

GREQAM

Groupement de Recherche en Economie
Quantitative d'Aix-Marseille - UMR-CNRS 6579
Ecole des Hautes Etudes en Sciences Sociales
Universités d'Aix-Marseille II et III

Document de Travail
n° 2006-26

**VOLUNTARY PARTICIPATION AS A
DETERMINANT OF “SOCIAL CAPITAL” IN
FRANCE:
ALLOWING FOR PARAMETER
HETEROGENEITY**

**Marie LEBRETON
Katia MELNIK**

Juin 2006

DT-GREQAM

Voluntary Participation as a Determinant of Social Capital in France: Allowing for Parameter Heterogeneity*

Marie LEBRETON[†]

Katia MELNIK[‡]

GREQAM

GREQAM

20th June 2006

Abstract

This paper studies the effects of income, education and active memberships in voluntary organizations and clubs on “social capital” by using individual French data and allowing for parameter heterogeneity (Durlauf and Fafchamps, 2003). Survey responses to the questions concerning trust, social norms and individual involvement in the local life are used as proxies of social capital. The model developed in this paper is an Artificial Neural Network model or more precisely the Neuro-Coefficient Smooth Transition Auto-Regressive (NCSTAR) model. It gives a vector of estimates for every observation of the dataset as a nonlinear function of its geographical position and its individual attributes. We show that accounting for parameter heterogeneity considerably improves the fit of the estimated model in comparison with the broadly used multinomial logit model. Our results suggest empirical evidences of significant positive direct and indirect effects of active membership in voluntary organizations on trust (or rather trustworthiness, Glaeser et al, 2000) and individual’s involvement in his or her community’s life. This finding supports the considering of membership in voluntary organizations in France as promoting

*The data used in this paper were documented and made available by the ZENTRALARCHIV FUER EMPIRISCHE SOZIALFORSCHUNG KOELN. The data for the ISSP “Social Network II” were collected by independent institutions. Principal investigators in France are Michel Forsé and Yannick Lemel. We thank the “Banque de Données Socio-Politiques” for providing us data. Further, the authors thank Jean-Benoît Zimmermann, Anne Peguin-Feissolle, and an anonymous referee for useful suggestions and comments.

[†]Marie LEBRETON, GREQAM, Centre de la Vieille Charité, 2 rue de la Charité, 13236 Marseille cedex 02, France.

[‡]Corresponding author: Katia Melnik, GREQAM, Centre de la Vieille Charité, 2 rue de la Charité, 13236 Marseille cedex 02, France. Tel: +33 (0)4.91.14.07.23, Email: melnik@ehess.univ-mrs.fr.

the values of cooperation and positive tendency towards public issues. However, the studied relationships are not stable across French departments and some regional patterns are detected.

JEL classification: C12, C22.

Keywords: Social capital, Parameter heterogeneity, Neural network models.

1 Introduction

Social capital represents a very popular metaphor in social science research. Generally it refers to the recognition of social relations as affecting social and economic outcomes at community and individual levels. We distinguish two concepts of social capital. Coleman's broadly used conception of "social capital" emphasizes community level outcomes. From this point of view "social capital refers to features of social organization, such as trust, norms, and networks that can improve the efficiency of society" (Putnam et al, 1993.) On the other hand, in Bourdieu tradition, social capital is defined as resources embedded in social networks and accessed and used by actors for actions (Lin, 2001.)

Why do economists care about "social capital"? In a number of empirical studies, the measures of social capital such as trust have been positively associated with economic growth, and more efficient provision of public goods (Knack and Keefer, 1997, Tabellini, 2005.) Trust is considered as an element that can cope with market imperfections and moral hazard in an uncertain environment, especially in economies where contracts are not sufficiently reinforced by formal institutions. In the literature the membership in voluntary associations is systematically linked to the notion of social capital. For instance, attitudes of trust may be determined by social relations in associations and clubs recognized as important vectors of interactions. Moreover, voluntary organizations are considered as contributing to building people's capacities for participating in political life. Finally, participation in a voluntary organization can mean an adherence to some values and social norms. However, some authors question the existence of relationship between social capital and membership in groups and voluntary associations, and emphasize the fact that promoting associations and participation in groups can be "counter-productive" (Knack and Keefer, 1997).

Given the attention paid to membership in voluntary associations as a determinant of social capital, and some controversial results, the question we raise here is about the relationship between social capital and membership in groups. For public policy this would mean that promotion of voluntary participation can have some effects on the formation of social capital. In this study we use individual-level data and we focus on only one country. To cope with the absence of a unique definition of social capital, we proxy it using a range of variables often put under this label. We use survey responses as proxies of social capital and construct them as categorical dependent variables. Following Knack and Keefer, we proxy community level social capital by indices of trust. To account for a vision of social capital as a resource for individual action, we use individual ability to influence his community life as a proxy of individual level social capital.

Methodologically, this paper is distinguished from most empirical studies devoted to social capital. Generally, in both cross-country and one-country studies, the geographical space is either ignored (Brehm and Rahn, 1997) or taken into account by proxies of area-specific features (Renno, 2000, Curtis et al., 1992.) Indeed, area is not necessarily neutral, this is due to some exogenous and endogenous factors, for example geographical position or local finances. For instance, one can speculate that the people living in isolated locations (e.g. mountains) will not have the same expectations toward people around them than those living in places much frequented by strangers (e.g. a port.) However the common practice of introducing dummy variables to account for location of observations under study does not allow to take into account some dynamic aspects, such as interactions between neighboring observations, or other interdependencies between geographical areas. Several empirical studies were criticized on that point by Durlauf (2002) and Durlauf and Fafchamps (2003). If the distribution of a given error depends on its associated geographical area, then a model allowing for parameter heterogeneity is appropriate to fit the data. There exist several models dealing with spatial heterogeneity¹, such as the Spatial Expansion Model (Casetti, 1972) and the Geographical Weighted Regression Model (McMillen, 1996.) However, none of them can be applied to a relationship with categorical dependent variable. In this paper we use a modified version of the Neuro-Coefficient Smooth Transition Auto-Regressive Model (Medeiros and Vega, 2000.) The

¹Spatial heterogeneity is defined as the lack of stability over space of the relationship under study (Anselin, 1988).

model gives a vector of estimates for each observation according to its geographical position, as well as to other individual attributes. The paper is organized as follows. After a brief review of the social capital concept in section two, the modified NCSTAR model is presented in section three. Section four is devoted to the description of the data used as social capital proxies and its determinants. The results of the multinomial logit and NCSTAR models follow in section five. Section six concludes.

2 Social Capital and Voluntary Participation

The term social capital² highlights the benefits that can be obtained from membership in more or less dense social networks or groups. Social networks and membership in groups are often part of the definition of social capital. The notion of social capital reflects a double level of benefits that can be obtained through social networks and membership in groups. The first refers to the individual-level outcomes facilitated by social ties and the individual's position in the social structure. The second aspect is related to collectivity-level benefits assessed in the literature as trust, cooperation, and social norms. The concept of social capital is closely related to membership in groups as it accounts for some advantages which can be obtained through social relations at individual as well as at community level. However as Portes (1998) and Durlauf (2002) showed, the different interpretations of social capital introduce some problems in empirical studies. This is particularly due to the lack of explicit models and mixing of the concept and its effects. Some studies equalize the stock of social capital to the level of associational involvement and participatory behavior or use them as proxies of social capital (Glaeser et al., 2002). Others consider memberships in voluntary organizations as determinants of social capital measured as levels of trust and civic cooperation (Knack and Keefer, 1997). As Durlauf (2000) noted, Coleman's "substantive ideas around social capital can be subsumed within a general membership theory...", according to which an individual's socioeconomic outcomes are influenced by the groups to which he belongs. Although membership in voluntary organizations as an endogenous affiliation of an individual is only a part of possible affiliations, in developed countries it represents the field of social interactions that should not be ignored.

²This term has been introduced by Bourdieu (1980) in France, and by Coleman (1988) in the English-speaking literature.

The voluntary organizations are recognized as alternative mechanisms (besides the market and public sector) of private provision of impure public goods (Weisbrod, 1977). The impure public goods provided by voluntary organizations may take very different forms, including defending members' common values or interests or merely practices of joint leisure activities.

Voluntary participation is the essential resource of voluntary organizations. According to Salamon et al. (2000), in the 22 countries under study, an average of 28 percent of the population reported contributing their time to nonprofit organizations. In France, the value of volunteering is relatively high as it attained 2,66 percent of GDP in 1995-2000 (Salamon et al., 2004). The French nonprofit sector counts more than 700 thousands of voluntary organizations with more than 7 millions of volunteers. According to the French National Institute of Statistics (Febvre and Muller, 2003), 55 percent of members benefit from common activities, 29 percent pay fees without participating while 17 percent exert responsibilities and 9 percent take part in the organization.

In an empirical study using the data from the US General Survey, Brehm and Rahn (1997) found that interpersonal trust and participation in voluntary associations are positively related one to another. Moreover, this relationship is asymmetric. In other words, respondents who are members of a group are likely to have highly positive beliefs about fairness of others, while the effect of trust on participation is positive but weaker. However, some authors question the vision of voluntary associations as vectors of trust and positive predisposition towards public good issues. For instance, they highlight that the selectivity of these organizations in their membership policies may lead to the emergence of exclusive groups and consequently to the formation of negative social capital. In their empirical investigation, Knack and Keefer (1997) use the variables of trust and civic norms to measure country-level social capital. They define country-level index of trust as the percentage of people who expect that most others will act cooperatively in prisoner dilemma context. Their trust indicator is the percentage of respondents of the World Values Surveys who replied that "most people can be trusted". To measure the variable of civic norms, Knack and Keefer used a large range of responses to questions supposed to reflect the willingness to cooperate with anonymous individuals when faced with various issues, for instance public good ones (e.g. cheating on taxes or avoiding a fare on public transport). They tested the impact of trust on the economic growth and found a strong

significant relationship. Concerning voluntary membership, their empirical investigation of the effects of social capital on economic payoffs concludes that “promoting horizontal associations through encouraging the formation and participation in groups may be counterproductive” as “membership in group...is unrelated to trust, to civic norms, and to economic performance”. In this study the measures of group membership indicated the average number of groups cited per respondent in each country and did not reflect the intensity of participation.

In the present study only active memberships are taken into account. Following Durlauf and Fafchamps (2003), we focus on the specific phenomena associated with the notion of social capital, namely trust, shared norms and civic participation. In other words, here we consider social capital as a positive externality of social interactions that can take the form of trust. For economists, trust reflects the individual’s expectation of the likelihood of non-negative outcome in situations characterized by uncertainty, notably in economic exchanges (Bhattacharya et al., 1998). The so-called generalized trust is based on the general knowledge of an agent concerning his social environment, while the personalized one is an outcome of individual experiences of repeated social interactions with peers. Both forms of trust are supposed to facilitate economic exchanges, cooperation and coordination in the provision of public good. Generally, the formal institutions based on laws are considered as more efficient in building generalized trust than repeated interactions³. However, social networks including voluntary organizations can either contribute to providing necessary support to public provision of public good, or be a “second best solution”. In both cases, voluntary organizations and social networks are crucial for higher involvement in decision-making process, for better understanding of public policy, and especially for its legitimization.

To summarize, there are two main ideas that underlie this study. The first one is that trust, shared norms, and individual ability of community level action, may be associated with social interaction based on interpersonal networks and associations. The second idea is that even if that is the case, the parameters associated with determinants of social capital can well not be identical across observations. The following section presents the model used to estimate the local effects of group membership on trust, social norms, and civic participation as proxies of social capital.

³For each pair of newly matched agents, the interpersonal trust takes time and effort to establish while the generalized trust is instantaneous (Durlauf and Fafchamp, 2003).

3 The model

Hereafter the method used for the empirical investigation is presented. The dependent variables in this study are categorical, i.e. y_i can take $K + 1$ levels. Let p_{ik} be the probability that $y_i = k, k = 0, \dots, K$. Usually, a multinomial logit or a multinomial probit models is performed to determine the p_{ik} 's. Then it is assumed that the functional form of the latent regression is linear and that the errors follow a logistic distribution in the multinomial logit case or a cumulative normal distribution in the multinomial probit case. However, these hypothesis are not always met in practice. As ANN models are universal approximator (Cybenko (1989), Hornik, Stinchcome and White (1989, 1990)), they have been used to approximate the linear latent regression as in Schumacher, Roßner, Vach (1995), Zeng (1999). Here we propose to use the Neuro-Coefficient Smooth-Transition Auto-Regressive (NCSTAR) model developed by Medeiros and Veiga (2000) to approximate the latent regression.

3.1 The original model

The NCSTAR model has been originally written as:

$$(1) \quad y_i = \Theta_i' \tilde{x}_i + e_i, \quad i = 1, \dots, n,$$

where y_i is the i^{th} element of the dependent variable, $\tilde{x}_i = [1, x_i']$ is a $(p+1) \times 1$ vector of explanatory variables and Θ_i is a $(p+1) \times 1$ vector of real coefficients with $\Theta_i = [\Theta_i^{(0)}, \Theta_i^{(1)}, \dots, \Theta_i^{(p)}]'$. More specifically, each output of the multi-layers feed-forward neural network with H units in the hidden layer is given by:

$$(2) \quad \Theta_i^{(j)} = \sum_{h=1}^H \beta_{jh} \Lambda(w_h s_i - c_h) - \beta_{j0},$$

for $j = 0, \dots, p$ and $i = 1, \dots, n$, where β_{jh} and β_{j0} are real coefficients. $\Lambda(w_h s_i - c_h)$ is the logistic activation function with s_i , a $(q \times 1)$ vector of transition variables, $w_h = [w_{1h}, \dots, w_{qh}]'$, and c_h are real parameters. As in Medeiros and Veiga (2000), it is assumed that s consists of elements belonging to x as well as to other variables. However, the approach is still valid if s is only composed by elements of x , as in Medeiros, Veiga and Pedreira (2001) or if $s=x$, as in Medeiros

and Veiga (2000). The logistic activation function is defined as:

$$(3) \quad \Lambda(w_h s_i - c_h) = \frac{1}{1 + \exp(-(w_h s_i - c_h))}.$$

Putting (2) in (1) and reparametrizing leads to:

$$(4) \quad y_i = G(\tilde{x}_i, \tilde{s}_i, \Psi) = \alpha' \tilde{x}_i + \sum_{h=1}^H \beta_h \tilde{x}_i \Lambda \left[\gamma_h \left(\tilde{\delta}_h' \tilde{s}_i \right) \right] + e_i,$$

where $G(\tilde{x}_i, \tilde{s}_i, \Psi)$ is a nonlinear function of the variables \tilde{x}_i and \tilde{s}_i with $\tilde{s}_i = [1, s_i']$ and $\Psi = [\alpha', \beta_1', \dots, \beta_H', w_1', \dots, w_H', c_1, \dots, c_H]'$, the $(p+1) \times (H+1) + (q+1) \times h$ vector of parameters with elements $\alpha = [\alpha_0, \dots, \alpha_p]' = [-\beta_{00}, \dots, -\beta_{p0}]'$ and $\beta_h = [\beta_{0h}, \dots, \beta_{ph}]'$. Moreover γ is a $(H \times 1)$ vector of slope parameters with $\gamma_h = \|\tilde{w}_h\|$ and $\tilde{\delta}_h' = [-\tilde{c}_h, \tilde{w}_h']$ with $\tilde{w}_h' = \frac{w_h}{\gamma_h}$ and $\tilde{c}_h = \frac{c_h}{\gamma_h}$ for $h = 1, \dots, H$.

The optimal specification of the model is based on Rech et al. (1999) to select the x_i 's and the s_i 's and on Luukkonen et al. (1988) and Teräsvirta et al. (1993) to determine h , the number of hidden units.

The NCSTAR network is composed by an input layer which contains the transition variables, a hidden layer and an output layer. The inputs are sent via weights noted $\tilde{\delta}$ to the hidden layer. The hidden units linearly combine the input variables with these weights and apply a logistic activation function to this combination. Then the results are conveyed to the output layer via the β weights. When they arrived to the output unit they are linearly combined and transformed via the identity output activation function to give the output of the network. As the identity function returns exactly what comes from lower layer, it has been omitted in (4)⁴. After estimating the set of global parameters Ψ in (4), the corresponding local Θ_i in (2) were calculated.

⁴With the identity output function explicitly written, (4) becomes:
 $y_i = I(G(\tilde{x}_i, \tilde{s}_i, \Psi)) = G(\tilde{x}_i, \tilde{s}_i, \Psi).$

3.2 The NCSTAR model as an approximation of the latent regression when the dependent variable is categorical

The p_{ik} probabilities are the output of the preceding network (4) if the softmax function is used as output activation function instead of the identity one. It produces valid posterior probability estimates (McCullach and Nelder, 1989, Finke and Muller, 1994) that sum to one. It is defined by Bridle (1990) and it is written for $j = 1, \dots, K$ as:

$$(5) \quad p_{ij} = \frac{\exp(G(\tilde{x}_i, \tilde{s}_i, \Psi_j))}{1 + \sum_{k=1}^K \exp(G(\tilde{x}_i, \tilde{s}_i, \Psi_k))}.$$

In (5), each k modality is related to a set of parameters Ψ_k common to all individuals. However, all these Ψ_k are not identified so the class probability associated with $j = 0$ is constrained to be null and becomes the reference outcome. Now, $K \times ((p + 1) \times (h + 1) + (q + 1) \times h)$ parameters have to be estimated by maximizing the following log-likelihood function (which is equal to minimize the cross-entropy function):

$$(6) \quad \ln L = \sum_{i=1}^n \sum_{k=1}^K y_{ik} \log p_{ik},$$

where y_{ik} is the value of the target variable for the i^{th} observation and the k^{th} category.

4 The data

In this empirical investigation, we examine the extent to which trust, shared norms and civic participation used as proxies of social capital are achieved via social interactions based on memberships in voluntary organizations. The data used in the study are individual and subjective. We consider that they provide coherent information about respondents' probabilistic expectations concerning others' behavior, shared norms, and civic participation. Mansky (2000) and Durlauf (2002) encourage the use of surveys as they provide a coherent information on people's characteristics and expectations. The dataset comes from the ISSP survey "Social Network 2" held in 2001 and includes 1398 individuals for France. As far as the spatial heterogeneity of the relationship between trust and its determinants is concerned, only one observation per department is needed. Thus to determine a representative individual per department, we proceed

as follows. For each department, the middle individual is found by averaging all observations relative to this department (this is what is usually known as the barycentre). Then the euclidian distances between the individuals of the department and the corresponding middle individual are calculated. The individual with the lowest distance is selected as the representative of his or her department. Tarn et Garonne, Vaucluse, Territoire de Belfort, Seine Saint Denis and Val d’Oise are missing values. Moreover the departments of Corse du Sud and Haute Corse have been deleted from the sample as they do not share any common border with other departments. These missing departments are colored in white in all the graphs. The sample arising from these considerations contains 89 observations. The sample variances are mapped in Figure 2. A minimum variance of zero corresponds to the departments with one available observation. The maximum dispersion is 40. Therefore, the results for the departments with the highest variance are to be taken with caution.

4.1 The dependent variables

In this section, two distinct variables reflecting individual expectations concerning other people are studied.

- The first one, called TRUST59, is supposed to reflect the level of “personalized trust”. To assess it we use survey responses to the question: To what extent do you agree or disagree with the statement “There are only a few people I can trust completely”. This variable is coded as follows:
 - TRUST59=0 for “Neither agree nor disagree ”,
 - TRUST59=1 for “Agree ”and “Agree strongly ”,
 - TRUST59=2 for “Disagree ”or “Disagree strongly ”.
- The second variable is supposed to proxy the level of “generalized trust”. TRUST61 describes the individuals’agreement or disagreement with the following statement“If you are not careful, other people will take advantage of you ”. It is coded as:
 - TRUST61=0 for “Neither agree nor disagree ”,
 - TRUST61=1 for “Agree ”and “Agree strongly ”,

- TRUST61=2 for “Disagree ”or “Disagree strongly ”.

As pointed out by Glaeser et al (2000), some experimental results showed that trust questions do not correlate well with real trusting behavior toward anonymous people. However the trust question is strongly correlated with trustworthy behavior in experiments. This allows to consider trust questions as still useful to assess the “social capital”.

- CIVIC63 was measured on the base of the responses to the question: “Suppose you wanted the local government to bring some improvement to your community life. How likely is it that you will be able to influence it? ”
 - The responses “Do not know”were coded as CIVIC63=0,
 - “Not at all likely”and “Not very likely”as CIVIC63=1,
 - “Very likely”and “Somewhat likely”as CIVIC63=2.

The dependent variable TRUST59 is supposed to reflect positive expectations towards people and in some extent it refers to the frequency of social contacts. The variable TRUST61 shows how an individual assesses the likelihood that other anonymous people will behavior opportunistically. The variable CIVIC63 highlights the individual’s ability to influence a public good. These dependent variables are mapped in figures 3(a) to figure 3(c). Figures 3(a) and 3(b) show respectively the respondent’s degrees of personalized and generalized trust. In both cases, most of people respond a low level of trust but in a lesser extent for generalized trust. However their geographic distributions are quite different. As to individual ability to influence a public good, only 19 percent of respondents give a high probability that they could influence their local community life. They are partly localized in the south-east of France, in the Provence Alpes Côte d’Azur region.⁵

4.2 The explanatory variables

This study focuses on the local relation between memberships in voluntary organizations and measures of trust, norms, and individual’s ability to influence his or her local community life.

⁵The list of the French departments as well as the corresponding regions are in Appendix A. The associated map is in Appendix B.

Thus, the explanatory variable GROUP has been constructed on the basis of responses concerning individuals' active or passive memberships in very different organizations, such as political parties, professional, charitable, leisure and neighborhood. GROUP is coded as 1 if people respond that they participate at least once per year in a group and 0 otherwise.

Contrary to many studies, the GROUP variable used in this paper allows us to distinguish between active and passive memberships. This distinction is important for the following reasons. Voluntary associations are generally considered as organizations which are characterized by the following key aspects: the conformity of members to common objectives, the formation of values expressed by participants, and self-regulation (Knoke, 1981). Thus, active membership better reflects the participants' commitment to the common norm linking the individual and the association than the passive one. Secondly, the role of socializing, namely of direct contacts with leaders and peers, facilitates the coordination in the provision of collective good. Indeed, according to numerous experimental results, communication and social relations between actors, absence of anonymity and identification as a member of a group, positively affect agents contributions to public good. Finally, active members are able to influence the provision of public good, whereas passive ones can merely consume the services or goods provided by the organization. The GROUP variable is mapped in figure 3(f). More than half of the respondents declare being active members of an association, a club or a group. The geographical distribution of this variable corresponds to the widespread idea according to which voluntary participation is particularly represented in the North and in the South of France. Most of "non-members" are in the center of France.

The choice of other explanatory variables was based on the assumption that trust, civic norms, and individual ability to influence a public good depend not only on the social network in which the individual is involved, but also on the individual's position in the larger social system, and on his or her individual characteristics (Knoke, 1981, Costa and Kahn, 2002). Unfortunately, the number of explanatory variables had to be limited because of the small sample size available here. Consequently only the INCOME and EDUCATION variables have been kept to account for individual characteristics. As noted Alesina and La Ferrara (2002), trust may be a moral or cultural attitude. In this case, it should be influenced by individual characteristics, e.g. level and type of education. In their empirical study on individual data from US, they found

that being unsuccessful in terms of income or education negatively influences trust⁶. Table 1 describes the values taken by the variables INCOME and EDUCATION.

Table 1: Code for the variables INCOME and EDUCATION

Code	INCOME	EDUCATION
1	<457	–
2	[457,762]	–
3	[763,1067]	elementary school
4	[1068,1500]	grammar school
5	[1501,2287]	professional training with GCEA level
6	[2288,3049]	professional training without GCEA level
7	[3050,3811]	high school with GCEA level
8	[3812,4572]	high school without GCEA level
9	[4573,6898]	undergraduate
10	>6898	postgraduate

Notes: the family income is in euro.

Value 3 of the variable INCOME corresponds to a monthly family income at the level of the guaranteed minimum wage in France. Values 5 and 6 correspond to the middle class in terms of family income. Figure 3(d) shows the geographical distribution and the histogram of INCOME. The half of the sample is composed by the people having middle class family revenues. The variable EDUCATION indicates the degree of education of the respondent. A strong heterogeneity in the geographical distribution of this variable is illustrated in the figure 3(e). People with higher education level represent less than 25 percent of the sample.

5 The results

In this section we present the main results of estimations.

5.1 A standard (linear) multinomial logit model

According to the number of category which equals to 3 for each dependent variable, a multinomial logit model can be performed for each dependent variable with $X = [1, \text{INCOME}, \text{EDUCATION}, \text{GROUP}]$ as explanatory variables. The McFadden's R^2 for TRUST59 equals⁷ 0.076. No parameter estimates are significant except the positive one for income when $\text{TRUST59} = 2$. The

⁶They used responses from US General Social Survey and they considered as trusting those people who responded that "most people can be trusted"

⁷The McFadden's R^2 is also known as the likelihood-ratio index. It compares the likelihood for a model with only an intercept to a model with the set of explanatory variables. It is defined as: $1 - \frac{\text{non restricted likelihood}}{\text{restricted likelihood}}$

LR ratio test⁸ with a p-value of 0.55 cannot reject the following null hypothesis: the appropriate model is the one with only a constant term as regressor. In the TRUST61 case, the McFadden's R^2 equals to 0.036, the null hypothesis cannot be rejected according to the LR ratio test and no estimated coefficients are significant. Finally, for the CIVIC63 dependent, the McFadden's measure of fit is 0.037, the LR p-value equals to 0.58 and the coefficients are not significant except for *GROUP* at the 13 percents level when $CIVIC63 = 2$ (the estimated coefficient for *GROUP* is positive in this case). Even if these results are poor, they succeed quite well in finding the values of the dependent variable: in 81 (respectively 48, 86 and 66) cases out of 89 for TRUST59 (respectively for TRUST61 and for CIVIC63). However, one has to note that there is a predominant value of 1 in the TRUST59 vector. This sample standardization is the outcome of the sample selection procedure.

5.2 A modified NCSTAR model

5.2.1 "Personalized trust"

Figure 4(a)⁹ maps the posterior probabilities of $TRUST59 = 1$. The NCSTAR model has selected *INCOME* as input variable i.e. $\tilde{x} = [1, INCOME]$. This means that *INCOME* enters linearly the model. The transition variables are constituted as follows:

$\tilde{s} = [1, INCOME, EDUCATION, GROUP, LONGITUDE, LATITUDE]$. Only one unit composes the hidden layer i.e. $h = 1$. With this architecture, the McFadden's R^2 equals to 0.439. Moreover, the null hypothesis of a model with only a constant term as explanatory variable can be rejected according to the LR ratio test. This network detects well 84 observations. The estimated global coefficients (noted before $\hat{\Psi}$) are given in tables 2 and 3¹⁰. The corresponding local estimates (noted before Θ) are in figure 4(b). The following regional pattern has emerged. While a strong posterior probability of $TRUST59 = 1$ is uniformly distributed (see figure 4(a)), the corresponding coefficients of *INCOME* are negative in the south of France and positive in the north (figure 4(b))¹¹. In other words, whatever the family income (as shown in figure 3(d)), the estimates present a switching regime from south to north. This suggests that the effects

⁸The Likelihood Ratio (LR) test considers the null hypothesis that the appropriate model contains only a constant term. If the LR p-value is less than 5 percent, the null hypothesis is rejected.

⁹All the figures are in the appendix

¹⁰(see figure 4)

¹¹All the estimated parameters showed in the figures hereafter are linked to the input variables, and are functions of the transition variables

of INCOME as a determinant of TRUST59 differ in the north and in the south. The limited number of $TRUST59 = 2$ does not allow us to consider the effect of INCOME on this category as relevant.

5.2.2 “Generalized trust”

Figures 6(a) and 6(b) map the posterior probabilities of TRUST61. The optimal architecture of the network for this dependent variable is shown in tables 4 and 5 (see Appendix). One can see that GROUP enters linearly and nonlinearly the model. The McFadden’s R^2 equals to 0.204. The null hypothesis can be rejected according to the LR ratio test and the network detects well 59 observations. The comparison of figures 6(c) and 6(a) shows the instability of the relationship, i.e the difficulty to find a generalized rule linking the value of the GROUP coefficients and the posterior probability of $TRUST61 = 1$. In other words, the increase in the values of the coefficients of GROUP in the regression of TRUST61, does not imply an increase in the posterior probability that TRUST61 equals to 1. Concerning $TRUST61 = 2$, greater coefficients of GROUP (in figure 6(d)) are associated with greater posterior probability. This result suggests the existence of a positive link between positive individual expectations concerning anonymous people behavior and participation in groups. According to Figure 6(d), the most of departments with the highest coefficients of GROUP are neighbors. This can suggest the existence of some local patterns.

5.2.3 Individual ability to influence public good

The posterior probabilities of categories 1 and 2 taken by CIVIC63 are mapped in figures 7(a) and 7(b). The architecture of the model is the same as for the two dependent variables mentioned above. The McFadden’s R^2 equals to 0.221, the null hypothesis can be rejected according to the LR ratio test and the network detects well 71 observations. When figures 7(a) and 7(c) are compared, one can see that the increase in the estimated coefficients is related to a decrease in the posterior probability of $CIVIC63 = 1$. In some northern departments, being a member of a group diminishes the probability of responding inability to influence local community life. But its impact is not sufficient to obtain a higher probability for people to be involved. Moreover, a higher posterior probability to be involved ($CIVIC63 = 2$), particularly in the south-east of France, (see Figure 7(b)) is positively associated with the variable GROUP

(see Figure 7(d)). In other words, people who take part in a voluntary organization or a group are more likely to influence their local community life.

6 Conclusion

This study estimates the local effects of voluntary participation on some social capital measures by taking into account the geographical position of each observation and by allowing for parameter heterogeneity. The results obtained from estimation of a global model are based on the assumption of parameter homogeneity. This means that the differences in outcome are assumed to be only the consequence of differences in the levels of the explanatory variables. However, this assumption is not met when dealing with any socioeconomic data set (Brock and Durlauf, 2001). Moreover the existence of externalities across neighboring units, due to social interactions may cause the absence of independency among observations. The administrative division of the territory and the geographic location may introduce some interdependencies in patterns of individuals' behaviors and expectations. Even if social interactions are irreducible to the geographical proximity, the latter supports them.

The following aspects have been highlighted in the present paper. Contrary to other empirical studies of social capital and voluntary participation, we do not make any assumption concerning which explanatory variables enter linearly and non linearly the model. Nevertheless, the GROUP variable enters linearly and non linearly the model for the regressions of generalized trust, shared social norms, and individual ability to influence public good.

Conversely to the Knack and Keefer's findings, we find empirical evidences of positive direct and indirect effects of active membership in groups on the individual willingness to provide public good, on the individual positive expectations concerning other's behaviors (generalized trust.) However, the relationships under study are not stable in space. Some regional patterns have been discerned, that allows to better account for public policy effects at local levels. Concerning the variable of personalized trust, it seems to be related to the income. The results confirm the distinction to be made between different measures of trust used un surveys.

We are aware of limitations of the present study which are particularly due to the lack of more detailed data set. A greater data set would enable us to take more explanatory variables and to better control relationship under study. Though considering of spatial parameter heterogeneity

is an emerging practice in regional science, the surveys often ignore more detailed information concerning respondents' locations, for instance the zip codes. Emphasizing the spatial non stationarity of a relation is helpful for better oriented public policies on appropriate levels. Further research should complete our results for better interpretation of the geographical patterns that have emerged. The analysis presented in this paper can be extended to other countries provided availability of adequate data.

References

- [1] Alesina A. and La Ferrara E. Who trust others? *Journal of Public Economics*, 85: 207–234, 2002.
- [2] Anselin L. *Spatial Econometrics: Methods and Models*, Dordrecht, Kluwer, 1988.
- [3] Bhattacharya R., Devinney T.M., Pillutla M.M. A Formal Model of Trust Based on Outcomes, *The Academy of Management Review*, Vol. 23, 3, 459-472, 1998.
- [4] Bourdieu P. Le capital social, notes provisoires. *Actes de la recherche en sciences sociales*, 1980.
- [5] Brehm J, Rahn W. Individual-Level evidence for the causes and Consequences of Social capital, *American Journal of political Science*, 41, 3: 999–1023, 1997.
- [6] Brock W and Durlauf S. Growth Empirics and Reality, *World Bank Economic Review*, 15, 3: 229–272, 2001.
- [7] Casetti E. Generating models by the expansion method: applications to geographic research, *Geographical Analysis* 4: 81–91, 1972.
- [8] Coleman J. Social Capital in the Creation of Human Capital, *American Journal of Sociology*, 94: 95–120, 1988.
- [9] Costa D.L. and Kahn M.E Civic Engagement and Community Heterogeneity: An Economist's Perspective, 2002.
- [10] Curtis E.J., Grabb E.G. and Baer D.E. Voluntary Association Membership in Fifteen Countries: A Comparative Analysis, *American Sociological Review* 57, 2: 139–152, 1992.

- [11] Cybenko G. Approximation by superpositions of a sigmoid function, *Mathematics of Controls, signals and Systems*, 2: 303–314, 1989.
- [12] Durlauf S.N. The Membership Theory of Poverty. The role of Group Affiliations in Determining Socioeconomic Outcomes. www.ssc.wisc.edu/econ/archive/wp2014.pdf.2000.
- [13] Durlauf S. N. On The Empirics of Social Capital, *The Economic Journal*, 112: 459–479, 2002.
- [14] Durlauf S.N., Fafchamps M. Empirical Studies of Social Capital: A Critical Survey, www.ssc.wisc.edu/econ/archive/wp2003-12.pdf.2003.
- [15] Febvre M. and Muller L. Une personne sur deux est membre d’une association en 2002, *INSEE Première*, 920, 2003.
- [16] Finke M. and Muller K.R. Estimating a-posteriori probabilities using stochastic network models *Proceedings of the 1993 Connectionist Models Summer School, Hillsdale*, eds M. Mozer, P. Smolensky, D. Touretzky, J. Elman and A. Weigend. NJ: Lawrence Erlbaum Associates, pp. 324-331, 1994.
- [17] Glaeser E.L.; Laibson D.I.; Scheinkman J.A.; Soutter C.L. Measuring Trust, *The Quarterly Journal of Economics*, Vol. 115, 3, 811-846, 2000.
- [18] Glaeser E. L., Laibson D. and Sacerdote B. An Economic Approach to Social Capital *Economic Journal*, 112, 483: 437–458, 2002.
- [19] Hornik K., Stinchcombe M. and White H. Multi-layer feedforward networks are universal approximators, *Neural Networks*, 2: 359-366, 1989.
- [20] Hornik K., Stinchcombe M. and White H. (1990), Universal approximation of an unknown mapping and its derivatives using multi-layer feedforward networks, *Neural Networks*, 3, 551–560, 1990.
- [21] Knack S. and Keefer Ph. Does Social Capital Have an Economic Payoff? A Cross-Country Investigation, *The Quarterly Journal of Economics*, 112, 4: 1251–1288, 1997.
- [22] Knoke D. Commitment and Detachment in Voluntary Associations, *American Sociological Review*, 46, 2: 141–158, 1981.

- [23] Lin N. *Social Capital*, Cambridge: Cambridge University Press.
- [24] Luukkonen R., Saikkonen R. and Teräsvirta T. Testing Linearity in Univariate Time Series Models , *Scandinavian Journal of Statistics*, 15: 161–175, 1988.
- [25] Manski C. Economic Analysis of Social Interactions, *Journal of Economic Perspectives*, 14: 114–136, 2000.
- [26] McCullagh P. and Nelder J.A *Generalized Linear Models*, 2nd ed., London: Chapman and Hall, 1989.
- [27] McMillen D.P. One Hundred Fifty Years of Land Values in Chicago: A Nonparametric Approach, *Journal of Urban Economics*, 40: 100–124, 1996.
- [28] Medeiros M.C., Veiga A. A Flexible Coefficient Smooth Transition Time Series Model, Working Paper Series in Economics and Finance, 361, Stockholm School of Economics, 2000.
- [29] Medeiros M.C., Veiga A. and Pedreira C.E. Modelling Exchange Rates: Smooth Transitions, Neural Networks and Linear Models, Forthcoming in *IEEE Transactions on Neural Networks, Special Issue on Financial Engineering* 2001.
- [30] Medeiros M.C., Veiga A. Diagnostic Checking in a Flexible Nonlinear Time Series Model, Forthcoming in *Journal of Time Series Analysis* , 2001.
- [31] Portes A. Social Capital: Its Origins and Applications in Modern Sociology, *Annual Review of Sociology*, 24: 1-24, 1998.
- [32] Putnam, R., Leonardi, R and Netti, R *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton: Princeton University Press, 1993.
- [33] Rech G., Teräsvirta T. and Tschernig R. A Simple Variable Selection Technique for Non-linear Models, Working Paper Series in Economics and Finance, 296, Stockholm School of Economics, 1999.
- [34] Renno L.R., Jr. Microfoundations of Social Capital: Membership to Associations in Latin America, 2000.

- [35] Salamon L.M., Sokolowski W.S. and Anheier H.K. Social Origins of civil society : an overview, Working Paper of the Johns Hopkins Comparative Nonprofits Sector projects, 38, 2000.
- [36] Salamon L.M., Sokolowski W.S., and Associates, *Global Civil Society: Dimensions of the Nonprofit Sector*, Volume Two. Bloomfield, CT: Kumarian Press, 2004.
- [37] Schumacher M., Roßner R. and Vach W. Neural networks and logistic regression: Part I, computational statistics and Data Analysis, 21: 661–682, 1996.
- [38] Tabellini G. Culture and institutions: economic development in the regions of Europe. [http://www.igier.uni-bocconi.it/filesGuido_Tabellini_regions_june05_col\[1\].pdf](http://www.igier.uni-bocconi.it/filesGuido_Tabellini_regions_june05_col[1].pdf).
- [39] Teräsvirta T., Tjøstheim D. and Granger C.W.J. Aspects of modelling nonlinear time series, Chap 48 of Handbook of econometrics, vol IV, Edited by R.F.Engle and D.L. McFadden, 1994.
- [40] Tobler W.R. A computer movie simulating urban growth in the Detroit region, *Economic Geography*, 46: 234–240, 1970.
- [41] Zeng L. Prediction and classification with neural network model, *Sociological Methods and Research*, 27, 4: 499–524, 1999.

Figure 1: The French departments and regions without Corsica, missing values are black

number	department	region	number	department	region
D67	Bas-Rhin	Alsace	D27	Eure	Haute-Normandie
D68	Haut-Rhin		D76	Seine-Maritime	
D24	Dordogne	Acquitaine	D75	Paris	Île-De-France
D33	Gironde		D77	Seine-et-Marne	
D40	Landes		D78	Yvelynes	
D47	Lot-et-Garonne		D91	Essonne	
D64	Pyrénées-Atlantiques		D92	Hauts-de-Seine	
D3	Allier	Auvergne	D93	Seine-Saint-Denis	
D15	Cantal		D94	Val-de-Marne	
D43	Haute-Loire		D95	Val-d'Oise	
D63	Puy-de-Dôme		D11	Aude	Languedoc-Roussillon
D14	Calvados	Basse-Normandie	D30	Gard	
D50	Manche		D34	Hérault	
D61	Orne		D48	Lozère	
D21	Côte-d'or	Bourgogne	D66	Pyrénées-Orientales	
D58	Nièvre		D19	Corrèze	Limousin
D71	Saône-et-Loire		D23	Creuse	
D89	Yonne		D87	Haute-Vienne	
D22	Côtes-D'armor	Bretagne	D54	Meurthe-et-Moselle	Lorraine
D29	Finistère		D55	Meuse	
D35	Ile-et-Vilaine		D57	Moselle	
D56	Morbihan		D88	Vosges	
D18	Cher	Centre	D09	Ariège	Midi-Pyrénées
D28	Eure-et-Loire		D12	Aveyron	
D36	Indre		D31	Haute-Garonne	
D37	Indre-et-Loire		D32	Gers	
D41	Loir-et-Cher		D46	Lot	
D45	Loiret		D65	Hautes-Pyrénées	
D08	Ardennes	Champagne-Ardennes	D81	Tarn	
D10	Aube		D82	Tarn-et-Garonne	
D51	Marne		D44	Loire-Atlantique	Pays de-La-Loire
D52	Haute-Marne		D49	Maine-et-Loire	
D25	Doubs	Franche-Conté	D53	Mayenne	
D39	Jura		D72	Sarthe	
D70	Haute-Saône		D85	Vendée	
D90	Territoire de Belfort		D02	Aisne	Picardie
			D60	Oise	
			D80	Somme	

number	department	region
D16	Charente	Poitou-Charentes
D17	Charente-Maritime	
D79	Deux-Sèvres	
D86	Vienne	
D04	Alpes-de-haute-Provence	Provence-Alpes-Côte-D'Azur
D05	Hautes-Alpes	
D06	Alpes-Maritimes	
D13	Bouches-du-Rhône	
D83	Var	
D84	Vaucluse	
D01	Ain	Rhône-Alpes
D07	Ardèche	
D26	Drôme	
D38	Isère	
D42	Loire	
D69	Rhône	
D73	Savoie	
D74	Haute-Savoie	

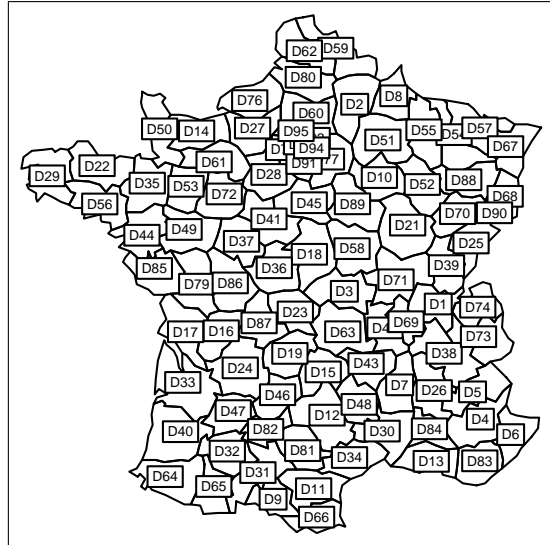


Figure 2: The sample variance

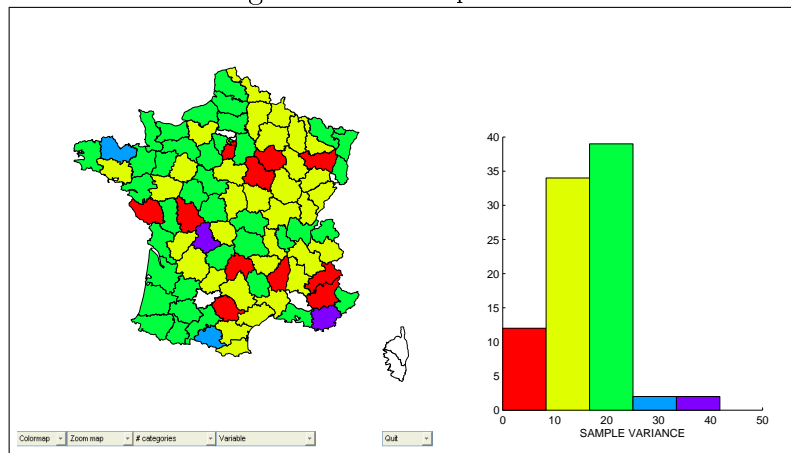
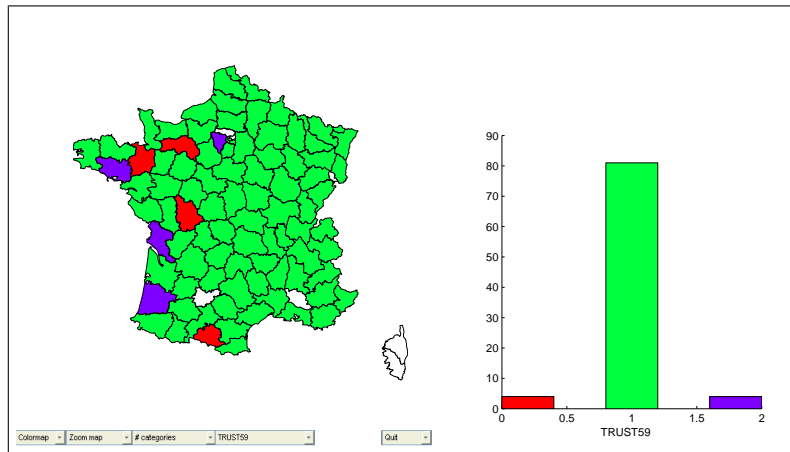
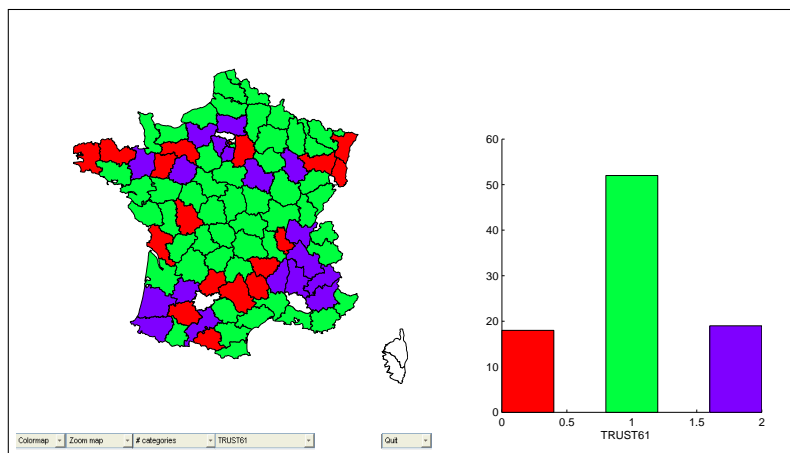


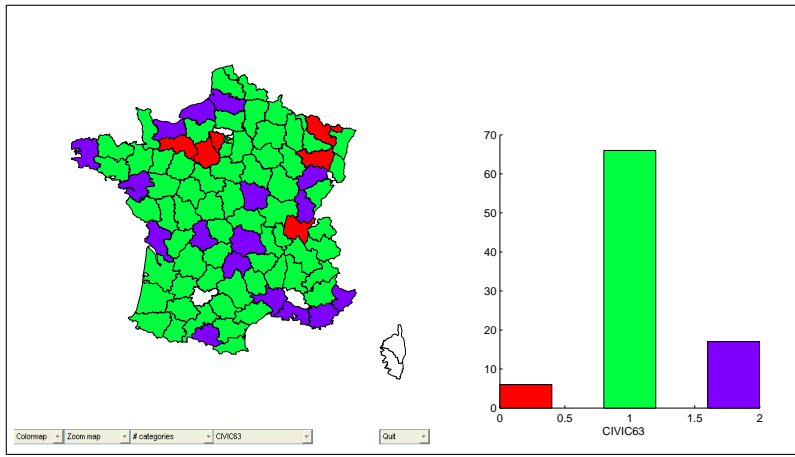
Figure 3: Dependent and explanatory variables



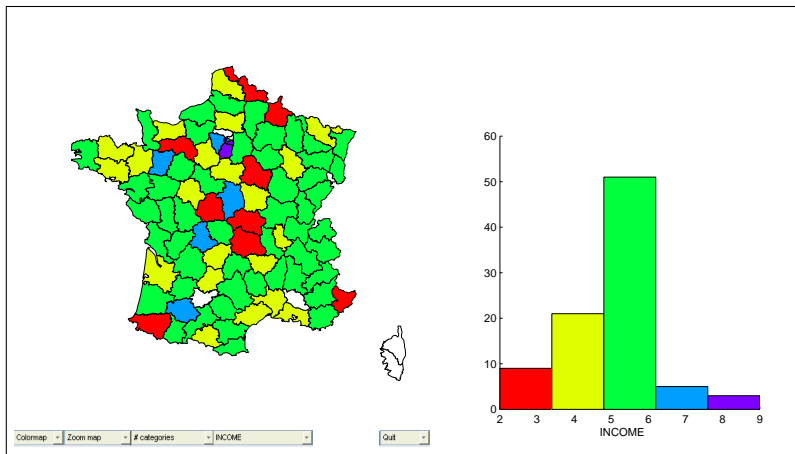
(a) TRUST59



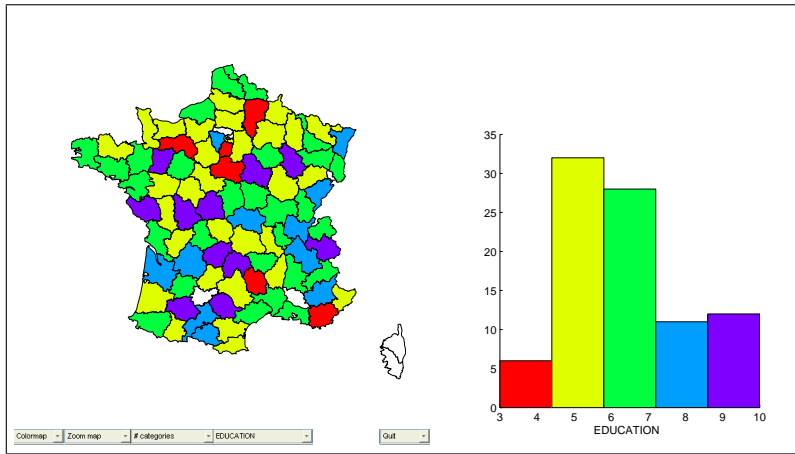
(b) TRUST61



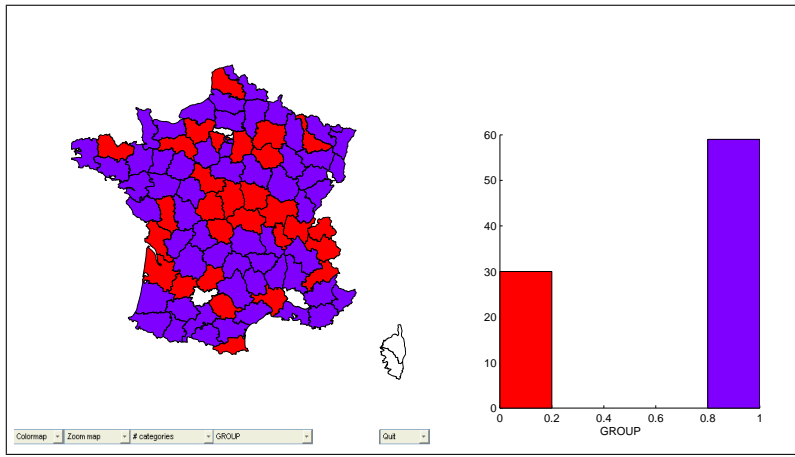
(c) CIVIC63



(d) INCOME

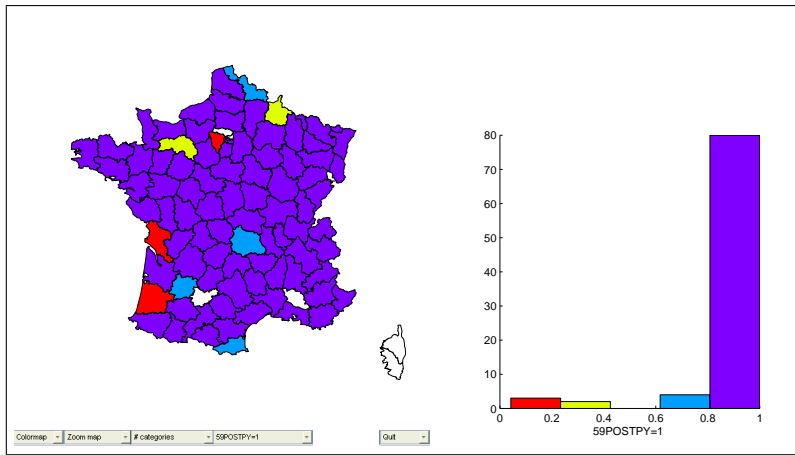


(e) EDUCATION

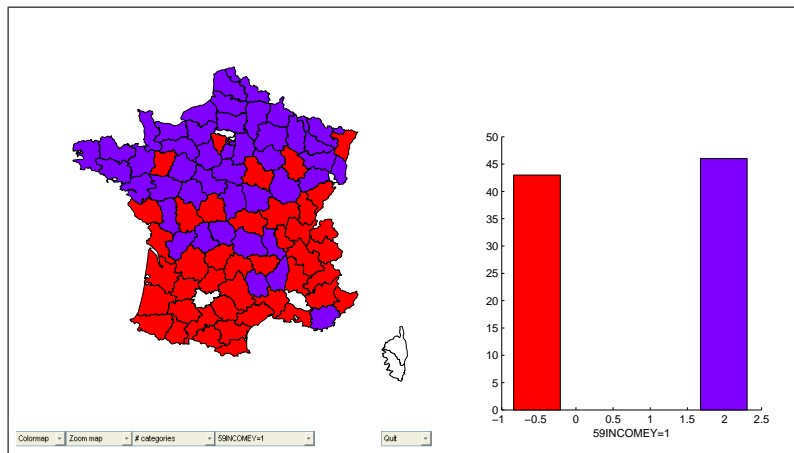


(f) GROUP

Figure 4: NCSTAR results for TRUST59



(a) TRUST59=1 posterior probabilities



(b) INCOME local parameter estimates for TRUST59=1

Figure 5: The NCSTAR global parameter estimates when the dependent variable is TRUST59

Table 2: TRUST59=1

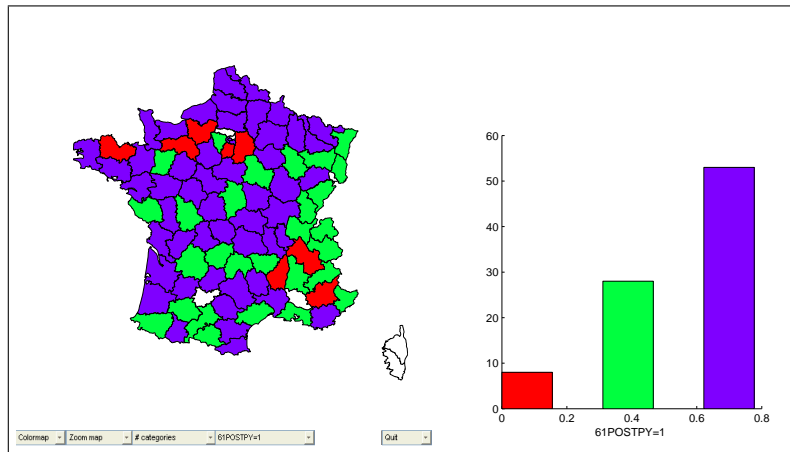
explanatory variables	parameters	TRUST59
constant term	α_{11}	4.79***
INCOME	α_{12}	2.31***
constant term	β_{11}	-1.72***
INCOME	β_{12}	-3.15***
constant term	c_{11}	-4.14
INCOME	w_{11}	-16.04
EDUCATION	w_{12}	144.0
GROUP	w_{13}	-11.04
LONGITUDE	w_{14}	10.68
LATITUDE	w_{15}	-121.88

Table 3: TRUST59=2

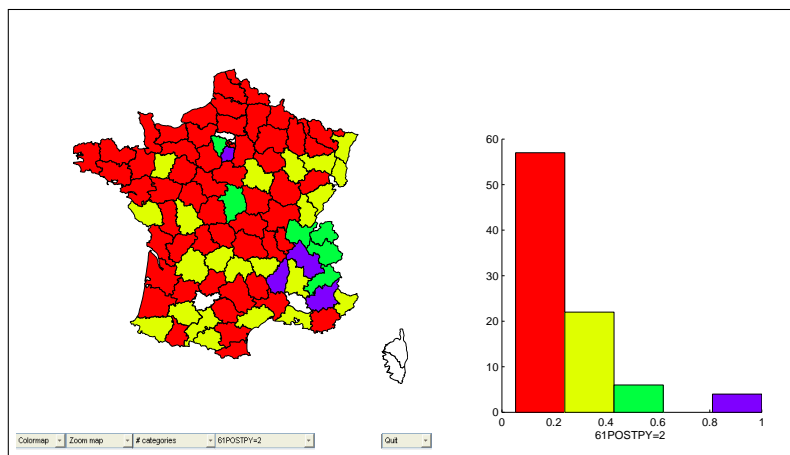
explanatory variables	parameters	TRUST59
constant term	α_{21}	2.08***
INCOME	α_{22}	1.64***
constant term	β_{21}	-197.13
INCOME	β_{22}	-66.34
constant term	c_{21}	-79.79
INCOME	w_{21}	-50.57
EDUCATION	w_{22}	86.87
GROUP	w_{23}	80.56
LONGITUDE	w_{24}	78.17
LATITUDE	w_{25}	-27.02

Notes: * denotes significance at 10 percent level and ** significance at 5 percent level.

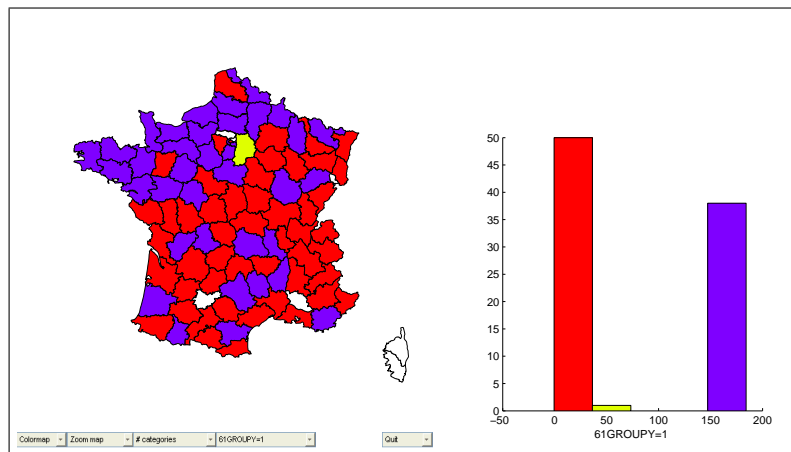
Figure 6: NCSTAR results for TRUST61



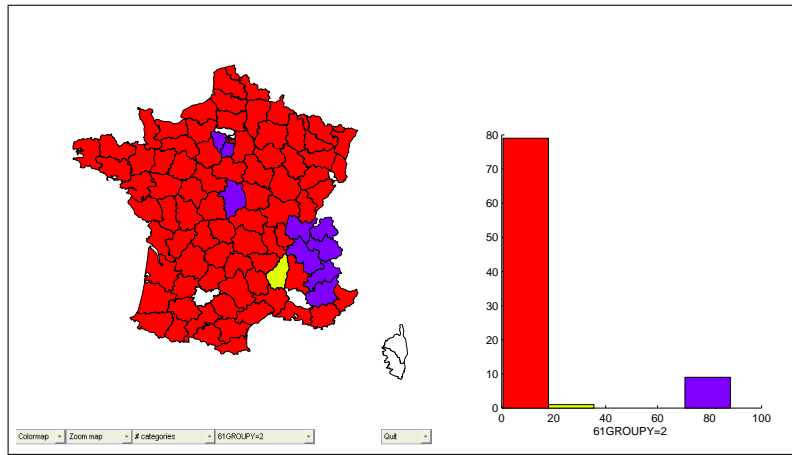
(a) TRUST61=1 posterior probabilities



(b) TRUST61=2 posterior probabilities

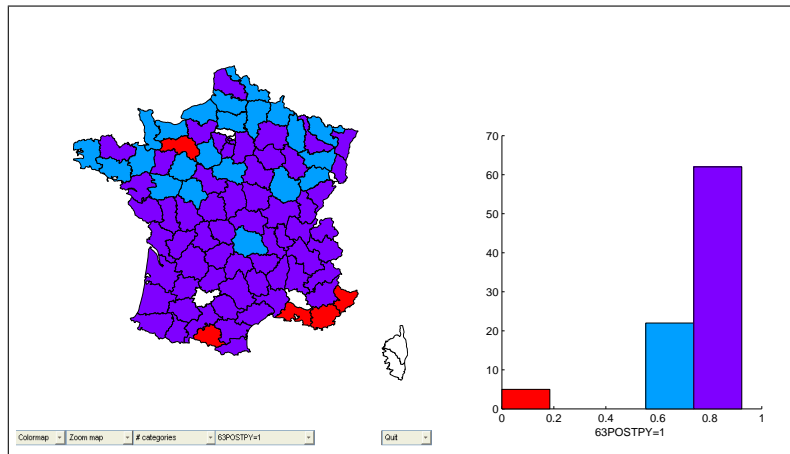


(c) GROUP local coefficients for TRUST61=1

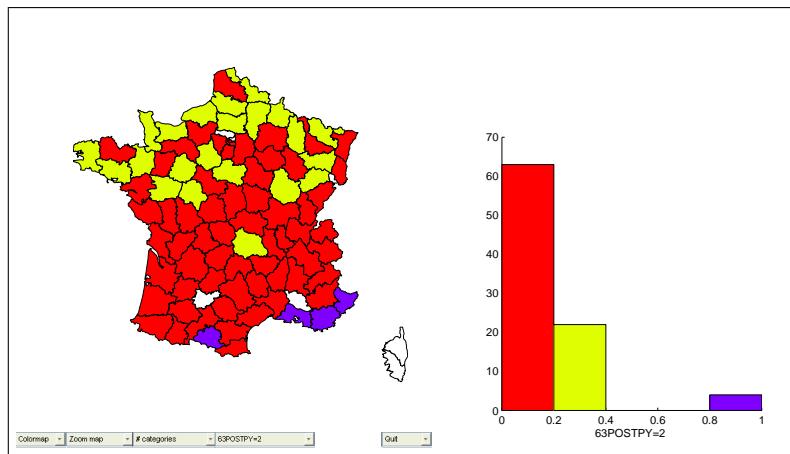


(d) GROUP local coefficients for TRUST61=2

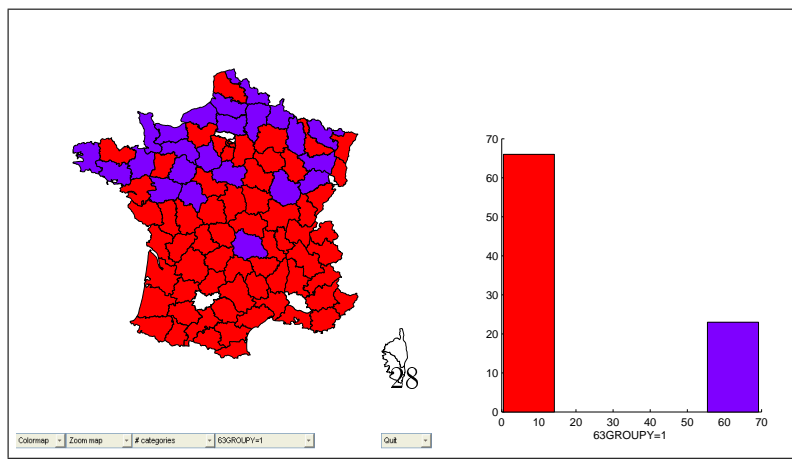
Figure 7: NCSTAR results for CIVIC63

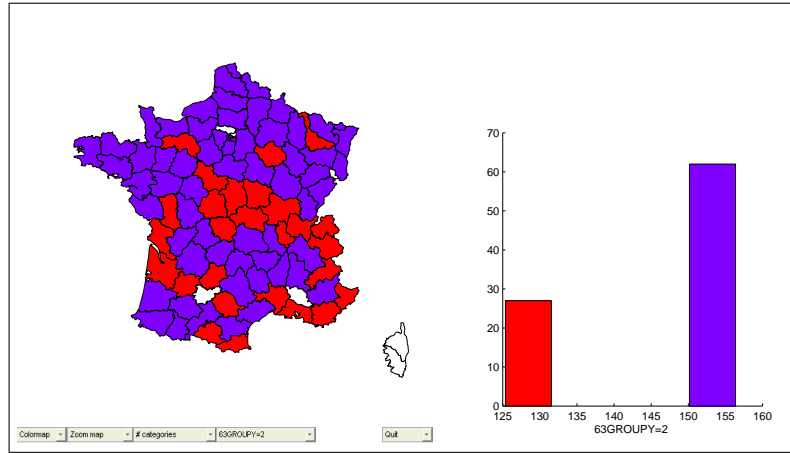


(a) CIVIC63=1 posterior probabilities



(b) CIVIC63=2 posterior probabilities





(d) GROUP local coefficients for CIVIC63=2

Figure 8: The NCSTAR parameter estimates of TRUST61 and CIVIC63

Table 4: For j=1

explanatory variables	TRUST61	CIVIC63
constant	-128.83***	3.12***
GROUP	184.22***	0.46***
constant	129.53***	-50.34***
GROUP	-184.8***	68.72***
constant	-118.91***	155.10***
GROUP	-201.07***	158.88***
INCOME	-111.03***	-82.22***
EDUCATION	291.97***	-70.0***
LONGITUDE	137.54***	-30.89***
LATITUDE	-86.12***	125.06***

Table 5: For j=2

explanatory variables	TRUST61	CIVIC63
constant	124.43***	175.54***
GROUP	88.0***	125.37***
constant	-124.89***	-285.20***
GROUP	-87.49***	30.99***
constant	-479.68***	-176.36***
GROUP	123.43***	251.90***
INCOME	-293.98***	20.72***
EDUCATION	-31.36***	-9.24***
LONGITUDE	-279.25***	-33.57***
LATITUDE	131.60***	198.27***

Notes: * denotes significance at 10 percent level and ** significance at 5 percent level, and *** at 1 percent level.