ARE CITIZENS' PREFERENCES FOR RURAL EXTERNALITIES HETEROGENEOUS? A BEST WORST-LATENT CLASS MODELLING APPROACH

Luis Pérez y Pérez[a*], Pilar Egea[b] y Tiziana de Magistris[a]

[a] *Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA) & Instituto Agroalimentario de Aragón-IA2. lperez@aragon.es.*

[b] *Universidad de Zaragoza & Instituto Universitario de Ciencias Ambientales (IUCA)*

Abstract

The cultivation of olive groves has been one of the most popular research topics on preferences for rural externalities. The aims of this study are a) to analyze the preferences of citizens for some externalities generated by traditional low-yield olive groves and b), to investigate if citizens are heterogeneous when assessing these externalities. To achieve these purposes a Best-Worst Scaling (BWS) approach with a Latent Class Model (LCM) was applied. Data come from an on-line survey administrated to a total of 549 respondents in Spain. The results showed that Spanish citizens value BIODIVERSITY as the most important externality while GOVERNANCE as the worst one. Moreover, our results confirm the heterogeneity of the citizen's valuation by obtaining four classes of citizens. Two different approaches have been used to characterize those classes. The first one is based on the parameters estimates of the LCM and the second one on some citizen socio-economic characteristics. The four identified classes have been the "socio-cultural & olive grove lovers", "environmental & educated lovers", "sustainability lovers" and "economic lovers". Our results confirm the heterogeneity of the citizens' preferences on rural externalities.

Keywords: Traditional olive groves, Citizens valuation of externalities, Recovery of abandoned crops.

1. Introduction

The objective of this study is to determine the citizen preferences for externalities generated by traditional low-yield olive groves and to verify whether these preferences are heterogeneous among citizens. Three types of externalities were selected to be evaluated: the improvement of food QUALITY and SAFETY (*economic*); fighting against soil EROSION or conservation of BIODIVERSITY (*environmental)* and the establishment of the rural POPULATION, the improvement of social GOVERNANCE or the recovery of natural and cultural HERITAGE (*socio-cultural)*. For this purpose a Best-Worst Scale (BWS) approach with a Latent Class model (LCM) was applied. To our knowledge, this study is the first to rank externalities for olive oil sector through a BWS-LCM approach. This approach has the advantage of providing the best way to discriminate the degree of importance given by citizens to each externality by overcoming the problem of bias caused by differences in the use of rating scale.

2. Methodology

2.1. Data

An online survey was carried out between 2016/17 in several places in Spain. After conducting a pilot questionnaire to 20 individuals, the final questionnaire contained a first set of questions to assess the externalities and a second one about the socio-economic characteristics of the respondents. The sample was set at 549 citizens over 18 years, resulting in a sampling error of +/- 4.2% and a confidence level of 95.5%.

2.2. The modelling approach

The BWS method consists of a task where respondents are asked to choose the most and the least preferred items in a series of questions that contain a combination of those items (Marley and Louviere, 2005). In our case items are externalities. In order to allocate them to different questions in the survey, we used the Sawtooth MaxDiff Designer (Sawtooth, 2007). This software allows carrying out simulations with different combinations of externalities to obtain the best experimental design properties. In our study, respondents answered seven questions, each one containing three externalities and each externality appearing three times in the questionnaire.

In a BWS study, the interviewed choose a pair of items that maximizes the utility difference between the elements of that pair. Then the probability that the individual n will choose the attributes i and j respectively in the t^{th} choice occasion as best and worst of a set of possibilities with J options, is the

probability of the utility difference between U_{nit} and U_{njt} to be greater than all M other possible utility differences in the set, where $M = J(J-1)$. This probability takes the multinomial logit (MNL) form.

The basic MNL model assumes preference homogeneity in the population, but as our objective is to understand citizen heterogeneity, we need to allow the externality parameters of observed variables to vary among the population. The analysis of heterogeneity of preferences in discrete choice models can be done using the LCM. The LCM assumes that individuals belong to different classes, each characterized by different parameters of utility of specific class. Therefore, an LCM has been estimated using NLOGIT 5.0. (Green, 2012)

The optimal number of classes has to be determined by taking into account different statistical criteria. We considered six information criteria: the minimums of Log likelihood at convergence, the Akaike Information Criterion, the modified Akaike Information Criterion and the Bayesian Information Criterion. Besides, the maximum of the Akaike Likelihood Ratio Index and the Negentropy statistic were calculated. We finally select the four-class model and its characterization was based first on the parameters estimates of the LCM and for the one-segment (Hynes et al., 2008). Secondly, to profile the four citizen classes, we carried out a bivariate analysis through the χ^2-Test, the *Z*-Test or the analysis of the variance depending on the type of variables.

3. Results and discussion

Table 1 showed that 53% of respondents were female, 77.3% with university degree and, on average, they were around 45 years old. About half of the sample was married and lived in households of 2.7 members. Household income *per capita* was 1,105 euros/month on average. Finally, 65.9% of the people had made some altruistic donation for any social or environmental reasons while only 20.9% stated that they donated specifically for the recovery of traditional olive groves.

Table 1. Estimated parameters for externalities and sociodemographic profiles

		Latent classes			
	One-segment Model	Class 1	Class 2	Class 3	Class 4
Quality	0.496(11.06)***	-0.235(-1.89)*	-0.082(-0.63)	1.223(6.42)***	1.123(12.45)***
Safety	0.420(9.21)***	-0.648(-4.57)***	-0.252(-1.96)**	0.937(4.86)***	1.351(13.73)***
Erosion	1.069(23.09)***	0.910(6.43)***	1.627(9.64)***	4.414(14.71)***	0.396(3.71)***
Biodiversity	1.199(26.33)***	1.149(8.92)***	2.904(12.51)***	2.929(12.61)***	0.566(7.03)***
Population	0.993(21.58)***	2.953(11.67)***	0.436(3.24)***	2.499(9.00)***	0.497(5.81)***
Heritage	0.769(15.97)***	1.614(10.31)***	2.238(10.63)***	1.417(6.70)***	0.011(0.12)
Male (%)***	46.1	54.1	58.3	42.9	34.6
Age (average)	45	50.8[a]	44.3[b]	46[b]	40.8[c]
Married (%)**	47.4	59	43.3	44.5	44.1
University (%)**	77.2	74.6	85.5	78.9	72.1
Aragon (%)***	60.5	50	56.7	58.6	71.5
Income (%)**	39.5	42.6	47.5	39.8	31.8
Altruistic (%)***	65.9	75.4	70	69.5	54.2
Olive donor (%)***	20.9	42.6	16.7	17.2	11.7
Class size		*0.226(9.89***)*	*0.218(9.57***)*	*0.228(9.83***)*	*0.328(13.66***)*

Note: Governance is the reference externality. Z-test in parentheses.
***, ** and * in parameters denotes statistical significance at the 1, 5 and 10 per cent respectively. [a], [b], [c] indicate differences in means for continuous variables (Bonferroni Test). ***, **, * in variables implies rejection of the null hypothesis of equality for discrete variables at the 1, 5 and 10 per cent respectively (Chi-Square Test).

Taking all the individuals as a whole (the one-segment model), all estimated parameters were positive and statistically significant at 1% level. The most preferred externality was BIODIVERSITY followed by EROSION. The following preferred externalities were POPULATION and HERITAGE. Nevertheless, QUALITY and SECURITY were less preferred. Finally, GOVERNANCE was the least preferred rural externality. However, the parameters by LCM corroborated the heterogeneity among the four classes since the estimated values were different between them, not only in sign, but also in magnitude or statistical significance.

In the first class, named "*socio-cultural & olive grove lovers*" people had a strong preference for POPULATION and, then, for HERITAGE. After that they ranked BIODIVERSITY and EROSION while they attached no much relevance to economic externalities. Interviewees from this class were older than other classes and mostly married males. They showed a high educational level but slightly below the average of the sample. They were residents both in Aragon and the rest of Spain in the same proportion. They had an income *per capita* slightly above the average of the sample and they were the most altruistic in general with the highest percentage of altruistic donors for the recovery of traditional olive groves.

The second class was called "*environmental & educated lovers*". People ranked in the first place BIODIVERSITY, followed by HERITAGE, EROSION and farther away POPULATION. However they undervalued GOVERNANCE and SECURITY and they ignored QUALITY. The percentage of men was above the average of the sample and the age slightly lower than average. These people had the highest *per capita* income and educational levels, and mostly were not married. They were altruistic, but their donations for the recovery of traditional olive groves were below of the sample.

The third class is constituted by the "*sustainability lovers*", who gave importance to all the externalities: EROSION was ranked the first, followed by BIODIVERSITY and then by POPULATION. Except for the women, whose percentage was slightly higher than the average, the rest of socio-economic characteristics were very close to the average of sample.

Fourth class is the "*economic lovers*", the most concerned with economic externalities. They ranked first SAFETY followed by QUALITY and quite far they ranked BIODIVERSITY, EROSION and POPULATION. People were indifferent towards HERITAGE and GOVERNANCE. This class consisted of two-thirds of women who were the youngest people among the classes, mostly come from Aragon, and show the lowest level of high-education, income *per capita*, altruistic character and willingness to donate for the recovery of traditional olive groves.

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