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Overlapping jurisdictions and demand for local public services: does spatial heterogeneity matter?

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Abstract: *This paper aims to test the existence of vertical interactions in terms of public spending between overlapping local jurisdictions in France using a data set of 110 French municipalities and their corresponding departments in 2001 and 2005. To do so, we consider that demand for municipal services is conditioned by the services provided by departments. We then estimate two specifications which allow spatial heterogeneity to be modeled and which are compared with a simple spatial error specification (without spatial heterogeneity). The two estimated spatial regimes models are able to eradicate spatial autocorrelation in the error term. The estimation results show that an appropriate consideration of spatial heterogeneity can lead to new insights. The spatial error specification reveals a robust complementary demand relationship between services provided by departmental and municipal governments. However, these results are not in accord with the results produced by the spatial regime models, which provide evidence of heterogeneity with independence, complementarity or substitution between the services offered by the two overlapping jurisdictions.*

JEL Classifications : C21; H72; H77.

Keywords: Local public expenditures; Overlapping jurisdictions; Spatial heterogeneity; Spatial econometrics.

1. Introduction

In every country with a decentralized form of government, there are multiple tiers of government services that may interact at the local level. This multi-tiered form of

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organization often is viewed as being economically inefficient because different levels of government may provide similar or related services. If evidence is found to support this view, it will have important implications for debates over decentralization and the provision of public sector services at the local level.

In economics literature, inflation in total local public spending is assumed to be produced by a complementary effect, that is to say a vertical positive interaction between demands for public services provided by overlapping jurisdictions (Turnbull and Djoundourian (1993)). The provision of public services then depends on the preferences of the median voter. At the lowest (municipal) level, it is assumed that the local incumbent adopts policies in the median voter's interest, taking into account public spending decisions at the next higher level (in the USA, for example, the county). A complementary relation appears as the median voter would increase her demand for municipal public goods when public spending at the county level increases. Therefore, if expenditures at one level are a complement to expenditures at the other level, the overlapping structure increases the size of the local public sector.

This model usually is implemented empirically by estimating a demand for municipal public expenditures function conditional on county expenditures in the spirit of Pollack (1971). To our knowledge, three articles examine the existence of such a complementary effect without explicitly considering the spatial dimensions of their data. Studying general purpose expenditures in U.S. municipalities and counties, Turnbull and Djoundourian (1993) and Campbell (2004) find that municipal per capita expenditures and county per capita expenditures are complementary[2]. Using panel data for Sweden over the period 1981-1986, Aronsson et al (2000) also find a positive correlation between county and municipal expenditures. Revelli (2003) alone includes spatial autocorrelation among district expenditures in the specification. He observes a spatial vertical externality among county and district expenditures and shows the importance of taking into account both vertical and horizontal externalities into the demand for public services function at the lowest level.

In light of these findings, this article aims to expand upon the existing literature in two ways. First, we analyze for the first time the links between the two most important levels of local government (eg municipal and departmental) in France. The conditional demand function then is estimated on a cross-sectional sample of French municipalities and their departments,

[2] Turnbull and Djoundourian (1993) do not confirm the complementary effect for individual service categories.

taking into account the spatial dependence among municipal public expenditures. Second, in the aforementioned studies, the authors focus on a global demand specification, with the same coefficient for all of the statistical units. The second innovative feature of this article therefore is to introduce spatial heterogeneity in the conditional demand function that is estimated.

Spatial heterogeneity is relevant when data are obtained for a cross-section of spatial units, Anselin (1992). In practice, spatial heterogeneity can be reflected by heteroskedasticity in the error term, coefficients varying with the location, or both. Due to historical and cultural differences at the regional level, France is known to be characterized by strong spatial heterogeneity. The country's territory therefore can be divided into a periphery constituted by a group of different regions and a core constituted by 'Ile de France', the area around and including the capital, Paris.

This article is therefore an original contribution to empirical regional science literature, and uses a dataset covering all of the largest French municipalities (except Paris) and their corresponding departments for two different years: 2001 and 2005. We first estimate a standard spatial error model, and find a complementary effect. However, once we include spatial heterogeneity in our econometric specification (considering two different spatial divisions of France), we find evidence of independence between departmental and municipal spending decisions. 'Ile de France' is the only French region systematically characterized by a complementary effect. Therefore, we agree Anselin (1990) as the presence of spatial heterogeneity has implications for the generality of regional science theories.

This paper proceeds as follows: in Section 2, we discuss the theoretical framework, and in Section 3, we develop the empirical methodology without including spatial heterogeneity. In Section 4, we present the empirical findings of the two spatial regimes specifications and in Section 5, we present our conclusions.

2. Conditional demand for municipal public services

Turnbull and Djoundourian (1993) and Aronsson et al (2000) developed a model of municipal expenditures which assumes that municipal expenditures are conditioned by the expenditures at the next higher level, the county. They assume that the median voter utility function depends on private consumption *x* and public services provided at the municipal level z_m and z_c^o at the county level (subscript *m* and *c* refer to municipal and county variables respectively).

Maximizing the utility function under budget constraint, Turnbull and Djoundourian (1993) and Aronsson et al (2000) derive the conditional demand for municipal public services:

$$(1) \qquad z_m = z_m\left(y_m^{mé*}, p_m^{mé}, z_c^0\right)$$

$y_m^{mé*}$ can be measured by the income of the median municipal voter less the taxes she pays at the county level. $p_m^{mé}$ denotes the median voter tax price:

$$(2) \qquad p_m^{mé} = \left(\frac{b_{m+c}^{mé}}{b_m}\right) p_m$$

$b_{m+c}^{mé}$ is the median voter (residential) tax base shared by the municipality and its county. b_m is the average municipal tax base, including the local business tax (respectively b_c for the county). Tax share $\frac{b_{m+c}^{mé}}{b_m}$ can be defined as the proportion of the tax burden associated with residential property. Tax price also includes unit costs of public services and the size of the population to deal with congestion effects.

The linkages between the two levels of local jurisdictions come from two different effects which are called income and preferences (or taste) effects. The impact of additional county level expenditure on the demand for the municipal public goods can be analyzed through this first-order condition:

$$(3) \qquad \frac{dz_m}{dz_c^o} = \underbrace{\frac{U_{mc}^{"} - p_m^{mé} U_{xc}^{"}}{\Delta}}_{\text{preferences effect}} \underbrace{- \left(\frac{b_{m+c}^{mé}}{b_c} p_c\right) \frac{U_{xm}^{"} - p_m^{mé} U_{xx}^{"}}{\Delta}}_{\text{income effect}} .$$

with $\Delta = 2p_m^{mé} U_{xm}^{"} - U_{mm}^{"} - \left(p_m^{mé}\right)^2 U_{xx}^{"} > 0$ and $U_{ij}^{"}$ is the second order partial derivatives of utility with respect to *i* and *j* (*x*: private consumption, *m*: municipal and *c*: county).

Income effect easily can be identified. If the municipal public goods and services are normal, an increase in the public services at the county level financed by a tax on the median voter will reduce the median voter's income and then her demand for municipal public services.

Preferences effect is indeterminate and depends on the cross partial derivatives of the utility function:

$$(4) \qquad \left.\frac{\partial z_m}{\partial z_c}\right|_{\substack{p_m^{mé} \\ y_m^{mé}}} = \frac{U_{mc}^{"} - p_m^{mé} U_{xc}^{"}}{\Delta}$$

Services provided at the two different levels of the local public sector can be considered as complements, substitutes or independent by the median voter. When larger allocations of county goods increase the willingness of the median voter to pay for municipal public goods, the goods are considered to be complements. This is referred to as the complementary effect. In contrast, when increases in county services decrease the marginal rate of substitution between municipal public services and private consumption, then county and municipal services are considered to be substitutes.

Formally, the conditional expenditure function estimated for municipal services can be expressed as:

$$(5)\quad EXP_m = \alpha_0 + \alpha_p \frac{b_{m+c}^{mé}}{b_m} + \alpha_y y_m^{mé*} + \delta\, z_d^o + X\,\beta + \varepsilon$$

Where ε is the error term. Price and income elasticities of demand are obtained using parameters α_p and α_y respectively, and mean values of median income and tax share. The parameter δ accounts for the influence of public spending at a higher level (eg county) on municipal public expenditure. If $\hat{\delta} > 0$, the two public goods are considered to be complements whereas $\hat{\delta} < 0$ reflects a substitute relationship. We consider them to be independent or unrelated if the coefficient is not significant.

In such a specification, which does not consider spatial heterogeneity, the parameters $\alpha_0, \alpha_p, \alpha_y, \delta$ and β's are assumed to be constant across municipalities. *X* includes control variables to deal with differences in unit costs for providing local public services and the specific characteristics of a municipal population.

3. Empirical modeling of demand for public services without spatial heterogeneity

We first offer a brief description of the local public sector in France and introduce the data selected for empirical analysis. Next, we present specification tests and the estimation results of equation (5) are discussed.

3.1 Overview of the organization of the local public sector in France

The local public sector includes 4 overlapping administrative divisions in France. In order from the lowest level up, there are 36,680 municipalities, 2,599 groups of municipalities, 100 departments, and 22 metropolitan regions.

Municipalities and departments, which were created in 1790 after the French revolution, form the two lowest levels of local government in France. They finance 90% of total local spending (60% financed by municipalities and inter-municipal groups and 30% financed by departments). In 2001, the median population of a French department was 511,012 inhabitants, which is 21 times larger than the median population of a U.S county.

Following the implementation of decentralization laws in the 1980s, municipalities provide a wide range of major public services: running water, garbage collection, primary education, public transport in the municipal area, town planning. In addition, municipalities are the most important public investor in France (before the national government). Investments mainly focus on school buildings, community facilities and municipal roads. Departments are specialized in providing decentralized welfare benefits, which account for more than 60% of their total spending (minimum benefits paid to those with no other means of support or to those concerned by the loss of independence, for example).

For the period under study, the French local public sector has experienced two important reforms. First, Since 2000, many municipalities have joined together to form cooperative groups, referred to in the remainder of this article as inter-communal organizations, to provide services to their respective communities. In 1999, 52% of French municipalities belonged to an inter-communal organization; this figure rose to 88% in 2005 and 95% in 2011. Inter-communal organizations are able to increase the variety of services provided at the municipal level. Second, in 2003 new decentralization laws have transferred new responsabilities to the local authorities.

3.2 Data description

Data are provided by the French Ministries of the Economy and Interior. To address the issue of heterogeneity in terms of population size, we concentrate on the largest French municipalities. Paris, Corsica and the 5 overseas departments of France were excluded due to their unique features. Sample data therefore covers 110 French municipalities with over 50,000 inhabitants and their corresponding departments (87 departments). We consider here two different years, 2001 and 2005, to check for the robustness of our results.

The dependent variable is measured by the operating expenditures plus gross saving which cover the repayment of loans coming from past investments. Such an approach seems desirable with cross-section data because the investment expenditures are discontinued in the

time dimension. We also use the same measure of aggregate expenditures per capita at the department level.

The income effect is measured by using the median income less residential department taxes. The median income is computed with the distribution of the taxable income of households in the municipality. It should be noted that welfare benefits are non-taxable income. As grants from the central government are the second most important revenue stream, we also include national grant per capita.

Tax share is measured by the municipal residential property tax base divided by the total tax base (including the local business tax). This variable accounts for the direct influence of taxation on the choices of the median voter. It denotes the share of taxes between firms and households. The ratio is near 1 in residential areas, while it tends towards 0 in industrial areas.

Following the standard procedure in empirical related literature, we use control variables to deal with differences in unit costs for providing local public services and the specific characteristics of municipal populations.

We initially used several control variables such as the number of recipients of welfare benefits or of secondary school pupils, and the number of social housing units. However, as insignificant values of some parameters were obtained in a preliminary step, we removed these explanatory variables. The set of variables that finally were used, measured in 2001 and 2005, and summary statistics are presented in Table 1:

Table 1

Data set description, French municipalities with over 50,000 inhabitants in 2001 and 2005 (Euros)

Description of variables	***Mean***		***Min***		***Max***	
	2001	***2005***	***2001***	***2005***	***2001***	***2005***
Total municipal expenditures per capita	1,135	1,139	664	731	2,776	3,137
Total expenditures per capita in departments	551	772	379	576	764	992
After tax yearly median municipal income	10,172	9,934	6,707	5,743	22,133	35,938
Tax share	0.20	0.25	0.11	0.12	0.35	0.41
National grant per capita	341	366	176	187	656	841
Municipal population	107,265	107,377	50,070	50,070	807,070	807,071
Number of secondary residences	1,795	1,795	90	90	23,560	23,560

Table 1 shows steady values between 2001 and 2005 for most variables except department expenditures per capita, which increased from 551 to 772 Euros, on average. This can be explained by decentralization laws in 2003 which transferred new responsibilities to the departments.

3.3 Specification tests

Econometric issues influence the choice of the estimator in our model (5). One issue is whether department expenditures can be considered to be exogenous in the municipal conditional expenditure function. The second issue is whether spatial autocorrelation should be included.

3.3.1 Endogeneity of department expenditures

In equation (5), department expenditures are likely to be endogenous to municipal expenditures if the department and the municipal public spending decisions occur simultaneously. We therefore have to implement a diagnostic test for endogeneity using an appropriate set of instruments.

In the spirit of the median voter model, tax share and after-tax median income, both measured at the department level, may be used as instruments for department expenditures. Since departments provide welfare benefits and support to those concerned by a loss of independence, we also use the numbers of recipients of social benefits, the number of social housing units, the unemployment rate, and the percentage of people over the age of 60. The number of municipalities (urban and rural), national grants per capita, and the number of secondary school pupils also are instruments considered for department expenditures.

An instrumental variable must satisfy two requirements. It must be correlated with the endogenous variable and be orthogonal to the error term. We therefore used the Bound et al (1995) test to select relevant instruments and performed the Sargan test to choose valid instruments[3]. The resulting set of relevant and valid instruments for department expenditures are population, unemployment rate and the number of rural municipalities. Finally, according to the Durbin-Wu-Hausman test of endogeneity (probability greater than 0.26), we cannot

[3] These tests were implemented with Stata10. See Baum and Schaffer (2003) for more details.

reject the hypothesis that department expenditures are exogenous in the municipal expenditure equation. This means that the median municipal voter considers department spending to be as given. Therefore, we do not need to instrument the department expenditures to estimate the single equation (5).

3.3.2 Spatial dependence

Our study focuses on vertical interactions between two overlapping local jurisdictions, but we also are interested in spatial horizontal interactions resulting from the behavior of incumbent municipal authorities (fiscal competition and yardstick competition). Corresponding statistical inference is based on different tests to detect spatial dependence (Moran's I, Lagrange Multipliers, Kelejian and Robinson (KR) test that does not require normality for the error terms)[4].

As the municipalities under study do not share a common border, we considered two spatial weights matrices. The first is a function of inverse (euclidean) distance between two municipalities. The second reflects the potential spatial interaction (in terms of competition) between two nearby and similar municipalities. It takes the value of one if the two municipalities belong to the same European NUTS1 region. We assume here that fiscal competition (through local public spending or taxes) mainly concerns municipalities located in the same European region. According to Newman and Sullivan (1988), once firms or households choose a region (the macro-localization choice), they then choose a municipality inside this region (the micro-localization choice).

Table 2 shows the diagnostics for spatial effects, considering each row-standardized weight matrix and each year:

Table 2

Spatial dependence tests (probability)

Test	NUTS1 weight matrix		Inverse distance weight matrix	
Year	2001	2005	2001	2005
SARMA	0.26	0.40	0.10	0.008
Moran's I	0.07	0.03	0.06	0.0006
Lmerr	0.32	0.18	0.44	0.043

[4] Spatial data analysis was conducted with SpaceStat.

Kelejian Robinson err	0.51	0.077	0.81	0.08
LM lag	0.49	0.67	0.21	0.11
Robust LM lag	0.19	0.94	0.145	0.10
Robust LM err	0.13	0.20	0.08	0.007

Whatever the weight matrix or year considered, Moran's I tests are significant and we are inclined to reject the null hypothesis of absence of spatial autocorrelation in the error term (at the 10% level). SARMA tests confirm this diagnostic with the inverse distance matrix only.

If we consider the inverse distance weight matrix, as we never reject the null hypothesis for the Lmlag and RLMlag tests, we decide to dismiss the spatial lag specification, whatever the year considered. Results obtained with the Lmerr and KR err tests are more contrasted. However, we decide to retain a Spatial Error model (SEM) for the two years considered.

3.4 Empirical results

The following table gives estimation results obtained for the years 2001 and 2005, using both an OLS method (with robust standard errors (se) to deal with heteroskedasticity) and a maximum likelihood estimation if we consider the spatial error model (SEM).

Table 3

Estimation results without spatial heterogeneity (inverse distance weight matrix)

Variables	**Coefficient estimates (probability)**			
Year	**2001**		**2005**	
Estimation method	**OLS robust se**	**Spatial error model**	**OLS Robust se**	**Spatial error model**
Constant	38	95	174	205
	(0.89)	(0.67)	(0.25)	(0.15)
National grants per capita	1.87	2.05	1.92	2.00
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Tax share	-892	-1180	-604	-766
	(0.0001)***	(0.000)***	(0.04)**	(0.001)***
After tax yearly median income	0.012	0.010	0.006	0.0059
	(0.43)	(0.33)	(0.15)	(0.18)

Municipal population	-0.0056	-0.0053	-0.0040	-0.0042
	(0.012)**	(0.003)***	(0.0001)***	(0.000)***
Secondary residences	0.024	0.024	0.033	0.034
	(0.019)**	(0.000)***	(0.00)***	(0.000)***
Department per capita	1.01	0.95	0.36	0.35
spending	(0.000)***	(0.000)***	(0.0054)***	(0.004)***
Intercommunity dummy	52	25	248	255
	(0.32)	(0.61)	(0.0001)***	(0.000)***
Autoregressive coefficient		0.49		0.57
		(0.03)**		(0.004)***
AIC	1462	1451	1402	1398
Breush Pagan probability	0.000***	0.0006***	0.000***	0.000***

*Significance level: *** for 1%, ** for 5 % and * for 10 %.*

The best model is the SEM with the lowest value for the Akaike Information Criterion (AIC). The results are similar to those of other studies, with $\hat{\delta}$ positive and significant in 2001 and 2005. This may suggest that the welfare benefits provided by departments are complementary to many of the services provided by municipalities.

However, the coefficient becomes smaller in 2005 (from 0.95 in 2001 to 0.35 in 2005). Therefore, we observe a decrease of the strength of the vertical interaction among municipalities and their departments between 2001 and 2005. One explanation key could be the development of inter-communal organizations which has increased the variety of services provided by municipalities. Therefore, it seems that the department' specificity in terms of providing the decentralized welfare repayment would become less visible.

Concerning other results, all of the significant coefficients present the appropriate sign. Results thus reveal a negative and significant impact of population size on per capita local public expenditures. An increase of 1000 inhabitants results in a decrease of 5 euros in per capita expenditures in 2001 (and a decrease of 4 euros in 2005). This confirms the existence of economies of scale in consumption. The introduction of the number of secondary residences is a proxy used to capture costs of public investment in terms of tourism or leisure. Estimates show that an increase of 100 secondary residences in 2005 generates an increase of around 3.4 euros in per capita total municipal spending.

Values for price and income elasticities (respectively -0.15 and 0 on average) reveal a weakly elastic publicly provided goods and services in the biggest French municipalities.

Furthermore, empirical results indicate that the coefficient relating to the inter-communal organization dummy variable (which is equal to 1 when the municipality does not belong to an inter-communal organization) is positive and significant in 2005 only. Next, results show that per capita national grants received by the municipality increase public spending in a greater proportion than an equivalent rise in local income (flypaper effect).

However, the Breush Pagan-test reveals the presence of heteroskedasticity, and as suggested by Anselin (1992), an indication of heteroskedasticity may point to the need for a more explicit incorporation of spatial heterogeneity in the form of spatial regimes. Cross-region variations of the parameters therefore were included in the specification and are discussed in the following section.

4. Empirical modeling of demand for public services with spatial heterogeneity

To introduce spatial heterogeneity in the conditional demand specification (5), we use a spatial regimes model. Each regime is characterized by different values for the coefficients associated to price, income and department expenditures. The number of regimes is defined by the spatial division of the French territory into regions. The two different spatial regimes specifications used are described and discussed in the first subsection. In the second, we present and discuss the estimation results obtained.

4.1 Spatial division of the French territory

French regions traditionally have been characterized by historical, cultural and economic differences. Like other countries (see for example Gérard, Jayet and Paty (2010) in Belgium), France is not a homogeneous nation, and consequently is particularly well suited for spatial heterogeneity studies. We propose here to divide the French territory, grouping contiguous French administrative regions[5] together and by differentiating 'Ile de France' from other regions. Ile de France (IDF), which includes Paris, is one French administrative region; it usually is considered to be different from all of the other regions. IDF is characterized by a high regional growth rate, high population density, high level education and a weak

[5] A finer spatial division, into the 22 French administrative regions, is not possible as the numbers of municipalities and departments in each region would be too small to allow an econometric analysis.

percentage of municipalities belonging to an inter-communal organization. Another distinctive feature is that departments and municipalities in IDF co-finance large expenditures in terms of transport networks, in particular.

To test the robustness of our results, we consider two different ways of dividing the territory of France:

- IDF/NORTH/SOUTH regimes

- Seven French European constituencies

Tests for the presence of structural instability have been implemented to justify the spatial divisions considered. The null hypothesis that the coefficients are the same in all regimes have been rejected for these two partitions of the French territory.

4.1.1 IDF/NORTH/SOUTH regimes

Two of these three regimes (North, South and IDF) include several French administrative regions and respectively 32 (IDF), 47 (North), and 31 (South) municipalities. The regimes also reflect the cultural, linguistic, and administrative differences that characterize regions in France, some of which date back to the Roman Empire. Furthermore, Table 4 shows that total municipal and departmental expenditures per capita are greater in jurisdictions located in IDF and in territories in the South compared with territories in the North.

Table 4

Average values, Ile De France, North and South divisions in 2005.

Variables	Ile de France	North	South
Total municipal expenditures per capita (Euros)	1,427	953	1,124
Total department expenditures per capita (Euros)	853	692	812
After tax yearly median municipal income (Euros)	11,047	7,724	8,590

Tax share	0.26	0.23	0.26

Such a difference in expenditure levels can be explained by different regional traditions (higher preferences for local public services in the South and IDF compared to the North) and by the highest income level and population density in municipalities located in Ile de France. Therefore, they provide a wider range of public services than in other regions (zoo effect, Oates (1988)). These statistics also suggest that the dependent variable under study is differentiated in space, and confirm the pertinence of the IDF, North and South spatial divisions.

4.1.2 Seven French European constituencies

The French territory is divided into seven different constituencies for European elections. The seven constituencies, which are similar to NUTS1 European regions, include respectively 32 (IDF), 13 (East), 13 (North-West), 16 (West), 10 (South-West), 8 (Centre), 18 (South-East) municipalities. This regime provides a finer spatial division than that discussed above.

The following table describes public spending levels at the municipal and departmental levels in each constituency:

Table 5

Average values, seven constituencies in 2005.

Variables	*Total municipal expenditures per capita (Euros)*	*Total departmental expenditures per capita (Euros)*	*After tax yearly median municipal income (Euros)*	*Tax share*
Ile de France	1,427	853	11,047	0.26
East	922	666	7,785	0.24
North West	938	748	7,033	0.19
West	987	663	8,144	0.25

South West	1,051	817	8,431	0.25
Centre	948	730	8,036	0.24
South East	1,200	817	8,764	0.26

These statistics confirm that the South, Centre, and Ile de France tend to spend more than other regions.

Based on these spatial divisions of the French territory, we estimate in the next subsection, spatial regimes models.

4. 2 Empirical results

For each regime, we estimate one specific coefficient to assess price, income and preferences effects.

4.2.1 IDF/North/South

Table 6 gives estimation results obtained for the years 2001 and 2005, using an OLS method with robust standard errors to deal with heteroskedasticity:

Table 6

Estimation results with spatial heterogeneity, IDF/North/South
(probability into brackets)

Year	**2001**	**2005**
Estimation method	**OLS robust standard error**	**OLS robust standard error**
Constant	277	66
	(0.35)	(0.74)
National grants per capita	2.24	2.06
	(0.000)***	(0.000)***
Municipal population	-0.0064	-0.0044
	(0.000)***	(0.0008)***

Secondary residences	0.026	0.021
	(0.001)***	(0.10)*
Intercommunity dummy	26	223
	(0.58)	(0.006)***
IDF income	0.011	0.004
	(0.53)	(0.71)
NORTH income	0.029	0.055
	(0.33)	(0.006)***
SOUTH income	0.006	0.05
	(0.35)	(0.012)**
IDF tax share	-2398	-819
	(0.000)***	(0.07)*
NORTH tax share	-337	-449
	(0.191)	(0.26)
SOUTH tax share	-470	-162
	(0.135)	(0.71)
IDF department per capita	1.02	0.55
spending	(0.001)***	(0.013)**
NORTH department per	-0.36	-0.14
capita spending	(0.40)	(0.42)
SOUTH department per	0.28	-0.09
capita spending	(0.297)	(0.66)
Adjusted R^2	0.78	0.89
AIC	1433	1390
Breush Pagan probability	0.011**	0.000027***
Moran's I probability	0.44	0.77
SARMA probability	0.55	0.52

*Significance level: *** for 1%, ** for 5% and * for 10%.*

The spatial regimes specification permits spatial autocorrelation to be removed, as suggested by the Moran's I and Sarma tests. Spatial autocorrelation in the error term can stem from the structural instability of coefficients of the demand model. The spatial regimes model is able to eradicate spatial autocorrelation in the error term.

Results obtained in 2001 and 2005 are robust. They show that the nature of the vertical relationships between departmental and the municipal spending decisions is prone to be different in Ile de France compared with other spatial divisions. These results reveal that

complementarities between services provided by municipalities and departments concern only Ile de France (IDF), with a coefficient that becomes smaller in 2005 (from 1.02 in 2001 to 0.55 in 2005). In contrast, municipalities and their departments seem to have independent public spending decisions in the South and North spatial divisions. As mentioned previously, those contrasting results can be explained by the high urbanization level in IDF where the range of public services is higher than in other regions. Indeed, in IDF, departments and municipalities co-finance high network spending (for example garbage collection, running water, regional transport network), which probably explains the significant complementary effect.

Whatever the year considered, insignificant coefficients obtained for the tax share reveal price elasticities equal to 0 in the South and North spatial divisions. The significant value obtained in IDF reveals a weak price elasticity equal to -0.15. In contrast, income elasticities are significant only in the North and South and in 2005 (respectively 0.44 and 0.38). Other estimated coefficients also have values similar to the one obtained before.

Overall, we find clear evidence that the vertical effects between spending decisions differ over the French territory. Results confirm the spatial heterogeneity in the preferences effect.

4.2.2 Seven French European constituencies

Table 7 reports final OLS estimates (with a heteroscedastic-consistent matrix) of the spatial regimes specification resulting from the spatial divisions into seven constituencies:

Table 7

Estimation results with spatial heterogeneity, 7 French European constituencies (probability into brackets)

Year	**2001**	**2005**
Estimation method	**OLS robust standard error**	**OLS robust standard error**
Constant	81	147
	(0.71)	(0.50)
National grants per capita	1.74	2.106
	(0.000)***	(0.000)***
Municipal population	-0.0042	-0.0041

	(0.001)***	(0.0026)***
Secondary residences	0.021	0.022
	(0.005)***	(0.118)
Intercommunity dummy	58	227
	(0.222)	(0.0056)***
IDF income	0.0019	0.0046
	(0.88)	(0.66)
EAST income	0.0028	0.056
	(0.94)*	(0.19)
NORTH WEST income	0.079	0.094
	(0.009)***	(0.000)***
WEST income	0.053	-0.0032
	(0.006)***	(0.87)

SOUTH WEST income	-0.066	0.057***
	(0.12)	(0.001)
MASSIF CENTRAL income	0.04	-0.0031
	(0.13)	(0.94)
SOUTH EAST income	0.021	0.054
	(0.16)	(0.045)**
IDF tax share	-825	-925
	(0.009)***	(0.048)**
EAST tax share	-196	-698
	(0.77)	(0.47)
NORTH WEST tax share	-2216	-787
	(0.000)***	(0.166)
WEST tax share	-756	-660
	(0.06)*	(0.47)
SOUTH WEST tax share	-492	-1188
	(0.37)	(0.059)**
MASSIF CENTRAL tax share	-560	163
	(0.15)	(0.84)
SOUTH EAST tax share	-507	57
	(0.22)	(0.91)
IDF department per capita spending	1.08	0.45
	(0.004)***	(0.054)**
EAST department per capita spending	0.76	-0.25
	(0.37)	(0.39)
NORTH WEST department per capita spending	0.51	-0.56

	(0.135)	(0.022)**
WEST department per capita spending	0.31	0.53
	(0.44)	(0.206)
SOUTH WEST department per capita spending	2.37	0.156
	(0.001)***	(0.54)
CENTRE department per capita spending	0.27	0.18
	(0.55)	(0.55)
SOUTH EAST department per capita spending	0.69	-0.34
	(0.038)**	(0.24)
Adjusted R^2	0.81	0.88
AIC	1449	1402
Breush Pagan probability	0.035**	0.002
Moran's I probability	0.24	0.95
SARMA probability	0.73	0.16

*Significance level: *** for 1%, ** for 5% and * for 10%.*

Once again, we observe that both the Moran's I and SARMA tests show no evidence of spatial dependence. We also find support for spatial heterogeneity in terms of the preferences effect across French constituencies. We observe a highly significant complementary effect for Ile de France in 2001 and 2005 and for South-West and South-East in 2001 only. In contrast, in 2005 only, the North-West regime is characterized by a negative relationship between municipal and departmental expenditures indicating substitutability among public spending at the two levels of local government. Other constituencies (Centre, East and West) show no significant vertical effect, indicating independence between local public spending decisions of the municipal and departmental tiers. This confirms the importance of spatial heterogeneity in the analysis of the preferences effect.

The coefficients associated to other variables (national grant, secondary residences) are robust and show positive effects on municipal public spending per capita. Next, we observe weak economies of scale in consumption and in production as the coefficients associated with the population and the intercommunity dummy variable are respectively negative and positive.

5. Conclusion

The main purpose of this article is to analyze the impact of the creation of multiple levels of local government, which ensues from decentralization, on the size of the total local public sector. Studies to date using data from various countries have found evidence of a complementary relation between spending at different levels of local government.

In our study, we use data from 2001 and 2005 that covers the 110 largest municipalities (excluding Paris) located in 87 departments in France. First, we assume the stability of regression coefficients over the observation set, and estimate a spatial error model to capture spending interactions among neighboring municipalities. In this step, we also find a strong complementary effect.

In a second step, we estimate a demand for local public services specification after controlling spatial heterogeneity. Two different spatial regimes models are estimated based on inter-regional differences in France, and the models are then compared. We thus allow cross-region parameter variation for the preferences, price and income effects. The specification is based on two spatial divisions of the French territory, one into three groups of regions (Ile de France/South/North), and one into seven (French European constituencies).

We then assess the importance of spatial heterogeneity in the analysis of the determinants of local public expenditures. The spatial regimes specification allows spatial dependence to be removed. In addition, the impact of an increase in departmental expenditures on municipal spending decisions is assessed differently if regional heterogeneity is present. Results then show that municipal and departmental spending decisions are complementary only in Ile de France (IDF). Other French regions show either independence or substitution between the services offered by the two different overlapping jurisdictions. From the perspective of policy

analysis, our results show that a multi-tiered form of organization does not systematically increase the total local public spending level. This result might be seen as contributing to the ongoing debate on the multi-tiered form of organization in France.

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