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Farmers' views on the future of olive farming in Andalusia, Spain

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ABSTRACT

Andalusia, located in southern Spain, is the major olive production area worldwide. Due to the relevance of this agricultural sector on the regional income, this article investigates olive farmer's perspectives regarding olive production after their retirement and potential factors affecting these including economic, social, environmental and spatial factors. We use data from a survey conducted to 431 olive farmers in Andalusia in 2010. Our findings show spatial dependence in explaining farmer's views on the future of olive farming at relatively small distances. In addition other factors such as bad economic performance, erosion or olive diseases affect farmer's perception. We make propositions on what elements should be taking into account when designing agricultural policies aiming at guaranteeing the sustainability of olive farming in future.

Introduction

Spain is the first world producer and exporter of olive oil and table olives. Olive grove is grown in 2,032,290 ha, considering both rain-fed and irrigated area (MAGRAMA, 2010). Spanish olive production yields 43% of the total olive oil world production in 2007/2008 (1.2 million tons) which comprises a gross production of 1990 million Euro (MAGRAMA, 2010, 2012). The region of Andalusia, located in southern Spain, is the major olive production area worldwide with a total area of 1.5 million ha (19% of the total olive grove area in the world, 30% of the total olive grove area in the EU and 59% in the Spanish territory) (CAyP, 2008). Olive production in this region is the second most important agricultural sector after horticulture, creating an overall income of 2660 million € in 2007 (26% of total agricultural production of Andalusia).

Further to its economic relevance, social and environmental aspects associated to olive production are also important. Concerning the social aspects, olive grove is identified as a 'social crop' since this is one of the agricultural activities that creates the most jobs per hectare (CAyP, 2008). Indeed the olive industry creates 32% of agricultural employment in Andalusia (91,327 direct jobs), more than any other agricultural activity (e.g. horticulture), being particularly relevant in rural municipalities in Andalusia where olive farming is almost the only source of income for the population.

Regarding environmental aspects, traditionally olive groves in Andalusia were associated with high biodiversity, being an example of a 'high natural value' agricultural system. This was possible due to low-intensity olive farming systems (i.e. low use of agrochemicals and low degree of mechanization), old olive trees with semi-natural herbaceous vegetation and their location in areas with different land uses (Duarte et al., 2008; Beaufoy and Cooper, 2009). However, in recent years this ecological value has diminished due to the 'modernization' of olive grove farming which has been based on the expansion of olive grove area, resulting in olive monoculture systems in large areas of Andalusia, and on the intensification of the olive farming systems (intensive use of fertilizers, pesticides and machinery). This modernization is partially result of the previous Common Agricultural Policy (CAP) olive oil subsidies, based on the amount of olive oil produced (De Graaff et al., 2008). In 2006 olive production was effectively integrated in the single payment scheme (De Graaff et al., 2010). From 2006 to 2010 Spain opted for a partial decoupling (entitlements were decoupled from current olive production in 93.61%), and from 2010 onwards Spain decided in favor of total decoupling. The application of total decoupling implies farmers' observance of cross compliance regulations in order to benefit from public support. Thus, farmers may receive payments if their land is maintained in good agricultural condition and if they comply with the standards of public health, animal and plant health, the environment and animal welfare (European Commission, 2003).

Due to the economic, social and environmental importance of olive production in Andalusia, this paper aims: (i) to investigate the perspectives of current olive farmers regarding olive production after their retirement and (ii) to identify the variables that may have an influence on the farmers' perspectives about the continuity/abandonment of the olive activity. As some authors have

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pointed out socio-economic and environmental factors may play an important role on olive farming abandonment (Baldock et al., 1996; Viana, 2003; Duarte et al., 2008).

The paper is organized as follows. Materials presents the data and methodology used, with a brief description of the questionnaire utilized and an explanation of the econometric approach to analyze farmers' prospect on the continuity of olive production. Results presents farmers' views about the continuity/abandonment of their activity and their determinants. Finally, conclusions contains a discussion of the results and the conclusions drawn.

Materials and methods

A survey was conducted in Andalusia between May and September 2010. A two-stage sampling was carried out to obtain a representative sample of olive farms. First, six agricultural districts were randomly chosen: Campiña Alta (Córdoba), La Loma (Jaén), Campiña del Norte (Jaén), Penibética (Córdoba), Sierra Sur (Jaén) and La Sierra (Córdoba). Fig. 1 shows the location of these agricultural districts in Andalusia.

These agricultural districts account for 474,405 ha of olive grove (32.4% of total olive grove area in Andalusia) (Gómez-Limón and Arriaza, 2011). Once the agricultural districts were selected, in a second step 80 farmers were randomly selected for being face-to-face interviewed in each district, and 480 questionnaires were obtained.[1] Some olive farmers did not provide information for all variables considered in the study and 49 questionnaires were disregarded. Consequently a sample of 431 valid questionnaires was finally analyzed including the main olive grove systems existing in Andalusia: traditional mountain olive groves (high sloping land and rain-fed conditions), traditional plain olive groves (moderate sloping land, rain-fed conditions and low density of olive trees per hectare) and irrigated intensive olive groves (moderate sloping land and water availability) (Gómez-Limón et al., 2012). Table 1 shows some farmers' socio-demographic data and farm structure information and productivity levels for the whole area under study and per agricultural district. Differences amongst agricultural districts were found in the percentage of farmers with secondary education, percentage of the farmers working full-time and the olive area size, percentage of irrigated olive area and farmland allocated to other crops.[2] Regarding the productivity of olive farms, significant differences were found. The presence of a higher number of irrigated farms increases the average productivity. La Loma with a large percentage of irrigated olive farms shows the highest productivity. Some significant differences were found as well in non-irrigated olive farms. Thus, districts such as Campiña Alta show higher productivity than La Sierra. To some extent these differences in productivity are related with the dominant olive grove system in each of these areas. Thus in Campiña Alta prevails the traditional plain olive grove whereas in La Sierra the traditional mountain olive grove, with lower yields.

A questionnaire was designed to collect information on farmers' views about the future use of the farmland after their retirement along with other information that may have an influence on the probability that their olive production will continue after their retirement. Amongst potential causes we distinguished economic issues such as the economic performance of on-farm activities, the location of the farm, and farm characteristics such as olive tree varieties, production type (i.e. organic vs. conventional), a tree pathology question related to whether there are olive trees with verticillium wilt in the farm and the estimated percentage of olive trees affected, soil erosion risk due to farmer's management practices. In addition, farmer's age has been included in the analysis.

Theory

Increasing attention has been paid to spatial processes in agriculture, resource and environmental economics since mid-90s (Bockstael, 1996; Weiss, 1996). Taking into account spatial effects in our model is important since not accounting for spatial aspects may lead to misleading inference (Anselin, 2001). We account for spatial autocorrelation to be present, which could arise from neighbor effects, spillover effects, or from topographic and climatic characteristics. Neighbor effects occur when farmer's view on olive production in future may be influenced by that of the neighbor farmer whereas spillover effects would be those caused by third parties and affect farmer's view on future olive production. Spatial effects can also capture spatial errors such as correlations in unobserved factors that determine farmer's views on the future of olive production such as climatic and topographic characteristics. We use a spatial autoregressive ordered probit model to examine a number of factors that may determine farmer's views on the prospect continuity of olive production. The model can be determined by:

$$y_i^* = \rho W y_i + x_i \beta + \varepsilon_i \quad i = 1, \ldots, n \tag{1}$$

where the subscript i refers to a farmer; y_i^* is a latent variable that represents farmer's perception of the future of olive farming; the spatial dependence parameter ρ captures the relationship between the farmer's views on future olive production and the average views on future olive production of farmer's neighbors; W is a spatial or connectivity symmetric matrix which defines farmer's neighborhood; x_i is a vector of factors that may influence farmer's views including a constant; β is a vector of parameters to be estimated associated with the explanatory variables; ε_i represents independently and normally distributed unobservable factors, with mean zero and standard deviation one. Following Greene (2003, pp. 736–740):

$$\begin{aligned} y_i &= 1 \quad \text{if } y_i^* \le \gamma_1 \\ y_i &= 2 \quad \text{if } \gamma_1 < y_i^* \le \gamma_2 \\ y_i &= 3 \quad \text{if } \gamma_2 < y_i^* \le \gamma_3 \\ y_i &= 4 \quad \text{if } y_i^* > \gamma_3 \end{aligned} \tag{2}$$

The cut points γ_j divide the categories of the dependent variable. Therefore, the probability that alternative $y_i = 1$ is chosen is the probability that the latent variable y_i^* is equal to or below γ_1. To calculate the probability that alternative 2 is chosen we need to calculate the probability that the latent variable y_i^* is between γ_1 and γ_2, and so on.

An important question in spatial analysis is what constitutes farmer's neighborhood. The specification of the spatial matrix can differ based on different interpretations of neighborhood. Two main approaches can be used to specify the spatial matrix. One approach is based on a spatial $n \times n$ matrix W with elements $W_{ij} = 1$ for farms $j = 1, \ldots, n$ considered as neighbors to farm i and $W_{ij} = 0$ for those no-neighboring farms. The diagonal elements of spatial matrix $W_{ii} = 0$, to preclude an observation of farmer i on his views about the future of olive production from directly predicting itself. The spatial matrix is usually row standardized such that the rows add up to one facilitating the interpretation of models coefficients. Under this approach neighborhood can have different interpretations. Thus, neighbors can be those farmers that are within a given council or within a given distance. For the latter, the elements of the matrix W are given by: $W_{ij} = 1$ if $0 <$ distance between $i,j < s$ (s is the distance beyond which no dependence is assumed); otherwise $W_{ij} = 0$. An alternative approach is the use of a spatial matrix based

[1] The maximum margin of error for the whole survey is ±2.4% with a confidence level of 95%, 2 sigma $p = q = 0.5$.

[2] These results are based on non-parametric Kruskall–Wallis tests.