Rural development policies and land use change: the Lombardy case study

Guido Sali

Department of Agricultural and Environmental Sciences, University of Milan, Via Celoria 2, 20133, Milan

guido.sali@unimi.it

Stefano Corsi

Department of Economics, Management and Quantitative Methods, University of Milan, Via Celoria 2, 20133, Milan

Chiara Mazzocchi

Department of Agricultural and Environmental Sciences, University of Milan, Via Celoria 2, 20133, Milan

chiara.mazzocchi1@unimi.it

Abstract

Since the second half of last century the land use change has become one of the most important problem linked to territorial policies and governance. In all the Europe farms plays an important role against the increasing urbanization in the urban but also in the rural areas. The Rural Development Program (RDP) is one of the most important tools to support agriculture, as it must support farms through direct funding concerning competitiveness, sustainability, diversification. The aim of this paper is to investigate the relationship between the RDP measure for modernizing farms, their permanence on the territory and land consumption in a case study area, by the Propensity score matching technique. The analyse shows a link between agricultural land consumption and presence of the measure 121 of RDP.

Introduction

Soil is a natural resource and nowadays its scarcity is one of the most important topic in European political debate and all over the world. In effect, land agricultural availability is strictly linked to food security and to future perspectives of meeting the food needs (FAO, 2011). Agricultural economic policies must be effective and their impact should be evaluated to improve the efficiency in using public resources. The rural development program evaluation is one of the key problem linked to Common Agricultural Policies (CAP) in Europe. Although the literature has investigated the effects of policy decisions on the evolution of farm structure and its permanence in the market, the understanding of the real impact of policies on agricultural sector is limited (Ahearn et al., 2005). The policy interventions are difficult to assess, partly because government programs have often different aims and each program uses a wide range of different tools to achieve its objectives (Sali et al., 2013).

However there are no literature references targeted at linking participation in funding programs with the characteristics of the territory in which farms work. The Rural Development Programme (RDP) measures implementation can show interesting connections between policies and land use, because it may reveal whether the distribution of the measures is related to land use change processes. Furthermore it could check for the existence of a causal relationship between the presence of certain RDP measures and the level of soil consumption.

Access to CAP financial support, may indicate a tendency by the farm closely related with the commitment to get financing: in the sense that some measures require minor efforts than others, like the agro-environmental ones. On the contrary, the measure related to the modernization of farms requires large commitments so it can be reasonably assume that a farm that accesses to that measure is involved into a long term development perspective. In this regard this paper furthers the understanding of the relationship between agricultural farms that access to a specific measure of RDP 2007-2013 regarding investments for modernizing farm structure, called "121"[1], and the location of these activities within the territorial context through the Propensity score, a non experimental method. More detailed, the possible relationship between the implementation of 121 and the agricultural land consumption will be investigated.

It is assumed that farms have accessed to funding for modernization (121 measure) are designed more than others to remain on the territory thanks to the advantage provided by the contribution; furthermore, they could be show different characteristics rather than the other farms that did not access to 121.

In this paper section 2 covers data and methodology for the analysis; section 3 concerns results and discussion; and section 4 summarizes the conclusions.

[1] In the Rural Development Program of Lombardy Region, the measure number 121 refers to the "measures aimed at restructuring and developing physical potential and promoting innovation through modernisation of agricultural holdings", mentioned in Article 20 (b), point i) of Council Regulation (EC) No 1698/2005. Measure 121 is one of the most important measures of Lombardy's RDP, since in the period 2007-2013 have been allocated to this measure € 400 million, compared to a cost of the RDP of € 1500 million.

Data and Methodology

Lombardy is one of the most densely populated regions in Italy, although there are large differences between the different areas of the Region. Effectively, on the one hand, there are scarcely populated areas in the mountains, on the other hand there are highly populated areas like Milan, classified by the OECD as the fifth most populous metropolitan area in Europe (OECD, 2006). Furthermore in recent years Lombardy is recognized as one of the Italian most built regions. It shows an increase of urbanized land from 1999 to 2007 of about 34,165 ha, corresponding to 11,3% of total urban areas in the region (ERSAF, 2010). The consumption concerns agricultural land that has decreased of 43,278 ha, mainly located in the plains (Mazzocchi et al., 2013), compared to a total agricultural area of 986,800 ha.

UAA losses	A	A	B	B	C	C	D	D
	ha	%	ha	%	ha	%	ha	%
Average	-24.85	-7.49	-35.68	-3.68	-22.38	-5.15	-21.90	-3.62
Min	-481.31	-57.34	-269.53	-28.26	-1030.14	-58.17	-251.45	-29.14
Max	8.57	21.81	17.28	3.52	302.43	269.65	68.01	73.18
Dev Std	44.62	7.39	37.38	4.08	75.94	18.95	47.15	9.70

Table 1. Descriptive statistics on UAA losses in Lombardy Region, our elaboration on Dusaf database 99-07.

For these reasons Lombardy has been chosen as the case study, beginning from an analysis on data regarding UAA consumption in Lombardy municipalities (Table 1). Data classification (A, B, C, D) derives from the RDP 2007-2013 that identified four areas: A as urban poles; B as rural areas with specialized intensive agriculture; C as intermediate rural areas; D as rural areas with development problems. On average in all areas there has been a loss of UAA, which means that the phenomenon of agricultural land consumption is widespread in the whole region. However, the most interesting is the one that concerns the geography of land use change: in area A and B, the loss of UAA is caused almost completely by an increase in urbanization, that detracts areas to agriculture. Conversely, the UAA losses in C and D zones seems to mainly be balanced by an increase of natural surfaces (woods, natural green areas, etc.) so it can be assumed that in these areas the agricultural land consumption is in large part due to the abandonment of agricultural activity and to a re-naturalization of these abandoned lands (Table 2).

	URBANISED SURFACE INCREASE (ha)	AGRICULTURAL SURFACE INCREASE (ha)	NATURAL SURFACE INCREASE (ha)
A	12,468.22	-11,331.57	-1,183.94
B	17,910.75	-20,370.62	3,186.54
C	2,935.54	-9,691.77	6,765.70
D	850.26	-1,883.16	1,045.58
total	34,164.76	-43,277.12	9,813.88

Table 2. Land use change in Lombardy Region, our elaboration on Dusaf database 99-07.

In Lombardy, the121 was attended by 1,461 farms and the large part of funding was allocated to B zone farms, that is the 80% of the total funding (Agriconsulting, 2010). The analysis was conducted on the farms divided into the RDP zones; it has been made a selection on farms to eliminate those which had incomplete data, obtaining a whole dataset with 7,352 farms, of which 510 had access to 121 measure.

The aim is to estimate the average effect on a sample subjected to treatment as compared to a control sample. The method used is based on the Propensity score matching. The choice of method depends on the fact that in many cases, in the evaluation of the effects of a particular treatment (in our case the access to a measure of investment), it is necessary to analyze observed data and it is not possible to structure an experimental plan constructed in advance. We are faced with the need to employ a non-experimental method, using administrative data referred to a sample of subjects that has not been previously randomized nor appropriately associated with a control sample. If the optimal answer to the question "what effects are attributable to the treatment received?" comes from the comparison between the effects observed on the treated sample and the effects on the same sample if it had not been treated, it is clear that this comparison is beyond the reach of any analysis.

On the other hand the *a posteriori* choice of a control sample runs the risk to compare subjects that for the intrinsic characteristics are very different and therefore cannot properly assess the effects of the measure. Through the method of propensity score matching, we can select a sample of subjects that have the same characteristics of the treated sample, according to a vector X of characteristics. This will reduce the bias in the comparison between groups that would be created in a non-experimental approach, as this is the case of participation in a program of economic policy.

The propensity score is defined as the conditional probability of receiving treatment, given a set of pre-treatment features (Rosenbaum e Rubin, 1983):

$$p(X) \equiv Pr\{D=1|X\} = E\{D|X\} \quad (1)$$

where D = {0,1} indicates, in this case, the adhesion or not of a farm to a particular measure of the RDP. If the adhesion to the measure is random with respect to subsamples defined by X, in the same way is random with respect to subsamples defined by the propensity score p (X).

Within the sample of firms, knowledge of the propensity score p (Xi) of the i-th farm for each i, allows to estimate the average effect of the measure on the participating farms (Average Effect of Treatment on the Treated, ATT) measuring the difference between the effects in the two counterfactual situations of adhesion and non-adhesion, as follows:

$$ATT = E\{Y_{1t} - Y_{0t} | D_t = 1\} \quad (2)$$

The estimate of ATT, given the propensity score p (X), can be obtained if two hypotheses are made. The first assumes the balancing of the pre-treatment variables X

$$D \perp X | p(X) \quad (3)$$

This means that the distributions of cases subject to treatment (as well as those not subject to treatment) and the control variables X are mutually orthogonal, given a propensity score p (X). If the condition (3) is satisfied the observations with the same propensity score must have the same distribution of characteristics X regardless to be part of the treatment process or not (or as in this case from joining or not to a measure of the RDP).

The second hypothesis can be expressed as follows:

$$Y_1 Y_0 \perp D | X \Rightarrow Y_1 Y_0 \perp D | p(X) \quad (4)$$

that indicates how the conditioning to the variables X with respect to which the counterfactuals groups have a different composition means that the potential effects are independent of the selection process (unconfoundedness).

Results

Pre-treatment variables employed were: Economic Dimension Unit (EDU), Livestock Cattle Unit (LCU), farm property, age of farmer, fuel consumption. The propensity score was determined by logit regression. The average of each of the variables observed for the treated sample and the untreated one does not differ, with a significance level of 0.01. The estimate of ATT was conducted by comparing the change occurred in UAA in the municipalities where there were farms accessing to 121 measure with the changes occurred in municipalities where no farms had accessed to 121 measure. In this research the analyzed phenomenon belongs to the "context" in which local farms operate and not exactly to farms; that is why talking about the policy effect (limited to the measure 121) is not correct . It should also be specified that the phenomenon of land use consumption is a structural process whose determinants forces are belonging to other sectors than the agricultural one. For these reasons, the analysis principally captures spatial relationships between allocation of funding and land consumption. In Table 3 the results are shown.

	Zone A	t (pvalue)	Zone B	t (pvalue)	Zone C	t (pvalue)	Zone D	t (pvalue)
Average soil consumption	-67.095	-	-64.655	-	-52.177	-	-69.507	-
Average outcome of the matched treated	-74.368	-	-62.158	-	-66.515	-	-36.688	-
Average outcome of the matched controls	-65.981	-	-54.123	-	-72.061	-	-63.786	-
ATT estimation	-8.386	-0.456	-8.035	-1.833	5.545	0.257	27.098	1.603

		(0.640)		(0.057)		(0.791)		(0.084)
ATT estimation (Bootstrapped std error)	-8.386	-0.377	-8.035	-1.589	3.523	0.166	30.273	1.598
Obs treated	73	-	300	-	68	-	69	-
Obs controls	67	-	263	-	61	-	37	-
Obs tot	1,228	-	4,876	-	888	-	360	-

Table 3. Effect on soil consumption (ATT)

ATT estimation was conducted using nearest neighbor matching with replacement (Becker and Ichino, 2002, Smith and Todd, 2005). The robustness of the estimate of ATT has been verified by the bootstrap estimate of standard deviation. A significant difference in the variation of the agricultural areas between municipalities where there are farms that have joined the measure 121 and municipalities where no farms have joined it has been verified. In B and D zones the difference between the means of treated and untreated areas is significant ($p<0.1$); conversely, in A and C zones is not significant. The land use dynamics do not vary in the municipalities in which come farms have joined to measure 121 and in those where there are not farms that joined to 121. The most interesting consideration is that in urban poles and in rural areas with specialized intensive agriculture, land consumption is greater in the municipalities in which exist some farms that have accessed to 121 measure, on the contrary, in C and D zones land consumption is larger in the municipalities in which there are no farms accessing to 121 measure. Consequent to what reported in par. 2 about the different dynamics of UAA losses between the different areas, it can be assumed that in the C and D areas farm investments may serve as reinforcement tool for farms and in some way it can contribute to the decrease UAA losses. Conversely in A and B zones, the 121 measure does not slow at all agricultural land consumption, almost entirely due to urbanization.

Conclusions

The results allow us to believe that the methodology may provide useful information with respect to the relationship between agricultural production structure, implementation of agricultural policies and land use. The propensity score matching seems an interesting technique to study and evaluate different aspects of agricultural policies impacts.
The analysis of the distribution of the measure 121 shows a high capacity to identify evolutionary characteristics of the territory which are not the primary objective of the measure. In fact, the farm competitiveness and the capacity to provide income is a necessary condition, although not sufficient, to the farm survival. The farm becomes a defense against the land use change, but the effectiveness of this measure in terms of contrast to UAA losses appears different in the diverse zones: in particular it is very low in the areas where the urbanization pressure is greater.

References

Agriconsulting (2010), **Rapporto di valutazione intermedia, valutazione del PSR della Regione Lombardia 2007-2013**, Regione Lombardia, Milano.

Ahearn M.C., Yee J., Korb P. (2005), **Effects of differing farm policies on farm structure and dynamics**, American Journal of Agricultural Economics, Vol. 87, n. 5, pp. 1182-1189.

Becker S.O., Ichino A. (2002), **Estimation of average treatment effects based on propensity scores**, The Stata Journal, 2, n. 4, pp. 358-377.

ERSAF (2010), **Uso del suolo in Regione Lombardia. I dati Dusaf**, Regione Lombardia, Milano.

European Environment Agency (2006), **Urban sprawl in Europe, the ignored challenge**, Office for Official Publications of the European Communities, Luxembourg.

FAO (2011), Land tenure and international investments in agriculture. Food and Agriculture Organisation, Rome.

Mazzocchi C., Sali G., Corsi S. (2013). Land use conversion in metropolitan areas and the permanence of agriculture: Sensitivity Index of Agricultural Land (SIAL), a tool for territorial analysis. Land Use Policy, 35, pp.155-162.

OECD (2006), OECD Territorial Reviews: Milan (Italy), OECD Publications, Paris.

Rosenbaum, P, M, Rubin, D, B 1983, The central role of the propensity score in observational studies for causal effects, Biometrika, Vol. 70, n. 1, pp. 41-55.

Sali G., Corsi S., Mazzocchi C.(2013), Politiche di sviluppo rurale e valori immobiliari, Convegno Evoluzione dei valori immobiliari e politiche agricole,pp. 87-98, C.E.S.E.T.

Smith J.A., Todd P.E.(2005), **Does matching overcome critique of non experimental estimators?**, Journal of Econometrics n. 125, pp. 305–353.

Author's data

Guido Sali

Department of Agricultural and Environmental Sciences, University of Milan, Via Celoria 2, 20133, Milan

t. +39 0250316480

guido.sali@unimi.it

Guido Sali is an Associate Professor in Agricultural and Environmental Economics and Politics. He is member of scientific committee of Research Centre for Appraisal and Land Economics. His research topics focus on agricultural economics and agro-food policies, rural development policies and multifunctional agriculture. He is Scientific Coordinator of several research projects on the use of natural resources in agriculture as well as relations between urban and rural areas.

Stefano Corsi

Department of Economics, Management and Quantitative Methods, University of Milan, Via Celoria 2, 20133, Milan

t. +39 0250316476

stefano.corsi@unimi.it

Stefano Corsi is a Researcher within the Department of Economics, Management, Quantitative Methods of the University of Milan. His main research interests pertain to environmental assessment, rural development, spatial planning and market. He participated in several national and regional projects.

Chiara Mazzocchi

Department of Agricultural and Environmental Sciences, University of Milan, Via Celoria 2, 20133, Milan

t. +39 0250316473

chiara.mazzocchi1@unimi.it

Chiara Mazzocchi is a Post-doctorate fellow at the University of Milan**.** Her main research interests are land use change, agricultural policies, peri-urban agriculture and Geographical Indications as rural development tools. She spent a training period of her PhD at the Ecole Nationale du Paysage de Versailles. She teaches several courses in master on the theme of territorial economy.