Evaluating agri-environmental schemes.
The case of Tuscany

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Abstract

The present paper describes the role of organic farming measures in the safeguard of the High Nature Value in Tuscany. Using National Census of Agriculture data (2010) the probability of program enrolment has been computed, through a Probit model. After, a Propensity Score Matching approach has been implemented, to verify what would have happened if treated farms would not have participated to the program. Hence, a control group with similar characteristics as the treated one has been built. Finally, the Average Treatment on the Treated has been computed, revealing organic farming measures have not statistical relevance in enhancing biodiversity.

Keywords: agri-environmental payments; biodiversity; Tuscany; treatment effect.

INTRODUCTION

Agri-environmental schemes, introduced during the 80s and become fully operational with EC Reg. 2078/92, represent the political tool to greening agriculture. They provide Member States with the obligation to implement them into their national regulation, although farmers' participation is completely voluntary. Their main aim is to encourage farmers in adopting farming practices compatible with the safeguard of the natural landscape (EC, 2005). The agricultural economic literature has investigated the role played by the European agri-environmental policy in enhancing biodiversity (Dwyer, 2013; Scheper *et al.*, 2013; Chabé-Ferret and Subervie, 2011; Jaraité and Kažukauskas, 2011; Schonhart *et al.,* 2010; Espinosa *et al.,* 2010; Kleijn *et al.,* 2006; Latacz-Lohmann and Hodge, 2003; Feinerman and Komen, 2002), but there is no agreement about its effects that, as pointed out by the related literature, depend on both the landscape and each scheme features. The main purpose of this paper is to evaluate the implementation of agri-environmental schemes (AES), namely Measure 214a.1 of the Tuscany Rural Development Program (2007-2013) concerning organic farming measures, and its contribution to the High Nature Value. The main idea is to measure what would have happened if treated individuals would have not participated in the program and the mean effect of the program participation (the so-called Average Treatment on the Treated) on the outcome variable (in this case the HNV). Hence, after having constructed a model of the probability of participation (a Probit model), based on observed characteristics not affected by the program itself, two groups of treated and untreated units have been built (through the PSM), on the basis of the closeness of the scores (Khandker *et al.,* 2010). Finally, the ATT has been computed, revealing the statistical non-significance of AES in the promotion of biodiversity.

METHODOLOGY: PROPENSITY SCORE MATCHING

According to Rosembaum and Rubin (1983), the Propensity Score Matching is a statistical model which predicts the probability of treatment assignment, e.g. participation to agri-environmental schemes, conditional on observed characteristics unaffected by the program (such as the pre-treatment socioeconomic characteristics). Analytically, it can be denoted as :

$$p(X) \equiv \Pr(P = 1|X = x_i)$$

where the function p(x) is the propensity score, that is, the propensity towards exposure to treatment, given the observed covariates X (Rosembaum and Rubin, 1983). The propensity function is unknown, so it may be estimated, may be using a logit (or probit) regression model. The predicted values are thus used in order to estimate the propensity scores, which will be used to create the control group that has the most similar characteristics to the treated one. Therefore attendees of payments are matched to those farmers who have similar propensity scores, but do not actually attend. After having constructed the sample matching, the ATT can be calculated as

$$ATT = E\left[(Y_i^1 - Y_i^0 \middle| T = 1, X)\right] = E[Y_i^1 \middle| T = 1] - E[Y_i^0 | T = 1]$$

which is the difference between the averages of the treated and control groups.

RESULTS AND DISCUSSION

The first relationship we investigated regards the probability of farms to implement organic farming measures. Therefore a probit regression model has been run, taking into account a set of 13 independent variables supposed to influence the program enrolment. The table summarizing the probit results is reported below:

MEASURE 214.A, EXPRESSED BY THE VARIABLE T_BIO		
_CONSTANT		-2.107 (-24.54)***
SEX OF THE FARM HEAD		-0.05 (-1.31)
AGE OF THE FARM HEAD		-0.01 (-8.81)***
HH COMPONENTS BELOW 40		0.24 (3.11)***
STANDARD OUTPUT		7.11e-12 (10.46)***
MOUNTAIN		0.07 (1.69)*
ARABLE		0.04 (0.62)
HORTICULTURE		-0.53 (-3.65)***
PERMANENT FARMING		0.01 (0.21)
ANIMAL FARMING		0.45 (6.74)***
MIXED FARMS		0.32 (4.10)***
% OF CROP VARIETY		0.78 (13.35)***
INTENSITY OF FARMING		-1.57 e-20 (-4.10)***
EDUCATION OF THE FARM HEAD		0.13 (5.60)***
McFadden's Pseudo R-squared	0.11	
Prob> Chi^2	0.000	

Source: Author's calculation. Standard Normal Z in brackets: *** p<0.001, ** p<0.05, * p<0.01.

Table 1. Probit Regression Results.

The probit model reveals that smaller farms (STANDARD OUTPUT) are those for which participation appears to be greater than for the larger ones, as well as for horticulture, animal and mixed farms. The young age of the household's components positively affects treatment attendance, as well as the higher level of education of the farm head. As expected, positive benefits from crop variety has been found, contrary to intensive farming practices. After that, the matching sample has been constructed. In particular the control group has been built, applying the Nearest Neighbor algorithm, which revealed that 649 untreated farms had the most similar characteristics with the treated ones. Hence, after having controlled for the balancing properties of the covariates (the related tables under request), the ATT has been computed. Results are shown in Table 2 (only the outcome from the Caliper Matching will be reported. Nearest-Neighbor and Kernel findings, which show the same results, under request):

Variable	Sample	Treated	Controls	Difference	S.E.	T-Stat
HNV	Unmatched	0.24	0.20	0.041	0.009	4.85
	ATT	0.24	0.23	0.008	0.011	0.53

Source: Author's calculation.

Table 2. Average Treatment on the Treated (Caliper).

As the table evidences, the implementation of organic farming measures has had a low impact on the safeguarding of biodiversity (ATT=0.2). Rather, the most surprising result emerges from the t-statistics, which points out the statistical irrelevance of AES in enhancing the promotion of biodiversity in Tuscany. A possible explanation may be attributed to the little stringent structure of the concerned policy. As participation is voluntary, farmers are only required to commit themselves to respect good environmental practices, without being submitted to an ongoing monitoring. Moreover, the ex-post monitoring to which they are subjected is rather slack (Mantino, 2008) and carried out by the Regions themselves. Additionally, as Mantino (2008) argued, after Agenda 2000 the admissibility criteria are less restrictive, as many production constraints were cut out. Farther, the compression of all the 22 measures listed in EC Regulation 1257/99 (AES are one of them) into a great box, namely Pillar Two, could have reduced the specificity of each single action. An implication of this extensive logic is that it allowed Member States to allocate European funding between different measures, in order to satisfy all the possible requirements. . A key policy priority should therefore be a more tailored and stringent agri-environmental policy, taking into consideration the specific needs of the areas where it is implemented (as Trisorio and Borlizzi, 2011, suggested). Moreover, an ongoing monitoring could have an *incentive-effect* on farmers, offsetting the less rigorous aspect of the free grants.
The findings of the present study are affected by some limitation, which are mainly attributable to both data and methodology adopted. The National Census of Agriculture provides cross-sectional data, that do not permit to provide a comprehensive overview of organic farming measures. As they refer only to 2010, it cannot state, in absolute terms, how much the organic measures are able or not to improve the diversity and density of flora and fauna species. For this purpose, the use of panel data would allow the measurement of a possible change in the *HNV* due to organic agricultural practices. Regarding the methodology, the balancing property presupposes the choice of some variables, at the expense of others that could be relevant to the impact of the final outcome. Certainly this is a limit of the model. Thus an argument for further research could be to apply Matching, integrating it with a Difference-in-Difference approach., to panel data: in fact, if data are available, a complete evaluation on the extent of the effects of conversion to organic farming on the *HNV* would be possible (as the study of Chabé-Ferret and Subervie, 2011 suggest).

CONCLUSIONS

The paper has examined the role of Measure 214 of the Tuscany rural development policy, specifically measure 214.a.1 regarding the organic schemes, in promoting and safeguarding plant and animal diversity. The main aim was to estimate what would have happened if treated farms would not have participated to the concerned program, and what has been the impact of this scheme to the High Nature Value. In order to do that, a Propensity Score Matching approach has been adopted, to create a counterfactual that could show the behaviour of treated farms in the absence of the treatment itself. First of all, a probit regression model has been run, aimed at evaluating factors affecting farmers involvement into the treatment and their probability of involvement. It revealed that education of the farm head, as well as youth of the households' components, are positively related to farm enrolment. Also smaller farms are more prone to participate in the program, as well as mixed farms and the herbivores ones. Moreover, crop rotations is positively related to organic measures, contrary to intensive farming, that contrasts with organic farming. After that, the matching methods have been applied in order to match the two treated and control groups and to compute the Average Treatment on the Treated (*ATT*). The balancing check of the covariates demonstrated that it was good enough: the three properties, e.g. insignificance of the *t-tests* after matching, the reduction of absolute and percentage bias, and the means between the two groups, were encountered. As discussed above, this permits the validation of the *ATT* findings that, interestingly, indicate that organic farming schemes are not statistically relevant in protecting animal and plant biodiversity (as the *t-test* reveals). This result is confirmed in all the three matching algorithms adopted: the Nearest-Neighbor, Caliper and Kernel matching. In other words, organic farming is not sufficient to enhance biodiversity. However, this study has several limitation. Firstly, cross-sectional data, as those of the National Census of Agriculture that we used, place some limits for the investigation of the extent of effective impact of organic schemes on the *HNV*. Additionally, the assumptions on which the methodology applied is based, e.g. the balancing checking, may generate partially deviant results. One interesting direction for further research might be to apply both Matching and Difference-in-Difference to a panel data, which could permit to identify if the outcome of interest, e.g. the *HNV*, has been altered by the implementation of organic farming practices.

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