Local public expenditure behaviour: The influence of municipality size on the relevance of demand or supply models

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Abstract

The relevance of models explaining local public expenditure behavior may depend upon the size of the municipalities. In order to refine this intuition, the article puts two alternative specifications in competition. The first one considers the demand side and the choice of public expenditure made by the median voter. The second one examines the supply side and the decision of public good provision by the local government. The data set includes 14,900 French municipalities for 1998. The econometric methodology employs the data-sorting method developed by Hansen (2000) to test whether the responsiveness of local government to voters is stable across small-size and large-size municipalities. It appears that the median-voter model is rejected by the data for municipalities with a large number of inhabitants, for which a supply-driven model fits better.

JEL classification: D7, R5, H72

Key-words: Public goods, local governments, median voter, structural change, J test.

This version: 19 September 2005

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1. Introduction

Determinants of public expenditure at decentralised levels of government mainly fit into two broad categories of models. On one hand, the agenda setting process is assumed to be mostly competitive and its results are as close as possible to local individual preferences. The latter are usually expressed through the median voter model. Elusive as it may be (Romer and Rosenthal, 1979), it still provides a significant stream of studies (Deno and Mehay, 1987; Holcombe, 1989; Turnbull and Djoundourian, 1994; Turnbull and Mitias, 1999) in the wake of the seminal article of Bergstrom and Goodman (1973). On the other hand, the agenda setting process may not be perfectly competitive, in which case the supply side does not strictly reflect local preferences. The causes for this departure may lie in bureaucratic behaviour (Wickoff, 1990), ineffective tax limitations (Dye and Mac Guire, 1997), interest groups (Congleton and Bennett, 1995; Ahmed and Greene, 2000) or rent-seeking (Downse, 1996).

The first category of models is thus driven by the demand for local public services. Conversely, the second explanation of local public expenditures rejects the assumption according to which spending levels are a function of the characteristics (income and tax price) of the median voter. The corresponding models are hence mainly driven by supply. The debate in the literature remains quite open as to the respective virtues of the two categories of models. It nevertheless seems to forget, to our knowledge, an important dimension of the problem, namely the influence of the size of the population on the explanatory power of the competing models. Intuitively, one may hypothesise that the higher the level of government, the less relevant is the median voter model. What is original in our approach is that it tests whether a similar thing happens *within a given level of government*.

Studies of the relative relevance of demand or supply driven explanations of public expenditures *across* levels of government are of course particularly important. For instance, Turnbull and Mitias (1999) show that the median voter model applies to the lowest tier of a federal structure but not to the higher levels of government. The question addressed here is

different. Considering a given level of jurisdiction (here local governments), we ask whether the size of a community inside this level of government influences the responsiveness of local governments to the preferences of the electorate. It thus may not be relevant to utilise only one model of explanation for a whole set of jurisdictions, even if they are at the same level. It may indeed be possible that the behaviour of large size communities be best explained by supply driven models while for communities of smaller size, the median voter model would perform better.

This article intends to test whether the power of the median voter model against a competing model changes with the size of the population within a given level of government. Estimations use data for French municipalities and allow for an unknown breakpoint. The empirical strategy amounts to building a statistical procedure combining the J test proposed by Davidson and MacKinnon (1981) with a test for sample splitting with threshold effect suggested by Hansen (2000). The article is organised as follows. Section 2 describes alternative political processes of public good provision, namely the median voter model and a supply driven model. Section 3 presents the econometric methodology. Empirical results are given in section 4, followed by concluding comments and discussion in section 5.

2. Alternative models of public good provision

Following Holcombe (1989), we take the median voter hypothesis as the benchmark for explaining the spending behaviour of a given level of government. To paraphrase Inman (1978), this hypothesis maintains that government behaves "as if" it maximises the median voter's utility. Thus, on the demand side explanation of public good provision, the median voter model is one of direct democracy. When one moves to a framework of direct democracy, then the assumption must be made of a strict commitment of the elected body towards the choices of the decisive voter. We use the standard logarithmic specification of the median voter hypothesis including the traditional extra assumption that income and grants may have asymmetric marginal spending effects (Turnbull, 1998). The demand-driven specification is thus:

$$\ln E_i = a_0 + a_1 \ln Y_i + a_2 \ln (b_m / b)_i + a_3 \ln G_i + a_4 \ln N_i + a_5 \ln D_i + u_i \qquad (1)$$

With indexes $i = 1,\ldots,I$ for the local jurisdictions. For each of them, E_i denotes local public expenditures per capita, Y_i is the median income, $(b_m / b)_i$ is the median voter's tax share for the local property tax (b_m is the median voter's tax base and b is the average tax base per inhabitant), G_i represents the total grants per capita received from other levels of governments, N_i is the local population, D_i is the population density and u_i is a stochastic error term. In which instances will this formalisation prove to be relevant? Before proceeding to the econometric tests, we now take into account an alternative form of expenditure behaviour, namely the supply-driven model.

The competing model rests on the supply side of local public expenditures. The "self-interested" elected politician may depart from the median voter preferences for many reasons. Bureaucracy, political agenda control, fiscal and institutional complexity may account for a drastic divergence from the demand for public spending as it is expressed by the median voter. The most significant departure involves the characteristics of the median voter. Following Denzau and Mac Kay (1983), we argue that agenda control by the elected politician helps him become quite independent from demand. Consequently, the representative does not have to take into account the characteristics of the median voter. Then, the income and tax price of this voter do not appear in the spending equation of the supply side model. The tax share is now $(1/b)_i$ since the representative does not consider the distribution of individual tax bases but only their average level. A logarithmic specification of the supply model can be written as:

$$\ln E_i = \alpha_0 + \alpha_1 \ln (1/b)_i + \alpha_3 \ln G_i + \alpha_4 \ln N_i + \alpha_5 \ln D_i + v_i \quad (2)$$

where v_i is a random disturbance. At which point in the sample must the demand model give way to the supply model? In order to test for the supply driven model against the median voter model before and after an unknown break point, we suggest to conduct the following testing strategy.

3. Testing strategy

We choose to combine the J test procedure (Davidson and MacKinnon, 1981) with a test for parameter instability and threshold effect suggested by Hansen (2000). Let the median voter and supply models be considered as rival non-nested models where the median voter is the null model and the supply model is the alternative. The J test statistic is the ordinary *t* statistic for $\gamma = 0$ in the following regression:

$$\ln E_i = a_0 + a_1 \ln Y_i + a_2 \ln (b_m / b)_i + a_3 \ln G_i + a_4 \ln N_i + a_5 \ln D_i + \gamma \ln \hat{E}_i^S + u_i \qquad (3)$$

where $\ln \hat{E}_i^S$ is the vector of fitted values from the OLS estimation of the supply model (*H1* model). Asymptotically, J is distributed as standard normal and Davidson and MacKinnon (1981) show that as $I \to \infty$, if $H1$ is true, the probability that $\hat{\gamma}$ significantly differs from zero approaches 1.

This procedure is adapted to the test of non-nested regression models where the sample is split into two groups (or 'regimes'), with one group generated by the $H0$ model while the other group is generated by $H1$ with an unknown breakpoint. The first assumption assumes a constant local public expenditures behaviour over the sample. The second hypothesis considers that under an unknown threshold θ, the demand model holds ($N_i \leq \theta$) while beyond this breakpoint the supply model prevails ($N_i > \theta$):

$$\begin{cases} H0: \quad ln\, E_i = a_0 + a_1 ln\, Y_i + a_2 ln\, (b_m / b)_i + a_3 ln\, G_i + a_4 ln\, N_i + a_5 ln\, D_i + u_i \quad i = 1, \cdots, I \\ and \\ H1: \quad \begin{cases} ln\, E_i = a_0 + a_1 ln\, Y_i + a_2 ln\, (b_m / b)_i + a_3 ln\, G_i + a_4 ln\, N_i + a_5 ln\, D_i + u_i & N_i \leq \theta \\ ln\, E_i = \alpha_0 + \alpha_1 ln\, (1 / b)_i + \alpha_2 ln\, G_i + \alpha_3 ln\, N_i + \alpha_4 ln\, D_i + v_i & N_i > \theta \end{cases} \end{cases}$$

where θ is the unknown parameter to be estimated from the data. Having in mind the threshold estimation technique suggested by Hansen (2000), we first define the indicator function $I_i(\theta)$ that takes a value of one when $N_i > \theta$ and zero otherwise. The estimated model we use to test for $H0$ against $H1$ can then be written as follows:

$$\ln E_i = a_0 + a_1 \ln Y_i + a_2 \ln (b_m / b)_i + a_3 \ln G_i + a_4 \ln N_i + a_5 \ln D_i + \gamma\, I_i(\theta) \ln \hat{E}_i^S + u_i \qquad (4)$$

Define $S_1(\theta)$ as the residual sum of squares with the threshold level of the N_i variable fixed at θ. The least squares estimators of θ are given by $\hat{\theta} = \arg\min_{\theta} S_1(\theta)$. It is important to determine whether the threshold effect is statistically significant. In equation (4), testing for no threshold effect amounts to testing the null hypothesis $H0: \gamma = 0$. Hansen (1996) suggests a bootstrap method to simulate the asymptotic distribution of the following likelihood ratio test of $H0: LR_0 = (S_0 - S_1(\hat{\theta}))/\hat{\sigma}^2$, where S_0 and $S_1(\hat{\theta})$ are the residual sum of squares under $H0$: $\gamma = 0$ and $H1: \gamma \neq 0$, respectively; and $\hat{\sigma}^2$ is the residual variance under $H1$. Moreover, Hansen shows that the best way to form a confidence region for $\hat{\theta}$ is to form the "no-rejection region" using the likelihood ratio statistic for tests on θ. We now apply this testing strategy to our data set.

4. Empirical results

The data set includes the 14,900 French municipalities with local population greater than 500 inhabitants for 1998. The framework is that of representative democracy. The local population variable (*N*) is used as our threshold variable to determine threshold effects in equation (4). Since the size of the sample is large, the search for the least-square estimators is limited to specific quantiles. We use the grid $\{0.40\%, 0.60\%, 0.80\% \cdots, 99.60\%\}$ which contains 500 quantiles.

We first verify that there is indeed evidence of a threshold by employing the Lagrange multiplier (LM) test for a threshold (Hansen, 1996). Since the threshold is not identified under the null hypothesis of no threshold, the p-values are computed by a bootstrap procedure. Using 1000 bootstrap replications, the p-values for the threshold model using local population is highly significant at 0.001, which indicates that there may indeed be a sample split based on local population.

Figure 1 displays a graph of the normalised likelihood ration sequence $LR_0(\theta)$ statistic as a function of the local population. The least square estimate of θ is the value that minimises this graph, which occurs at $\hat{\theta} = 448$. This corresponds to a local population of 5033 inhabitants and the percentage of municipalities in the "small population " category is

close to 89.40% of the sample. The asymptotic 95% critical value (7.35) is shown by the horizontal dotted line. Where it crosses $LR_0(\theta)$ it displays the confidence set [442, 450] or equivalently [4540, 5181] when expressed in terms of local population. Figure 1 also indicates that there may be a second dip in the likelihood ratio around [100,150]. Following the procedure suggested by Bai (1997), we have tried to further split the "small population" group of municipalities but none of the bootstrap test statistics were significant and therefore no further splitting was possible with the retained threshold variable.

[Figure 1 about here]

Table 1 presents estimates for the threshold regression and for each regime. All coefficients are statistically significant at the 5 percent level in the threshold model. Recall that the existence of a threshold cannot be inferred simply from the significance level of the coefficient on the term $I(N > 5033).\ln \hat{E}^S$ since the distribution of the t-statistic for this variable is highly nonstandard under the null hypothesis of no threshold effect. However, the distribution of the t-values of all explanatory variables retains its usual distribution under the alternative hypothesis of a threshold effect.

[Table 1 about here]

Taken as a whole, the results seem to indicate that the median voter model is supported by French data for municipalities with local population smaller than 5033 inhabitants. At the opposite, the supply driven model seems to be superior for municipalities with a local population above 5033 inhabitants. This testing procedure seems to support the view that these two models have to be considered as complementary explanations of the level of public good provision in French municipalities.

The third and fourth columns of Table 1 present coefficient estimates in each regime. Except for the income elasticity estimated with the median voter model, all the coefficients are significant at the usual 5% confidence level. Price elasticities calculated from price coefficient estimates behaves in the usual way in both regimes. Price coefficient estimates are given by $(\hat{a}_2 - \hat{a}_3)$ in the median voter model and $\hat{\alpha}_1$ in the supply model. They are negative and significant, respectively -0.605 and -0.203 for regime 1 (median voter model) and regime

2 (supply model). The lower value of the price elasticity in the supply model may be due to the different fiscal share it takes into account. Moreover, these values are similar to those obtained in other studies, for example McGreer and McMillan (1993) for Canada or Feld (1999) for Switzerland. The income coefficient takes an unusual negative sign in Regime 1 but the estimated coefficient is close to zero and only marginally significant at the 5% level. Testing for a zero income coefficient in this model leads to a p-value of 6.02% so that there is some evidence in favor of a zero income elasticity, which is consistent with previous work (Gramlich and Rubinfeld, 1982). Grants always have a significant impact on per capita local public expenditures and they appear with the expected positive sign. Finally, popuplation and population density are also significant.

5. Conclusion and discussion

The intuition according to which median voter based spending models perform less adequately for higher levels of government is usually confirmed by empirical tests (Turnbull and Mitias, 1999). To our knowledge, no attempts have been previously made to test the responsiveness of such models inside a given fiscal tier. Our estimations have focused on the lower level of government in France, namely the municipalities or *communes*. Since they present a high degree of variety in population, one may expect that spending decisions need not follow the same model throughout the range of local communities. We have allowed for an unknown breakpoint and have found that the median voter model is relevant for populations of approximately less than 5000 inhabitants. Above this threshold, determinants of public good provision no longer significantly build on the characteristics of the median voter (income and tax price).

At this stage, we cannot provide more than tentative explanations for what appears to be a nevertheless significant chasm in public spending behaviour. Turnbull and Mitias (1999) offer two possible hints (but which they do not corroborate in their empirical study). Firstly, they account for the increased complexity of the budgetary structure as population grows. In the French case, bigger budgets certainly increase fiscal illusion and possibly generate a sense of remoteness of decisions that provides a form of independence for the representative. This independence can be unintended (a kind of isolation effect) or strategic (as in Denzau and Mac Kay, 1983). Secondly, Turnbull and Mitias (1999) mention urbanisation effects: As

population grows, the range of services for a given function is provided by an increasing number of overlapping jurisdictions (this is the case for instance with the provision of security or infrastructures). In the case of France, the *communes* basically have the same assignment of prerogatives whatever the size of their population. This is a constitutional statement and changes in prerogatives are legislative decisions that are to uniformly apply to every local community. It nevertheless remains that politicians take their decisions in quite different surroundings whether they are elected in small or big communities. This is corroborated by the estimations. Finally, to these supply side explanations can be added a demand side factor. Borck (2002) documents how political participation decreases with population size. Since participation is not evenly spread throughout the population, this will possibly shift power from the theoretically decisive median voter. This gives more degrees of freedom for the elected politician to follow his or her own agenda and less interest in taking the median characteristics into account.

Taken together, supply side and demand side explanations suggest that the determinants of public spending behaviour do change with increases in population. This may happen both across levels of government and within a given fiscal tier as this article has demonstrated in the case of French municipalities.

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Figure 1:

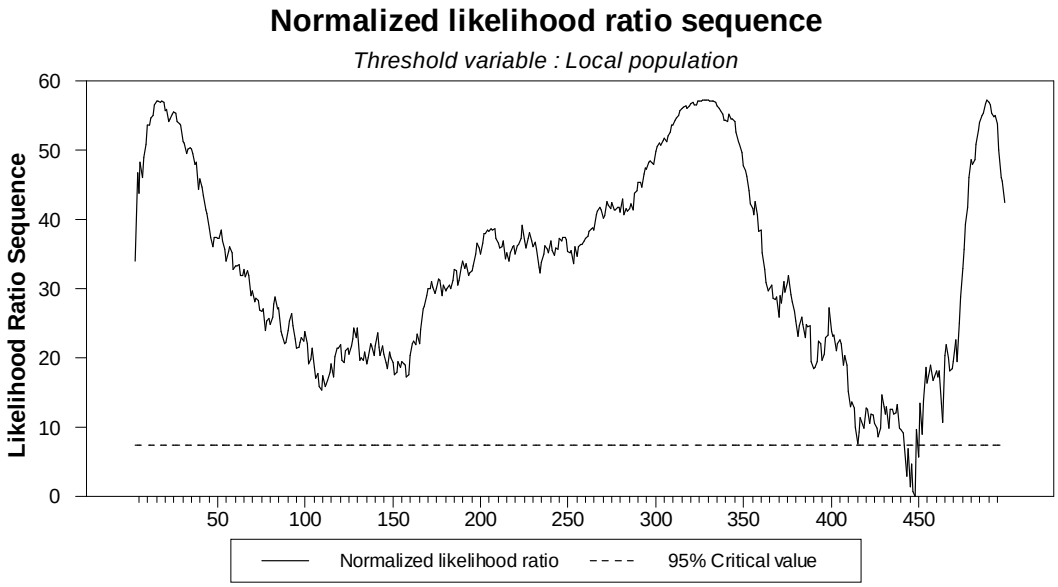
Normalized likelihood ratio sequence
Threshold variable : Local population
Likelihood Ratio Sequence
60
50
40
30
20
10
0
50
100
150
200
250
300
350
400
450
Normalized likelihood ratio
95% Critical value

Table 1 : Regression estimates

Regressor	Threshold regression	Regime 1 $N \leq 5033$	Regime 2 $N > 5033$
constant	4.234* (0.097)	4.164*(0.107)	3.379* (0.103)
$ln\,Y$	-0.021* (0.009)	-0.018 (0.010)	
$ln(b_m / b)$	-0.172* (0.007)	-0.170* (0.007)	
$ln(1/b)$			-0.203* (0.015)
$ln\,G$	0.438* (0.007)	0.435* (0.007)	0.402* (0.013)
$ln\,N$	0.080* (0.003)	0.080* (0.003)	0.065* (0.005)
$ln\,D$	0.053* (0.003)	0.062* (0.003)	0.019* (0.004)
$I(N > 5033).\ln \hat{E}^S$	0.008* (0.001)		
R^2	0.725	0.669	0.755
SEE	0.201	0.205	0.149
Obs.	14900	13321	1579

Standard errors are given in parentheses. * indicates significance at 5% level.