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Cooperation among local governments to deliver public services: a « structural » bivariate response model with fixed effects and endogenous covariate

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**Cooperation among local governments to deliver public services:
a “structural” bivariate response model with fixed effects and
endogenous covariate**

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Abstract:

Cooperation among local governments has been encouraged to enable the aggregation of resources and improved public sector efficiency. However, if cooperation through the joint delivery of local public services is likely to be welfare enhancing for the agglomeration, but will lead to losses for one of the parties, it is unlikely that the losing municipality will cooperate. Using a unique panel

¹ Acknowledgments: We are grateful for the many helpful comments and suggestions from Jan Brueckner, Benny Geys, Teemu Lyytikainen, Franco Peracchi and Federico Revelli.

dataset of 30,000 French municipalities for 1995-2003, we estimate the relationship between cooperation decision and the fiscal revenues raised to provide local public goods. We employ a new econometric strategy based on Lee (1978), developing a non linear method controlling for fixed effect, endogenous covariates and cluster standard error. We find evidence that a positive difference between the expected fiscal revenues of a cooperating locality and the actual revenues realized by an isolated locality significantly increases the probability of joining an inter-municipal community.

Keywords: inter-municipal cooperation, fiscal revenues, bivariate response variable, panel data, endogeneity

JEL codes: C3, H2, H4, H7

1. Introduction

Inter-municipal cooperation is a current phenomenon in Western European countries (Hulst et al., 2009). The OECD (2006, p. 25) notes that “Inter-municipal cooperation has been and remains an important element of most national programmes.” For example, Austria and Sweden in the 1950s, Germany and Belgium in the 1970s and more recently, Switzerland, Greece and Denmark have been encouraging their sub-national jurisdictions to cooperate. The first experience of inter-governmental cooperation in France involving municipalities administering some local public services, dates back to 1890. However, there is a variety of institutional arrangements for cooperation providing for the joint delivery of local public services, ranging from simple (or functional) cooperative agreements between independent municipalities, to complete mergers or amalgamations.

Issues related to consolidations of states and jurisdictions have been debated by economic theorists (see e.g. Blume and Blume, 2007, which provides a review of the pros and cons of local

authority mergers). The joint provision of public goods by communities (i.e. groups of municipalities) is likely to create economies of scale and thus to offer more possibilities for cutting costs. However there is a trade-off between the achievement of economies of scale that provide incentives for consolidation, and respect for local heterogeneity in preferences (as pioneered by Tiebout, 1956) which tends to favor separation. Several papers including Miceli (1993) and Spolaore (2004) analyze the optimal size of coalitions. Cooperation is also justified on the grounds of internalizing inter-jurisdictional spillovers (see e.g. Bradford and Oates, 1974): the benefits of public expenditure (infrastructure, road building, cultural facilities...) often spread beyond the boundaries of the supplying jurisdiction and affect the welfare of the citizens in neighboring localities. Hoyt (1991) shows that consolidation can be an efficient policy corrective for the undersupply of local public goods generated by tax competition among local jurisdictions. He demonstrates that limiting competition by reducing the number of the localities in a metropolis increases tax rates and welfare. Finally, based on comparative research on eight European countries, Hulst et al. (2009) argue that increased production scale, urbanization and market pressure tend to favor the development of cooperative arrangements. Globalization puts pressure on local authorities to become more competitive by creating larger spatial units, and the financial crisis has provided a huge incentive to seek economies of scale in the provision of local public goods.

Despite frequent claims that cooperation among local governments is a potential solution to inefficiencies, there are few studies on its determinants.² To our knowledge, the related empirical literature is quite recent and is concerned mainly with the characteristics of optimal coalitions - such as school districts - in the US context (Brasington, 1999, 2003a, 2003b; Gordon and Knight, 2009). Weese (2011) uses political coalition formation games to explain mergers between Japanese municipalities. Saarima and Tukiainen (2010) investigate the political decision making process

² Also, to our knowledge, very few papers focus on the consequences of cooperation on expenditure. However see for Israel (Reingewertz, 2012), Italy (Ermini and Santolini, 2010), and France (Frere et al., 2012).

behind coalitions in Finland. Also for Finland, Sorensen (2006) shows the impact of political transaction costs on voluntary local government mergers. He identifies the role of state grants, revenue disparities and expected changes to party strengths after unification, on the process of merging. However, these empirical papers investigate extreme cases of cooperation since they analyze local mergers (i.e. new jurisdictions in which former members disappear).³ To our knowledge, there has been no published theoretical or empirical work on the determinants of inter-municipal cooperation arrangements (or functional cooperation) aimed at the joint delivery of public services.

The objective of this paper is to contribute by analyzing the determinants of inter-municipal cooperation using the French experience, where “functional” cooperation (but not mergers) between municipalities is decided voluntarily by municipal councils, to provide joint public goods. Our hypothesis is that the formation of this type of cooperating community can be analyzed using the concepts and tool of cooperative game theory. Bottom-up cooperation through horizontal negotiations among neighboring local authorities can produce situations where all partners win. Where cooperation is welfare enhancing for the whole agglomeration but leads to losses for one municipality it is unlikely that this authority will agree to cooperate. As far as we know this approach is novel in local public finance.

The main empirical contribution of this paper is that it exploits the characteristics of the French institutional setting to test the impact of fiscal revenues on the probability to cooperate. For many years and especially since 1999, the French government has favored the creation of inter-municipal jurisdictions based on large state grants, to solve the problem of “municipal fragmentation” in France.⁴ Inter-municipalities are groupings of several municipalities to enable

³ See also Moisis (2012) on mergers in Northern European countries.

⁴ In 2010 there were some 36,500 French municipalities, i.e. nearly half of all European (EU15) municipalities. 87% of

collective financing and management of some local public services. Currently, most French municipalities (more than 90% in 2010) are grouped within larger jurisdictions (known as ‘Etablissements Publics de Coopération Intercommunale’ or EPCI). Like French municipalities, EPCI have high levels of autonomy to set their own local tax rates.

Econometric modeling of the determinants of cooperation can be complicated because fiscal revenues and cooperation decision in practice are simultaneous. We can expect municipalities to consider their expected fiscal revenues when joining an inter-municipal agreement, while fiscal revenues within a locality depend on local intergovernmental agreements. To address this problem of simultaneity (or reciprocal causation) as well as other econometric issues related to the economic setting, we propose a new applied econometric strategy based on the seminal idea in Lee (1978) and developed by Brueckner and Follain (1988), which we augment to account for the panel structure of our data (1995-2003). We follow Papke and Wooldridge (2008) in developing a bivariate panel model with endogenous covariates and fixed effects. We provide a careful explanation of the econometric procedure used and address the standard errors issue. Thus, we contribute to the a relatively small empirical literature that deals with cross-sectional dependence in practice. First, we find that municipalities’ fiscal revenues are relevant to cooperation decision. A positive difference between the expected fiscal revenues of a cooperating locality and the actual revenues achieved by an isolated locality significantly increases the probability of joining an inter-municipal community. Conversely, if a municipality would receive a higher fiscal revenue by remaining (or becoming) isolated, the propensity of this locality to cooperate becomes negative. Second, our estimation results show that a municipality will be more inclined to cooperate if the neighboring municipalities are members of the inter-municipal jurisdiction.

We believe that the issues raised by cooperation will contribute to the debate on the optimal

French municipalities had less than 2,000 inhabitants, accounting for 25% of the metropolitan French population

organization of the public sector. Reorganization of sub-national jurisdictions is still on the political agenda in many countries. Our work seems to provide support for the idea that expected additional fiscal revenues provide a strong incentive to cooperate within an agglomeration.

The paper is organized as follows. Section 2 discusses theoretical considerations related to cooperation decision based on cooperative game theory. The French institutional context and the wave of local cooperation are discussed in Section 3. Section 4 describes the empirical model and Section 5 presents the results of our estimations. Section 6 offers some concluding remarks.

2. Theoretical considerations related to cooperation decision

We begin by presenting a simple representation of municipal government behavior in the decision to join a community or not. Our hypothesis is that forming a community can be analyzed by applying the concepts and tools of cooperative game theory developed by Shenoy (1979) and Hart and Kurz (1983) for the study of coalition formation.

A cooperative game is defined by a set $N = \{1, \dots, i, \dots, n\}$ of n players (or municipalities) i and a characteristic function v , which associates to each subset S of N a payoff value $v(S)$. We assume that this payoff can be assimilated to the fiscal revenues received by the municipality/player i in any subset S of N . We assume also a particular modeling of the behavior of the municipality/player. The literature proposes various ways to express the objectives of local governments, encompassing a wide range of possibilities, from benevolent maximizers of their citizens' welfare (as e.g. in Wildasin, 1988) to self-seeking revenue maximizers (Brennan and Buchanan, 1980). For simplicity, we assume that municipal governments' objective is to combine local residents' utility from the consumption of local public goods and the rents accruing to policy-makers (as in Edwards and

Keen, 1996). As the levels of public services and rents are financed by total tax revenues, we suppose that a municipality/player i tries to maximize the level of total tax revenues, which is given by $p_i B_i$ where p_i is the population of municipality i and B_i is per capita tax revenue.

Shenoy (1979) and Hart and Kurz (1983) propose several conditions under which a stable partition of the players emerges, using different solution concepts to model the repartitioning of wealth among the players when a coalition forms. A partition $P = (S_1, \dots, S_l)$ is a collection of coalitions such that any player belongs to exactly one coalition in P ; Π is the set of all possible partitions. A payoff solution concept is a function $S : \Pi \rightarrow 2^{E^n}$, where 2^{E^n} denotes the set of all subsets of the Euclidian space E^n . The payoff solution indicates the value received by player i in coalition S_i when partition P forms. The main issue in this literature is identifying solution concepts that guaranty the stability of the partition. In other words, for a given allocation rule that reallocates the payoff $v(s)$ generated by the coalition S , we want the partition to be stable. No player or coalition of players has an incentive to deviate, that is, to quit the coalition and join another one.

From game theory, we can derive some results that help our understanding of some key factors that favor the creation of a stable community. Individual rationality⁵ asserts that, within a coalition, the payoff received by a player should be superior or equal to the payoff she would receive as an individual. This is the simplest criterion that can be applied to explain the creation of a community. The growth of the total budget raised by the community must be high enough to reallocate fiscal revenues so that no player loses by joining the coalition. More formally, Shenoy proposes a sufficient condition for the formation of a grand coalition:

⁵ Shenoy and also Hart and Kurz study other payoff solution, such as the core, the Shapley value, the Von Neumann Morgenstern Stable sets, etc. which propose other disbursements to the players when a coalition forms.

Theorem (Shenoy 1979). A game (N, v) is super additive if:

$$S_1 \cap S_2 = \emptyset, S_1, S_2 \in 2^N \rightarrow v(s_1) + v(s_2) \leq v(s_1 + s_2)$$

And strictly super additive if strict inequality always holds. If the game is strictly super additive, the grand coalition is stable for individually rational payoffs.

In other words, a necessary condition for forming a grand coalition is that each additional player or coalition brings extra value to the union. Let us consider the simple case where there are two municipalities/players S_1 and S_2 , with population p_1 and p_2 respectively. B_1 and B_2 are their respective fiscal per capita revenues, with $B_1 > B_2$. We can associate the payoff value $v(s_1)$ with the total fiscal revenues $p_i B_i$ of municipality s_i ($i = 1, 2$). Cooperation between both municipalities, S_1 and S_2 , leading to coalition $(s_1 + s_2)$ is possible only if:

$$v(S_1 + S_2) > v(S_1) + v(S_2),$$

otherwise the stand alone option is an equivalent possibility. This implies

$$(p_1 + p_2)B_{12} > p_1 B_1 + p_2 B_2$$

$$B_{12} > \frac{p_1}{p_1 + p_2} B_1 + \frac{p_2}{p_1 + p_2} B_2$$

where B_{12} is the fiscal revenue of the community per capita. The new p.c. revenue should always be superior to the average of previous revenues, which is technically impossible without new revenues. Hence, the only ways to make the game (strictly) super additive are to raise existing tax rates or to get sufficiently high value state grants to compensate the loss of revenue of some of the players.

Cooperative game theory suggests that for cooperation to emerge, municipalities must achieve new fiscal revenue through *i)* higher rates on existing taxes or new taxes, and or *ii)* higher levels of existing state grants or new grants. To test this theoretical prediction, we exploit the characteristics of the French institutional setting and its existing experience in intergovernmental

cooperation.

3. The institutional context

In this section, we provide some information on the French local institutional context and the development of local government cooperation.

The French local institutional context is characterized by three overlapping tiers of local government. The lowest tier consists of some 36,700 municipalities; the middle-tier consists of 96 counties (or French “départements”); and the top tier consists of the 22 French regions. Municipalities are responsible for local urban services, buildings, provision of nurseries, primary schools, and sports facilities, and maintenance of municipal roads and urban public transport. Counties administer social assistance, and maintain county roads and middle schools. Regions are responsible for provision of vocational training, economic development, and building and maintenance of high schools.

Local revenues come mainly from taxation (54%), grants (23%) and borrowing. The local business tax (or "Taxe Professionnelle")⁶ is the major source of local government tax revenues, accounting for approximately 45% of the revenue derived from direct local taxes. The tax base consists mainly of capital goods and is based on the rental values of buildings, and of equipment (assumed to be 16% of the cost of the equipment). The remaining fiscal revenues are collected from households in the form of residential tax (“taxe d’habitation”), property tax (“taxe foncière sur le bâti”), and land tax (“taxe foncière sur le non bâti”). All municipalities receive a state grant,

⁶ This tax, which was related mainly to private capital, was removed in 2010 and replaced by a territorial economic contribution based on property and firm value added.

according to several criteria such as population and tax bases.

Since the beginning of the 1990s, several laws have been passed on local cooperation to solve the problem of “municipal fragmentation”.⁷ Based on the volunteer principle, neighboring municipalities that want to finance and manage some public services collectively are allowed to create, or join, an inter-municipal community (or EPCI).⁸ Local cooperation is expected to i) reduce local public spending by achieving substantial economies of scale in the production of some local public goods such as public transport, cultural and sport facilities etc, and ii) limit fiscal and spending inequalities between member municipalities. This dual objective is financed by transferring some tax and spending powers from the municipalities to the corresponding inter-municipal group.

Local cooperation has been widely promoted by government based on financial incentives. Since 1999, the inter-municipal community has been awarded a new state grant⁹ (based mainly on community population and inter-municipal tax bases) and new tax revenues. It can apply an additional tax rate to the four municipal tax rates (business, residential, property and land taxes) or set a single business tax rate (SBT or “Taxe Professionnelle Unique”).¹⁰ If it chooses to set a SBT,

⁷ There are three main laws on the development of inter-municipalities in France: the law of 6th February 1992 which laid the basis for inter-municipal cooperation and was reinforced and simplified by the law of 12th July 1999, and the law of 13th August 2004 which rationalized the inter-municipal map.

⁸ The inter-municipal community is managed by a board of delegates elected by member municipalities from their local councilors through an absolute majority. Therefore, unlike municipalities, “départements” or regions, inter-municipal jurisdictions operate under indirect democracy and remain a decision making level rather than a strict administrative level.

⁹ Note that this state grant attributed to the inter-municipal community coexists with the state grant attributed to the municipality. The latter is the same whether the locality cooperates or not.

¹⁰ During the period of our study, there was a third – marginal – case, which was a mixed case where the community set

the municipality loses the right to set its own business tax rate but can still set the rate for the three remaining taxes (residential, property and land).

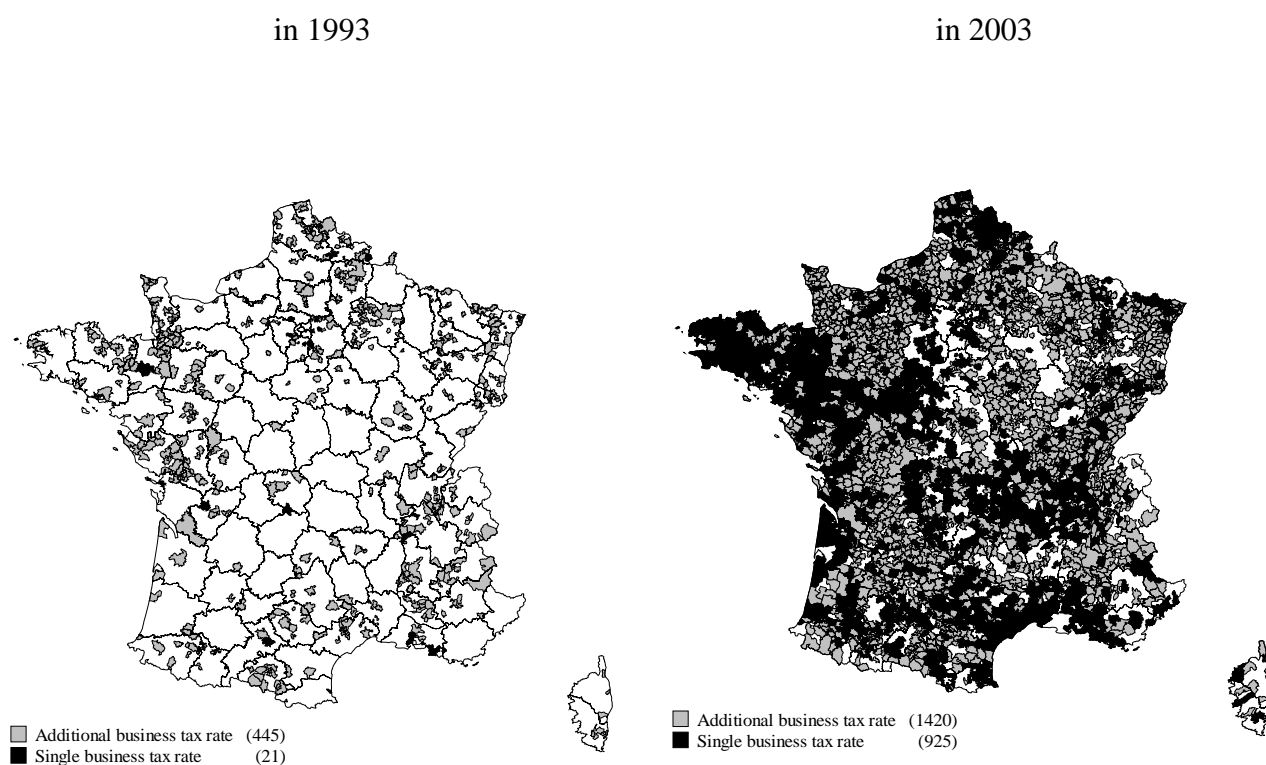
As predicted by the theory (see Section 2), new fiscal revenues must be levied for cooperation to emerge voluntarily among a set of municipalities. In the French case, the community gets new fiscal revenues through *i*) a new tax rate (SBT) or an additional tax rate on business and *ii*) a new state grant. As a consequence, the residents of those municipalities often enjoy extra public output or better quality public services thanks to these new fiscal revenues.

Although Map 1 reflects the reality that inter-municipal cooperation was a success during 1993 and 2003, some municipalities remained isolated during the period studied. The more intuitive reason is that the obvious financial gains from cooperation and the provision of extra public goods are counterbalanced by the fact that each cooperating municipality loses some fiscal autonomy through devolution of competences and tax revenues to the community.¹¹ By concluding a cooperative agreement with other localities, a relatively “rich” municipality loses control over part of its revenues which are redistributed among the entire community. Therefore, concluding a cooperative agreement with other municipalities might be a difficult choice for each individual municipality. Intergovernmental cooperation and the associated devolution of local competencies might lead to a lower level of public good provision within a cooperating locality.

a single business tax rate and an additional tax rate on households. The community received double tax revenue from households and business while municipality *i* set a tax only on households.

¹¹ There might be some hidden coordination costs but by their nature they are difficult to measure.

MAP 1: Distribution of inter-municipal jurisdictions and their tax regimes



Source: Charlot et al. (2012)

4. Empirical Model

To assess the trade-off between remaining isolated and cooperating, we argue that a municipality compares the level of fiscal revenues (i.e. tax revenues and state grants) raised to provide local public goods before and after joining an inter-municipal community. As argued in our theoretical section (Section 2), new fiscal revenues must be levied for cooperation to emerge voluntarily among a set of municipalities. In our case, the community gets new fiscal revenues through new tax revenues and a new state grant. Given that inter-municipal fiscal revenues (i.e. tax revenues levied by the community and state grant allocated to the community) are reallocated to citizens through the supply of joint public services in every cooperating municipality, the level of fiscal revenues accruing to each cooperating municipality must be carefully addressed.

Hereafter, per capita fiscal revenues, that is the available revenue that can be used to finance the provision of both municipal and joint public goods, where appropriate, to every citizen, will be calculated as follows:

- If municipality i remains isolated, its fiscal revenues p.c. raised to provide local public services will be formed by municipal tax revenues p.c. and state grant p.c.
- If municipality i cooperates within a community, the available fiscal revenues p.c. raised to provide the whole range of public services (municipal and joint public services) will be formed by municipal tax revenues p.c., state grant p.c. allocated to municipality i , state grant p.c. allocated to inter-municipal group and inter-municipal tax revenues p.c.

Appendix 1 provides more detail on this computation.

Our aim is to determine whether the predicted difference (DIFFREV) between the two possible fiscal revenues, one based on the choice to remain isolated and one based on the choice to conclude an inter-municipal agreement has an impact on local governments' cooperation decision (COOP). Given the peculiarity of our framework, we need to address the following issues.

First, since our dependent variable (COOP) is a dichotomous variable (COOP=1 if the municipality cooperates and COOP=0 otherwise), we need to test a non-linear specification that acknowledges the bounded nature of the cooperation decision variable. Second, we expect that municipalities will take account of their expected fiscal revenues when joining an inter-municipal agreement; however fiscal revenues within a locality will depend on local intergovernmental agreement. Therefore, fiscal revenues are determined simultaneously with the decision to cooperate, which introduces endogeneity issues. Third, spatial spillover among municipalities might influence the choice to join an inter-municipal community. For several reasons explained in more detail below, it is likely that a municipality will be influenced by neighboring municipalities' decisions to

cooperate (or not), which points to the need to include a spatial smoother among the regressors and/or to estimate appropriate robust cluster standard errors. Finally, one municipality may raise more revenue than some others due to the existence of a natural advantage in the form of natural resources, land, climate, historical importance, accumulated human capital or just its accumulated tax base. Any missing natural characteristic that influences the cooperation choice implying a change in revenues, will bias estimates of the tax revenue coefficient.¹² To cope with unobserved fixed municipal characteristics, panel data are desirable.

To sum up, we would suggest that the best estimation strategy is a non linear model which is robust to simultaneity with bounded decision making and spatial dependence among observations, and which has independent, and unobserved fixed municipal characteristics.

4.1. Econometric issues

Our novel econometric strategy is based on two different strands of the literature that deals with bivariate response models in the presence of endogenous covariates. The first draws on the seminal paper by Lee (1978) which proposes a simultaneous equation model for a limited dependent variable to estimate the effect of union membership on individual wages. More specifically, our strategy includes an extension to this methodology, as developed in Brueckner and Follain (1988).¹³ They model a mortgage choice equation in which the borrower faces an adjustable or fixed rate. In the mortgage case, the choice is made in combination with a decision on the rate type (fixed or adjustable). Only actual choices are observable in the data although the decision

¹² An empirical proof of how much bias can occur in a spatial framework without fixed effects is given by Cassette et al. (2012)

¹³ A similar strategy can be found in Rosenthal and Helsley (1994) where vacant rural land prices are estimated.

making process faced by the borrower involves counterfactual non-observable information i.e. the rate in the alternative choice. Similarly, as already argued, the cooperation choice made by local government is based on the predicted difference between the two possible fiscal revenues, one based on the choice to remain isolated and one based on the choice to conclude an inter-municipal agreement. We observe only actual choices (i.e. remaining isolated or cooperating, and associated fiscal revenues); therefore we need to implement a strategy that involves computation of a counterfactual tax revenue value, that is, the expected revenue in the alternative non-observed choice. Following Lee (1978), we estimate a counterfactual tax revenue earned by the local municipality in the alternative possible, non observed choice. This is achieved within the econometric structure of the model using observable characteristics. Once this counterfactual variable is computed, it is possible to obtain the difference (DIFFREV) between the predicted (non-observed) fiscal revenue, and the actual fiscal revenue observed in the data.¹⁴ We apply this to each observation which allows us to examine how DIFFREV affects the propensity to join an inter-municipal jurisdiction.

To achieve our objective, we follow the four step procedure in Brueckner and Follain (1988). First, we estimate a probit model where the dependent variable is COOP and the fiscal revenue is omitted; the inverse Mills ratio is computed using the remaining observable characteristics. Second, we estimate two linear fiscal revenue equations, first on the subsample of observations that have joined an inter municipal group, and second on the subsample of isolated municipalities. We add to these equations the inverse Mills ratio from the first non-linear step, in order to deal with selectivity bias problems. Third, we predict fiscal revenues for each observation within the sample, using the coefficient estimate in the second step, and compute DIFFREV.

¹⁴ Let us mention that as in Lee (1978), the actual fiscal revenue is also re-estimated through the structural approach and used to compute DIFFREV. Therefore, DIFFREV is in fact indirectly computed using actual observed values. This will be clarified in the following econometric section.

Finally, from our procedure we derive a non linear model which includes DIFFREV.

Due to our economic setting, unlike Lee (1978) and Brueckner and Follain (1988), we need to deal with unobserved heterogeneity. We allow unobserved time-constant municipal effects, which capture natural differences among localities, which are systematically related to municipal revenues. In so doing we follow Papke and Wooldridge's (2008) contribution to the bivariate models literature, by deriving a structural bivariate response model with fixed effects and endogenous covariates. Intuitively, we nest Brueckner and Follain's (1988) structural model¹⁵ within Papke and Wooldridge's (2008) procedure. As suggested by the latter, we use the Mundlack-Chamberlain device (along with a Probit function and Gaussian error) to take account of fixed effects.

In our setting, revenues may be correlated with time-varying unobservable characteristics and also municipal-level heterogeneity. Building a counterfactual a la Lee (1978), and computing differentials, should solve this problem. In any case, our procedure is sufficiently flexible to allow additional external instruments in both of the linear equations, note that they can be considered as exclusion restrictions, which may help to identify Lee procedures. Therefore we use the state grant allocated to municipalities as the excluded instrument in the fiscal revenues equations. Because of the four-step nature of this procedure, standard errors need to be adjusted regardless of the estimation method used; alternatively bootstrapping can be employed by re-sampling the cross-sectional units. Following Papke and Wooldridge (2008), we rely on bootstrapping in our empirical work. All the stages and related specifics are described in the next subsection.

¹⁵ The term structural captures the fact that we estimate the counterfactual value within the econometric specification using observed characteristics only.

4.2. Econometric approach

In the binary response contexts, the choice between logistic and probit conditional mean functions for the structural expectation is largely a matter of taste, although it is well established that the probit mean function has distinct advantages in relation to coping with the endogenous explanatory variables (Papke and Wooldridge 2008). Our econometric approach is as follows.

Under a non linear formulation (probit), fiscal cooperation choice is based on an index of the form:

$$\Omega_{i,t} = \beta X'_{i,t} + \eta_i - e_{i,t} \quad (1)$$

where $X_{i,t}$ is a matrix of the explanatory variables (discussed in detail in the next section) for observation i at time t , β is a coefficient vector, and $e_{i,t}$ is a standard normal error term. Cooperation is chosen when $\Omega_{i,t} > 0$, alternatively we are in the isolation case, η_i are time invariant effects that in our case are represented by Mundlack devices.

We start from a reduced form probit equation:

$$\Omega_{i,t} = \alpha Z'_{i,t} + \eta_i - w_{i,t} \quad (2)$$

where $Z_{i,t}$ is a matrix that contains all the covariates appearing in $X_{i,t}$ but not DIFFREV, η_i are Mundlack devices and $w_{i,t}$ is the idiosyncratic error term. Computing $\hat{\alpha}$ from (2) we can create the selectivity bias variables SBC and SBI as:¹⁶

$$SBC = \phi(Z'\hat{\alpha}) / \Phi(Z'\hat{\alpha}); \quad SBI = \phi(Z'\hat{\alpha}) / (1 - \Phi(Z'\hat{\alpha}))$$

These are two Mill's ratios that have to be added in the following linear equations (3a) and (3b), to be noticed that we are in panel fixed effect setting, therefore it is advisable to compute SBC and SBI in more than one step, the better way to proceed regressing (2) for each time period and then to construct the vectors SBC, SBI (Wooldridge, 1995):

$$REVCOOP_{i,t} = \lambda_{coop} X'_{i,t} + SBC_{i,t} + I_{i,t} + \pi_i - k_{i,t} \quad (3a)$$

¹⁶ SBC is selectivity bias cooperation; SBI is selectivity bias isolated.

This regression is made just on the subsample of municipalities that cooperate, $REVCOOP_{i,t}$ is the tax revenues per capita and SBC is an appropriate inverse Mill's ratio from (2).

$$REVISO_{i,t} = \lambda_{iso} X'_{i,t} + SBI_{i,t} + I_{i,t} + \pi_i - k_{i,t} \quad (3b)$$

This regression is estimated only on the subsample of municipalities that remain isolated, $REVISO_{i,t}$ is the tax revenues and SBI is an appropriate inverse Mill's ratio from (2). $I_{i,t}$ is our excluded instrument (municipal grant) which we consider is correlated with revenues but independent of the choice to cooperate (see the next section), π_i are fixed effect and $k_{i,t}$ the idiosyncratic error term.

We can then compute:

$$DIFFREV_{i,t} = \widehat{REVCOOP}_{i,t} - \widehat{REVISO}_{i,t} \quad (4)$$

Finally we regress Equation (1) as in Papke and Wooldridge (2008) adding $DIFFREV_{i,t}$ to $Z_{i,t}$ obtaining $X_{i,t}$, and bootstrap the whole procedure in order to obtain robust errors. In particular, we use a block bootstrap and resample over counties (“département”), in order to get cluster standard errors, which is recommended in our case. We are aware that in an economic setting of this kind observation could not be considered i.i.d.

To check the robustness of our econometric strategy, we estimate an alternative approach: a conditional logistic model with fixed effects, with the dependent variable $COOP$. In this alternative specification, we use the same covariates but substitute $DIFFREV_{i,t}$ by the variable $DIFFBTWCOUNT_{i,t}$, which is the difference between the actual values of the revenues for municipality i and a counterfactual value. We calculate this counterfactual value using the average fiscal revenue of those municipalities belonging to the same county (or “département”), that made the opposite choice made in i .

More specifically, if s denotes neighboring municipalities in the same county, DIFFBTWCOUNT_i is computed as follows:

- If i is isolated, $\text{DIFFBTWCOUNT}_i = E(\text{REV}_i - s \mid \text{COOP} = 1) - \text{REV}_i$
- Otherwise, if i cooperates, $\text{DIFFBTWCOUNT}_i = \text{REV}_i - E(\text{REV}_i \mid \text{COOP} = 0)$

In order to avoid simultaneity problems, tax differentials are one period time lagged.

4.3. Covariates and instruments

Given the nature of our spatial framework, we rely on specific covariates. Fiscal revenues (explained in Appendix 1) - our main variable of interest - is a complicated linear combination of different tax bases, different tax rates, municipal and inter-municipal grants. To avoid collinearity, we choose to focus on the broad value of fiscal revenues.

Since fiscal revenues may be correlated with time-varying unobservable characteristics, we need to find an appropriate instrument. Following Papke (2005) and Papke and Wooldridge (2008), we identified the state grant allocated to municipalities as an appropriate instrument since it forms part of the local revenues always levied by the municipality regardless of the decision to cooperate or not. This leads to $E(I_{i,t} \mid e_{i,t}) = 0$ and ensures a positive correlation between $I_{i,t}$ and $Z_{i,t}$.

As already discussed, we include another explanatory variable as a spatial smoother, that is, the share of localities that cooperate within the same county (“département”). Since cooperation decision is strongly dependent on what neighbors decide, we expect a positive sign on the parameter associated with this variable. By law, an inter-municipal community must include contiguous localities. If no neighbors cooperate, the probability of joining an inter-municipal community will be lower than if close neighbors already cooperate. Moreover, we can expect some mimicking behavior from local officials in terms of cooperation, on the grounds that it may be stigmatizing to

remain isolated when most neighboring localities have signed an intergovernmental agreement. Citizens/voters may become aware of new public services provided by a community (e.g. public transport, cultural and sports facilities) and may put pressure on their local government to join the community.¹⁷ Officials might be aware also that remaining isolated from an existing close community (which provides a range of good public services to firms and households) could lead to capital flight from the territory. Tax base mobility can explain the propensity of officials to imitate the cooperation decisions of neighbors.¹⁸ It is likely also that municipalities, when deciding whether or not to cooperate, will mimic neighbors' behavior following the trend suggested by Manski (1993). We can expect also that information on cooperation (expected revenues, expected state grant, etc.) will be more easily obtained by an isolated municipality that is located next to a group of cooperating municipalities. Mimicking behavior related to cooperation is likely to be observed in this context. The literature on local fiscal decision-making provides extensive developments on this kind of spatial spillover and its identification (Brueckner, 2003). Since we need a spatial smoother, we compute the share of municipalities, within the same county, that have made the decision to join an inter-municipal community.¹⁹ Since, by definition, a previous decision to cooperate in a neighboring municipality is exogenous, we lag this variable by one period with respect to our dependent variable.²⁰

Finally, drawing on the literature on local public finance, we include some socio-economic characteristics of the municipalities:

¹⁷ The argument is similar to yardstick competition models (Salmon, 1987; Besley and Case, 1995) where incumbents imitate the public decisions of their neighbors to stand for reelection.

¹⁸ This is a tax competition argument.

¹⁹ An alternative approach would be to find appropriate instruments to cope with this new endogeneity problem. Future research should address this problem.

²⁰ Di Porto and Revelli (2011) show that a time lagged spatial smoother can be considered a valid predictor of the actual spatial smoother and using one or other does not lead to hugely biased estimates of spatial spillover.

- municipal population and population density. Their respective expected sign is ambiguous. First, we can expect a positive sign since the larger the population of the municipality, the greater will be local public needs and the public goods spillovers on the neighboring localities. In order to reduce free riding behavior from citizens who do not live in a city but benefit from its public good provision, the municipality will have an incentive to share or to transfer some competences and the associated supply of services, to the inter-municipal group. Second, we could also expect a negative sign given that bigger municipalities, which are usually richer cities, do not need to collaborate to deliver public services.
- the unemployment percentage and the share of people in the municipality i who are more than 60 years old. The expected impact of these variables on the probability to cooperate are positive. If existence of a community is seen as a solution to sharing or transferring the supply of specific services to these categories of the population, we should observe a positive impact.

Although local politics is an important issue in empirical work on consolidation within Northern European countries (Sorensen, 2006; Saarima and Tukiainen, 2010; Moisio, 2012), for various reasons, we do not include any political variables. For example, since more than 80% of our municipalities are very small (less than 2,000 inhabitants), many French mayors do not have political affiliations and do not want to be associated with a particular political party. Moreover, unlike the situation in Finland following a merger, the French municipalities continue to exist as entities after joining an inter-municipal body, and there are political consequences of cooperation in the French case. However, there is no doubt that the political affiliation of the elected president of the inter-municipal council (elected by members of the inter-municipal council former members of participating municipal councils) can have an impact on the decision of an isolated municipality to join. A positive decision to join a community will be more likely if the president of the inter-municipal council belongs to the ruling party in the municipality. Unfortunately, we cannot test this

hypothesis.

Data sources are presented in Appendix 2 and summary statistics in Table 1 in Appendix 2.

5. Results

Estimation results of the fiscal revenues equations are shown in Table 2.

TABLE 2. Structural Bivariate Response Model and Conditional Logistic Regression

Dependent Variable: COOP	Structural bivariate response model without fixed effect	Structural bivariate response model with fixed effect	Conditional fixed effect logistic model
	(1)	(2)	(3)
DIFFREV	-6.501*** (.856)	70.839*** (12.988)	
DIFFBTWCOUNT (t-1)			4.754*** (.484)
Share coop. in department (t-1)	2.084*** (.112)	3.134*** (0.401)	1.287** (.674)
Unemployment (%)	4.015*** (1.084)	-24.507*** (8.406)	16.106 (14.628)
Population	-.000*** (3.90e-06)	-.001*** (.0001)	-.001* (.000)
Density	.000*** (.000)	.000*** (0.000)	.000 (.000)
Old pop. (%)	-1.850*** (.277)	-11.689*** (6.025.)	.742 -7.757
Year dummies	YES	YES	YES
FE	NO	YES	YES
obs.	202,146	202,146	202,146

Note: for every model we report coefficients and standard error. Model (1) and (2) show bootstrapped standard errors, 300 replications were performed, model (3) report robust standard errors

The inverse Mill ratio coefficients in Table 2 (SBC for cooperating localities in column 1 and SBI for isolated localities in column 2) both exhibit a positive sign. As stated by Lee (1978), the selection effect needs not to be positive or negative. Moreover, in a panel case, it is difficult to theoretically predetermine the sign of the selectivity parameters.

In Table 3, columns 1 and 2 present the estimation results of the structural bivariate response model without and with effects respectively.²¹ The estimation results of the conditional fixed effects logistic model are presented in column 3.

TABLE 3. Fiscal Revenues Equations

Dependent variable: Fiscal revenues p.c.	Fiscal revenues equation	Fiscal revenues equation
	cooperative municipalities (1)	isolated municipalities (2)
Unemployment (%)	1.067*** (0.133)	0.420*** (0.092)
Population	.000** (3.48e-06)	6.23e-07 (8.92e-06)
Density	-.000** (4.64e-07)	-.000** (1.93e-07)
Old pop. (%)	0.667*** (0.088)	0.343*** (0.045)
SBC	0.029*** (0.005)	
SBI		0.029*** (0.001)
I	0.000*** 6.38e-06	-3.78e-06 (4.11e-06)
year dummies	YES	YES
FE	FE	YES
obs.	112,098	118,050

Note: for every model we report coefficients and standard error

²¹ For simplicity, we do not comment on the estimation results shown in column 1 since fixed effects need to be taken into account.

Column (2) shows that the parameter associated with DIFFREV is strongly significant and positive, suggesting that *municipality fiscal revenues are relevant for the cooperation decision*. However, to understand this positive sign, we should consider two possible alternative cases based on the sign of DIFFREV.

Let us first consider the case where the value of DIFFREV is positive, meaning that deriving from Equation (4), a municipality receive (or could receive) a higher fiscal revenue within an inter-municipal jurisdiction. The positive sign of the parameter of DIFFREV confirms that this municipality has a positive probability to join (or to remain a member of) an inter-municipal jurisdiction. Therefore, we confirm *that a positive difference between the expected fiscal revenues raised by a cooperating locality and the actual revenues of an isolated locality significantly increases the probability to join an inter-municipal community*. Moreover, a cooperating municipality, which predicts that its fiscal revenue will fall if it leaves the community, will have a higher probability of staying a member of the inter-municipal jurisdiction. Most municipalities probably see inter-municipal cooperation as an efficient solution to increasing fiscal revenues and improving the quality and completeness of the supply of public services to their residents.

Conversely, if the value of DIFFREV is negative, i.e. *when a municipality gets a higher fiscal revenue by remaining (or becoming) isolated, the propensity of this locality to cooperate becomes negative*. This outcome perfectly explains why a rich isolated locality will have a lower incentive to conclude an inter-municipal agreement with its relatively poorer neighbors. We confirm that when cooperation is welfare enhancing for a set of localities (through new financial incentives) but leads to losses for one “rich” municipality (due to the transfer of previous achieved tax revenues to the inter-municipal level) it is unlikely that this locality will cooperate.

The estimation results for the conditional fixed effects logistic model (column 3) confirm the robustness of this outcome since we have a positive coefficient of DIFFBTWCOUNT. Higher (corresp. lower) fiscal revenues p.c. raised through cooperation significantly increase (corresp. decrease) the probability to conclude an agreement.

Next, we turn to interpretation of the parameter for the impact of neighbors' cooperation behavior on the decision-making behavior of local officials; this has a highly significant positive sign. As expected, this suggests that the cooperation choice of neighboring municipalities is extremely relevant for the cooperation decision. *A municipality will be more inclined to join an existing community if its neighbors have already joined an inter-municipal jurisdiction.*

As explained in subsection 4.3, there are many possible explanations for this result. Given that it might be stigmatizing to remain isolated when most neighboring localities have concluded an intergovernmental agreement, local officials may adopt some form of mimicking behavior related to cooperation. As argued in the yardstick competition literature (Salmon, 1987; Besley and Case, 1995), citizens/voters may be aware of additional public services provided within a close community and may put pressure on their authority to join a community. A tax competition argument based on potential mobility of the tax base might also explain this propensity to be influenced by the decisions of neighbors. Officials are aware that staying outside an existing community that provides a high level of public services to firms and households might lead to capital flight from the territory.

Finally, the remaining covariates based on socio-demographic characteristics have the expected positive signs for the parameter associated with density (although not significant in column 3), suggesting that high population density may be an incentive for the municipality to transfer some competencies to the community level in order to achieve the expected economies of

scale in the provision of public goods. Moreover, in order to reduce free riding behavior from citizens who do not live in a city but benefit from its public good provision, the municipality may have an incentive to share or to transfer some competences and the associated supply of services, to the inter-municipal group. Finally, somewhat surprisingly, the respective coefficient of the population variable, unemployment and share of old people, is negative or not significant. In all cases, we cannot reject the possibility that endogeneity may be biasing the estimation results.

6. Concluding remarks

Cooperation among local governments has been encouraged to enable the aggregation of resources and improved public sector efficiency. However, if cooperation through the joint delivery of local public services is likely to be welfare enhancing for the agglomeration, but will lead to losses for one of the parties, it is unlikely that the losing municipality will cooperate voluntarily. Inter-governmental cooperation involving municipalities administering some local public services is likely to imply new state grants and tax revenues. This paper explores the role of fiscal revenues in the decisions of local authorities to cooperate. We discuss some theoretical considerations related to local cooperation decision from cooperative game theory. Next, using a unique panel dataset of 30,000 French municipalities for 1995-2003, we estimate the relationship between cooperation decision-making and fiscal revenues. Due to the particularity of our economic framework, we employ a non-linear estimation with fixed effects and endogenous covariates to develop a novel applied econometric strategy. Thus, we contribute to the very small literature that deals with cross sectional dependence in practice. We find evidence that municipalities' fiscal revenues are relevant to cooperation decision. A positive difference between the expected fiscal revenues of a cooperating locality and the actual revenues realized by an isolated locality significantly increases the probability of joining an inter-municipal community. Conversely, if the municipality would receive

a higher fiscal revenue by remaining (or becoming) isolated, the propensity of this locality to cooperate becomes negative. Finally, our estimation results show that a municipality will be more likely to cooperate if the neighboring municipalities are members of the inter-municipal jurisdiction.

However, further research should be done to enhance our understanding of the determinants of fiscal cooperation. Cooperation is a complex process involving different levels of cooperative behavior. In the French context, municipalities can opt for a single business tax regime, an additional tax regime or a mix of the two. The determinants of each choice may differ and require investigation.

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Appendix 1. Fiscal Revenues

In this appendix, we try to explain to what extent, in the French case, municipal fiscal revenues are modified once the local authority has concluded a cooperation agreement. These revenues depend on the tax regime which has been chosen by the community (single business taxation or additional taxation). When a municipality is isolated, it receives a state grant, based on several criteria (but mainly population). When a municipality enters an inter-municipal community, it still receives the same central grant (to the same amount as long as municipal population remains the same) but the community receives an extra state grant to supply joint local public services.²² In what follows, for the sake of simplicity, we assume that all municipalities that are part of the same community, receive the same per capita proportions of this state grant.

²² This extra central grant is also based mostly on population (within the community) and also on the number of competencies delegated by municipalities to the inter-municipal government, and is paid annually as long as the inter-municipal community exists.

If a municipality is not part of a cooperation agreement as described above, we denote t_i^m , as the tax revenues on households in municipality i , T_i^m the business tax revenues in municipality i , g_i^m the state grant for municipality i , p_i^m the population in locality i . Then the municipal fiscal revenue p.c. can be written:

$$B_i^m = (t_i^m + T_i^m + g_i^m) / p_i \quad (1)$$

If the municipality i has joined an inter-municipal group I , which has chosen an additional tax regime (both levels of government set a business tax rate on the same tax base), its potential fiscal revenue p.c. becomes:

$$B_i^{m'} = (t_i^{m'} + T_i^{m'} + g_i^m) / p_i + (t_i^a + T_I^a + G_I^a) / p_I \quad (2)$$

where T_I^a is the local business tax revenue raised by the community I , G_I^a the state grant attributed to the community I and p_I the population in community I . The community now has a formal source of tax revenue with $(t_i^a + T_I^a + G_I^a)$. For the isolated cases, there may be variations in the business tax revenue and the household tax revenue raised by the municipality. We denote these new revenues $t_i^{m'} + T_i^{m'}$. Let $R_i^{m'}$ be the amount of tax revenues raised within municipality i for its own budget, and R_I the amount of fiscal revenues raised within municipality i for the community's budget. Assuming that the benefits of cooperation are equally distributed among community members, the potential fiscal revenue p.c. can be rewritten as

$$B_i^{m'} = R_i^{m'} / p_i + R_I / p_I \quad (3)$$

If the municipality i has joined a community with a single business tax rate (where the municipality no longer sets a business tax rate), its potential fiscal revenue can be written:

$$B_i^{m''} = (t_i^{m''} + g_i^m) / p_i + (T_I^s + G_I^s) / p_I \quad (4)$$

where T_I^s is the local business tax revenue raised by the community I , G_I^s the state grant attributed to the community I and p_I the population in community I . The community now has a formal source

of tax revenue with $(T_i^s + G_i^s)$. With regard to the isolated cases, the only possibility is for the municipality to tax households only. We denote these new revenues by $t_i^{m''}$. Let $R_i^{m''}$ be the amount of tax revenues raised within municipality i for its own budget, and R_i'' the amount of fiscal revenues raised within municipality i for the community's budget. Assuming that the benefits of the cooperation are equally distributed among community's members, the potential tax revenue p.c. can be rewritten as²³

$$B_i^{m''} = R_i^{m''}/p_i + R_i''/p_I \quad (5)$$

APPENDIX 2. Data

Our dataset includes 36203 municipalities observed over 8 years (1995-2003). Our dataset is a balanced panel. For convenience, we develop our regressions excluding the municipality of Paris which is a clear outlier, and the Corsican municipalities for which a spatial matrix (W) is difficult to construct.

Fiscal data are from the Direction Générale des Collectivités Locales (DGCL, Ministère de l'Intérieur) and were provided by INRA-CESAER (Dijon). The remaining control variables are taken from the Centre Maurice Halbwachs.

Table 1 shows summary statistics, mean standard deviation and maximum of the main covariates used in the regressions

²³ There is a third marginal case – a mixed case- where the community raises a single business tax rate T_i^s and an additional tax rate on households t_i^s . The community gets double tax revenue on households and business $(t_i^s + T_i^s + G_i^s)$ while the municipality i only sets a tax on households. The municipal tax revenue can be written as $B_i^{m''} = (t_i^{m''} + g_i^m)/p_i + (t_i^s + T_i^s + G_i^s)/p_I = R_i^{m''}/p_i + R_i''/p_I$

TABLE 1. Summary statistics

1995-2002	COOP	Fiscal Revenues p.c.	Unemployment %	Population	Density	Old People %
Mean	.483	.254	.043	1766.253	823.776	.235
Standard deviation	.499	.314	.019	8097.353	3988.969	.081
Minimum	0	0	0	5.014	.364	0
Maximum	1	12.552	.333	455134	199163.9	.999