The role of social capital components on local economic growth: Local cohesion and openness in French rural areas

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Summary – *This paper investigates empirically the economic role of some sociological factors, such as the intensity and nature of local social relationships, on economic growth in rural areas at the micro level. We use the bonding/linking/bridging classification suggested in the social capital literature (Putnam, 2000; Woolcock, 1998). Bonding links consist of strong linkages between similar people, which ensure the stability of relationships, but tend to lead to inertia and closure. Bridging links are weak ties that often lead to valuable new opportunities. Linking social capital is an intermediate category that consists of links between people from different social categories. This form of social capital favors both stability and openness. We use French data to examine these three forms of social capital within a local population and employment growth model inspired by Boarnet (1994), and to evaluate their impacts on local economic growth. The results suggest that all three forms of social capital have a robust and positive role on change in rural population and employment.*

Keywords: *social capital, rural economic development, population and employment growth*

Rôle du capital social sur les composantes de la croissance économique locale : cohésion et ouverture dans les zones rurales françaises

Résumé – Cet article étudie empiriquement le rôle économique de certains facteurs sociologiques, tels que l'intensité et la nature des relations sociales, sur la croissance économique locale à un niveau fin. Il utilise la classification *bonding/linking/bridging* utilisée dans la littérature sur le capital social. Le *bonding* se manifeste par des liens forts et locaux qui garantissent la stabilité de l'environnement, mais peuvent aussi engendrer de l'inertie et de la fermeture. Le *bridging* consiste en des liens plus lâches, mais qui peuvent donner accès à des opportunités nouvelles. Le *linking* est une catégorie intermédiaire qui comprend des liens reliant des individus de milieux sociaux différents. Cette dernière forme de capital social combine les vertus de stabilisation et d'ouverture. Les trois formes de capital social font l'objet de construction d'indicateurs, qui sont ensuite introduits dans un modèle économétrique de croissance de population et d'emploi inspiré de Boarnet (1994), pour évaluer leur impact sur la croissance locale. Les résultats suggèrent que les trois formes de capital social ont un effet positif et robuste sur la croissance.

Mots-clés : capital social, développement local, croissance de la population et de l'emploi

JEL descriptors : A13, R11, Z13

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1. Introduction

This paper investigates the role of some sociological factors on local economic growth, in terms of rural employment and population dynamics. It focuses on the notion of 'social capital', which translates the idea that social relationships and social norms may give access to valuable resources that can improve the welfare of individuals (Fafchamps and Minten, 2002), of households (Narayan and Pritchett, 1999), of communities (Bowles and Gintis, 2002) or even of regions or nations (Zak and Knack, 2001). The "social capital" concept attempts to synthesize the various effects of sociological factors on economic welfare, although there is no consensus on how the latter should be defined and measured.

The fact that social relationships have a significant impact on individual economic success has a sound theoretical and empirical basis (Granovetter, 2005), but at the aggregate (for instance, regional) level, things are much more complicated. In issues related to regional economic development, the role of sociological factors is much less clear (Durlauf and Fafchamps, 2005). However, it is of significant theoretical and empirical interest because regional policies are more and more often based on "bottom-up strategies", in which local organization is considered an asset for regional development.

Although intuitive, the notion of social capital is difficult to define, particularly at aggregate levels. In this paper, we use the definition proposed by Nan Lin (2001), which is both clear and rigorous and states that social capital consists of the: "*resources embedded in a social structure, which are accessed/mobilized in purposive actions*". Lin's definition focuses on the individual level, which makes it easier to relate social capital to economic phenomena. It also highlights the ambiguous nature of social capital. Indeed, at the regional level, some forms of (individual) social capital may reduce (aggregate) efficiency. The best-known problem here is moral hazard: Knowing that I will be helped in the case of dire need, I will have no incentive to behave in the most productive way. Moreover, social capital may have positive short run effects in protecting people from the economic shifts, but these may lead to significant lag in productivity in the long run. Last but not least, collective organization may resonate with collusion and exclusion. A particular group may maximize the interests of its members at the expense of the rest of the society, leading to a negative net effect. For example, Shortall (2004) warns against the negative overall effects of some "bottom-up" policy approaches.

Consequently, social capital cannot be reduced to a single component with a universal effect. According to Ronald Burt (2000), (individual) social capital has two main components, related to its two main virtues, which are, first, to stabilize the environment of agents, ensuring more secure deals, thus fostering collective action and enhancing trust more generally. The second virtue is related to providing new resources that are not easily accessed by markets. These resources consist of information on technologies, matching partners and so on. Ronald Burt labels this component "structural holes", *i.e.* non-redundancy of networks.

At the regional level, Putnam (2000) and others suggest distinguishing between two mechanisms of social capital: a cohesive component (bonding) and an openness

component (bridging). These are roughly similar to Burt's distinction between cohesion and structural holes, the former corresponding to strong social links between similar people and the latter referring to "cross-cutting ties", *i.e.* weaker links connecting people from different social circles. Some authors have also suggested a third category, called "linking social capital" (Woolcock, 1998). While bonding social capital consists of strong local links between individuals of similar status, linking social capital refers to links between individuals who have complementary ("horizontal differentiation") and especially hierarchical ("vertical differentiation") relative positions, generally viewed in terms of social categories. This category was introduced to take account of institutional aspects and power relationships. The "linking" concept deals with those cases in which both cohesion and diversity are at play. It represents another form of social openess that can be related to Mark Granovetter's notion of the "strength of the weak ties". Linking social capital encompasses the links that connect individuals from different social categories, and have significant influence based on geographical proximity. Thus, in terms of economic mechanisms, it is an intermediate category of social capital between bonding and bridging.

Despite much theoretical controversy about the nature and definitions of the components of social capital, work is needed on providing empirical measures of social capital and evaluating their role on macroeconomic development. In an extensive review of the empirical literature, Durlauf and Fafchamps (2005) focus on measures of the "cohesion" component of social capital while Rauch (2001) exploits data on ethnic networks, across countries. However, based on Burt's findings, the "openness" (bridging) aspect is essential, and is often the factor limiting the positive effects of social capital. A few studies introduce both aspects, such as Beugelsdijk and Van Shaik's (2005) European regional NUTS 1 level analysis, or Callois and Aubert's (2007) analysis of French regional data. However, despite the body of work on the role of social capital on economic development (Grootaert *et al.*, 2002), to our knowledge, none of it introduces the "linking" category or tries to measure the impacts of the three components on local development simultaneously.

This paper studies how these three components influence the growth of population and employment in French rural areas, exploiting a regional development model based on Boarnet's (1994) strategy. A focus on rural areas is interesting because they are generally seen as more conservative than urban areas. Thus, their sociological characteristics could be stabler over time. In addition, much of the political discourse and academic studies in Europe and the US consider that rural development can be enhanced by local cohesion and local identity (*e.g.* Shortall, 2004 ; Carpenter *et al.*, 2006 ; Cochrane and Wojan, 2008 ; Dwyer and Findeis, 2008). The wide variations in the levels of local cohesion across rural communities (especially in France), make rural communities an interesting case for testing the relationship between sociological characteristics and economic development.

The definition and measures of bonding, linking and bridging in the remainder of this paper have been adapted to the characteristics of rural areas. Bonding is defined by the intensity of the social norms linked to collective action, and the density of the social links in small areas. Due to the unavailability of other types of indicators at a local level, we measure only one aspect of bridging social capital: the links between previously local

inhabitants who, as a result especially of migration to an urban community, now live in a distant area. Indeed, for rural areas, which may lack diversity, outer linkages are a key source of bridging social capital. Linking social capital is measured by the intensity of the relationships among individuals living in the same area (*i.e.* geographically close), but with different social status. The variables are constructed based on data from several French datasets and introduced in the simultaneous equation model suggested by Boarnet (1994) to test the impacts on local changes in population and employment. Our spatial econometric model is estimated adapting instrumental variable methods. According to the econometric issues emphasized by Manski (1993) and Durlauf and Fafchamps (2005), we test for exogeneity in social capital variables and deal with potential endogeneity where necessary.

The results of our estimations show that the three categories of social capital do play significant and positive roles in employment growth, and that none of these categories is reducible to any other. They provide evidence of complementarities between bonding and bridging social capital and suggest that, because it assesses the strength of the ties between individuals in different categories, "linking" could be the most efficient social capital component for stimulating employment growth. We find that the role of bonding social capital in local population change is more ambiguous (either non significant or even negative) while bridging and linking social capital seem to have significant and positive impacts on population change.

The rest of the paper is organized as follows. Based on a discussion of their conceptual definition, section 2 describes how we build the set of indicators used to measure the different forms of social capital at the regional (local) level. Section 3 presents a regional development model including the social capital variables, corresponding econometric issues and the data. Section 4 presents the results of the estimations and section 5 discusses these results and provides a conclusion.

2. Measuring three components of social capital: 'bonding', 'bridging' and 'linking' indicators

We have suggested above that only a multidimensional view of social capital can reveal the effects of sociological factors on local economic growth. This section proposes a set of indicators of bonding, linking and bridging social capital. It should be noted that our econometric study focuses on French rural areas at the level of "*bassins de vie*" (INSEE, 2003), which is based on statistical criteria combining two requirements. First, "*bassins de vie*" must be integrated with regard to services to population. Most of those services regarded as "basic" for the population are available within the particular *bassin de vie*. Second, areas must be integrated with regard to commuting: Most inhabitants of a *bassin de vie* work inside it. This geographical scale, therefore, mixes both economic and sociological aspects.

2.1. Bonding social capital: Cohesion and the propensity to co-operate

There are two aspects to bonding social capital – the intensity of the social norms linked to collective action, and the density of social linkages. This is because the effects of bonding social capital may stem from two very different kinds of sociological

mechanisms. First, cultural predisposition eases co-operation by reinforcing trust, reciprocity and collective identity. Second, co-operation can be achieved through social control, which prevents opportunistic behavior. These two sub-components of bonding social capital are referred to respectively as "*cognitive*" and "*structural*" social capital (Uphoff, 1999). Clearly, they may reinforce one another, but also one can exist without the other [1]. Moreover, they do not evolve within the same time scale. Cultural predispositions provoke high levels of inertia. They are built slowly and decay slowly. Social control, on the other hand, may be achieved quickly, although it cannot work without a degree of cultural predisposition. That these two forms are not necessarily closely correlated implies that they need to be distinguished in empirical studies. For instance, Bjørnskov (2006) contends that cognitive social capital is the key component of social capital and (positively) affects governance and life satisfaction [2]. Therefore, we need two types of indicators: indicators of trust, reciprocity or identity (cognitive social capital), and indicators of social network density (structural social capital).

For **cognitive social capital**, previous empirical studies use indicators of trust and civic values, from such databases as the World Values Survey or the European Values Survey (Zak and Knack, 2001). Some use number of blood donors as an indicator of reciprocity, and electoral turnout as an indicator of civic values (Guiso *et al.*, 2004). Unfortunately, apart from information on electoral turnout, these are not available in France at the local level we are analyzing here. An alternative indicator of trust, used successfully by Callois and Aubert (2007), will be called "phonebook trust indicator". It is obtained by dividing the number of entries in the phonebook by the number of households as recorded in census data [3]. This approximates for the share of households with an entry in the phonebook. In place of blood donors, we use data on gifts to charity although, unfortunately, these are available only at *département* level, which is one administrative and political unit higher than *bassins de vie*.

Cognitive social capital indicators are more easily derived for the agricultural sector. Despite its low share in local employment, the agricultural sector continues to have a strong influence on rural areas in France, in particular because it uses 54 % of the whole French territory. It also has many linkages with other economic sectors (food industry, transportation). Moreover, because of its historical importance, it is still influent even among the non-agricultural population. That is why we consider two

[1] The fact that there may be social control without social norms dictating co-operation is easy to accept and the opposite would perhaps be more surprising. However, a study by Hofferth and Iceland (1998) suggests that norms of reciprocity can survive long after social circles have changed.
[2] Some authors include institutional aspects in social capital. *E.g.*, Collier (2002) distinguishes civil (informal) and governmental (formal) social capital. We do not address this issue for three reasons. First, it is difficult to build indicators for formal institutions at the local level; second, formal institutions are quite homogenous in France; third, much more theoretical research is needed to understand the relationships between sociological and institutional aspects.
[3] The idea behind the "phonebook indicator" is that people who do not want their names entered in the directory either dislike social contact or distrust other people. Of course, there may be other reasons that are unrelated to social capital (*e.g.* not wanting to be bothered by cold callers). Because all our indicators suffer from similar biases we use Principal Components Analysis (PCA) to extract the common factors among them.

agricultural indicators, which potentially could provide interesting results. First, a simple indicator of intensity of co-operation among farmers for agricultural equipment, which is the ratio of number of farms belonging to a CUMA [4] to the farming land area. The second is an indicator for share of farms producing under agrofood quality labels. Producing labeled products implies some degree of organization among farmers in order to build a common advertising strategy, to define a common production process, and so on. Of course, there is no guarantee that co-operation in agriculture should spill over to other sectors, although social norms are generally considered very stable in a given area (Putnam, 2000).

Another proxy for cognitive social capital is based on formal co-operation among municipalities. French municipalities are being encouraged to pool increasing shares of their fiscal resources in order to provide local public services more efficiently. A tax integration indicator that measures the share of fiscal resources pooled across municipalities can be built. The validity of this indicator is based on the assumption that the co-operative behavior of local politicians reflects the behavior of the whole population. Again, this is a very specific indicator, and there is no guarantee that strong co-operation among politicians will be correlated with co-operation in the population in general.

In terms of **structural social capital**, the most widely used indicator in the social capital literature is association membership [5]. Although the existence of voluntary organizations is supposed to be declared to the French administration, it is poorly accounted for in official national statistics. For instance, recording an association is only compulsory if it employs at least one worker, and the dissolution of associations is often never registered. Despite these limitations, we use this indicator, scaled by total population. We also use the number of bars ("cafés") *per capita* as a proxy for social relationships. A high number of bars may indicate strong desire for social relationships. However, just the presence of a bar does not provide information on number of customers. We assume that the presence of at least one employee indicates a minimal level of activity or/and profitability. Thus, we only consider bars with at least one employee. Similar considerations led us to use densities of sports and of cultural facilities as indicators of structural social capital [6]. Because the resulting indices may only be proxies for population density, even when normalized by population, the final indicators are the residuals of a regression of each index on population density. Furthermore, to avoid potential multicolinearity between many different kinds of sports and facilities, we constructed a synthetic index using PCA [7].

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[4] The CUMA ("*coopérative d'utilisation de matériel agricole en commun*") is a cooperative enabling use of shared agricultural equipment.

[5] Note that Putnam uses associations as indicators of bridging social capital (*e.g.* bowling centers where people with diverse background meet). However, we argue that in the case of rural areas, associations are really an indicator of bonding, because they connect similar people (first, because people are more similar in rural areas, second because associations are generally created on a voluntary basis by people with common interests and are seldom open to others).

[6] These variables include number of football/rugby pitches, tennis/basketball courts, sports centers, sports associations, socio-cultural centers, folk groups, vocal groups, and instrumental groups.

[7] Because we perform PCA (principal component analysis) and use the position of each observation on axis 1 to obtain both indicators, the means of the corresponding variables in Table A.1 in the Appendix equal zero.

Table 1. **Indicators of bonding social capital**

Class	Indicator	Proxies for	Calculation	Sources
Cognitive	Phonebook	Trust	# phone numbers on phonebook / # households	France Télécom (2004), 1999 census
	Charity gifts	Reciprocity	Share of households having a fiscal deduction for charity gift	Ministry of finance (2001)
	CUMA	Co-operation (agriculture)	Farms using a CUMA / farming area	1988 Agricultural census
	Agr. quality labels	Co-operation (agriculture)	# agricultural labels / # farms [a]	2000 Agricultural census
	Tax integration	Co-operation (politics)	Share of taxes pooled between municipalities	Ministry of interior affairs (2001)
Structural	Associations	Formal sociability	# registered associations (with employees) / population (thds)	1999 SIRENE file, 1999 population census
	Bars per capita	Demand for sociability	# bars (with at least one worker) / population (thds)	1992 UNEDIC data, 1990 population census
	Sport facilities	Demand for sociability	Index constructed by PCA from the number of different facilities (axis 1, see text)	1988 municipal inventory, 1990 population census
	Cultural facilities	Demand for sociability	Index constructed by PCA from the number of different facilities (axis 1, see text)	1988 municipal inventory, 1990 population census

Note: [a] When a farm has several labels, it is counted several times, which is why the indicator may be higher than 1.

Table 1 summarizes the computation and sources of our bonding indicators. It distinguishes cognitive and structural social capital. However, we can assume that all such indexes are highly correlated and are likely to produce multicolinearity problems in an econometric approach. Thus, after testing the proper role of each indicator, we perform a PCA to summarize the corresponding information by independent variables.

2.2. Linking social capital: Links of intermediate strength connecting different categories

Linking social capital is based on stable relationships (but which are not as strong as required for bonding social capital) that connect individuals of different social status. This type of social capital, therefore, is associated with both virtues of social capital, viz. stability and openness/diversity. Thus, the challenge is to measure the intensity of contacts between people belonging to different social categories.

There are two measurable phenomena that might indicate a high degree of linking social capital. First, in areas where different social categories coexist closely, inhabitants should have higher linking social capital than in areas where the social

categories are spatially segregated. Second, areas with high levels of intraregional migration might display stronger relationships between social groups because local population is mixed through short-span migration.

Measuring local coexistence of different social categories is similar to measuring spatial segregation. The two main ways of constructing a spatial segregation index are by dissimilarity and interaction indexes which can be expressed as (Duncan and Duncan, 1955):

$$Dissimil\ i = \frac{1}{2}\sum_{k=1}^{K}\left|\frac{a_k}{A_i} - \frac{b_k}{B_i}\right| \qquad Interact\ i = \frac{1}{A_i}\sum_{k=1}^{K}\frac{a_k b_k}{a_k + b_k} \tag{1}$$

where index k sums over all elementary units (i.e. municipalities) inside the unit i (*i.e.* "*bassins de vie*"). a_k and b_k respectively are the numbers of people belonging to the two categories in elementary unit k, and A_i and B_i are the sums for the regional unit i. Both indices are comprised between 0 and 1. Whereas *Dissimil* increases with segregation, it is the reverse for *Interact*.

We compute the interaction index for two options, *i.e.* comparing people without a degree with people with a college degree, and comparing workers *versus* executives. We found that both variables are strongly correlated (r = 0.91), and give similar results in the econometric estimations. For this reason, we use only one of them, *i.e.* comparing individuals by level of education.

Second, we use an "Internal mixing" indicator, which measures the intensity of internal migrations inside the local unit i (*i.e. bassin de vie*):

$$Mixing_i = \sum_{k \neq k'} M_{kk'} / P_i \tag{2}$$

where indices k and k' sum over all elementary units (*i.e.* municipalities) inside unit i. $M_{kk'}$ is the number of migrants from unit k to unit k' during a given period $[t-1,t]$, and P_i is the population of unit i in period t. We computed this indicator using population census data, which provides information on the location of individuals at the time of the current and previous censuses.

2.3. Bridging social capital: Openness and access to external opportunities

The part of bridging social capital we want to measure consists of the long distance links that bring information and new opportunities to local population and local economy. We assume that bridging social capital could be realized by people, able to forge linkages between rural areas that we are analyzing and the rest of the country. For reasons of data availability, we focus on two mechanisms for measuring the bridging component of social capital: migration flows to or from urban areas, and political networks [8].

[8] Business networks are sometimes considered a form of (bridging) social capital. Business relationships among regions may influence investment decisions significantly. In particular, business networks are expected to play a major role in international trade (Rauch, 2001). They will also be important at the regional and inter-regional levels. This form of social capital is not included in the present study: In addition to the difficulties involved in building the relevant indicators, these relationships are clearly not "pure" social relationships. Thus, it would be difficult to disentangle the effect of social capital from the effects of market or investment relationships.

First, (inward or outward) migration flows, to or from urban centers, can connect people with different backgrounds. Outward migrants remain in touch with former friends while at the same time accumulating new experience (and perhaps wealth), outside the rural area. Inward migrants contribute to the rural areas by the knowledge they bring with them, and also continue to keep in touch with friends and acquaintances from the urban areas. The building of bridging social capital (*i.e.* resources) based on migration requires three elements: flows of migrants, the existence of valuable resources outside the area (information, knowledge or simply help), and the activation of these resources (which requires the incomers to be socially integrated into their new place of residence) [9].

We can compute a "migration bridging" indicator as follows. Suppose that the most valuable resources are located in urban centers. This assumption is motivated by empirical and theoretical research on agglomeration processes, and the role of agglomeration on innovation (Rosenthal and Strange, 2005). For each regional unit i, and each urban center j, an "access to outside resources *via* migrants" index can be defined as the product of three factors:

– migration rate, computed as the share of urban center inhabitants in the most recent census (time t) who formerly resided in region i according to the previous census (time t–1) ;
– level of resources in the urban centre, which is taken as the log of local employment ;
– access to these resources by migrants, measured as an index of the similarity between the social categories of the migrants and those of the urban population.

Formally, the outward migration (*out-migration*) bridging indicator is computed by the following expression:

$$Emigrationbridging_i = \sum_{j=1}^{U}\left[\ln E_j \cdot \left(\frac{M_{i\to j}}{NM_i + M_{i\to j}}\right)\left(1 - \frac{1}{2}\sum_{k=1}^{6}\left|\frac{M_{k,i\to j}}{M_{i\to j}} - \frac{N_{k,j}}{N_j}\right|\right)\right] \quad (3)$$

where index j sums over all urban centers, E denotes local employment in each urban center j at time t, M is the number of (outward)migrants from regional unit i to urban centre j during the period $[t–1,t]$, and NM is the number of non-migrants in regional unit i during the same period. Index k splits the populations of migrants (M) and inhabitants of urban centers (N) at time t into the six main socioeconomic categories

[9] Note that for some authors, migration reduces social capital levels in a community (Schiff, 1992; Glaeser *et al.*, 2000) by affecting the strength of interpersonal relations and trust among community members. Migration tends to weaken local networks and associations, as members depart and critical mass is lost. Putnam (1995) writes: "*mobility {…} tends to disrupt root systems, and it takes time for an uprooted individual to put down new roots*" (p. 669). Furthermore Rupasingha *et al.* (2006) use the percentage of people who live in the same county at two dates and show the positive impact of this indicator on associational density, indicating that communities with more "permanent" residents also have more civic activity. Despite this negative effect, we consider here that migration to urban centres could create new opportunities and new channels for connecting local residents to urban resources through the relationships they maintain with their former neighbours. That is why we postulate that the "new opportunities" effect dominates the "disturbance" effect.

used in French statistics (farmers, independent workers, executives, intermediary occupations, clerks, factory workers) [10].

A similar index is constructed for inward migration (*in-migration*). We consider migration from an urban center to a rural unit. The similarity index compares the breakdown of migrants across social categories with the breakdown of the residents in the regional unit (but not the urban center this time). Formally:

$$Immigrationbridging_i = \sum_{j=1}^{U} \ln E_j \cdot \left(\frac{M_{j \to i}}{NM_i + M_{j \to i}} \right) \left(1 - \frac{1}{2} \sum_{k=1}^{6} \left| \frac{M_{k,j \to i}}{M_{j \to i}} - \frac{N_{k,i}}{N_i} \right| \right) \quad (4)$$

The second form of bridging social capital considered here, we call "political relationships". It entails all the relationships of regional leaders outside their region, which may have an impact on the local economic activity. A typical example is a local politician with good relationships with members of the government, such that it is possible to influence decisions about the building of infrastructures, or the funding of projects. For this analysis to be rigorous, "political relationships" should not to be restricted only to political leaders, but systematic information on other types of leaders is almost impossible to collect. According to Krishna (2001), political influence outside the region can be decisive in triggering bonding social capital.

An indicator for political social capital is most easily constructed by assuming that political influence is correlated to the level of responsibility in the political system. Here, we use data on the residential addresses of members of the French national parliament to account for this phenomenon. Intuitively, we would assume that a member of parliament will tend to favor investment in the region that elected him or her. The *parliament bridging* indicator is a dummy variable that equals 1 if (at least) a member of parliament lives in the *bassin de vie*.

3. A local development model embedding social capital components: The role of social capital on changes in the local population and employment

In order to test whether social capital has an influence on local economic development, we embed social capital indicators in a regional/local development model similar to the population and employment change model developed by Boarnet (1994).

3.1. The model and corresponding econometric issues

As noted by Rosenthal and Strange (2005), employment change is almost the only indicator available at local level that can be used to measure economic growth [11]. As

[10] An alternative would be to take the share of executives in employment as an indicator of access. This would be based on the assumption that resources are mostly transmitted by the highest social categories. Both types of indicators yield similar results, so we consider only this one here.

[11] Combes (2000) as well as Rupasingha *et al.* (2000) also uses this indicator at county or LMA (Local Market Area) level as a proxy of local economic growth, instead of GDP (gross domestic product), which is unavailable at these levels.

employment and population changes are closely interlinked, they are best studied together. Boarnet's (1994) model tests the reciprocal influences of population and employment changes. It is based on the simple idea that individuals tend to locate where jobs are offered and that firms tend to locate where labor is available. This modeling strategy based on linear estimations, is well suited to the study of rural areas, which mostly encompass activities with low agglomeration economies (Schmitt *et al.*, 2006).

The specificity of the Boarnet model (compared to similar models such as the seminal model by Carlino and Mills, 1987) is the use of a spatial weight matrix. This matrix takes account of the fact that local jobseekers (firms) are not constrained by the boundaries of spatial units in searching for jobs (labor). Basically, the assumption here is that local population change is influenced by local employment density and changes in both area of residence and neighboring areas, but the neighboring areas are weighted by a coefficient that decreases with distance. Henry *et al.* (1999) and Schmitt *et al.* (2006) studied rural areas and tested several alternative models, for various countries. They found that overall the Boarnet model performed the best.

Introducing social capital in the Boarnet model extends it as follows:

$$E^*_{i,t} = \Phi(POP^*_{i,t}, A_{E,i}, SC_i) \tag{5}$$

$$P^*_{i,t} = \Psi(EMP^*_{i,t}, A_{P,i}, SC_i) \tag{6}$$

where $P^*_{i,t}$ and $E^*_{i,t}$ are equilibrium population and employment in the ith rural area at time period t; $EMP^*_{i,t}$ and $POP^*_{i,t}$ are equilibrium employment and population in *local labour market* and *residential zones* centered on the ith rural area – and not inside this area alone; $A_{E,i}$ and $A_{p,i}$ are vectors of the control variables for employment and population density respectively and measure the local features attracting firms and/or households. In the employment equation, control variables typically include indicators of economic structure and local labor market characteristics (such as unemployment rate and human capital indicators). In the population equation, they include indicators for services to the population, natural amenities, and labor market characteristics (unemployment rate, average income as a proxy for wage rate). Among local features, we focus on social capital variables, SC_i. We introduce the same set of social capital variables in both our employment and population equations on the assumption that these three types of social capital act on both dynamics.

Using linear forms of (5) and (6) and with substitution to eliminate unknown equilibrium values, the expected changes in population and employment in each rural areas are given in equations (7) and (8):

$$\begin{cases} E_{t+1} - E_t = \alpha_0 - \chi_E E_t + \alpha_1 (W + I) P_t + \alpha_2 (W + I)(P_{t+1} - P_t) + \alpha_3 A_E + \alpha_4 SC + \mu_E & (7) \\ P_{t+1} - P_t = \beta_0 - \chi_P P_t + \beta_1 (W + I) E_t + \beta_2 (W + I)(E_{t+1} - E_t) + \beta_3 A_P + \beta_4 SC + \mu_P & (8) \end{cases}$$

where W is a spatial weight matrix, defined below in Subsection 3.2 and I is the identity matrix. E_t and P_t respectively denote employment and population densities at time t, therefore $E_{t+1} - E_t$ and $P_{t+1} - P_t$ are changes in employment and population densities between t and $t+1$, and the parameters χ_E and χ_P represent the rates of adjustment to employment and population equilibrium. Because of the spatial nature

of the dependent variables, the error terms μ_E and μ_P could be affected by a spatial autocorrelation phenomenon, that could be expressed as:

$$\begin{cases} \mu_E = W\mu_E + \eta_E & (9) \\ \mu_P = W\mu_P + \eta_P & (10) \end{cases}$$

Finally, we need to estimate the simultaneous equations (7) and (8), which involves spatial autoregressive terms on endogenous cross variables and potential spatial autocorrelation in the error terms. To deal with the first issue, for both equations we applied the instrumental variables (IV) method including all exogenous variables and their spatial lag as instruments and some additional instruments. We conducted Sargan tests to examine the validity of our set of instruments (*i.e.* non-correlation between this set and the errors) and looked at the quality of the first stage regressions by examining their R^2. We tested for spatial autocorrelation in the errors using an I-Moran test adapted for simultaneous equation models, and, where necessary, we used the generalized method of moments (GMM) estimator, as described by Keleijan and Pucha (1999).

According to Durlauf (2002), social capital is likely to be endogenous in both equations (7) and (8). In particular, the local level of social capital could be affected in turn by local economic growth, based on the characteristics of the inward migrants or firms. Thus, we performed exogeneity tests using the set of instruments defined below (see fn. 18) in augmented regressions. Note that the exogeneity tests always reject the hypothesis of endogeneity. In addition, we defined most of our explanatory variables at the beginning of the study period in order to limit potential endogeneity problems.

3.2. Data

Data are collected from French databases aggregated in the 1,916 *bassins de vie* defined above, 1,745 of which are classified as rural [12]. Rural *bassins de vie* can be quite small: populations (1999 census data) range between 270 to 60,000 inhabitants. The average population of a rural *bassin de vie* is some 12,000 inhabitants, with a standard deviation of 9,500 inhabitants. To reduce data reliability problems, we restricted the study area to continental France and to *bassins de vie* with more than 2,000 inhabitants, which resulted in a sample of 1,704 areas.

The period of analysis is the period between the two most recent population censuses, *i.e.* 1990-1999. The elements w_{ij} of the spatial weight matrix W are proportional to the inverse of the time-distance between the centroids of the two units i and j under consideration [13]. However, we set $w_{ij} = 0$ when the distance is larger than

[12] They are *bassins de vie* whose centre is an urban centre (or municipality) with less than 30,000 inhabitants. We use here the INSEE (French Institute of Statistics) definition of an urban centre, *i.e.* an urban unit with a working population of more than 5,000. In the 1999 population census data, there are 357 urban centres, of which 171 have over 30,000 inhabitants.

[13] The time-distance we use corresponds to travel time by car. It was computed by combining road distances between "*bassins de vie*" centers with possible speeds on the corresponding roads. We tried to avoid potential 'island' effects from restricting our calculation to the study areas (*i.e.* only the rural ones) by applying a spatial weight matrix including all "*bassins de vie*" (rural and urban) to compute the terms $(W+I)P_t$, $(W+I)E_t$, $(W+I)(P_{t+1} - P_t)$ and $(W+I)(E_{t+1} - E_t)$.

120 minutes (considered as the longest commuting time an individual could afford). Lines (and columns) are normalized to 1.

The ***dependent variables*** are $E_{t+1} - E_t$ and $P_{t+1} - P_t$, which are changes in employment and population densities over the study period.

Social capital variables are computed according to the methodology described in section 2. They are proxies for the three components of social capital (bonding, linking, and bridging) collected from different sources. However, as already suggested, proxies for bonding social capital are expected to be correlated with each other. PCA was used to build a synthetic measure of bonding to avoid multicolinearity problem. The results of the PCA with bonding variables are given in Appendix (table A.2). The first axis of the PCA seems to be a suitable generic bonding indicator. This index is also quite robust to slight changes in the set of indicators [14]. Most variables contribute positively to the first axis, although *tax integration* is almost orthogonal to it. This is related to political elements and is shown overall to be disconnected from local cohesion.

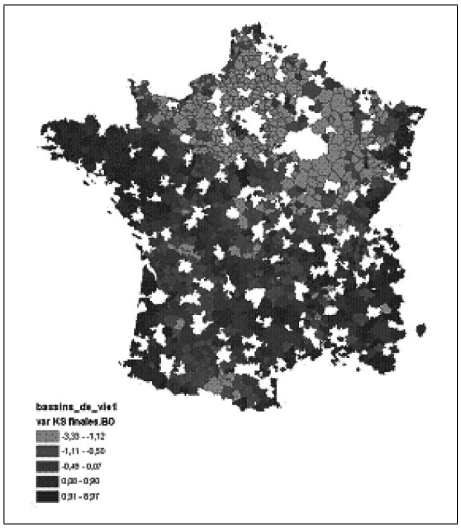
Map 1 provides a spatial repartitioning of the *bonding* index built by distinguishing five equivalent classes. The resulting pattern is remarkable. Regions well known for their rich cultures, such as Brittany and Alsace (at the North-West and North-East of the hexagon respectively), show high values, while the alluvial plains of the *Bassin parisien* in the centre of France, known for their individualism, show low values. There are some possible sources of distortion, however. For instance, the number of big ski resorts in the Alps implies an upward bias for several indicators (sports, bars and phonebook, in particular).

For bridging and linking indicators, composite indices are not relevant, because migration and political networks are likely to be very different channels. Note, however, that the migration indicators presented in table 2 are strongly and positively correlated (r = 0.62). This is significant as it might have been expected that inward and outward migration would be negatively correlated, especially among rural areas. Map 2 provides a spatial repartitioning of the sum of the variables *out-migration* and *in-migration bridging*, which are strongly correlated. The main pattern that emerges here is the concentration of high values around the big metropolitan areas. Conversely, and also as expected, no noticeable pattern emerges from the map of the *parliament bridging* indicator (map 3). In terms of linking variables, the map of the *educational interaction* variable (map 4) reveals high values around cities, and, interestingly, in some rural regions where the *bonding* index is also high. This is consistent with the intermediate nature of linking social capital.

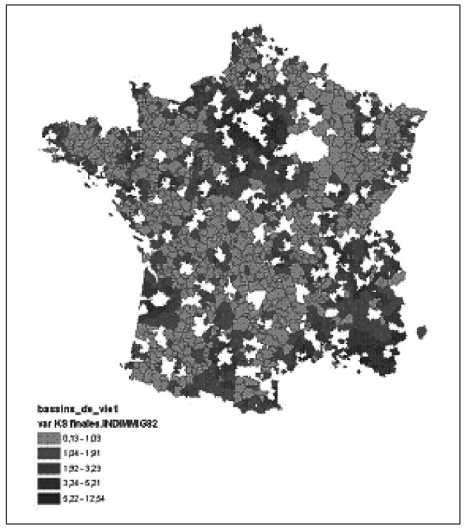
We now look at the correlation matrix of social capital variables (table 2). All correlation coefficients are positive, with the notable exception of *Mixing*, which is negatively related to all variables. As the econometric results confirm, *Mixing* is a poor proxy for social interactions, and may even be a reverse index of social cohesion.

[14] Interestingly, PCA results do not differentiate cognitive from structural indicators, although they are of a different nature. This fact corroborates the consistency of the "bonding" category.

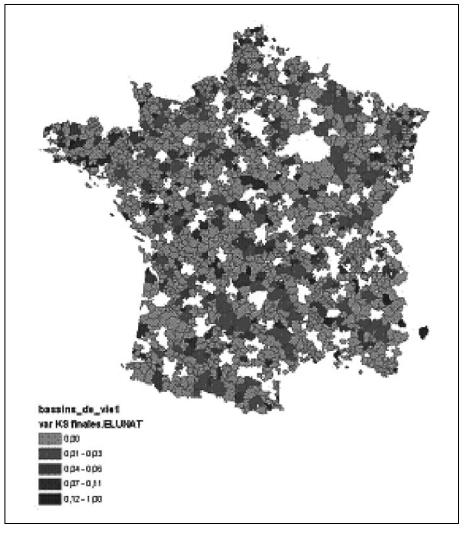
Map 1. **Bonding, first component of PCA** (equal repartition of rural "*bassins de vie*" between five classes)



Map 2. **Immigration bridging** (equal repartition of rural "*bassins de vie*" between five classes)



Map 3. **Parliament bridging** (equal repartition of rural "*bassins de vie*" between five classes)



Map 4. **Linking: local coexistence of educated *vs* low-educated people** (equal repartition of rural "*bassins de vie*" between five classes)

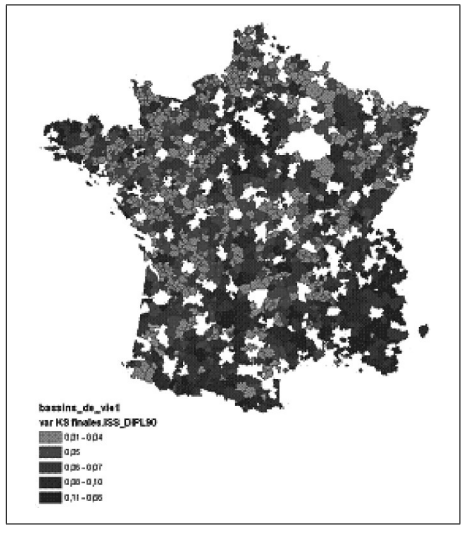


Table 2. **Correlation matrix between social capital variables**

	Bonding index	Emigration bridging	Immigration bridging	Parliament bridging	Coexistence of educated & low-educ. people	Mixing by internal migrations
Bonding index	1.00	0.01	0.11*	0.09*	0.24*	– 0.32*
Emigration bridging	0.01	1.00	0.62*	0.12*	0.44*	– 0.19*
Immigration bridging	0.11*	0.62*	1.00	0.08*	0.63*	– 0.30*
Parliament bridging	0.09*	0.12*	0.08*	1.00	0.18*	– 0.08*
Coexist. Educ.-Uneduc	0.24*	0.44*	0.63*	0.18*	1.00	– 0.21*
Mixing by intern. migr.	– 0.32*	– 0.19*	– 0.30*	– 0.08*	– 0.21*	1.00

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level.

Both migration bridging indicators are positively, but weakly correlated to the *Parliament bridging* indicator. This confirms the intuition that migration and political bridging are very different forms of social capital.

As expected, the correlation coefficients of the bonding and bridging indicators are low. Correlation coefficients of the *Educational interaction* and *Bonding index* are higher and higher still for *Educational interaction* and migration bridging. This again is coherent with the intuition that bonding and bridging social capital are very different forms of social capital, and that linking is an intermediary category between bonding and bridging.

Based on the results of correlation analysis, we introduce only the following variables: *Bonding index, Educational interaction, Mixing by internal migration, Immigration bridging* and *Parliament bridging* [15].

The selection of ***control variables*** is based on the results of the model without the social capital variables implemented by Blanc and Schmitt (2007). For the employment change equation, we tried to capture on the one hand the geographical characteristics of rural area, and on the other hand, the economic characteristics of the area including type of employment, labor force and labor market.

Two variables control for the position of the *bassin de vie* in the French urban-rural structure:

– *Remote rural area*: A dummy variable that equals 1 if the pole of the *bassin de vie* is not classified as rural (*i.e.* a town with more than 2,000 jobs);

– *Distance to urban centre*: Distance to the nearest urban pole with more than 100,000 inhabitants (1988 data).

[15] The *Emigration bridging* indicator, which is closely correlated to *Immigration bridging*, was not included in the results presented here; it turns out to be always non-significant, whether or not it is instrumented.

A set of economic variables describes the local characteristics of economic structure and local labor market (skill level of active population, unemployment). They are usually used to analyze the drivers of employment location in rural areas:

– *Residential employment*: Share of employment in the residential sector in 1990 [16];
– *Managers/executives ratio*: The ratio of (managers+junior managers) to (workers + employees), (1990 values);
– *Self-employment rate*: Share of independent workers (1990 data);
– *Unemployment rate* (1990 data).

For the population change equation, we first used three geographical characteristics of the area, which are not exactly the same as those used for employment change equation [17]:

– *Periurban areas*: A dummy variable that equals 1 if the pole of the *bassin de vie* is classified as a periurban city (*i.e.* more than 40% of the working population works in an urban pole);
– *Remote rural area*: See above;
– *Sunny region*: Dummy variable that equals one if the *bassin de vie* belongs to a "sunny" (southern) region;

Because the accessibility of services is the most crucial issue for population location in rural areas, we introduced variables for capturing the density of and accessibility of services (*e.g.* health, education, other personal services), and information on the wealth of local households:

– *Health facilities*: Number of health care facilities in the *bassin de vie* (hospitals, clinics, labs, and so on) (1988 data);
– *School*: A dummy variable that equals 1 if there is at least one high school in the *bassin de vie* (1988 data);
– *Services accessibility*: Average time required to access basic personal services (1988 data);
– *Taxable household income*: Average taxable household income (1990 data);
– *Unemployment rate* (1990 data).

4. Estimation results

Estimations are first run with each social capital variable separately (with the IV and the GMM estimators), to examine potential colinearity problems between them [18]. Tables 3 and 4 respectively present the results for employment and population changes. Note that the exogeneity tests performed for the social capital variables always

[16] The residential sector basically includes services to the population (excluding business services) and the construction sectors (see INSEE, 2003, for details).
[17] We essentially replaced *Distance to urban centre* used in the employment change equation by *Periurban area* in order to control for the urban sprawl that affects more households than jobs. The distance to urban centre is more able to measure the trade costs that affect goods produced in the area.
[18] The set of instruments includes various spatially lagged variables, income proxies, market potential proxies, etc. The list of instruments used for population/employment variation and social capital is available from the authors upon request.

Table 3. **Estimates for the employment change equation (models with only one form of social capital)**

	Bonding index		Immigration Bridging		Parliament Bridging		Linking: Coexistence of educated & low-educ. people		Linking: Mixing by internal migrations	
	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.
Intercept	−0.496	−1.718	−0.568	−2.284**	−0.870	−2.135**	0.450	−0.973	−0.642	−1.924*
(W+I).Δ POP	0.232**	0.231**	0.341***	0.299**	0.426***	0.438***	0.278***	0.243**	0.400***	0.413***
90 Empl. density	−0.021***	−0.023***	−0.018***	−0.022***	−0.019***	−0.021***	−0.022***	−0.026***	−0.018***	−0.021***
(W+I).Pop. dens.	−0.003	−0.001	−0.014***	−0.010*	−0.013***	−0.010**	−0.006	−0.000	−0.012***	−0.010*
Residential empl.	0.022	0.022	0.029*	0.026	0.033**	0.032**	0.021	0.019	0.035**	0.033**
Remote rural	−0.379	−0.351	−0.299	−0.198	−0.371	−0.322	−0.053	0.028	−0.422	−0.366
Dist. to urban center	−0.020***	−0.019**	−0.019**	−0.016	−0.018**	−0.016*	−0.020***	−0.019**	−0.018**	−0.016*
Managers/execut. rate	0.083***	0.093***	0.058***	0.064	0.071***	0.081***	−0.048**	−0.045*	0.076***	0.085***
Self-employment rate	−0.171**	−0.143*	−0.116	−0.073	−0.133*	−0.110	−0.150**	−0.112	−0.128*	−0.104
Unemployement rate	0.039	0.073	−0.002	0.040	0.015	0.050	0.0419	0.080	0.020	0.055
Bonding index	0.784***	0.777***								
Immigration bridging			0.696**	1.007***						
Parliament bridging					11.31***	11.86***				
Coexist. Educ/Low-Educ							52.39***	56.28***		
Mixing by intern. migr.									−4.651*	−4.000
Adj R^2	0.121	0.108	0.119	0.113	0.118	0.119	0.131	0.120	0.109	0.109
λ (sp. autorr. in errors)		0.254***		0.302***		0.259***		0.294***		0.237***
Sargan test Qs =	26.83		16.12		13.26		6.99		14.72	
Prob =	0.177		0.584		0.776		0.990		0.681	
First-stage R^2	0.719		0.744		0.709		0.714		0.710	
Exogeneity test (F-value)	50.73***		30.48***		32.50***		42.06***		33.53***	
I-Moran test (I)	0.036***		0.043***		0.037***		0.043***		0.033***	

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level

Table 4. **Estimates for the population change equation (models with only one form of social capital)**

	Bonding index		Immigration Bridging		Parliament Bridging		Linking: Coexistence of educated & low-educ. people		Linking: Mixing by internal migrations	
	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.
Intercept	−11.241***	−4.752	7.338*	6.203*	−8.277*	−3.481	3.087	5.539	−7.908*	−3.910
(W+I).Δ EMP	−0.210	1.043	−0.087	0.481	−1.402	1.311	−1.759	−0.676	−1.102	1.180
90 Pop. density	0.098***	0.097***	0.091***	0.089***	0.101***	0.097***	0.095***	0.093***	0.100***	0.097***
(W+I).Emp dens	−0.046***	−0.068**	−0.115***	−0.130***	−0.074**	−0.073***	−0.051*	−0.066**	−0.068**	−0.068**
Periurban areas	4.967***	4.266***	−2.567**	2.831***	5.706***	4.283***	4.378***	3.777***	5.051***	4.027***
Remote rural	1.871**	1.393*	0.759	1.290*	1.677*	1.301	0.858	1.009	1.547	1.292
Health facilities	−0.003	−0.002	−0.002	0.001	−0.007	−0.002	−0.015**	−0.010**	−0.003	−0.001
School	−1.377	−0.536	−0.834	−0.383	0.347	−0.257	0.386	0.217	−0.472	−0.608
Services accessibility	0.009	0.141	−0.224	−0.077	−0.243	0.141	−0.387	−0.045	−0.133	0.161
Taxable Hh income	0.865***	0.358	−0.816***	−0.931**	0.989***	0.235	−0.424	−0.882**	0.962***	0.310
Sunny region	5.357***	3.208*	1.493	0.214	6.643***	2.675	4.506***	2.063	6.381***	3.110*
Unemployment rate	−0.227**	−0.442***	−0.635***	−0.599***	−0.335**	−0.473***	−0.331**	−0.382**	−0.294**	−0.435***
Bonding index	0.735	0.078								
Immigration bridging			7.844***	8.335***						
Parliament bridging					21.60***	19.81***				
Coexist. Educ/Low-Educ							102.03***	99.75***		
Mixing by intern. migr.									−17.91**	−7.751
Adj R^2	0.468	0.319	0.582	0.412	0.439	0.328	0.452	0.339	0.445	0.424
Λ (sp. autocorr. in errors)		0.735***		0.734***		0.742***		0.731***		0.736***
Sargan test Qs =	3.411		1.143		2.666		0.256		2.298	
Prob =	0.332		0.565		0.264		0.880		0.317	
First-stage R^2	0.367		0.219		0.221		0.235		0.228	
Exogeneity test (F-value)	19.78***		3.77*		6.73***		7.60***		6.58***	
I-Moran test (I)	0.125***		0.125**		0.156**		0.155**		0.142**	

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level

reject the endogeneity hypothesis (see Appendix, table A.5). Although only the composite bonding social capital index is used, Appendix tables A.3 and A.4 test the consistency of this index by looking at the impact of each original bonding variable.

It is satisfactory that with the exception of the *Mixing* indicator, all social capital variables have positive and significant signs in the employment change equation. Section 3 showed that *Mixing* was negatively correlated to all other social capital variables and, in particular, to the interaction variable *Educational interaction*. This suggests that the intuition behind the *Mixing* indicator was incorrect and that *Mixing* may be an indicator of avoidance (and thus of segregation) rather than exchange. High levels of mixing could mean that local migrants are trying to escape their former places of residence, which leads to social polarization. This result echoes the findings of Putnam (2007) and Rupasingha and Goetz (2007) that, in the short run, mixing increases social tensions and decreases social capital [19]. If this interpretation is correct, then the negative correlations with other social capital variables are not surprising. In the remainder of the paper, we drop this indicator. Appendix table A.3 presents the effects of each *bonding* variable. Only *Charity gifts* and *Agricultural labels* are not significant. The former is measured at a crude level (*département*), which makes interpretation of this isolated variable rather difficult. *Agricultural labels* is linked to the ability to co-operate, but also to the opportunity to produce high quality goods (which is related to sociological factors, and is also a consequence of exogenous natural endowments). Consequently, it will be biased and should not be used on its own.

Social capital variables display similar qualitative behavior in the population change equation, with the exception of the *Bonding index*, which is not significant. The positive signs of the other social capital variables suggest that migrants are attracted to places that are both open (bridging) and not segregated (linking). The positive sign of *Immigration* suggests that immigration habits tend to be stable over time, especially when they give access to greater opportunity. In terms of the *Parliament* indicator, the result might be based on the fact that politicians tend to locate in demographically dynamic areas. The positive sign of the *Interaction* variable is more surprising, as it implies that migrants tend to locate in socially diverse areas. This contradicts the intuition that individuals tend to locate close to like-minded people and a closer look at the data suggests that a high *Interaction* value tends to slow outward migration. A natural interpretation is that areas with a high linking social capital are endowed with satisfying social lives and good economic opportunities.

We next look at the signs of the initial bonding variables in the population equation (see Appendix table A.4); the four variables *CUMA*, *Agricultural labels*, *Charity*, and *Tax integration*, have significant negative signs. The first two variables are linked to the agricultural sector and, thus, a negative sign may indicate simply that inward migrants are not attracted to areas with a poor urban infrastructure. Again, the *Charity* variable should not be interpreted in isolation, although it has the satisfactory

[19] It is interesting that our indicator of "*migration bridging*" does not have the same property. These migrations bring new opportunities, not social tension. They bring into contact different people who often share the same cultural background.

property of being positively correlated to most other *bonding* variables. Finally, *tax integration* is roughly orthogonal to the other variables. Consequently, *Bonding* seems to play no role in population dynamics. It is probable that migrants to an area cannot assess the level of cohesion/solidarity of a new place. However, it might have been expected that a high level of bonding would work to slow out migration. These results suggest that a high social cohesion is not a sufficient condition for remaining in a region where economic opportunities are lacking. This result should be compared to the positive sign of the *Interaction* variable discussed earlier.

Because the *Bonding* index is the result of PCA, it is a centered variable, thus, it is not possible to compute elasticities at the mean point in order to compare the relative impact of the different forms of social capital. However, comparison of the R^2 of the different employment regressions suggests that the linking form (measured by *Educational interaction*) has a slightly higher impact on employment growth. This is an interesting result, as linking social capital is supposed to combine both virtues of social capital, *i.e.* cohesion and diversity. In the population change equation, the only significant, but not surprising feature is that the highest R^2 is found with the *Immigration bridging* variable.

Table 5 presents the results for all types of social capital introduced simultaneously, as well as the interaction between the *Bonding index* and *Immigration bridging*, which are two opposite forms of social capital. A positive sign on the interaction term suggests that these two forms of social capital reinforce each other.

All social capital variables are significant when they are introduced simultaneously. This suggests that they capture different mechanisms, which is consistent with theory. The (expected) positive sign of the interaction variable *Bonding * Immig* suggests complementarity between these two forms of social capital. Interestingly, the significance of the bonding variable is weakened by the introduction of the linking indicator *Educational interaction* (without it, *Bonding index* remains significant at the 1% level). This result is consistent with the idea that bonding also tends to promote closure, and it corroborates the negative aggregate effects of this form social capital.

5. Discussion and concluding remarks

The econometric results tend to corroborate the hypothesis of a positive effect of all forms of social capital on economic growth. Although these are indirect indicators, the relationships among them suggest that they do capture a good part of the different components of social capital. Moreover, they display robust relationships with economic performance. Another interesting result is the existence of complementarities among the different forms of social capital.

This study was restricted to rural areas and further research is needed to apply this methodology to an urban context. Note however that most of the indicators in this study are suited to rural areas with the exception of the linking indicator, which could be used to transfer this kind of study to urban environments, especially if tested at different geographical levels.

Table 5. **Estimates for the equation systems with introduction of different forms of social capital and interaction between bonding and bridging ones**

	Equation system (1)				Equation system (2)			
	Employment change		Population change		Employment change		Population change	
	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.	IV estim.	GMM est.
Intercept	1.707*	– 0.211	4.905*	9.831***	1.587	– 0.348	5.379*	9.882***
(W+I).Δ POP or Δ EMP	0.010	– 0.141	1.826***	0.759	0.003	– 0.138	1.711***	0.663
90 Empl. or Pop. density	– 0.026***	– 0.030***	0.085***	0.088***	-0.026***	– 0.030***	0.086***	0.088***
(W+I).Pop. or Emp. dens.	– 0.002	0.006	– 0.088***	– 0.128***	0.000	0.007	– 0.081***	– 0.124***
Residential empl.	0.003	0.001			0.005	0.003		
Periurban areas			– 3.493***	– 2.694***			– 3.269***	– 2.442***
Remote rural	0.025	0.119	1.091	1.099	0.011	0.109	1.192	1.217*
Dist. to urban center	– 0.020***	– 0.021**			-0.020***	– 0.021**		
Managers/exceutives rate	– 0.060**	– 0.064**			-0.056**	– 0.060**		
Self-employment rate	– 0.207***	– 0.125			-0.189***	– 0.114		
Health facilities			– 0.003	– 0.001			– 0.003	– 0.001
School			– 0.877	0.082			– 0.983	– 0.035
Services accessibility			– 0.021	– 0.098			– 0.045	– 0.120
Taxable Hh income			– 1.120***	– 1.388***			– 1.109***	– 1.348***
Sunny region			0.465	– 0.562			0.546	– 0.513
Unemployement rate	0.033	0.070	– 0.522***	– 0.607***	0.010	0.055	– 0.566***	– 0.622***
Bonding index	0.795***	0.755***	– 0.750**	– 0.210	0.461**	0.440*	– 1.491***	– 1.024**
Immigration bridging	1.053***	1.490***	7.356***	7.862***	0.985***	1.396***	7.143***	7.585***
Bonding*Immigr. Bridg					0.171*	0.156*	0.414***	0.414***
Parliament bridging	9.607***	11.460***	12.569***	17.517***	9.725***	11.548***	12.990***	18.019***
Coexist. Educ/Low-Educ	45.823***	50.734***	19.214**	27.042**	44.332***	49.414***	18.930**	27.031**
Adj R^2	0.156	0.147	0.622	0.420	0.157	0.149	0.623	0.422
λ (sp. autocorr. in errors)		0.390***		0.744***		0.387***		0.742***
Sargan test Qs =	29.06		2.997		20.08		3.120	
Prob =	0.113		0.392		0.112		0.373	
First-stage R^2	0.759		0.380		0.759		0.382	
Exogeneity test (F-value)	49.31***		2.82*		50.32***		3.24*	
I-Moran test (I)	0.060***		0.093***l		0.059***		0.094***	

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level

What empirical studies on social capital often fail to take account of is the scale at which social capital works. The focus of these studies is often on either very local (bonding, such as in local development literature) or vast (bridging, such as in the studies about the effect of ethnic networks in international trade) scales. The bonding/linking/bridging classification is a first operational approximation of the notion of *radius of trust* developed by Francis Fukuyama (1995). Radius of trust describes the span of relationships in the social space. In the framework of this paper, a low radius of trust means much bonding and little bridging. A high radius of trust implies that all forms of social capital are high (high bridging combined with low bonding social capital would probably lead to lack of stability in economic exchange). Clearly, it is necessary to explore all scales of social capital in order to grasp the full contribution of social relationships to growth.

An interesting policy implication of these results is that it seems that the most efficient way to increase the positive effects of social capital on employment growth is to enhance the "linking" component. Policies aimed at decreasing social segregation could increase both social cohesion and the exchange of productive ideas.

Naturally, the indicators used in this paper are very indirect, due to the fact that they rely on statistical data rather than fieldwork. Unfortunately, for many phenomena linked to social capital, the relevant measures do not exist in current databases, and also cannot be constructed. It is for this reason that testing hypotheses on regional development issues requires a combination of case study and econometric work. More fieldwork would give more precise insights into the respective roles of institutions and sociological characteristics, and also the spatial scales at which co-operation and information transmission occurs. However, econometric work remains essential in order to test the generalizability of the results of any case study.

Very little information on sociological or institutional features is collected systematically by government statistical offices. As these results show, refining measures of social capital and its span would be valuable. This is all the more important since rural development policies are increasingly being inspired by the "social capital paradigm", which invokes vague concepts such as "identity" or "endogenous resources", but do not rely on a clear idea of the mechanisms at play.

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APPENDIX

Table A.1. **Descriptive statistics**

Variables	Mean	Std Dev
90-99 ΔPOP	5.089	16.972
90-99 ΔEMP	1.167	7.246
1990 Empl. Density	24.147	35.941
1990 Pop. Density	79.777	108.564
Residential employment (%)	47.555	12.365
Health facilities (#)	42.487	76.549
School in the area	0.053	0.224
Services accessibility	10.736	2.251
Taxable Hh income	0.227	0.419
Distance to the nearest urban center	56.088	27.554
Manager/executive ratio	35.611	15.117
Self-employment rate (%)	9.285	2.964
Unemployment rate (%)	10.318	3.342
Phonebook	0.798	0.180
Charity gifts	0.210	0.026
CUMA	0.077	0.061
Agr. Quality labels	0.500	0.514
Tax integration	0.212	0.146
Associations	21.970	15.696
Bars per capita	3.769	6.775
Sport facilities (*)	0.000	1.812
Cultural facilities (*)	0.000	1.463
Bonding index (*)	0.000	1.359
Immigration bridging	1.549	1.205
Emigration bridging	1.380	0.458
Parliament bridging	0.017	0.062
Linking: Coexist. Educ/Low-Educ	0.067	0.047
Linking: Mixing by internal migration	0.074	0.062

Note: (*) Sports facilities, Cultural facilities and Bonding index all have means of zero because they are components in PCA.

Table A.2. **Eigenvectors of the PCA on bonding variables**

	F1	F2	F3	F4	F5
Phonebook	0.395	– 0.182	– 0.181	0.320	– 0.227
Charity gifts	0.221	– 0.320	0.435	– 0.149	0.615
CUMA	0.244	0.526	0.289	0.016	– 0.291
Agr. quality labels	0.257	0.051	0.538	– 0.474	– 0.394
Tax integration	0.028	0.428	0.287	0.644	0.222
Associations	0.159	– 0.436	0.416	0.415	– 0.089
Bars per capita	0.305	– 0.384	– 0.180	0.133	– 0.354
Sport facilities	0.545	0.235	– 0.278	0.012	0.102
Cultural facilities	0.504	0.094	– 0.201	– 0.212	0.370
% variance	22.8	15.0	12.0	11.1	10.1

Table A.3. **Estimates for employment change equation with bonding variables (IV estimator)**

	Phonebook	Charity gifts	CUMA	Agr quality labels	Tax integration in 2001	Associations (# in 1999)	Bars per capita in 1990	Sport facilities in 1988	Cultural facilities in 1988
Intercept	– 2.282**	0.787	– 1.257	– 0.375	– 2.445**	– 1.213	– 1.003	– 1.095	– 0.942
(W+I).Δ POP	0.400***	0.426***	0.362***	0.355***	0.416***	0.421***	0.393***	0.343***	0.375***
90 Empl. density	– 0.019***	– 0.017***	– 0.025***	– 0.040***	– 0.018***	– 0.019***	– 0.019***	– 0.017***	– 0.017***
(W+I).Pop. dens.	– 0.011***	– 0.014***	– 0.009**	– 0.005	– 0.012***	– 0.011***	– 0.011***	– 0.010**	– 0.011***
Residential empl.	0.029*	0.034**	0.033**	0.022	0.038**	0.023	0.025	0.036**	0.032**
Remote Rural	– 0.497	– 0.380	– 0.495	– 0.629	– 0.399	– 0.431	– 0.337	– 0.320	– 0.337
Dist. to Urban center	– 0.019**	– 0.019***	– 0.019***	– 0.019***	– 0.018**	– 0.020***	– 0.020***	– 0.020***	– 0.019***
Managers/executives rate	0.080***	0.080***	0.0751***	0.073***	0.078***	0.075***	0.080***	0.080***	0.079***
Self-employment rate	– 0.171**	– 0.122*	– 0.101	– 0.085	– 0.097	– 0.118*	– 0.136*	– 0.123*	– 0.123*
Unemployement rate	0.032	0.002	– 0.005	– 0.013	0.011	0.0337	0.043	0.013	0.015
Phonebook	2.082*								
Charity gifts		– 7.963							
CUMA			5.665**						
Agr Quality labels				0.073					
Tax integration					4.368***				
Associations						0.024**			
Bars							0.051*		
Sport facilities								0.223**	
Cultural facilities									0.265**
Adj R^2	0.110	0.108	0.108	0.114	0.116	0.109	0.108	0.109	0.111
Sargan test Qs =	13.233	14.679	20.334	22.301	14.990	15.598	13.035	27.260	14.201
Prob =	0.778	0.794	0.437	0.324	0.777	0.741	0.876	0.162	0.820
First-stage R^2	0.711	0.715	0.715	0.709	0.715	0.716	0.716	0.718	0.719
I-Moran test (I)	0.032***	0.339***	0.037***	0.035***	0.025***	0.034***	0.036***	0.033***	0.034***

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level

Table A.4. **Estimates for population change equation with bonding variables (IV estimator)**

	Phonebook	Charity (amounts in 2001)	CUMA	Agrofood quality labels	Tax integration in 2001	Associations (# in 1999)	Bars per capita in 1990	Sport facilities in 1988	Cultural facilities in 1988
Intercept	– 14.641***	– 3.009	– 18.787***	– 23.504***	– 20.378***	– 23.039***	– 10.852***	– 11.219***	– 10.416***
(W+I).Δ EMP	– 0.926	– 0.192	6.287***	6.831***	6.065***	5.862***	– 0.198	– 0.239	– 0.422
90 Pop. density	0.100***	0.100***	0.077***	0.037***	0.082***	0.082***	0.098***	0.099***	0.099***
(W+I).Emp dens	– 0.057**	– 0.064***	0.043*	0.084***	0.036*	0.035	– 0.053***	– 0.055***	– 0.059***
Periurban areas	5.487***	5.072***	1.386	1.529	1.341	1.386	5.243***	4.849***	5.060***
Remote Rural	1.428	1.903**	3.184***	3.172***	3.107***	3.070***	2.055**	1.937**	1.891**
Health facilities	– 0.003	– 0.005	0.002	0.003	0.003	0.003	– 0.005	– 0.004	– 0.005
School	– 1.120	– 0.714	– 3.371**	– 4.737***	– 4.038***	– 3.906**	– 1.309	– 0.885	– 0.464
Services accessibility	– 0.216	– 0.079	0.696***	0.636***	0.833***	0.835***	– 0.075	– 0.014	– 0.094
Taxable Hh income	0.956***	0.911***	0.238	0.535**	0.283	0.388*	0.847***	0.914***	0.938***
Sunny region	6.167***	6.405***	1.682*	1.938**	1.267	1.661	5.729***	5.828***	6.020***
Unemployment rate	– 0.288**	– 0.343***	0.150	0.330**	0.106	0.116	– 0.226**	– 0.256**	– 0.272**
Phonebook	6.916								
Charity		– 32.093**							
CUMA			– 31.010***						
Agr Quality labels				– 3.171***					
Tax integration					– 7.407***				
Associations						0.002			
Bars							0.115**		
Sport facilities								0.321	
Cultural facilities									0.090
Adj R^2	0.451	0.468	0.426	0.308	0.469	0.470	0.468	0.466	0.461
Sargan test Qs =	3.040	3.315	0.644	3.496	4.826	0.977	2.823	3.226	2.678
Prob =	0.219	0.346	0.886	0.479	0.306	0.613	0.244	0.358	0.444
First-stage R^2	0.260	0.253	0.268	0.250	0.253	0.229	0.249	0.327	0.292
I-Moran test (I)	0.137***	0.129***	0.214***	0.236***	0.218***	0.218***	0.130***	0.127***	0.133***

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level

Table A.5. **Exogeneity tests: Fisher test and t-students of endogenous variables (including social capital ones) from augmented regressions**

	Bonding index	Immigration Bridging	Parliament Bridging	Linking: Coexistence of educated & low-educ. people	Linking: Mixing by internal migrations
Employment change equation:					
Fisher test	25.57***	16.24***	16.64***	21.13***	16.82***
t-student for (W+I).Δ Pop	6.25***	4.99***	5.68***	6.07***	5.19***
t-student for social capital var.	– 0.07	– 0.54	– 0.91	– 0.27	– 0.14
Sargan test Qs =	26.601	14.316	12.281	6.815	14.632
Prob =	0.145	0.644	0.783	0.986	0.622
Population change equation:					
Fisher test	11.19***	1.91	5.11***	3.83**	3.91**
t-student for (W+I).Δ Emp	4.69***	1.35	1.94**	2.75***	2.44***
t-student for social capital var.	0.94	– 0.32	1.76*	– 0.70	– 1.02
Sargan test Qs =	0.958	1.108	0.014	0.211	0.690
Prob =	0.622	0.292	0.907	0.646	0.406

Note: ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level