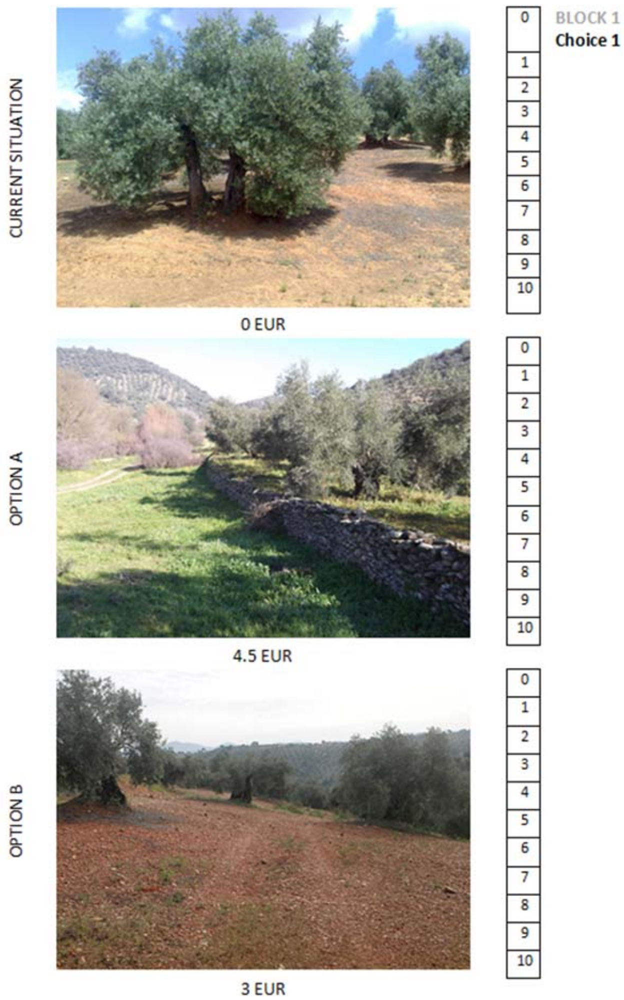
ES1 (Montoro, Spain):
Is landscape attractiveness a driver of rural economy? The case of a pathway restoration in olive groves.

Objective

This study evaluates how landscape changes made in order to improve the visual quality of olive groves may trigger first- and second-order effects (FOEs and SOEs) on the rural economy. The choice experiment method is combined with the probability of visiting to estimate the marginal increase in recreational demand in the landscape of the restored pathways.

Methodology

In this study we estimate the Second Order Effects (SOEs) arising from an increase in landscape attractiveness due to changes in the management of green cover, stone walls and woodland islets in olive groves. By means of the Choice Experiment method (CE) we estimate the First Order Effects (FOEs) for three landscape elements (i.e. the willingness to pay (WTP) for agricultural landscape features) and at the same time we gather information about the increase in recreational demand which arises from improved landscape attractiveness. This demand is subsequently associated with a set of economic impacts on the local economy which can be considered SOEs of the increase in landscape attractiveness. Here you can see an example of cards shown in the population survey.



Results

Estimating FOEs

Of the 331 respondents in the CE, 23 were identified as protest bidders according to the information they provided in the open-ended follow-up question on the reasons behind systematically choosing the SQ alternative. Consequently, these respondents were omitted from the analysis. The results of the Latent Class Model (LCM) are shown in Table 1, where we also present the coefficients of a conditional logit model that assumes preference homogeneity. The LC model is highly significant and allocates 68% of respondents to class one and 32% to class two. Compared with the conditional logit model, the LC model shows a significantly improved fit and log-likelihood function at convergence (LR=776, p<0.000), revealing that accounting for heterogeneity contributes to a better understanding of respondents' choices.

Table 1. Latent class estimates

Utility function	Conditional logit	Latent class 1	Latent class 2
ASCSQ	-0.198**	-1.118***	-0.359
GREEN-COVER	1.065***	1.082***	1.098***
STONE WALLS	0.486***	0.546***	0.246
GREEN ISLET	0.043	0.060	0.067
PAYMENT	-0.267***	-0.182***	-0.919***
SET A	-0.051	-0.097	0.060
SET B	0.249**	0.385**	0.785***
SET C	-0.171	-0.287	0.267
Class membership function			
Intercept		-1.265***	--
PROPERTY_ RIGHTS		1.717***	--
VISIT_FRECUENCY		0.219**	--
YOUNG		0.889*	--
MIDDLE		0.945**	--
RURAL_BUDGET		0.898**	
PARK_AWARENESS		0.453	
Latent class probability		0.68	0.32
LL	-2378.22	-1990.95	
ρ^2	0.12	0.265	
Number of choices	2464	2464	

*Note: *,**,*** asterisks denote statistical significance at 10%, 5% and 1% respectively.*

Regarding class membership, it is important to bear in mind that the model estimates the effect of variables on membership probability relative to the second segment, for which all parameters are normalized to zero to allow estimation. In class one, all parameters except park awareness are statistically significant. In comparison with class two, membership of class one is associated with a stronger belief that farmers should be compelled to improve the landscape aesthetic and that part of the rural development budget can be used for this purpose. Respondents who belong to this class are younger and go to the countryside for recreation activities more often. Turning to the utility function parameters of this class, the green cover and stone walls coefficients are highly significant with the expected sign. Individuals of class one prefer a landscape programme that incorporates green cover and stone walls in the olive orchards. The presence of woodland islets appears unimportant according to the respondents' preferences. A possible reason is the low visibility of these islets inside the orchards, as the vegetation islet does not stand out over the olive trees and, in general, weak chromatic differences appear in the pictures. As may be expected, the coefficient of the parking fee is negative and highly significant, revealing that the respondents' probability of visiting decreases with higher fees. The high significance and the negative sign of the alternative specific constant (ASC) show that there are other reasons associated with the aesthetic improvement of the landscape not described by the attributes used in this study, which provide utility to individuals. Finally, the significance of the coefficient of the landscape scenes belonging to set B reveals that there is a framing effect. In particular, respondents are more likely to choose a landscape scene that is portrayed in this set. A possible reason could be that in general the pictures in this set are slightly brighter, thus conveying a greener aspect of the vegetation cover, which is the most valued landscape element. People who belong to class two only experience an increase in utility from the green cover element of the landscape. They are neutral to the presence of either stone walls or woodland islets. The coefficient of the parking fee is significantly smaller compared to that of class one, indicating that respondents of this class have a larger disutility from higher parking fees. Respondents of this class also showed a higher probability of selecting B scenes.

The marginal WTP for the presence or absence of landscape elements can be estimated from the model coefficients. This is particularly useful for policy analysis since it allows for assessment of welfare gains from landscape changes. Table 2 shows the implicit prices for the attributes and the two classes, along with the 95% confidence intervals estimated using the Delta method. Respondents of class one are, on average, willing to pay a daily parking fee of about €6 for visiting the paths when there is green cover in the olive orchards and €3 when there are stone walls in the orchard boundaries. On the contrary, the WTP for the presence of woodland islets was not significant. Those belonging to class two are willing to pay only for the green cover element of the landscape, although the lower marginal utility of income reduces the WTP by a factor of five. Overall, considering the class probability, green cover is the most valued landscape element (€ 4.41 per household) and the presence of stone walls is the second (€ 2.11 per household). The existence of woodland islets alone has a value which does not differ from zero. Assuming independence between the WTP for the individual landscape elements, WTP for various combinations of landscape features can be obtained by adding the WTP values for the individual elements. Thus, the WTP for a landscape with the most valued elements (green cover and stone walls) is about € 6.52 .

Table 2. Marginal willingness to pay (WTP) estimates for each attribute across classes.

	WTP a Latent class 1	Latent class 2	Overall weighted WTP b
GREEN COVER	5.95*** (4.32 – 7.57)	1.19*** (0.76 – 1.62)	4.41** (3.29 – 5.52)
STONE_WALLS	3.00*** (1.95 – 4.05)	0.27ns (-0.12 – 0.66)	2.11*** (1.40 – 2.83)
WOODLAND_ISLET	0.38ns (-0.36 – 1.01)	0.09ns (-0.29 – 0.44)	0.22ns (-0.23 – 0.72)

[a] *95% confidence intervals were calculated using the Delta method.*
[b] *Assuming the protest answers (7%) exhibit the same WTP of the sample.*

Estimating SOEs

Once the landscape preferences had been analysed, the question on the probability of visiting allowed us to estimate the potential demand of the projected pathways with and without changes to the landscape. To do so, we estimated the potential demand for the current situation and the increase in this demand due to the presence of the landscape elements, which supposedly improve the landscape attractiveness. For this, according to the selected cut-off point (80% of visiting probability) and respondents' stated intentions of visiting, 2.7% of the target population would visit the pathways in the next year without any landscape intervention, leading to a potential demand for the SQ of 5,766 tourists.

From this baseline scenario, we estimated the marginal probability of visiting for each of the landscape combinations. The average marginal probability of visiting was weighted by the choice frequency factor (CF) to calculate the marginal impact on demand over the SQ (MDi). In the fourth column of Table 3 it can be seen that Landscape 2 generates the largest impact on demand, regardless of the fact that there are landscape combinations with higher average marginal probability of visiting (Landscape 3, 4 and 6). These, however, are associated with lower choice frequencies. The last column of the table shows the estimated number of additional visits compared with the SQ: the landscapes whose main components are green covers and stone walls (Landscape 2) or green cover, stone walls and woodland islets (Landscape 3) present the largest increase in demand for visiting. In addition, it highlights the lowest marginal demand for the woodland islets (Landscape 1) when the green cover and stone walls are not present in the landscape. As a general remark we observe that green cover is a key driver of public preferences in the olive grove landscape. This element is present in the three landscapes with the highest shares of marginal demand. Overall, the Landscape 2 and 3 have the highest potential to increase the demand for the Montoro pathways and to trigger a set of second-order and multiplier effects as described below.

Table 3. Number of visitors for each landscape change.

	Description	Choice frequency (CF)	Averaged marginal probability of visiting (PV_i)	Marginal impact on Demand (MD_i) (%)	Marginal number of visitors over SQ (5,766 visitors) [b]
1	Woodland islets	77	2.26	11.75	678 (226-1,505[c])
2	Green cover + Stone walls	378	2.89	73.83	4,256 (1,424-9,454)
3	Green cover + Stone walls + Woodland islets	280	3.34	63.12	3,640 (1,218-8,083)
4	Stone walls + Woodland islets	191	3.08	39.77	2,293 (767-5,093)
5	Green cover	230	2.36	36.72	2,118 (708-4,703)
6	Stone walls	145	2.97	29.06	1,675 (560-3,721)
7	Green cover + Woodland islets	327	1.81	40.09	2,312 (773-5,133)
SQ	SQ (bare soil, no stone walls and no woodland islets)	703	2.10[a] (APsq)		

[a] APsq - Averaged visit probability of the SQ landscape
[b] Marginal demand and potential demand of visitors according to the landscape combination
[c] In parentheses we indicate the confidence intervals considering the cut-off points 70% and 90%, respectively

As an example, to illustrate the overall economic impact on the rural economy that may result from improving the landscape attractiveness of the olive groves surrounding Montoro's pathways, the following four scenarios were considered:

- Scenario 1: this scenario represents the current situation, where the landscape is characterized by the absence of green cover, stone walls, and woodland islets.
- Scenario 2: this scenario is characterized by the presence of green cover and stone walls in the olive orchards. We called this scenario “optimal in terms of potential demand” given that it corresponds to the most in-demand landscape by potential visitors to the pathways. Besides, the green cover contributes positively to reducing soil erosion and increasing carbon stocks in soil.
- Scenario 3: the stone walls of scenario 2 are replaced by woodland islets, despite the low value assigned by respondents to this landscape feature. Nonetheless, the woodland islets are considered vital for biodiversity purposes, hosting a variety of arthropods that are a valuable food source for insectivorous birds and amphibians. They also provide ecosystem services such as pollination and biological control of pests. We defined this scenario as “optimal in terms of agricultural multifunctionality”.
- Scenario 4: in this scenario, green covers are the only elements added to the current landscape. We called it “optimal in terms of implementation simplicity” given that there are already agri-environmental measures that may be used to sow green cover in olive orchards.

In Table 4, we show the FOEs and SOEsV for the four scenarios, assuming for the SOEsV an average expenditure of €6.5 for each respondent. The FOEs can be associated with the revenues generated by the parking fees, and the SOEsV with visitors’ expenditure during their trip. The main result is that there are important gains in both FOEs and SOEsV when the landscape attractiveness is improved.

For example, comparing the SQ scenario (Scenario 1) with the second scenario, we observe an increase in the FOEs and SOEsV of €29,118 and €27,670 respectively. The overall benefit of Scenario 2 with respect to the SQ is calculated as the sum of the FOEs and the marginal SOEsV, that is, €56,788.

Table 4. Valuation scenarios of the olives grove landscape options.

Scenario	FOEsa	SOEsV	Marginal SOEsV (SOEsVscenario$_i$ – SOEsVscenario $_s$q)	Overall marginal impact
SC1: SQ *Absence of green cover, stone walls and woodland islets	0 visitors €0	5,766 visitors €37,479 (€12,539 – €83,233)	€0	€0
SC2: Green cover + Stone walls * Optimal in terms of potential demand	4,256 visitors €29,118 (€9,741-€64,664)	10,023 visitors €65,149 (€21,796-€144,682)	€27,670 (€9,257-€61,450)	€56,788 (€18,998-€126,114)
SC3: Green cover + W. islets * Optimal in terms of agricultural multifunctionality	3,640 visitors €24,895 (€8,329-€55,287)	9,406 visitors €61.137 (€20,453-€135,771)	€23,658 (€7,915-€52,539)	€48,553 (€16,243-€107,826)
SC4: Green cover * Optimal in terms of implementation simplicity	2,117 visitors €14,483 (€4,845-€32,164)	7,883 visitors €51.242 (€17,143-€113,798)	€13,763 (€4,605-€30,566)	€28,247 (€9,450-€62,730)

[a] *In parentheses we indicate the confidence intervals considering the cut-off points 70% and 90% respectively for estimating the potential demand for the SQ.*

Links connecting agents and causal connections through which landscape can potentially affect rural economies and societies

The results from the population survey, which assessed three landscape elements, namely green cover, stone walls and woodland islets, indicate that the enhancement of landscape attractiveness in olive orchards not only has a positive effect on visitor wellbeing but also contributes to the economic and territorial development of rural areas. When the visual elements of the landscape are improved by means of the use of green cover and stone walls, the global impact on the economy increases by a factor of approximately 2.5, with the expected total impact on the economy in terms of GDP being €263,534. As with the SQ scenario, tourism and the agro-food industry are among the sectors that benefit the most, as Table 5 shows.

Table 5. Income multiplier effects of landscape change.

Landscape	Local income (€)	Total impact on the economy of the province (€)	Impact by sector (€) SOEsM
SQ	37,479 from tourism (SOEsV)	103,645	Tourism = 41,148 Agro-Food Industry = 21,231 Trade = 13,181 Public Services = 7,525 Permanent crops = 2,576 Other sectors = 17,984
Green cover and stone walls	29,118 from public services (FOEs) 65,149 from tourism (SOEsV)	263,534	Tourism = 75,203 Public services = 51,590 Agro-Food Industry = 43,945 Trade = 31,070 Permanent crops = 5,581 Other sectors = 56,145

Source: Own elaboration from the Social Account Matrix of Cordoba.

Lesson learned & Policy Recommendations

From an agricultural policy perspective, the concluding remark points to the benefit of designing specific landscape policies that takes visitors and the local population into account when determining payments to be granted to farmers for improving the aesthetic quality of the landscape. Such policies should be designed taking into account the fact that there are different beneficiaries of the landscape features who should bear the cost of the measures implemented to guarantee the provision and avoid market failure. In this regard, the core question is how much each beneficiary should pay and in what way.

The information generated in this study can help disentangle these values from the general economic value of landscape aesthetics in order to tailor the instruments employed to incentivize farmers for the supply of public goods and services. According to the results, green cover was the most valued element, followed by stone walls. The presence of woodland islets was not deemed important.

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