Agri-environmental schemes in olive growing: Farmers' preferences towards collective participation and ecological focus areas

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ABSTRACT

This paper tackles several issues under-studied concerning agri-environmental schemes (AES), namely requirements related to ecological focus areas (EFA) and collective participation. For this purpose, choice experiment was used to assess farmers' preferences towards AES in olive growing of Southern Spain. A high heterogeneity was found, being identified four different classes of farmers, from potential participants to intermediate and non-participants. Almost half of the farmers would implement EFA at low monetary incentives (€8-9/ha per 1%-EFA) and the rest would do it at moderate to high monetary incentives (€41-151/ha per 1%-EFA). Most of farmers would not participate collectively with an up-to-30% bonus.

KEY WORDS: Environmental public goods, Olive groves, Collective participation, Ecological focus areas, Choice experiment.

1. Introduction

Agri-environmental schemes (AES) have received wide attention by researchers (Uthes and Matzdorf, 2013). However, deeper knowledge is still needed in some important issues. Three of these issues are analysed here, namely the implementation of AES in agricultural systems formed by permanent crops, the inclusion of ecological focus areas (EFA) and of collective participation in such schemes. For it, farmers' preferences towards AES concerning these issues have been analysed here using choice experiment. In particular, AES in olive groves system of Southern Spain have been used as case study. Therefore, the main objective of this study is to support public decision-making regarding AES in olive growing while advance in the knowledge concerning EFA and collective participation in AES.

2. Method

2.1. Choice experiment approach

Choice experiment is a stated preference valuation technique based on Lancasterian Consumer Theory of utility maximization which postulates that consumption decisions are determined by the utility or value derived from the attributes of the good being consumed (Lancaster, 1966). The econometric basis of the approach lies on the random utility theory (McFadden, 1974). For an extensive explanation of the choice experiment theory and practice, see Hensher et al. (2005). In particular, choice experiment is well suited to measuring the marginal value of the attributes of a good or policy, thus assuming farmers' choices among subsidy schemes depend on their specific characteristics –attributes– (Ruto and Garrod, 2009). Its use to support policy-making concerning AES has been developed recently (Ruto and Garrod, 2009; Espinosa-Goded et al., 2010; Broch and Vedel, 2012; Schulz et al., 2013). Therefore, this is the approach taken by this study.

2.2. Case study, attributes and levels

The case study selected for the analysis is the olive growing of Andalusia (Southern Spain). Olive groves are the main crop grown in this region, with more than 1.5 million of hectares (48% of Andalusian crop area). Villanueva et al. (2014) have recently highlighted a large potential to improve the production of public goods by olive growing, particularly environmental ones. In particular, they find that soil fertility, visual quality of the landscape, biodiversity and contribution to fighting climate change are the four public goods that present more margin for their production to be enhanced. These four public goods are demanded by EU and Andalusian society (Rodríguez-Entrena et al., 2012; Salazar et al., 2013). Thus, it is justified to design an AES aiming at promoting the production of these public goods by olive growing. Such AES must present agronomic attributes or practices adequate to that aim. Hence, in the choice experiment some of them are analysed as well as other design attributes. In particular, six attributes were considered to build possible AES, half of them agricultural management attributes (regarding cover crops use, CC, and EFA), two policy design attributes (regarding collective participation and monitoring) and payment. In Table 1 attributes and levels used in the choice experiment are shown.

Table 1. Attributes and levels used in the choice set design.

Attribute [Acronym]	*Explanation*	*Levels*
Cover crops area [CCAR]	Percentage of the olive groves area covered by cover crops	25 and 50%
Cover crops management [CCMA]	Farmer's management of the cover crops	Free and restrictive management
Ecological focus areas [EFA]	Percentage of the olive groves plots covered by ecological focus areas	0 and 2%
Collective participation [COLLE]	Participation of a group of farmers (5 at least) with farms in the same municipality	Individual and collective participation
Monitoring [MONI]	Percentage of farms monitored each year	5 and 20%
Payment [PAYM]	Yearly payment per ha for 5-year AES contract	€100, 200, 300 and 400/ha

Source: Own elaboration.

2.3. Experimental design and data collection

The methodological approach proposed by Street and Burgess (2007) was used, obtaining 192 profiles and a D-efficiency of 91.3%. The 192 choice sets were blocked into 24 blocks of 8 choice sets each (one farmer answered one block). In each choice set, farmers were asked to choose between three alternatives, two of them hypothetical AES and one of no-choice option under which the farmer continues with his current practice.

A total of 330 Andalusian olive growers were interviewed using random route sampling. Among them, 35 were considered to be protest (i.e. those who chose no-choice option systematically due to the lack of trustworthy on public institutions), restricting the total number of valid interviews to 295 (i.e. 2360 choices). Interviews were carried out from October 2013 to January 2014. A cheap talk to ensure correct understanding of farmers was used before answering the questionnaire.

2.4. Latent class model and willingness to accept (WTA) estimates

To incorporate preference heterogeneity into choice modelling we used a Latent Class Model (LCM). LCM is well suited to the task of considering respondents' preference heterogeneity and revealing its causes (Greene and Hensher, 2003). Several works have recently used LCM to analyse the heterogeneity of farmers' preferences towards agri-environmental policy (Ruto and Garrod, 2009; Schulz et al., 2013, among other works). These works prove the usefulness of this approach to this type of analysis. Our heterogeneity assessment is only based on the farmers' preferences differences concerning AES because we wanted to group farmers by their preferences towards AES and not also by their characteristics. LCM formulation used can be consulted in Greene and Hensher (2003). To choose the optimal number of classes, log-likelihood, minimum Akaike Information Criterion (AIC), and minimum Bayesian Information Criterion (BIC) statistics were used. Considering these statistics, we opted for a four-class solution, which also presented higher parameters' significance into each class and greater model parsimony.

Marginal rates of substitution between non-monetary and the monetary attribute (PAYM) were estimated by calculating the ratio of the coefficient of the former to the negative of the coefficient of the later. These are also called the "implicit prices", representing the WTA for a 1% increase in the quantity of the attribute in question if it is quantitative (e.g. EFA), or for a discrete change in the attribute (e.g. from free to restrictive CCMA) if it is qualitative.

3. Results

The results of the LCM are presented in Table 2. As can be observed, four different classes were obtained in function of their preferences towards AES. All but one attributes are highly significant determinants of choice, and in every case their coefficients have the expected sign. MONI is the only attribute that clearly has received less attention from farmers, suggesting that the level of monitoring has played a minor role on their choices.

Table 2. Latent Class Model.

Attributes	***C1***		***C2***		***C3***		***C4***	
	Coef.	*s.d.*	*Coef.*	*s.d.*	*Coef.*	*s.d.*	*Coef.*	*s.d.*
CCAR	-0.015 **	0.005	-0.026 ***	0,006	-0,050 ***	0,002	-0,118 ***	0,015
CCMA	-0.163	0.126	-6.104 ***	0,472	-0,811 ***	0,058	-1,120 ***	0,296
EFA	-0.119 *	0.059	-0.059	0,041	-0,559 ***	0,032	-0,260 ***	0,049
COLLE	-0.592 ***	0.130	-0.717 ***	0,214	-1,306 ***	0,072	-5,023 ***	0,747
MONI	-0.009	0.007	-0.041 **	0,015	0,002	0,005	-0,043	0,026
PAYM	0.014 ***	0.001	0.006 ***	0,001	0,004 ***	0,000	0,006 **	0,002
ASCsq	-0.571	0.456	-2.284 ***	0,323	-0,419 ***	0,118	4,095 ***	0,690
Share (%)	29.7%		14.6%		42.1%		13.7%	
LL=-1569.7 Pseudo-R^2 = 0.395	Respondents: 295		Choices: 2360					

*, **, and *** reflect significance at 5, 1, and 0.1% levels respectively.

Source: Own elaboration.

The differences among the four classes are better appreciated observing Table 3, which shows WTA estimates. Observing this table, there is clearly one class that groups potential participants (Class C1, that represents 29.7% of the surveyed farmers), thus presenting low WTA for the attributes. After it, there is another class (Class C2, 14.6% of the farmers) that groups farmers who would only be willing to participate in AES in case of the use of tillage and herbicides was not be restricted to manage CC (restrictive CCMA), while this class also shows a moderately high WTA for COLLE. Class C3 (42.1% of the farmers) and specially Class C4 (13.7% of the farmers) group potential non-participants but for different reasons. The former would not be willing to participate in AES that includes EFA and displays moderately high WTA for the rest of the attributes. The latter would not be willing to participate in collective AES which includes the use of CC (COLLE and CCAR), while the WTA for CCMA and EFA is also moderately high.

Table 3. Willingness to accept (WTA) of the attributes (€/ha)[µ].

Attribute	***C1***	***C2***	***C3***	***C4***
CCAR	1.0** (0.3/1.7)	4.1*** (1.8/6.5)	13.5*** (10.6/16.3)	20.4** (8.1/32.7)
CCMA	11.3 (-6.0/28.6)	978.6*** (657.3/1300.0)	220.3*** (169.8/270.8)	193.6* (41.3/345.9)
EFA	8.2* (0.2/16.3)	9.4 (-4.6/23.5)	151.8*** (120.1/183.6)	44.9** (13.3/76.6)
COLLE	41.2*** (23.3/59.0)	115.0** (33.9/196.1)	354.7*** (277.6/431.7)	868.0** (306.8/1429.3)
MONI	0.6 (-0.4/1.6)	6.5* (1.4/11.6)	-0.5 (-3.1/2.1)	7.4 (-3.3/18.2)

[µ] In the case of EFA, MONI and CCAR, it is € per 1% of increase in each of them (e.g. 1% of EFA in olive groves area).

*, **, and *** reflect significance at 5, 1, and 0.1% levels respectively.

Source: Own elaboration.

4. Discussion and policy implications

Some relevant points are worth being discussed, outlining main policy implications from them. First, there is a high heterogeneity of olive growers' in function of their preferences towards AES and policy maker must take it into account when designing such schemes. A potential participant class (C1) is clearly identified, counting 30% of farmers, whatever the combination of attributes of the scheme. If more farmers were desired to be participants, careful attention would have to be put on the combination of attributes and the monetary incentive established. For instance, if an additional 15% of farmers (class C2) were desired to participate in AES, a moderately high monetary incentive and free CCMA would be set. Also, if most of another 42% of farmers (class C3) was desired to be participants, high monetary incentives would be required but with low levels of stringency in each attribute. Yet, there is a group of farmers (C4) that would not participate in AES for any combination of attributes.

Second, such heterogeneity is also reflected separately in most of the attributes studied. Hence, we find different intensity of preferences towards all the attributes when they are compared within classes. Actually, there is clearly one class that refuses EFA and another that refuses restrictive CCMA, two classes that refuse both collective participation and using CC in a high share of olive tree area, existing intermediate classes in all the attributes. The only exception is the level of monitoring, which has received scarce attention from farmers. This specific result about monitoring calls for further research given other works find the opposite (e.g. Broch and Vedel, 2012), that is, that monitoring is a determinant of farmers' preferences towards AES. In contrast, we have found that farmers are less aware of monitoring, at least when there are other attributes that are perceived more important.

Third, specific policy implications can also be derived regarding EFA and COLLE. As regards EFA, almost half of the farmers would be willing to accept it at low monetary incentives (€8-9/ha per 1% of EFA) while the rest would do it at moderate to high monetary incentives (€41-151/ha per 1% of EFA). This is in line with Schulz et al. (2013) whose results also distinguished between farmers willing and not willing to use EFA in their arable land (with average WTA of €8.9 and 51.4/ha respectively). With regard to C1 and C2-farmers, their WTA are in the same level of magnitude as their rent forgone (€8.2 and 15.7/ha, using rent results from Gómez-Limón and Arriaza, 2011). However, the low willingness to participate in AES shown by C3 and C4-farmers appears to result in higher WTA, thus not aligned with their rent forgone. Despite that, for high share of EFA (e.g. 5-7%) it is presumably that these estimates would be higher due to the intrinsic spatial restrictions of olive groves. Given these results, making use of the equivalent elements to EFA that the CAP regulation allows would be needed if EFA was enforced also in permanent crops.

With regard to collective participation, the four classes of farmers reflect very different levels of disutility, from low (C1, €41.2/ha) to very high WTA (C4, €868.0/ha). Given this wide range, setting the monetary incentive is crucial to promote collective participation in AES. CAP regulation includes an up-to-30% EU-wide bonus to promote such participation. For a typical magnitude of AES payment implemented in Andalusia (i.e. €200-300/ha), this bonus would represent €60-90/ha, thus implying that only C1-farmers (counting 29.7%) would participate collectively in these schemes. However, policy-maker should ensure that this incentive does not outweigh gains (due to reducing public transaction costs and increasing environmental performance) obtained from such participation (Franks, 2011). In this sense, although expected gains from the reduction of transaction costs could fairly be estimated, those from the higher environmental performance are far more difficult. In particular, expected gains from such performance would be different depending on not only the requisites/practices included in the AES, but also the closeness and configuration of enrolled farmland (Sutherland et al., 2012) and the presence/absence of threshold effects that typically characterized the production of environmental public goods. So, an up-to-30%

bonus is considered to be too rough to reflect society's net gains from collective participation. Therefore, it is clear that much research is needed to cover knowledge gaps about costs and – specially– gains of collective participation. This research would help to design future collective AES, thus encouraging the production of environmental public goods by agricultural systems.

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