départements*, structural reforms, such as this decentralization process, are considered as important means of fiscal consolidation that appear to be necessary in order to overcome the increasing pressure on public budgets. Furthermore, the restructuring aims to help improving the public sector's productivity and efficiency.

To identify the efficiency of public spending and potential improvements, we use Data Envelopment Analysis, a nonparametric deterministic approach of efficiency analysis, to a sample of the 96 *départements* in metropolitan France in 2008. This approach is particularly suitable since the behavior of public sectors might not be adequately represented by production or cost functions relying on microeconomic assumptions. We define total expenditures as the single input administrative units employ. For the representation of the responsibilities, we focus on the obligatory tasks. Hence, the best practice displays the minimal amount of expenditures required to provide the given level of obligatory tasks provided. Similar to analyses on the spending efficiency at municipal (Loikkanen and Susiluoto, 2006) and national levels (Afonso et al., 2005), we find significant inefficiencies in public service provision at the intermediate level of government. More precisely, we identify an average spending efficiency of the French *départements* of about 78 to 90 %, depending on the model specification. Hence, the expenditures could be reduced by 10 to 22 %, while providing the same amount of public services. The range of efficiency varies significantly among the *départements*, which is in line with previous analysis on local governments (e.g. Afonso and Fernandes, 2008). Based on our results, the *départements* in the northern regions can serve as reference points to identify possible improvements since they perform better compared to other regions. However, our results also indicate that inefficiency is not only due to inefficient usage of resources.

In fact, exogenous factors can contribute to inefficiency and, thus, must be taken into account when evaluating the potential improvement. We are interested in identifying those factors that impact the *départements'* performance but are not under their control. For this purpose we conduct a bootstrapped truncated regression as proposed by Simar and Wilson (2007). Our results suggest that the population structure, the households' median income and distance to Paris negatively affect the spending efficiency.

Concluding, our analysis shows that the efficiency of French sub-national governments could be increased, and hence, improve the fiscal position. Against the background of the increasing importance of sub-national tiers, this is particularly relevant for the public provision of goods and services and for the public budget from a global perspective. In 2008 France established a committee for the reform of territorial collectivities (*Comité pour la réforme des collectivités locales*) with the objective of reviewing the territorial organization and local administration. Following the arguments by OECD (2003), this process should address the allocation of responsibilities and implementation of proper control mechanisms. Efficiency analysis could contribute to this discussion being a useful tool not only for the performance evaluation, but also for assessing the consolidation of budgets and territories.

References

Afonso, A., Schuknecht, L. and Tanzi, V. (2005): Public Sector Efficiency. An International Comparison. *Public Choice, 123 (3/4),* 321 - 347.

Afonso, A. and Fernandes, S. (2006): Measuring Local Government Spending Efficiency: Evidence for the Lisbon Region. *Regional Studies, 40 (1),* 39 – 53.

Afonso, A. and Fernandes, S. (2008): Assessing and Explaining the Relative Efficiency of Local Government. *The Journal of Socio-Economics, 37 (5),* 1946 – 1979.

Arcelus, F.J., Arocena, P., Cabases, F. and Pascual, P. (2007): On the Efficiency of the Delivery of Municipal Services. Universidad Publica de Navarra. Working Paper Series DT 92/07.

Athanassopoulos, A. and Triantis, K. (1998): Assessing Aggregate Cost Efficiency and the Related Policy Implications for Greek Local Municipalities. *INFOR, 36 (3),* 66–83.

Atkins, P. and van den Noord, P. (2001): Managing Public Expenditure: Some Emerging Policy Issues and a Framework for Analysis. OECD Economics Department. Working Paper No. 285.

Balaguer-Coll, M, Prior-Jimenez, D. and Vela-Bargues, J. (2002): Efficiency and Quality in Local Government Management. The Case of Spanish Local Authorities. Universitat Autonoma de Barcelona, WP 2002/2.

Balaguer-Coll, M.T., Prior, D. and Tortosa-Ausina, E. (2007): On the Determinants of Local Government Performance: A Two-Stage Nonparametric Approach. *European Economic Review, 51 (2),* 425 – 451.

Balaguer-Coll, M.T., Prior, D. and Tortosa-Ausina, E. (2010): Decentralization and Efficiency of Local Government. *The Annals of Regional Science, 45 (3),* 571 – 601.

Banker, R.D., Charnes, A. and Cooper, W.W. (1984): Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science, 30 (9),* 1078 – 1092.

Banker, R.D. and Gifford, J.L. (1988): A Relative Efficiency Model for the Evaluation of Public Health Nurse Productivity: A Statistical Foundation. Carnegie Mellon University. Pittsburgh.

Banker, R.D. and Chang, H. (2006): The Super-Efficiency Procedure for Outlier Identification, not for Ranking Efficient Units. *European Journal of Operational Research, 36 (2),* 1311 – 1320.

Benito, B., Bastida, F. and Garcia, J.A. (2008): Explaining Differences in Efficiency: An Application to Spanish Municipalities. *Applied Economics, 42 (4),* 515 – 528.

Bogetoft, P. and Otto, L. (2011): Benchmarking with DEA, SFA, and R. Springer. Berlin.

Bradford, D., Malt, R. and Oates, W.E. (1969): The Rising Cost of Local Public Services: Some Evidence and Reflections. *National Tax Journal, 22,* 185–202.

Charnes, A., Cooper, W.W. and Rhodes, E. (1978): Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research, 2 (6),* 429 – 444.

CLENCH (2010): Les Collectivités Locales en Chiffres 2010. DirectionGénérale des Collectivités Locales. Paris.

Coelli, T.J, Rao, D.S.P., O'Donnell, C.J. and Battese, G.E. (2005): An Introduction to Efficiency and Productivity Analysis. 2nd edition. Springer Science+Business. New York.

Cole, A. (2006): Decentralization in France: Central Steering, Capacity Building and Identity Construction. In: *French Politics, 4,* p. 31-57.

Cooper, W.W., Seiford, L.M. and Zhu, J. (2004): Data Envelopment Analysis: History, Models and Interpretations. In: Cooper, W.W., Seiford, L.M. and Zhu, J. (Eds.): Handbook on Data Envelopment Analysis. Kluwer Academic Publishers. Dordrecht.

De Borger, B., Kerstens, K., Moesen, W. and Vanneste, J. (1994): Explaining Differences in Productive Efficiency: An Application to Belgian Municipalities. *Public Choice, 80 (3/4),* 339 – 358.

De Borger, B. and Kerstens, K. (1996): Radial and Nonradial Measures of Technical Efficiency: An Empirical Illustration for Belgian Local Governments Using an FDH Reference Technology. *The Journal of Productivity Analysis, 7 (1),* 41 – 62.

De Borger, B. and Kerstens, K. (2000): What is Known about Municipal Efficiency? The Belgian Case and Beyond. In: L.T. Blank (Ed.): Public Provision and Performance. Contributions from Efficiency and Productivity Measurement. Elsevier Science B.V. Amsterdam.

De Sousa, M. and Stosic, B. (2005): Technical Efficiency of the Brazilian Municipalities: Correcting Nonparametric Frontier Measurements for Outliers. *Journal of Productivity Analysis, 24* (2), 157 – 181.

Edvardsen, D.F. (2004): Four Essays on the Measurement of Productive Efficiency. Diss. School of Economics and Commercial Law. Göteborg University.

European Commission (2010): Public Finances in EMU 2010.

Farrell, M. (1957): The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society, 120 (3),* 253 – 281.

Fried, H.O., Schmidt, S.S. and Yaisawarng, S. (1999): Incorporating the Operating Environment into a Nonparametric Measure of Technical Efficiency. *Journal of Productivity Analysis, 12 (3),* 249-267.

Giménez, V.M. and Prior, D. (2007): Long- and Short-Term Cost Efficiency Frontier Evaluation: Evidence from Spanish Local Government. *Fiscal Studies, 28 (1),* 121 – 139.

Geys, B., Heinemann, F. and Kalb, A. (2007): Local Governments in the Wake of Demographic Change: Efficiency and Economies of Scale in German Municipalities. Zentrum für Europäische Wirtschaftsforschung, Working Paper 07-036.

Geys, B. and Moesen, W. (2009): Measuring Local Government Technical (In)efficiency: An Application and Comparison of FDH, DEA and Econometric Approaches. *Public Performance and Management Review, 32(4),* 489-504.

Geys, B., Heinemann, F. and Kalb, A. (2010): Voter Involvement, Fiscal Autonomy and Public Sector Efficiency: Evidence from German Municipalities. *European Journal of Political Economy, 26 (2),* 265 – 278.

Giordano, R. and Tommasino, P. (2011): Public Sector Efficiency and Political Culture. Bank of Italy, Economic Working Papers No. 786.

Gorman, M.F. and Ruggiero, J. (2008): Evaluating US State Police Performance using Data Envelopment Analysis. *International Journal of Production Economics, 113 (2),* 1031 – 1037.

Hauner, D. (2008): Explaining Differences in Public Sector Efficiency: Evidence from Russia's Regions. *World Development, 36 (10),* 1745 – 1765.

Hauner, D. and Kyobe, A. (2010): Determinants of Government Efficiency. *World Development, 38 (11),* 1527 – 1542.

Hirschhausen, C.v., Cullmann, A. and Kappeler, A. (2006):Efficiency Analysis of German Electricity Distribution Utilities: Non-parametric and Parametric Tests. *Applied Economics, 38(21),* 2553–2566.

Hjalmarsson, L., Kumbhakar, S.C. and Heshmati, A. (1996): DEA; DFA and SFA: A Comparison. *Journal of Productivity Analysis, 7,* 303-327.

Kalb, A. (2010): Public Sector Efficiency: An Application to Local Governments in Germany. Gabler Verlag. Wiesbaden.

Kellermann, K. (2007): Die Öffentlichen Ausgaben der Kantone und ihrer Gemeinden im Quervergleich. Eidgenössisches Volkswirtschaftsdepartement EVD, Strukturberichterstattung NR. 37. Bern.

Kriese, M. (2008): Effizienzanalyse der Sächsischen Gemeinden. *ifo Dresden berichtet, 5/2008,* 3 – 13.

Loikkanen, H.A. and Susiluoto, I. (2006): Cost Efficiency of Finnish Municipalities in Basic Service Provision 1994 – 2002. Helsinki Center of Economic Research Discussion Paper No. 96.

Loikkanen, H.A., Susiluoto, I. and Funk, M. (2011): The Role of City Managers and External Variables in Explaining Efficiency Differences of Finnish Municipalities. Helsinki Center of Economic Research Discussion Paper No. 312.

Maudos, J., Pastor, J.M., Serrano, L. (2003): Human Capital in OECD Countries: Technical Change, Efficiency and Productivity. *International Review of Applied Economics, 17 (4),* 419 – 435.

Mueller, D.C. (2003): Public Choice III. Cambridge University Press. New York.

OECD (2007): Economic Surveys France. Volume 2007/13, June 2007.

OECD (2009a): OECD Economic Surveys France. Volume 2009/5, April 2009.

OECD (2009b): Governance at a Glance 2009, Country Note: France.

OECD (2010a): Economic Outlook 2010.

OECD (2010b): Economic Factbook 2010.

Prieto, A.M. and Zofio, J. (2001): Evaluating Effectiveness in Public Provision of Infrastructure and Equipment: The Case of Spanish Municipalities. *Journal of Productivity Analysis, 15 (1),* 41 – 58.

Seitz (2008): Die Demographieabhängigkeit der Ausgaben und Einnahmen der Öffentlichen Haushalte. Eine Empirische Analyse unter Berücksichtigung der Föderalen Verflechtungen. Bertelsmann Stiftung. Gütersloh.

Simar, L. (2003): Detecting Outliers in Frontier Models: A Simple Approach. *Journal of Productivity Analysis, 20 (3)*, 391 – 424.

Simar, L. and Wilson, P.W. (2000): Statistical Inference in Nonparametric Frontier Models: The State of the Art. *Journal of Productivity Analysis, 13 (1),* 49 – 78.

Simar, L. and Wilson, P.W. (2007): Estimation and Inference in Two-Stage, Semi-Parametric Models of Production Processes. *Journal of Econometrics, 136 (1),* 31 – 64.

Simar, L. and Wilson, P.W. (2008): Statistical Inference in Nonparametric Frontier Models: Recent Developments and Perspectives. In: Fried, H., Lovell, C.A.K. and Schmidt, S.S. (Eds.): The Measurement of Productive Efficiency.2nd edition. Oxford University Press. Oxford.

Stiglitz, J. E. (2000): Economics of the Public Sector. 3rd edition. Norten. New York.

Tanaka, T. (2006): Cost Efficiency in Japanese Local Governments: The Economic Effect of Information Technology in Japanese Local Government. 46th Congress of the European Regional Science Association. Osaka.

Vanden Eeckhaut, P., Tulkens, H. and Jamar, M. (1993): Cost Efficiency in Belgian Municipalities. In: Fried, H.O., Knox Lovell, C.A. and Schmidt, S.S. (Eds.): The Measurement of Productive Efficiency. Oxford University Press. Oxford.

Worthington, A.C. (1999): Performance Indicators and Efficiency Measurement in Public Libraries. Australian Economic Review, 32 (1), pp. 31–42.

Worthington, A.C. (2000): Cost Efficiency in Australian Local Government: A Comparative Analysis of Mathematical Programming and Econometric Approaches. *Financial Accountability and Management, 16 (3),* 201 – 224.

Worthington, A.C. and Dollery, B. (2000): Efficiency Measurement in the Local Public Sector: Econometric and Mathematical Programming Frontier Techniques. Queensland University of Technology, School of Economics and Finance Discussion Papers and Working Papers Series No. 078.