Community preferences in support of a conservation programme for olive landraces in the Mediterranean area

R. Sardaro[1,a], F. Bozzo[2], A. Petrontino[1] and V. Fucilli[2]

[1]Sinagri S.r.l., University of Bari Spin-Off, Bari, Italy; [2]Department of Agricultural and Environmental Science, University of Bari, Bari, Italy.

Abstract

This study focused on the willingness of the Apulian community in Italy to pay for olive landraces in a conservation programme. A choice experiment approach through a latent class model was carried out in order to investigate different characteristics of people that could increase the effectiveness and efficiency of conservation policies by decision-makers. The analysis allowed us to identify three groups of families, each with very different socioeconomic characteristics. Policy implications suggest the need to develop a better knowledge system on the benefits of olive landraces and to implement suitable strategies for better placement of local products in the market.

Keywords: olive landrace, choice experiment, latent class model, conservation policy, Apulia

INTRODUCTION

Landraces are one of the components of agro-biodiversity, and their cultivation over the centuries has enabled production of food, stabilization of yields and lower levels of inputs (Jackson et al., 2013), in particular water, fertilizers and pesticides. However, over recent decades, in several areas of the world there has been a considerable loss of local landraces in favour of modern intensive cropping systems based on monoculture farming.

In order to stop these losses, it is possible to set proper regulatory systems for landrace conservation, namely direct payments that are designed to increase farmers' revenues and make the cultivation of landraces more convenient (Narloch et al., 2011; Krishna et al., 2013; Rocchi et al., 2016). The utility derived from the conservation of agro-biodiversity impacts different groups of stakeholders (farmers, consumers, etc.), which typically exhibit different expectations of benefits. Hence, investigation of this diversity among groups within the community is very useful for the setting of an effective and efficient conservation programme, based on better-informed decision-making through the setting of priorities and the highlighting of programme characteristics that affect stakeholder benefits.

The study aimed to explore the ways by which the characteristics of a conservation programme for olive landraces could satisfy preferences of groups of individuals. To this end, we carried out a choice experiment (CE), a stated preference approach based on conjoint analysis and discrete choice theory (Louviere and Woodworth, 1983). Through hypothetical scenarios, this valuation method allowed us to ask respondents to choose the programme characteristics that give the greatest relative utility (Hensher et al., 2005). In particular, we measured the willingness to pay (WTP) for the participation of the community in a conservation programme for olive landraces in Apulia; the study therefore contributes to the literature investigating the determinants of individuals' preferences for the conservation of Mediterranean plant species. Overall, such an approach adds knowledge on the employment of the CE method in the assessment of the community valuation of Mediterranean agro-

[a]E-mail: ruggiero.sardaro1@uniba.it

biodiversity components (Birol et al., 2006).

MATERIALS AND METHODS

The questionnaire

The CE method is based on a survey questionnaire which, in this study, was divided into three sections. The first section collected the respondents' opinions about aspects related to Apulian olive landraces, such as farming practices, landscape issues, product preferences and knowledge about the extinction risk of typical olive cultivars (Rocchi et al., 2016). In the second section, respondents were asked to make choices about possible action plans aimed at preserving local olive cultivars. Finally, the third section contained socioeconomic and structural questions about the respondents (sex, age, marital status, education level, etc.).

The CE and survey design

Attributes and their levels (Table 1) were selected through two focus group meetings (each of about 45 min) involving citizens (three) and consumers' representatives (two). The objectives concerned the illustration of the research framework and the definition of the attributes and respective levels of the hypothetical programme able to influence the conservation of olive landraces in Apulia.

Table 1. Attributes and levels used in the choice experiment (first level = status quo).

Attribute definition	TEV component	Code	Levels
Farmers that cultivate Apulian olive landraces, ensuring market products such as protected designation of origin (PDO), protected geographical indication (PGI) and traditional specialities guaranteed (TSG) (table olives, olives in brine, extra virgin oil, olive paste, etc.)	Direct use vale	Farmers	450, 1000, 2000
Protection of Apulian olive landscape by farmers through cultivation of regional olive landraces, avoiding their extinction	Indirect use value	Landscape	No, yes
Possibility of scientific research to preserve Apulian olive landraces in gene banks, in order to prevent their extinction	Option value	Research	No, yes
Availability of Apulian olive landraces for future generations	Bequest value	Future generations	No, yes
5-year contribution to the conservation of Apulian olive landraces (€ year^{-1})	-	Contribute	0, 5, 10, 20, 50

Given the great number of alternatives resulting from the combination of the selected attributes and their respective levels, in this study, we produced a D-efficient Bayesian design, which allows the maximization of statistical efficiency by minimizing D-error. Therefore, 28 profiles were generated in Ngene (version 1.1.2, ChoiceMetrics, Sydney, Australia), so that 14 choice tasks were assembled and subdivided into two blocks of seven.

Finally, 800 interviews were planned, 400 for each block. They were stratified through the population of each province (ISTAT census 2010) and carried out in the period September 2014-May 2015. Interviews were conducted face to face and lasted about 40 min. Feedback on survey design, attributes and levels was gathered following each survey. Altogether, a total of 761 complete and coherent questionnaires were collected, while 39 were discarded as respondents did not complete the choice tasks or gave protest responses at the end of section 2.

The statistical method

Econometric analysis was carried out through the latent class model (LCM) (Lazarsfeld and Henry, 1968). LCM captures preference heterogeneity across classes, i.e.,

segments of respondents, but assumes homogeneous parameter estimates within each class (Train, 2009) so that, on the basis of the logit form, the conditional choice probability of finding the respondent *i* in the class *q* for the observed alternative *j* is:

$$\pi_{ij|q} = \frac{\exp\left(\beta_q' x_{ij}\right)}{\sum_{q=1}^{Q} \exp\left(\beta_q' x_{ij}\right)} \quad (1)$$

where x_i denotes a set of characteristics that are associated with class membership and β_q are specific class-related coefficients to estimate. The conditional probability that respondent *i* chooses alternative *j* is:

$$\pi_{ij} = \sum_{q=1}^{Q} \pi_{iq}\ \pi_{ij|q} \quad (2)$$

Finally, in order to best explain the choices of respondents, the estimation of the parameter values was carried out through the maximization of the log likelihood function:

$$\ln L = \sum_{i=1}^{N} \ln \left[\sum_{q=1}^{Q} \pi_{iq} \left(\prod_{t=1}^{T_i} \pi_{it|q} \right)^{y_{ij}} \right] \quad (3)$$

where y_{ij} is 1 or 0 if respondent *i* chooses the alternative *j* or not, respectively.

The LCM specifications were estimated using NLOGIT version 5. For the choice of the number of classes, the Bayesian information criterion (BIC) and the Bozdogan AIC (AIC3) were used. WTP estimates were carried out through the delta method.

RESULTS AND DISCUSSION

Sample characteristics

The sample, consisting of non-farmers, was balanced enough for the gender variable. Respondents were on average 51 years old, married, with three household members and 11 years of schooling. The household income was in line with the census data (ISTAT census 2010). About one-third of respondents resided in large urban centres (more than 50,000 inhabitants) and one-quarter in communes with an olive utilized agricultural area (UAA) higher than 50%. Seventeen per cent of respondents owned a farm, mostly inherited by parents, and a small share of the sampled respondents (15%) belonged to families with at least one member employed in agriculture. Almost one-third of the respondents had a forebear in agriculture, was a consumer of olive products from local landraces and spent recreational time in farm holidays. On the whole, the ranges of variables showed considerable variation, so that an LCM was implemented to better understand the nature of the related heterogeneity.

CE results and discussion

The minimum BIC and AIC3 values were obtained in the presence of three classes, so that a three-segment model was selected. In particular (Table 2), the first segment (41% of the sample) identified respondents with a high conservation attitude (LCM1). The alternative specific constant (ASC) was positive and significant, confirming that individuals wanted changes to the current state. On the first attribute, they expressed greater interest in payments to support 2000 farmers in the cultivation of olive landraces in Apulia, while aid

for 1000 olive growers was not considered useful for an effective and efficient conservation strategy. Strong interest was also expressed in the possibility of handing down regional olive landraces to future generations (highest utility value), but also for the landscape and research issues. Looking at the socioeconomic variables, the group included respondents in large urban centres, with a high level of schooling and income. Besides, these respondents had no connection with the agricultural sector in terms of forebears, income, job, etc., and, mostly resident in the central southern part of Apulia, they consumed typical olive products and also spent recreational moments in farm holidays. Overall, this group was made up by urban residents with no link to the agricultural sector, but with a strong inclination to environmental, traditional and cultural aspects, so that the conservation of regional olive landraces was an important issue and the settlement of a proper programme was considered unavoidable.

Table 2. Latent class model (LCM) estimates of utility functions. ASC, Alternative specific constant.

Class probability	LCM1 (0.412)		LCM2 (0.363)		LCM3 (reference class) (0.225)	
	Coeff.	*t*	Coeff.	*t*	Coeff.	*t*
	Utility function					
1000 Farmers	-0.686	-1.02	0.227	0.77	1.107	6.09***
2000 Farmers	1.762	9.51***	-0.464	-2.15*	-0.559	-3.22**
Landscape	1.681	11.83***	0.592	2.94**	0.692	2.16*
Research	1.384	3.86**	0.390	2.10*	0.420	1.08
Future generations	2.036	2.98**	0.441	0.43	0.810	2.10*
Contribute	-0.019	-6.70***	-0.053	-3.03**	-0.020	-3.30**
ASC	1.971	15.82***	-1.082	-2.91**	1.053	4.12**
	Segment probability function					
Male	0.282	0.66	0.427	0.07		
Age	0.304	0.32	0.690	0.38		
Married	0.072	1.13	0.155	1.31		
Schooling	0.515	3.18**	0.423	0.93		
Income	0.009	3.43**	0.003	2.39*		
Household	0.173	0.57	0.031	0.82		
Residence	0.774	9.58***	0.491	3.13**		
Commune	-0.832	-0.14	-0.337	-2.84**		
Owner	-0.495	-2.19*	0.529	2.91**		
Member	-0.610	-2.90**	0.620	2.00*		
Forebear	-0.713	-2.33*	0.851	5.86***		
Products	0.852	4.90***	0.730	0.41		
Farm holidays	0.528	3.41**	0.051	0.30		
F	-0.412	-1.13	0.831	2.18*		
B	0.592	3.19**	0.644	2.70**		
Br-T-L	0.381	2.53*	0.718	2.96**		
Observations	4566					
McFadden pseudo-R^2	0.30					

Significance: ***, 1%; **, 5%; *, 10%.

The LCM2 group (36% of respondents), in contrast, were less well disposed toward the conservation programme. In particular, the negative and significant ASC revealed that these respondents were not willing to move from the status quo, and variables concerning attributes and levels were barely significant. Individuals did not consider the payment of

the1000-farmer premium and highlighted aversion for the 2000-farmer payment. A moderate propensity was expressed for landscape and research aspects, while the possibility to hand down regional olive landraces to future generations was not considered at all. These respondents were residents in large urban centres, were characterized by high income, had forebears and/or family members (generally father) in the agricultural sector and owned plots of land (commonly from hereditary succession). Fairly distributed across the whole region, they were not sensitive to the consumption of typical olive products and did not prefer holiday farms in their free time. Overall, the LCM2 individuals were high-income residents in large urban centres characterized by a past connection with the agricultural sector (forebears, part-time or full-time job when younger), but with little interest in the positive externalities of olive landraces (local traditions, landscape, research, future generations) and were not at all in favour of the payment of a premium for farmers.

Finally, the LCM3 group (22% of respondents) was a reference class characterized by individuals with a certain inclination towards the change in the status quo (ASC positive and significant), but preferring minimum participation in the conservation programme. In particular, the payment for just 1000 farmers was chosen, while the possibility to support 2000 farmers was refused. Little interest was expressed in the generation and landscape issues, while payment for research was not considered. These respondents were characterized by a medium income, resided in small urban centres with an olive UAA higher than 50%, had at least one family component and forebear in agriculture and were employed part-time in agriculture.

The payment variable in all three classes was negative and significant, as expected (WTP). In this regard, the 5-year WTP in the LCM1 group for the conservation policy was €94.20 $year^{-1}$ $family^{-1}$ as support for farmers who undertook to cultivate olive landraces on their farms. In the LCM3 group, the payment for 1000 olive growers was €57.10 $year^{-1}$ $family^{-1}$, while respondents in the LCM2 group showed aversion for such a conservation strategy (-€7.40 $year^{-1}$ $family^{-1}$). In addition, consideration of future generations was very important for the LCM1 individuals (€101.80 $year^{-1}$ $family^{-1}$), as well as for the landscape component (€82.10 $year^{-1}$ $family^{-1}$); this latter factor was also appreciated (although at much lower levels) by the LCM2 (€15.30 $year^{-1}$ $family^{-1}$) and LCM3 (€35.40 $year^{-1}$ $family^{-1}$) groups.

Such considerations could be used by policy-makers to formulate a suitable conservation programme the starting point of which could be based, for example, on the settlement of proper informative plans created ad hoc for different groups of citizens. This strategy could strengthen the preferences of the more sensitive individuals, for example leveraging aspects related to typical products and environmental benefits, as well as to increase the participation of the more sceptical citizens.

CONCLUSIONS

The emerging aspects of the study showed the need (i) to include socioeconomic characteristics of respondents in studies aimed at the setting of agro-biodiversity conservation programmes; (ii) to develop new markets through certification strategies able to appreciate the characteristics of typical olive products, ensuring higher profits to olive growers; (iii) to boost the genetic and transformation research fields in order to study possible nutritional properties of local products, which could be used in market strategies based, for example, on specific brands; and (iv) to involve the community in informative programmes on agro-biodiversity and related benefits. Such an approach could boost new landrace markets and allow wider cultivation of local cultivars by farmers, also ensuring their conservation for future generations.

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