A spatial analysis of participation in RDP measures: a case study in Emilia Romagna Region

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Summary

A large body of literature has highlighted and analysed the issues which affect the quality and the reliability of evaluation results of the RDPs measure. In addition to weaknesses in the specification of objectives, measurement of the additionality, several authors have pointed-out a lack in evaluation of the cross-effects across space of the measure.
The objective of this contribution is to develop a spatial analysis of the participation rate in the measure 121, highlighting, as a determinant, the effect of the set of priorities established by the local administration. The analysis is realised by two steps: the first is the realisation of an Exploratory Spatial Description Analysis (ESDA) of the participation rate in the Emilia Romagna Municipalities and the second is the development of a spatial econometric model of the participation rate in measure 121.
Results highlight the relevance of the spatial analysis in improving the predictability of the participation to rural development measures. In particular they show a positive effect of the neighbouring and of the spatial location in the explanation of the participation rate; the results also show the effect of the priority mechanism implemented by each province in determining participation.

keywords: rural development measure; farm modernisation; spatial econometrics; participation

JEL Classification codes: Q18 - Agricultural Policy; Food Policy; Q10 - General

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1. INTRODUCTION

The diffusion of innovation or new technologies represents a central issue into the development process of agricultural sector. Also, the innovation diffusion process has a central role into the strategy for the Europe 2020 and is a priority within the horizon 2020 proposal.

The economic literature has pointed out that agricultural policy is one of the main driver of the diffusion and adoption of innovation and of the new technologies in the rural areas, as well as farm, famer and territorial variables. Within the Common Agricultural Policy (CAP), both direct payments and a measure of the rural development plans aim directly to promote a farm modernisation process and the adoption of new technology (Bartolini et al., 2010). However, the literature has highlighted that these policy instruments affects the farmers' adoptions of the new technology in a different ways. The first pillar policy affects the development of innovation changing the overall profitability of the sector and hence modifying the willingness to invest or to innovate; or ensuring liquidity to incentive the innovation/investment (Bartolini et al., 2011). While the measure 121 supports the adoption mainly reducing the innovation cost through co-funding mechanism (Bartolini et al., 2011).

A large body of literature has highlighted the issues which affect the quality and the reliability of the results of evaluation of the RDP measures (Fenton et al., 2011; Finn et al., 2009). In addition to weaknesses in the in specification of objectives, measurement of the additionality, several Authors have highlighted a lack in evaluation of the cross-effects across space of the measure as well as of the spatial spillover effects (Bartolini and Viaggi, 2011). Improving the current RDP evaluation results with a spatial analysis could enrich the current valuation system with a more suitable quantification of the measure effectiveness, allowing for better designing future policies. For these reasons a spatial analysis became more relevant when the policy are spatially targeted to the local and territorial features such as the RDP measure.

The objective of this paper is to highlight the potentiality and the applicability of spatial analysis in to the RDPs evaluation. The analysis is carried out using the participation rate in the measure 121 at municipality level, highlighting as a determinant, the effect of the set of priorities established by local administration. The analysis is realised in two steps: first a Exploratory Spatial Description Analysis (ESDA) of the participation rate in Emilia Romagna (ER) municipalities is realised and then a spatial regression model (with different assumptions of the spatial weights matrix) explaining the participation rate to the measure 121 is applied. The analysis has been conducted within the 7FP project named SPARD (SPatial Analysis of Rural Development Measure).

In the next section the description of the measure 121 implementation in ER are provided. In the section 3 and 4 the methodology applied and the data used are described, and then in the section 5 and 6 the results and the conclusions are presented.

2. IMPLEMENTATION OF MEASURE 121 IN EMILIA ROMAGNA REGION

While the direct payments are mainly implemented at EU level, the rural development measures are designed at local level in order to better tailor policy to the local features and peculiarities. As pointed out by the literature, decentralised design allows to implement more accurate measures (Vatn, 2001). However, such a decentralised design increases the policy costs such as public transaction costs, especially those connected to the design and evaluation phases.

To achieve a better targeted policy, hence, the local administration in charge of implementing RDP measures can set-out some mechanisms of priority and/or level of payment which allows to increase the participation to target areas or target actors at these voluntary measures.

Due to high heterogeneity of the agricultural systems across the region, in Emilia Romagna a mechanism of delegation to lower administrative level at Province level (NUTS3) was implemented. Such delegation implies that each Province has a portion of the regional RPD budget and is in charge to select the beneficiaries.

The budget is allocated to all Province based on the following criteria: the number of farmers, the number of farmers younger than 50 years old, the UAA, the percentage of the gross production in the region, the number of farm employees and the historic amount of payments.

The selection of the beneficiaries is carried out applying two levels of priorities: an upper level, set by the regional administration, and local level of priorities, set at the local (Province) level.

The upper level of priorities is mainly composed by location of the farm, the farming sector and by the altitude (3x3 zoning are obtained by location: centre, eastern and western and by altitude plain, hill, mountain). As a result, the regional priorities could be summarised as:

- centre-eastern planning area with high priority level for fruit and arable sector;
- centre-western mountain area with high priority level: for livestock production;
- centre-eastern mountain area with medium priority level for livestock production;
- western hill area with medium-high priorityfor livestock productions;
- centre-eastern hill area with medium-high priority for livestock productions;
- centre-eastern hill area with medium priority for fruit and wine productions.

In addition to these regional priorities, in the call each Province has established additional priorities based on eligible investments typologies within the farming sectors (e.g. high priority for Authomatic Milking Systems for livestock farms) or based on farm characteristics (for example is some Provinces gives high priority that the applicant is a woman or in other province the involvement of the farm in production network or cooperatives).

3. METHODOLOGY

3.1. Overview

The spatial analysis is a growing topic in the economic literature. Since preliminary works of Paelinck and Klaassen (1979) several papers dealt with the effects of space on the value of observed variables (Anseline 1988).

The methodology proposed is composed by two steps: first an Exploratory Spatial Description Analysis (ESDA) of the participation rate in the Emilia Romagna Municipalities is realised and then a spatial regression model of the participation rate to the measure 121 is applied.

Generally the spatial analysis is realised assuming spatial effect following the contiguity or the neighbouring between areas. In this paper three alternative Queen weights matrix are considered, based on different order of contiguity between municipalities. In the first order, two municipalities are considered contiguous when they share their borders. In the second and in third level, two municipalities are considered contiguous also if there are one or two other municipalities respectively. The hypothesis of difference in the order of contiguity allows to consider different spatial patterns on the participation rate. For example, with the first order of contiguity is possible to include effects on participation rate of the different advise and consultancy service provided, different chain relations and organisations different access to the information about RDP. Otherwise with higher contiguity order the expected effects on participation rate are due to difference in farming systems due to climatic and geographical conditions, and different access to the information about RDP and different mechanism of selections.

3.2. Explanatory Spatial Description Analysis (ESDA)

The availability of Geographical Information Systems (GIS) have supported the development of techniques of spatial data analysis. The Exploratory Spatial Description Analysis (ESDA) is a branch of the Exploratory Data Analysis (ESA) methods applied to spatial data (Anselin, 1995). ESDA has four objectives: describe spatial distributions; discover patterns of spatial associations; detect possible data errors (eg. spatial outliers); formulate different hypothesis of spatial regimes or different form of spatial instability (Anselin, 1995).

In this paper ESDA is performed in the two following steps: the first is a spatial distribution analysis and the second is the spatial association analysis. Within the first analysis the cloropleth map with the relevant variables (participation rate and applicants rates) are performed using different spatial weights matrix. Then a Local Indicators of Spatial Association (LISA) with the meaning to provide indications of significant spatial clustering, among observation, and a measure of global indicator of spatial association (Anselin, 1995) are provided. The measure of global indicator of spatial correlation is performed using the global Moran's Index, i.e. an indicator of the spatial association. Such indicator could have value between -1 and +1. While value less than zero represent a negative spatial association (e.g. increasing the distance the effect of one variable is reduced), the value greater than zero represent a positive spatial association (e.g. neighbourhood or more closer areas increase the value of the observed variables). The global Moran's Index indicator is calculated as:

$$I = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\left(x_i - \bar{x}\right)\left(x_j - \bar{x}\right)}{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)} \qquad (1)$$

Where:

w_{ij} is the spatial weight, which is obtained by the spatial function between generic areas i and j;

x_i, x_j are the observed value of variable x for the *i*th and *j*th location

$\bar{x}$ are the average value of the variable and n is the number of observations.

The Moran scatterplot provides information about the different regimes of spatial associations (Anselin, 1995) and is used to identify spatial clustering ("hot spots" or "cold spot") or spatial outliers. In fact, the scatterplot is divided into four different quadrants. The one on the top and on the right represent the "hot spots" where the participation rate of the municipality observed is higher than the average and the participation rate in the neighbouring region is greater than the average. The one at the bottom and on the left, represent the "cold spots". Such quadrant states that the observed participation rate is above the mean, as well as the average of the neighbouring. The other two quadrants represent the outliers. In fact, in the one in the top and on the right the observed participation rate is above the mean and the average participation rate of the neighbouring is greater than the mean.

The Moran scatterplot does not provide any information about the statistical significance of spatial clustering. In order to obtain also statistical significance Anselin (1995) have developed the LISA, based on local Moran's Indicator

In a very general term LISA for an observation *i* (L_i) could be expressed as : $L_i = f\left(x_i, x_{Ji}\right)$ where x_{Ji} are the participation rate observed in the neighbouring municipalities. Following Anselin (1995) L_i allows to infer the statistical significance of the spatial patter associated with location *i*: $\Pr\text{ob}\left[L_i > \delta_i\right] \leq \alpha_i$, where the δ_i is the critical level and α_i is a chosen significance.

In addition Anselin (1995) suggests an additional requirement of LISA, that be related to the global statistic: $\sum_{i}^{n} L_i = \gamma\Lambda$ where Λ is the global indicator of spatial association and γ is the scale factors. Following Anselin (1995) such equation allows to test the significance of the global indicator of spatial association as: $\Pr\text{ob}\left[\Lambda > \delta\right] \leq \alpha$.

3.3. Spatial Regression model

Participation to RDP measures has been explained using several econometrics techniques, in which the heterogeneity of the methods are generally a consequences of the data available and the analysis of the participation to the RDP measures are strongly data-driven. In fact the varieties of models applied follows the difference concerning the units observed (payments, farms, etc.), the territorial level observed (individual farm; several geographical areas; etc) and the timing of available observations (all RDP time programming; yearly etc.). The most used methods are panel data using FADN data or regression analysis focusing on payments or participation rate at one specific territorial level.

Results highlight that farmers attitude, farmers characteristics, territorial/geographical features, quality and efficiency of institutions involved and quality of consultancy services are determinants of difference in participations.

Most of these variables could have a spatial pattern, which could assume the form of spatial dependence between observations and/or spatial heterogeneity in the model (LeSage and Pace, 2009). As a results spatial location is relevant and when dependent variable are affected by the space, is violated the Gauss-Markov assumptions used in regression modelling (LeSage and Pace 2009). In fact, when in many economic processes are considered proximity or distance functions the variables observed are not independent of each other (Brady and Irwin, 2011). Concerning the participation to RDP measures, location could affect quality and efficiency of local institution, perception by farmers, agricultural systems and quality of advises and consultancy services.

Following LeSage and Pace 2009, the spatial dependency could be modelled as an extension of the standard linear regression model. As a result, the regression could be written as (Breustedt and Habermann, 2011):

$$\begin{aligned} & r = \rho W_1 r + X\beta + \varepsilon \\ & \varepsilon = \lambda W_2 \varepsilon + \mu \\ & E\left[\mu_i^2\right] = \sigma^2 h(z_i) \\ & E\left[\mu_i \mu_j\right] = 0 \text{ with } i \neq j \end{aligned} \qquad (2)$$

Where r is the observed participation rate; X is the $n \times k$ matrix of the k determinants of the participation rate, β is the regression parameter to be estimated, ε is the error term, W_1 and W_2 are the $n \times n$ matrix of spatial weights; ρ are the spatial lag parameter; and λ spatial error coefficient. Where i th element of $W_1 r$ represent the spatial weighted average of the participation rate for municipality i and $W_2 \varepsilon$ are the error lag and represent a specification of the error term.

Under several assumptions about of the ρ and λ the equation 1 could yield:

with $\rho = 0$; $\lambda = 0$ the equations return a standard linear regression model (model 1);

with $\lambda = 0$; the equations return a spatial lag model (model 2);

with $\rho = 0$;the equations return a spatial error model (model 3);

Spatial lag model and spatial error model take into account differently the spatial patterns of the participation to RDP measures. In a spatial lag model it is assumed that participation of one area is affected by the participation of neighbouring areas; while in the spatial error model, some unknown variables shared with the neighbourhood influence the participation rate.

4. DATA

The data used in the analysis concern the three calls of the measure 121 which cover the years 2008-2010. The data used for the explanatory variables are obtained from the ISTAT and Census 2000.

The applicants and the participants are obtained dividing respectively the cumulative number of farms (at 2011) who were applicants to measure 121 and the cumulative number of farms (at 2011) who got the payments in each municipality, with the total number of farms in each municipality.

In table 1 and the statistical descriptives of the above mentioned variables are presented.

Table 1. Statistical descriptives of the applicants rate and participation rate per Province.

		Applicants				Participations			
Province	**Municipality (#)**	**Mean (%)**	**Std. Dev.**	**Min (%)**	**Max (%)**	**Mean (%)**	**Std. Dev.**	**Min (%)**	**Max (%)**
BOLOGNA	60	2.83	2.18	0	8.47	1.72	1.55	0	5.93
FERRARA	26	5.03	2.84	0.57	10.54	3.59	2.16	0.23	7.22
FORLI CESENA	30	3.08	2.45	0	9.46	1.63	1.49	0	6.25
MODENA	47	2.50	1.44	0	6.17	1.43	1.12	0	4.66
PARMA	47	3.25	1.87	0	9.23	1.13	1.05	0	3.68
PIACENZA	48	5.08	4.93	0	16.67	4.22	4.61	0	16.67
RAVENNA	18	5.17	2.46	1.05	10.44	3.93	2.29	0.83	8.79
REGGIO EMILIA	45	3.66	2.81	0	14.75	1.65	1.32	0	4.92
RIMINI	20	1.24	1.76	0	7.94	0.78	1.29	0	5.61
TOTAL	341	3.49	2.96	0	16.67	2.14	2.48	0	16.67

The average applicants rate for the entire Region is 3.49%, with minimum value of zero (it means no applicants in the municipality) and maximum value about 17% of the farm of a municipality. The rate of applicants are strongly diversified across the Emilia Romagna provinces. Three provinces (Ravenna, Piacenza and Ferrara) have high rate participation, about 2 % more than the average value of the region. Three Provinces (Rimini, Bologna and Modena) have very low rate of applicants compared to the others. Such Provinces have less than 3% of applicants rate, almost half value of the three province with the highest value. Finally, the remaining three provinces (Reggio Emilia, Forlì Cesena and Parma) have the value closer to the average of the region. The high standard deviation value shows high differences between the observation within Provinces (municipality). In particular, a strong heterogeneity is observed in Piacenza province. In fact in this Province there are several municipalities whit no applicants and the municipalities with the maximum percentage of applicants 17%. With exception of the provinces Ferrara and Ravenna there are several municipalities in which there has been no applicants

Due to the high competitiveness of the measure, the priority sets implemented by each local administration has resulted relevant in the ranking of the applicants and in the access to the payments. The average value of the participation in the entire region is 2.14%. Compared with the applicants rate, there is a reduction of the 1.50% of the number of farm. Such a strong reduction is due to the selection mechanism implemented in each Province. The ranking is realised using the priority criterion set by each Province. The average value of participation rate in each province is included between 0.78% in the Rimini province and 4.22% in the Piacenza Province. As explained in the paragraph 2, the calls of the measure 121 has been very competitive and the ranking of eligible farms has been established using the regional and local priority mechanism. Within the province there is strong heterogeneity. The higher participation rate is in one municipality in the Piacenza Province with all applicant that have received the payments.

The variable of participation rate has been used as dependent variable in the econometric models and the variables presented in table 2 are used as explanatory variables.

Table 2. Statistical descriptives of the data used.

Category	Variable	Descriptions	Obs	Mean	Std. Dev.	Min	Max
Policy design	Dlfa	Less favourable area (dummy)	341	0.41	0.49	0	1.00
	prob_crops	Regional and province priority	341	16.27	6.05	0	32.23
Characteristics of the farmers	potsuccess	Percentage of farm with potential successor	341	97.90	5.09	9.94	100.00
	Young	Percentage of young farmer (less than 40 years old)	341	8.87	3.41	0.80	21.25
	age_more65	Percentage of farmers older than 65 years old	341	38.26	8.08	18.06	63.41
	Agredu	Percentage of farms which have owner with anagricultural education	341	6.51	6.23	0	37.35
	high_edu	Percentage of farms which have the owner with university degree	341	4.09	3.11	0	26.44
Legal status	part_colle	Percentage of cooperative	341	0.13	0.35	0	3.36
	cond_dir	Percentage of farms which are conducted directly by the farm	341	91.02	8.55	8.85	100.00
Structure of the Farm	labcon_sup	Percentage farms for which the owner work full-time	341	9.52	8.90	0	50.59
	Partime	Percentage of part-time farmers	341	58.62	13.95	24.61	95.13
	only_hhlab	Percentage of farms which use only household labour	341	82.09	12.13	47.73	100.00
	lab_more2	Percentage of farm which use more than 2 FTE works	341	13.10	7.69	0	43.14
	prop_mach	Percentage of farm which are owned of the machinery used	341	85.90	8.99	21.38	100.00
	tractor_less 100cv	Percentage of farmers with tractor with low power than 100cv	341	72.67	18.77	0.07	98.40
	tractor_more 100 cv	Percentage of farmers with tractor with high power than 100cv	341	44.88	21.12	0	98.36
	ave_farmsize	Average dimension of the farm (ha)	341	11.68	6.77	1.77	47.88
	sau_sat	Percentage of UAA on the TAA	341	0.75	0.19	0.14	0.97
	corpi_av	Average number of plots in each municipality (#)	341	4.81	6.99	1.27	59.94
Farming systems	Arable	Percentage of farm with arable crops	341	73.63	20.63	0	100.00
	Fruit	Percentage of farm with fruit crops	341	22.51	22.36	0	94.12
	Forest	Percentage of farm with forest	341	38.92	39.22	0	100.00
	Pigs	Percentage of farm with pigs reared	341	4.54	4.26	0	35.09
	livestock	Percentage of farm with livestock	341	14.51	11.71	0	67.19

The explanatory variables are classified in five categories (table 2). The first category concerns the characteristics of the policy design variables, which are mainly connected with the location in less favourable areas (which is priority for the measure 121) and the variable prob_crops. Such variable represents the sum of the percentage of the farms by the relative priority in the area. Such variable have theoretically value between 0 and 1. The lower value represents the situation with all farmers in one municipality having priority equal to zero, at the contrary value one represent the situation where all farmers of a municipality have the maximum priority score.

The second category of variables concerns farm characteristics. These variables refer to the ageing, farm successor and the farm education. These variables are measured as percentage of the farmers in each municipality with potential successor (potsuccess), younger than 40 (young), older than 65 years old (age_more65), with agricultural education of the owner (agredu) and with high level of education of the owner (edu_high).

The third category (legal status) is composed by only two variables: the percentage of the in each municipality farms associated in cooperative (part_colle) and the percentage of the farmers in each municipality who conduct directly the farm (cond_dir).

The fourth category refers to the farm structure in each municipality. The variables considered are the amount of household and external labour used on the farm, the farm size and the capital used.

Concerning the labour several variables about the percentage of part-time farming (part-time) the percentage of farms where the owner allocate all the working time to agricultural activities (labcon_sup), the percentage of farms that use only household labour (only_hhlab) and the percentage of farm who use more than two full time equivalent (lab_more). The variables used as proxy of farm size are: the average farm size of the farm in the municipality (ave_farmsize), the ratio between UAA and total agricultural area (uaa_taa) and the average number of plots in the municipality (corpi_av). The capital used are measured using three variables: the percentage of farm who are owner of the machinery (prop_mach) and the percentage of farms with tractor with power more and less than 100cv (tractor_more100 and tractor_less100).

The last category are the farming system of the municipality and are measured as a percentage of farms with arable crops (arable), with fruit (fruit), with forest (forest) and which are rearing pigs or cows (pigs or livestock).

5. RESULTS

The results are structured in two sub chapters: the results of the ESDA and the results of the spatial regression model.

5.1. ESDA

5.1.1. Spatial distribution

The distribution of percentage of applicants and the percentage of beneficiaries in each municipality of the Emilia Romagna are presented in figure 1.

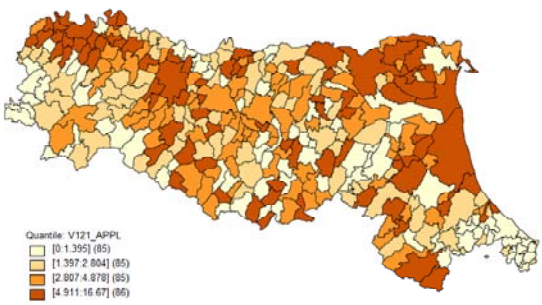

Figure 1A: Cloropeth map of applicants ;

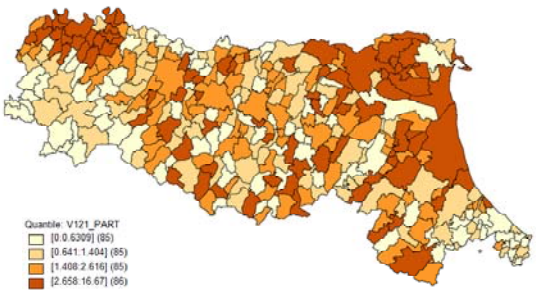

Figure 1B: Cloropeth map of beneficiaries

The maps shown the percentage of applicants to measure 121 (Figure 1A) and the participation rate for each municipality of Emilia Romagna Region (Figure 1B). In both figure applicants and participations rate are grouped in quartiles. The results shown the value of both applicants and participation are included between zero (which means that no farmers applied for the measure in the municipality) and 16%, which represent the maximum applicants rate and participation rate.

As shown by the maps, the highest applications rate are localised in the north-west part and in the Adriatic board (eastern part). The part of the region with higher percentage of applicants is located in the plain area of the Piacenza, Parma, Reggio Emilia province and in Ferrara and Ravenna provinces.

The pictures provided by figure 1A could be representative also for the participation rate (figure1B). In fact, generally there is a correspondence between area with high participation and area with high applicants. This is particular evident in the Piacenza Province (north western part) and in the municipalities of Ferrara and Ravenna Provinces. Only in the central part of the region there is a high amount of excluded farm (see figure 2).

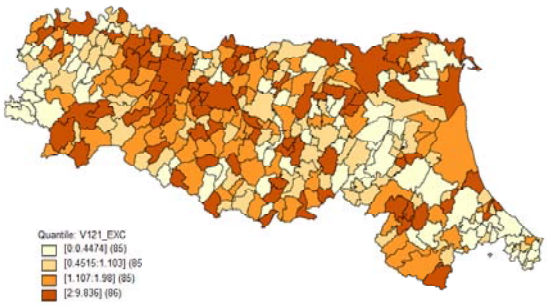

Figure 2: Cloropeth map of not eligible farmers (applicants - beneficiaries)

5.1.2.LISA, Moran's I and Moran scatter plots

In this part of the chapter the results of the Moran scatter plots and the results of the LISA are presented.

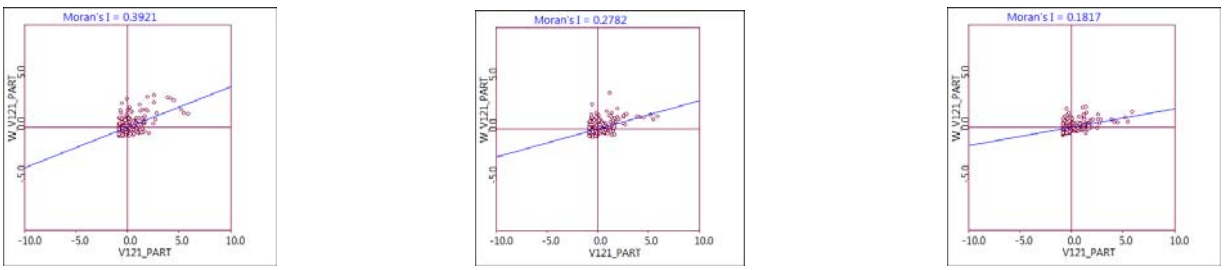

Figure 2 Moran I of the cumulative participation at 2011 to measure 121 using different spatial weight matrix (queen 1, queen 2 and queen 3) respectively.

The figure provides the value of global Moran'I and the Moran scatterplots under three hypotheses of spatial weights matrix. In each scatterplot on the *x*-axis the deviation from the mean for the observed value of the participation rate is presented, while in *y*-axis the average value of the deviation from the mean of the

neighbouring observation are shown. As pointed out in the methodology the location in the four quadrants represent a regime of spatial association. Despite, due to the low value of the average of the participation rate the greater part of municipality are close to the average, and only few of municipality are clearly distant from the origins of the axis and are positioned in the high and right quadrants. Several municipalities are located in the top and right quadrant which represent a hot spot clustering.

The same queen contiguity is used, but is assumes different orders of contiguities. From the left to the right is provide the value of Moran ‘s I and the Moran scatterplot increasing the order of contiguity from 1 to 3. The value on the top on each scatterplot shows the global Moran’s I value. In all three figures a Moran’s I value greater than zero shows that there is some positive spatial association in the participation rate. In other words the participation rate of one municipality is positively influenced by the participation rate of the neighbouring region. Under the hypothesis of the first order of contiguity the value of Moran’s I is quite high, about 0.40, which means that there is a relevant spatial pattern on the participation. The value is differentiate according to the spatial weight considered. Increasing the level of queen contiguity the spatial association is reduced.

Figure 3 shown that increasing the order of contiguity a reduction of the deviation from the mean is observed. This is highlighted by the more closeness of the observation to the x-axis.

In figure 4 the result of LISA are provided.

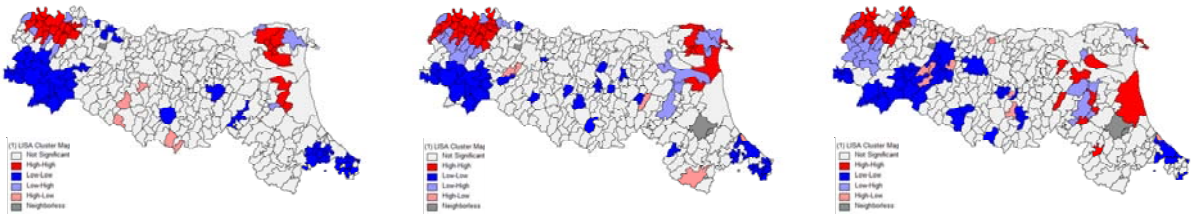

Figure 3. LISA of the Cumulative participation at 2011 to measure 121, using queen contiguity matrix of the first (A), second (B) and third level (C).

Each map shows the spatial cluster obtained by LISA. All the painted municipalities are those municipalities which are significant at least at 0.05. The red colours represent a hot spot cluster, while the Blu the “cold spot” cluster and the pink and the sky-blu the spatial outliers.

Figure 4 confirms that the province of Piacenza, Parma, Ferrana and Ravenna have several municipalities with higher participation rate and this also applies to the neighbours. In the case of the first order of contiguity, it is possible to note that the province of Piacenza and Parma have very high heterogeneity within the territory of the province. In fact in these two provinces there are both hot spots and cold spots clusters. Otherwise, in the rest of the territory there are different regime of spatial associations. In fact it is possible to see only very distant clusters about the two regimes. Finally, there are few spatial outliers. These are mainly closer to hot spot clusters and represent a group of municipalities with lower participation closer to municipality with higher participation rate. In addition there are also few and very spread outliers with higher participation rate compared to the neighbouring municipality (pink cluster)

With higher order of the contiguity the cluster is quite differentiated, especially in the composition of the outliers. In fact under the hypothesis of second or third order the outliers increasing and are mainly those closer to the hot or cold spot clusters.

5.2. Spatial Econometrics

In the table 3 the results of the three regression models are shown.

Table 3. Model results.

	model 1		model 2								model 3					
			queen 1		queen 2		queen 3		queen 1		queen 2		queen 3	
Variable	Coeff	sign	coeff	sign	coeff	sign	coeff	sign	coeff	sign	coeff	sign	coeff	sign
d_lfa	-0.5007	**	-0.4339	*	-0.4245	*	-0.4709	**	-0.4071	*	-0.4257	*	-0.5261	**
dens_ab	0.0000		0.0002		0.0002		0.0002		0.0002		0.0001		0.0002	
only_hhlab	-0.0252	*	-0.0199		-0.0197		-0.0257	*	-0.0267	*	-0.0247	*	-0.0276	**
cond_dir	0.0477	**	0.0455	**	0.0494	***	0.0490	***	0.0485	***	0.0506	***	0.0480	***
part_colle	0.6665	**	0.6916	**	0.6698	**	0.6763	**	0.8007	***	0.7352	***	0.6457	**
corpi_av	-0.0015		0.0042		0.0025		-0.0023		0.0020		0.0029		0.0009	
Potsuccess	-0.0067		-0.0057		-0.0045		-0.0077		0.0069		-0.0022		-0.0088	
Arable	-0.0093		-0.0072		-0.0073		-0.0078		-0.0038		-0.0059		-0.0088	
Fruit	-0.0075		-0.0065		-0.0052		-0.0067		-0.0072		-0.0073		-0.0090	
Grazing	-0.0001		-0.0001		0.0024		0.0019		-0.0017		0.0008		-0.0012	
Forest	0.0072		0.0047		0.0043		0.0054		0.0000		0.0012		0.0068	
Livestock	-0.0108		-0.0094		-0.0074		-0.0071		-0.0022		-0.0034		-0.0093	
Pigs	-0.0647	**	-0.0504	**	-0.0479	*	-0.0563	**	-0.0533	**	-0.0445	*	-0.0536	**
prop_mach	0.0103		0.0088		0.0089		0.0080		0.0080		0.0110		0.0096	
tractor_le	-0.0170	**	-0.0171	***	-0.0182	***	-0.0183	***	-0.0175	***	-0.0170	**	-0.0176	***
tractor_mo	0.0009		0.0018		0.0034		0.0020		-0.0013		0.0000		-0.0005	
labcon_sup	-0.0300		-0.0227		-0.0269		-0.0271		-0.0228		-0.0271		-0.0267	
young	0.0714	*	0.0581		0.0521		0.0654	*	0.0793	**	0.0551		0.0714	*
age_more65	-0.0002		0.0054		-0.0003		0.0017		-0.0003		-0.0049		0.0013	
partime	-0.0165		-0.0141		-0.0151		-0.0144		-0.0059		-0.0141		-0.0165	
Agredu	-0.0156		-0.0134		-0.0099		-0.0122		-0.0077		-0.0083		-0.0132	
uaa_more50	0.2539	***	0.2280	***	0.2459	***	0.2343	***	0.2667	***	0.2804	***	0.2494	***
ave_farmsize	0.0171		0.0073		-0.0003		0.0139		0.0008		-0.0138		0.0104	
sau_sup	2.7057	**	2.0641	*	2.3008	**	2.4869	**	1.5448		2.0352	*	2.6825	**
prob_crops	0.0836	***	0.0768	***	0.0790	***	0.0811	***	0.0758	***	0.0794	***	0.0845	***
_cons	-1.9035		-2.4285		-2.8863		-2.2222		-2.8602		-2.0341		-1.4382	
RHO			0.2515	***	0.2598	***	0.2249	**						
LAMBDA									0.3130	***	0.3206	***	0.2244	
R2	0.45		0.53		0.52		0.51		0.53		0.51		0.49	

The first model refers to the standard linear regression, while model 2 and 3 refer to the spatial lag model and spatial error models respectively. Those last two models are performed using three different orders of queen contiguity.

The first model highlights that the variables which contribute positively to the participation rate are those connected with the farm structure such as farm size and the percentage of farmers with large farm and labour such as the direct conduction of the farm. In addition municipality with high percentage of young farmers and high percentage of farms organised in associative legal status have higher participation rate. In addition the priority score of the municipality, concerning the ranking of farms for the priorities of the

measure 121 increase strongly the participation rate. The first model shows that municipalities with high percentage of farmers invest less capital and with high percentage of farm which use only household labour have lower participation rate. In addition municipalities with high percentage of farms specialised in pork production and the location of the municipality in less favourable areas influence negatively the participation rate. Finally, the model return a quite satisfactory value of R2.

The second model refers to the spatial lag model. Such a model allows to include neighbouring effect in the dependent variable. With exception of the percentage of the young farm, the significant variables are the same and have the same sign, but with a lower magnitude than the model 1. The model provides an estimation of the spatial lag coefficient, which is about 0.25 for the first two order of the contiguity and is reduced for the third order of contiguity. Moving to the spatial lag model the R2 has been strongly increased, which means that the ability of the model to reproduce the observed with the inclusion of the spatial pattern is increased.

The third model refers to the spatial error model. Such model allows to include the spatial patterns into the error term, which means that the error term have a component which is spatially distributed. With exception of the ratio between uaa_taa in each municipality, the significant variable are the same and have the same sign, but with a different magnitude with respect the model 1 and model 2. Different to the model 2 increasing the order of contiguity there a reduction of significance in the spatial error parameters, and in the case of the third order is not significant. Again, adding the spatial error in the error term there is a strong increasing of the R2 compared to the model 1.

6. CONCLUSIONS

In this paper the spatial patterns of the participation rate in the municipality of the Emilia Romagna are investigated. The paper represents a first attempt to investigate the participation in the measure 121, trying to take into account relevant information about the spatial patterns, and the results confirm that the participation rate have a spatial component which should be investigate. Results highlight the relevance of the spatial analysis in improving the predictability of the participation on rural development measures. In particular they show a positive effect of the neighbouring and of the spatial location in the explanation of the participation rate; the results also show the effect of the priority mechanism implemented by each province in determine the eligibility of the application.

An important results is about the spatial weight considered. In fact results are affected by the different hypothesis about the neighbourhood and the relation between locations. Altogether for a correct interpretation of the spatial issues is very importance to identity a priory which form of spatial relation should improve the explanation of the observed phenomena. In our case due to the dimension of the analysis the first order of contiguity could be enough to explain the spatial pattern which affect the participation. However, additional insight about the effect of the spatial pattern in the explanation of the participation rate is needed to enrich the predictability of the participation.

Additional weakness of this paper are concerning the data availability at municipality level which could better describe territorial issues and allow for a better distillation of the spatial components by the territorial components. However, the analysis could be improved using data at farm level which allows to include further spatial effects such as for example imitation which could provide more insight in the explanation of the participations.

The weakness of the paper allows to improve the analysis in several directions. However to be able to improve the RDPs evaluation such analysis could be extended to impact indicators, but the availability of reliable data at disaggregate level or proxy of impact (municipality or individual) is low.

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