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Tourists' perception of Ecosystem Services provided by mountain agriculture

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Abstract: Ecosystem services (ESs) can be defined as the values and benefits provided by ecosystems for human well-being. The main characteristic of ESs are that they benefit people. Agriculture is an important provider of ESs for society, culture, the environment and the economy. In mountain areas, agriculture embodies different functions. This work assesses the value of ESs provided by mountain farms according to mountain tourists' opinions, using a Choice Experiments (CEs) approach and quantitative surveys. CEs allow multiple scenarios with different attributes associated with monetary values that respondents have to choose. The sample comprised 840 mountain tourists, interviewed through an online survey in April 2020. The main results show that the ESs provided by agriculture and preferred by tourists are the maintenance of pastures and grazing, which are considered to shape the mountain landscape and provide for cultural and environmental ESs. Moreover, biodiversity conservation is also one of the most appreciated attributes, being fundamental for protecting the environment. A noticeable result is the importance associated to the ES provided by agriculture referred to the regulation of hydrogeological assets, meaning that the awareness on the subject of hydrogeological instability of mountain slopes is widespread and that tourists are sensitive to this topic.

Keywords: choice experiments, ecosystem services; mountain areas; mountain farms

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1. Introduction

Ecosystem services (ESs) can be defined as the values and benefits provided by ecosystems to human well-being [1]. According to Bernués et al. [2], they can be divided into provisioning ESs, related to material and energy outputs, regulating ESs, dedicated to biophysical processes, supporting ESs, crucial for providing other ESs, and cultural ESs, which include, for example, recreational enjoyment and aesthetics values. The main characteristic of ESs is that they benefit people [1]. Agriculture is an important provider of ESs for society, culture, the environment and the economy [3], furnishing both market and non-market assets [4]. This approach recognizes that the agricultural sector produces goods like food and fiber, called primary, and secondary goods like landscape, flood control, protection against soil erosion, having characteristics of public good [5].

In the mountains, agriculture embodies different functions. The benefits for humans provided by agriculture include maintaining the rural heritage and tradition and a typical food supply supported by agri-food certifications such as the Geographical Indication (GI) and the mountain product brand [6–8]. Meadows, pastures and non-intensive agriculture are essential for the conservation of the mosaic of the Alpine landscape and constitute a soft tourist attraction without the heavy investments in infrastructure required by other mountain activities (such as skiing) and with a low environmental impact that can revitalize local economies [9]. In addition, the farms are the pillars on which the

primary sector maintains a healthy and functional economy for mountain areas, which are increasingly subject to depopulation. The mountain area is the territory characterized by the presence of reliefs having altitudes of not less than 600 meters. The areas between the reliefs, consisting of highland valleys and similar soil configurations, are included in the mountain area. In recent decades, these areas have often faced considerable pressure from land abandonment [10], mainly due to the characteristics of mountain areas, such as remoteness. Younger generations are also attracted by cities and urban contexts in search of more qualified work, higher job remuneration, job satisfaction, and a more attractive living environment [11]. This social impoverishment is also a threat to the viability and competitiveness of mountain farms, namely the agricultural enterprises that are in mountain areas and work there, mainly due to the advanced age of farmers: a problem linked not only to the rural mountain community but to society in general. Alongside the social function of mountain agriculture, its environmental functions are equally important in regulating water and preventing hydrogeological and slope instability, especially through cultivation and the maintenance of meadows and pastures. The good management of the permanent meadows in the mountains permits the slowing of the erosive phenomena of soil and landslides and the absorption of excess water in the case of flood events. In addition, traditional extensive agriculture is more sustainable than intensive agriculture and has a role in maintaining biodiversity, both in terms of animal and plant species [12], being less detrimental than intensive agriculture, which exposes the natural environment to higher rates of biodiversity loss. In this sense, according to Liu et al. [13], "biodiversity conservation" is one of the main topics covered by the recent literature on mountain ESs due to its importance at the global level. Mountainous areas represent about 25% of the world's surface and are home to 12% of the world's population [1]. In addition, mountains are where half of the world's biodiversity is located, providing fresh water for drinking and irrigation purposes for rural and urban populations. Consequently, providing environmental, cultural and social ESs, may be important for understanding people's awareness and demand for mountain agriculture.

Although the research on mountain ESs is rich and extensive, to the best of our knowledge, it lacks a focus on tourists' perceptions and awareness of mountain ESs, as well as the paucity of information on their willingness to pay for them. These, however, are important topics since although the population living in the mountains directly benefits from the ESs that agriculture can offer in these locations, the entire human population indirectly benefits from these services. Thus, to what extent do people that do not live in the mountains care about agricultural ecosystem functions? To what extent are city dwellers interested in the functions of mountain farms? What is the value of these ESs for non-mountain dwellers?

Our hypothesis is that tourists' awareness of the ESs furnished by mountain agriculture exists: this work aims to assess the value that tourists assign to these ESs, by means of a Choice Experiments (CE) approach. Tourists represent a proxy of people who do not live in the mountains but can benefit from their agricultural ESs, directly and indirectly. We argue that by assessing and quantifying the value tourists associate to mountain farming ESs, it is possible to create guidelines for policymakers that may aid in enhancing the resilience and sustainability of mountain agriculture. The tourists' WTP is a proxy for this value. The CE approach is usually employed in consumer studies but is now widely applied in the context of evaluating environmental assets for its flexibility and the reliability of its results. CEs are rooted in the Random Utility Theory [14] and in the Theory of Value [15], and consist in a survey-based method in which people are requested to make choices among a set of alternatives that differ in terms of their attributes and intensity degree of these attributes. Thus, CEs allow to assess the value of all elements considered by the experiment, that is CEs permit a classification of the consumers' preferences from both the valued characteristics and the levels of these characteristics [16]. This is a crucial issue in valuing the ESs because many policy decisions do not involve a complete loss or gain in the provision of a particular ES but different levels of provision [2].

The literature on the ESs of mountain agriculture using a methodological approach with data from surveys of ES users is varied but not very rich. Although there is much research on mountain ESs in bibliographic [17] and bibliometric [13] works, few are related to the perception of tourists and the value they confer on ESs.

Mountain areas furnish humanity with a wide spectrum of ESs, like providing water resources, clean air, timber and wood, feed and habitat for animals, and food [13]. Moreover, mountains can protect from natural disaster impact [18] and Viviroli et al. [19] found that global population living in lowlands will be more and more supported by mountains for the supply of water, thus mountain areas should benefit of a great attention for their actions in water management resources and sustainable development. Other authors [20] highlight the importance of cultural ESs provisioned by mountains, with a specific focus on traditional landscape, threatened by the abandonment of alpine agriculture with meadows and pastures and the agriculture intensification of the use in the bottom of the valley. The maintenance of mountain landscapes also regards the provisioning of supporting ESs as the protection of biodiversity and regulating ESs as the flood mitigation and erosion control [21,22]. Thus, the mountain agroecosystem can be defined as multifunctional, providing private and public goods [23]. In this sense, mountain agriculture furnishes non-market values as provisioning, regulating, supporting and cultural ESs from which the whole society benefits [23].

According to Liu et al. [13], in the last 20 years, much research has been realized, mainly on water and forest resources, land management, climate change assessment and impacts on mountain regions. At first, great attention was paid to forested landscapes, and in the last decade, studies have focused more on forest management and protection and soil carbon dynamics.

Nevertheless, a small body of research is dedicated to mountain ESs employing the CE approach, and this specific branch of the literature is described in the following paragraphs.

One of the first articles linking politics to mountain ESs is that of Bernués et al. [2], where the authors attempted to assess the economic functions of agriculture in the mountains using CEs with attributes drawn from the ESs framework. The respondents showed preferences for quality food provisioning and traditional landscape maintenance. A very similar framework was used by Faccioni et al. [24] with local stakeholders that considered noticeable the outcomes of the dairy farming system, especially the fact that water quality is regulated. Other studies [25] emphasized the attitudinal characteristics of respondents that can influence the perception of mountain ESs using CE and factor analysis or the landscape value of mountain agriculture [26] through images. The CE approach was used considering attributes such as the watershed protection service, the harvesting of medicinal plants and the water supply, mainly focusing on environmental and cultural CE typologies [27].

Other studies in the framework of ES have assessed a specific function of mountain agriculture, such as the maintenance of meadows and pastures [7,28], the integrity of the agricultural landscape [29], and biodiversity conservation [30]. In a previous work, Mazzocchi and Sali [7] proposed supporting extensive mountain farms where the diversification of agricultural activities can be economically beneficial, such as agritourism and on-farm processing activities. They assessed people's preference for the traditional alpine agricultural economy, a possibility encouraged by other authors [28], adding that expensive traditional livestock methods, such as transhumance, could aid in the conservation of traditional grasslands and their ecosystem functions. Biodiversity is a crucial element for the value of mountain agricultural ES, as investigated in literature [31]. Our contribution to the existing literature on ESs of mountain agriculture is related to three main elements. First, to the best of our knowledge, no research has yet been published on tourists' perceptions of mountain agriculture ESs. This is an important issue related to our understanding of how policy can foster mountain farming resilience. A greater understanding of mountain tourists' opinions on ESs can suggest ways in which it is possible to raise

awareness of these systems and their provision of important ES also among populations that do not live in these areas but who benefit from its ESs. Secondly, our study tries to propose the best CE design for mountain farming ESs, focusing on a mountain area in Italy, highlighting the most important attributes to investigate agriculture ESs in the mountain context. Lastly, we included the water course management by agriculture among the attribute of our CE, an ES never investigated before but of fundamental importance, because the global population benefits from it.

3. Materials and methods

Over the last twenty years, the valuation of goods or products with characteristics of public goods is a topic that has become increasingly important to value the benefits of natural and common resources. Valuation approaches attempt to capture shadow prices not reflected in the market price. One of the most important methodologies employed in the literature is CE, mainly because it allows multiple scenarios with different attributes associated with monetary values that respondents have to choose. The aim is to assess the value of a good using the respondents' choices from the various alternatives, deriving their marginal utility by obtaining the trade-offs between the attributes. As explained previously (see Sect. 1), mountain agriculture produces goods and services that are not remunerated by the market, thus fitting well into the framework of CE. In the CE, defining the asset to be evaluated precisely is necessary. In our CE, the good being estimated is the sustainable management of mountain areas by mountain farms, defined by the chosen attributes: the ESs. Works focused on making tourists aware of the ESs of mountain agriculture, and their willingness to pay for these services is lacking, and CE is one of the best methodologies to assess this value. In addition, the CE approach allows us to order the respondents' preferences relating to the attributes and levels proposed in the choice sets. Therefore, the outcomes of this study indicate which ESs are best evaluated.

3.1. Data collection

Data collection was carried out with online interviews using an online CE survey conducted by a professional market research company. Mountain tourists were the survey target, recruited according to a quota sampling criterion by the company. The first question to the potential respondents was: "Do you go to the mountains as a tourist?". People answering affirmatively to this question were interviewed; all the others were eliminated from the sample. Respondents were sampled from a representative panel of the Milan city and Milan Province population and recruited to match the socio-demographic characteristics of the 2018 Italian population census.

The respondents came from Milan city and Milan Province, in order to include mountain tourists living in a metropolitan area. The idea was to select respondents living far from the natural setting of the mountains who would visit these places by personal choice, would enjoy the mountain areas and benefit directly and indirectly from their ESs. In fact, mountain agriculture provides ESs to all of society, not just to people living in mountain areas.

A pilot study with 40 respondents was conducted in February 2020, precisely from 7 to 12 of February, to calibrate the questionnaire and the CE design, checking the questions' length and clarity. 860 respondents were interviewed, and 840 completed questionnaires were obtained (97%). The participants were adult mountain tourists, from 18 years old to over 65 (Table 2). On average, the time to complete the survey was approximately 15 minutes. The data was collected from 2 to 14 of April 2020.

3.2. Selection of attributes

The selection of attributes corresponding to ESs aimed to estimate the value of ESs provided by mountain farms, trying to elicit the marginal willingness to pay (mWTP). The

"price" attribute allows calculating the mWTP for each attribute and the attribute levels (Table 1).

Table 1. Description of attributes and levels proposed in the CE questionnaire.

Attributes		Levels
Pastures and grazing (PAST)	1.	decrease in pastures and meadows and parallel increase in spontaneous woods (SQ [1])
	2.	maintenance of existing pastures and meadows
	3.	maintenance of existing pastures and meadows with grazing cows
	4.	increase of existing pastures and meadows with grazing cows
Biodiversity (BIO)	1.	general decrease in existing plant species (SQ)
	2.	maintenance of existing plant species
	3.	increase in existing plant species
	4.	increase in existing plant species and spread in several areas
Water and land management (WAT)	5.	no regulation (SQ)
	6.	maintenance of traditional agricultural water management systems
	7.	maintenance of traditional agricultural water management systems and repair of disused systems
	8.	maintenance of traditional agricultural water management systems and repair of disused systems, protection against hydrological instability
Recreational services (SER)	1.	no recreational services (SQ)
	2.	sale of local high-quality agricultural products
	3.	sale of local high-quality agricultural products and catering services
	4.	sale of local high-quality agricultural products and catering services and overnight accommodation
Tax (€/year) (PRI)	1.	0 (SQ)
	2.	25
	3.	45
	4.	65

The current work aims to fill the gap on this issue by considering ESs as characteristics of mountain agriculture using the scheme proposed by Bernués et al. [2] in which ESs are offered as attributes in choice sets. The ESs taxonomy [32] describes the agricultural functions dividing them into several categories. In our study, we employed the multifunctionality framing of mountain agriculture to assess the tourists' perception of ESs value. Then, the different functions of mountain farming were converted into several types of ESs and employed in economic estimation by using CE. These ESs strictly depend on the permanence of the traditional and sustainable mountain agricultural system.

The first attribute concerned the function of maintaining the traditional alpine landscape, with grazing and pastures (PAST), considered a cultural ES, having a non-extractive direct use value with recreational function. In previous works [7], this feature was considered a fundamental function of mountain agriculture, providing benefits to the whole society, and it has been considered a public good.

The second attribute concerns the issue of biodiversity (BIO), a supporting ES with the non-use existence value, that is, the preservation of biodiversity [2]. Many scholars have investigated the consumer's preferences for environmental practices in agriculture related, as an example, to pollution and to the agricultural impacts [33, 34]. Indeed, global intensive agriculture is responsible for the loss of biodiversity, considering it as the variability among living organisms and including diversity within and between species and of ecosystems [35]. This means that conservative agricultural practices, such as grazing and grassland, are necessary to maintain a healthy environment because there are several interactions between the various characteristics that influence each other. The importance of the attribute BIO as an ES of mountain agriculture is related to the fact that thanks to extensive agriculture and the maintenance of meadows and mountain pastures, native

[1] SQ = status quo

herbaceous species have the possibility of surviving and spreading[2]. In some cases, the presence of herbaceous species specific to the territory gives grazing cows' milk products characteristics linked to the taste and fat composition, as in the case of some typical Alpine cheese [36].

The third attribute (WAT) concerns the maintenance of traditional water management systems by mountain farms, an issue rarely addressed by the CE literature [31], and considered a regulating ES. However, this issue is very important because agro-sylvo-pastoral activities and related services have a strong capacity to counter economic and environmental shocks and pressures [37]. For instance, vegetation cover as meadows and pasture plays a role in improving slope stability, and reducing the risk of natural hazards [37]. Furthermore, the correct management of watercourses and water reserves by agriculture can reduce slope instability and the incidence of landslides.

The recreational services and the typical local productions provided by agriculture (SER) are the fourth attribute in the CE, as a provisioning ES (food) [2]. Local food productions meet market demand for traditional products and often represent a tourist attraction. In addition, traditional food is linked to the extrinsic dimensions of quality, such as cultural heritage, tradition, and habits. In summary, the non-monetary attributes refer to four dimensions of ESs: the aesthetic value of the landscape (cultural ES), the environmental value of the biodiversity (supporting ES), the economic and environmental value of the water management (regulating ES), the cultural value of the food products (provisioning ES).

Finally, the price variable is included, with levels shown in local currency based on realistic average environmental taxes per year. The price is expressed in euros, and not just as a percentage, to facilitate the understanding of the tax attribute.

3.3. Experimental design

The questionnaire was divided into three parts: (i) personal characteristics of the respondents, (ii) frequency of the tourists' visits and knowledge of the issue proposed in the survey, (iii) choice sets. There was a short introductory text explaining the subject of the questionnaire and indicating the correct way to complete the survey, where the status quo was described, to ensure that this option was "understood, accepted and viewed as credible" [38, pp.10]. The idea expressed in the text was that mountain agriculture generally performs a number of fundamental functions for the environmental system: the ESs. The status quo corresponded to the current decline of mountain farms, which could eventually lead to the decline of most of these services. The status quo can be seen as the benchmark against which any trade-off is measured. Furthermore, the text illustrated and described each attribute. Therefore, the attributes were clearly defined in the questionnaire. In accordance with Johnston et al. [38], the attributes and levels proposed in the questionnaire are precisely determinable, without ambiguity in the definition of the attribute levels.

Additionally, a cheap talk script was given, to encourage people in revealing their true preferences [39] in making the choice requested in the choice sets.

The good under estimation was defined in the CE as the mountain farms' agro-system, described by attributes and levels that reflect the ESs. Thus, the mountain farms' agro- system defined by the highest levels of attributes corresponds to the scenario with the highest price.

In order to design the survey a Bayesian approach was employed. A prior distribution of likely parameter values is considered, optimizing the design on the defined distribution without assuming fixed priors [40]. To produce the pilot survey on a sample of 40 respondents a D-Optimal design was generated, successively calculated by means of a multinomial logit model (MNL). To produce the final Db optimal design coefficients,

[2] The right term to use in the questionnaire would have been "native" or "autochthonous" plant species, but these terms are too specific and technical for our sample. Thus, we have chosen "existing plant species".

estimates were used as priors [41]. According to Caussade et al. [42] the design process has created 24 choice sets included in two blocks, thus 12 choice sets for each block, and to derive the marginal utility of the opt-out option in a block, each respondent had to make 12 choices from three alternatives (two alternatives + one opt-out). The model employed unlabeled alternatives to avoid potential biases related to the fact that labels might play a role in individual choices reducing the attention that respondents might give to attributes and levels. Moreover, unlabeled alternatives usually do not entail identifying and using all the possible alternatives in the choice sets and they encourage respondents to select an alternative by trading off attribute levels, a desirable perspective for non-market goods [43].

To avoid path dependency and any order effects, a randomization process in the survey software was used.

3.4. Econometric model

Econometric model started from the following utility function:

$$Unjt = ß'n + Xnjt + Enjt \quad (1)$$

where n is the individual, j is the product, t is the choice occasion. In order to took into account the heterogeneity of preferences, ßn is a vector of individual specific parameters. Only the price parameter was kept fixed, while all the others parameters were assumed as random. The parameters were included in the eq. (1).

The WTP is defined to be normally distributed, without the possibility to have a positive price coefficient in the results [44,45].

The choice probability for the product p and the choice set t was:

$$Pnj\ (ßn) = \exp\ (ß'n + Xnjt)/\Sigma je(\beta'nXnj) \quad (2)$$

With jt is the number of products in choice set t. In order to analyze results of the survey a mixed logit model (MXL) was chosen. The mixed logit probability is a weighted average of the logit formula evaluated at different values of ß; the weights are derived from the density f(ß). The MXL model allows the heterogeneity of preferences not related to observed characteristics.

Table 3 shows Model a, with the main attributes results, and Model b, with the main attributes with interactions. The interactions are realized by using both socio-economic variables and variables concerning the relationship between the respondents and the research question. The best-fitting model was estimated by means of the log-likelihood (LL) value , including interaction terms. The best interactions to consider in the full model were assessed by adding a variable step by step controlling the increasing (or decreasing) of LL.

The Formula (3) defined the mWTP for attributes and levels:

$$mWTP = -\ ßx/ßp \quad (3)$$

x = 1, 2, 3, 4, represent the coefficients of the non-monetary attributes, with βp that is the price attribute. The Stata 14 command MIXLOGIT was used.

4. Results

The results of the descriptive statistics of the sample are shown in Table 2. The average age value is 2.75, which represents the two central age groups, i.e. the 25-34 years old class (23.54% of the total sample), and the 35-44 year old class (35.55%). 55% of the sample was made up of women and the remaining 45% of men. The respondents had an average level of education (average of 2.01), possibly because the sample was mainly composed of people who had on average attained a secondary school diploma. The declared average annual income was quite low, around €15,000, probably due to the fact that the sample included a large number of young people, with 15% aged between 18-24 and 24% in the range 25-34. There is also a quota of women which may only work part-time or may be

unemployed, maybe married to professionals and managers. The majority of the sample visited the mountains in summer and winter (46.25%) and a small percentage preferred to go to go only during summer (19.86%) or during winter (14.03%). The average value of knowledge is 2.52 on a Likert scale of 1 to 5 but the classes comprising most respondents were the third-class (38.53%) and first-class (27.82%) ratings.

Table 2. Table 2 shows the results of the descriptive statistics of the sample, thanks to the data collected in the CE questionnaire, for a total of 840 respondents.

Variables	Average value	Standard deviation	Observations (number)	Min	Max
Age (AGE) (1=18-24; 2=25-34; 3=35-49; 4=50-64; 5= over 64)	2.75 (1=15.21%; 2=23.54%; 3=35.55%; 4=22.59%; 5=3.09%)	1.06	30,276	1	5
Sex (SEX) (dummy: f=1)	0.55	0.50	30,276	0	1
Education (EDU) (level 1 = primary and secondary school; level 2 = secondary school; level 3=degree and PhD studies)	2.02	0.13	30,276	1	3
Net income of the previous year (INC) (1=x<15,000; 2=15,000<x<25,000; 3=25,000<x<50,000; 4=50,000<x<70,000; 5=x>70,000)	1.03	0.24	30,276	1	5
When do you go to the mountains? (WHEN) (1= in summer; 2= in winter; 3= all year round)	2.33	0.85	30,276	1	3
Knowledge of the question proposed in the study (KNOW) (Likert scale 1-5)	2.52	1.18	30,276	1	5

Table 3 shows the results of the CE, and Table 4 the WTP related to the attributes of Model A, including only the main effects and confirming the quality of the choice of the attributes, showing all the coefficients with a significance level of 99%. This result has confirmed the experimental design and the efficiency of the sample size. The attributes can be treated as random parameters, being significant at the 99.5% level. The observed heterogeneity is explained by the significant standard deviation of beta parameters.

Different models with interaction terms were tested, by means of Log-likelihood values and Akaike's Information Criterion (AIC). In this work, a stepwise approach was applied, adding a variable at each step to control for the increasing or decreasing values of the two indicators. At the end, the best fitting model with interactions was retained (Model B).

Model A represents the main effects model (Table 3).

Table 3. Table 3 shows the results obtained by the econometric model (Mixed logit model). For each variable employed in the model the table reports the coefficient of the variable in the main effects model, called Model A, and the coefficient of the variable in the model with the interactions with the socio-demographic variables, called Model B (see par. 3.4 for detailed descriptions).

Variables	Coefficients	
	Model A (main effects)	**Model B (with interactions)**
PRI	-0.02*** (0.00)	-0.02 *** (0.00)
OPT OUT	-0.52*** (0.13)	-0.54 *** (0.13)
PAST_1	-0.02 (0.08)	0.01 (0.12)
PAST_3	0.52*** (0.06)	0.51 *** (0.06)

PAST_4	0.36*** (0.07)	0.3 *** (0.08)
SER_1	-0.60*** (0.10)	-0.58 *** (0.10)
SER_3	0.06 (0.08)	0.06 (0.08)
SER_4	0.03 (0.08)	0.03 (0.08)
WAT_1	-0.90*** (0.09)	-0.67 *** (0.11)
WAT_3	0.30*** (0.08)	0.32 *** (0.08)
WAT_4	0.54*** (0.07)	0.56 *** (0.07)
BIO_1	-0.47*** (0.09)	-0.45 *** (0.08)
BIO_3	0.19** (0.07)	0.18 ** (0.07)
BIO_4	0.30*** (0.07)	0.31 *** (0.07)
PAST_1*SEX_F		-0.37** (0.12)
WAT_1*SEX_F		-0.43*** (0.12)
PAST_1*AGE_1		0.7*** (0.18)
WAT_1*AGE_1		0.37* (0.17)
PAST_4*AGE_4		0.34* (0.13)
BIO_1*EDU_2		-0.95* (0.43)
SER_1*EDU_2		1.18** (0.45)
PAST_1*KNOW_1		0.4** (0.13)
Number of observations	30,276	30,276
Log- likelihood	-8,077.50	-8,042.15
AIC	16207.1	16152.3

The significance thresholds are: * p<0.05; **p<0.01; ***p<0.001; standard errors in parentheses.

The parameters have four different levels (1,2,3,4), being discrete variables, but level 2 of all variables was considered as the base level attribute, and therefore was not included in the utility function and not shown in Table 3. Model A shows the "Opt-out" and "Price" variables as negatively related to dependent, confirming that the higher the price, the lower the preference for this attribute. At the same time, respondents did not prefer the "Opt-out" attribute, as assumed. Similarly, level 1 of the parameters SER, WAT and BIO, corresponding to the status quo condition, had negative coefficients, i.e. the status quo level of these attributes was not chosen by the respondents. The PAST_1 level was not statistically significant, and nor were the SER_3 and SER_4 levels.

Regarding the other levels of attributes, levels 3 and 4 of PAST, SER, WAT and BIO are positively related to the dependent and highly statistically significant, both in Model A and in Model B, showing the robustness of the results.

Model B includes the interaction terms between the non-monetary attributes and the personal characteristics of each respondent and derives from the stepwise approach. Significant interactions were found between personal characteristics, including age, gender, level of education and knowledge. The parameter related to young people, represented in the models with the variable AGE_1 (18-24 years), is positively related to the choice of level 1 of "Pastures and grazing" (PAST_1) and of "Water and land management" (WAT_1) both corresponding to the status quo. This means that in the sample the probability that young people chose PAST_1 and WAT_1 was high (respectively coeff.: 0.79; 0.37). It is possible to find the same relationship between the AGE_4 variable (50-64 years old) and PAST_4 parameter (coeff. 0.34), defined as "increase in existing pastures and meadows with grazing cows" which is the highest level for the attribute PAST. In model B, women are negatively related to PAST_1 (coeff. -0.37) and WAT_1 (coeff. -0.43), indicating that they chose less frequently than men these two parameters which corresponded to the status quo. Significant interactions between EDU_2, i.e. "people with a high school diploma" and the status quo levels of BIO_1 and SER_1, corresponding to "the general decrease in existing plant species" (BIO_1) (coeff. -0.95) and "no recreational services" (SER_1) (coeff. 1.18), are found. Finally, PAST_1 shows a positive relationship with KNOW_1, defined as the lowest level of "Knowledge of the issue proposed in the study" (coeff. 0.4). In Table 4, the mWTP results are shown.

Table 4. Results of marginal willingness to pay.

Variables	WTP (€)
OPT-OUT	-32.24
PAST_1	-0.95
PAST_3	32.03
PAST_4	22.09
SER_1	-37.10
SER_3	3.56
SER_4	1.79
WAT_1	-55.53
WAT_3	18.42
WAT_4	33.15
BIO_1	-29.05
BIO_3	11.50
BIO_4	18.56

5. Discussion

Regarding Model A, with the results of the main effects, some conclusions can be drawn. Except for PAST_1, SER_3, SER_4, all the levels of the attributes are statistically significant. As mentioned in Section 4, the price parameter turns out to be negatively linked to the dependent, respecting the starting hypothesis for which the higher the price, the weaker the purchase choice. Similarly, the opt-out option is characterized by a negative coefficient because, among the possible options, the respondents usually find their favorite. The variables "maintaining existing pastures and meadows with grazing cows" (PAST_3) and "increase of existing pastures and meadows with grazing cows "(PAST_4) are strictly related to the issue of the resilience of mountain farms. In fact, the extensive livestock systems in the mountains have allowed the agricultural economy to survive mainly in disadvantageous areas [24] shaping the mountain landscape of pastures and meadows, thus providing cultural and environmental ESs.

The interest for these categories of ESs is confirmed in Bernués et al. [2], although in their study the sample was made up of residents and not tourists. The results of the current study demonstrate a preference for cultural and environmental ESs provided by mountain farms by people who usually visit the mountains. Regarding this result, the landscape with pastures and meadows is an ES well understood by respondents, probably because it can be easily enjoyed by tourists. In more detail, the level "PAST_3" shows an absolute value of 0.52, higher than the value of "PAST_4" (0.36). This is why the tourists' feeling for mountain meadows and pastures is so strong and rooted that they feel those that currently exist should be maintained (PAST_3) but not increased (PAST_4). Thus, the estimate of level 3 of "Pastures and grazing" attribute, that is the maintenance of pasture and grazing, is higher in absolute value than level "4", indicating that the welfare gains from avoiding the decrease in pasture (PAST_1) is greater than the gains from increasing grassland and pasture (PAST_4).

For the SER attribute, with the exception of the SQ condition, the other levels are not statistically significant. The interviewees tended not to prefer options where there are no recreational services on mountain farms. This is in line with other previous works [45], where the consumer's preference for huts and farms selling local food production was observed.

According to the literature [37] hydrogeological instability is one of the major problems in mountain areas. Mountain agriculture is important for soil management, especially for limiting the risk of landslides and erosion. Similarly, the management of mountain water resources by the agricultural sector is of fundamental importance in the provision of environmental ESs [47].

The results show strong awareness of tourists on the topic of hydrogeological instability, with positive coefficients both for "the maintenance of traditional agricultural water management systems and the repair of disused systems" (WAT_3) and for "maintenance of traditional agricultural water management systems and repair of disused systems, protection against hydrological instability "(WAT_4). This result is interesting for the difference in the absolute values of the two levels. In fact, WAT_4 also includes the "protection against hydrogeological instability" (0.54) which is clearly favored at the WAT_3 level (0.3). This means that knowledge or awareness of the subject of hydrogeological instability of mountain slopes is widespread and that tourists show a high level of sensitivity regarding this topic, being willing to pay to benefit from this ES partly provided by the agricultural system. This may be due to the fact that people tend to enhance the value of ES whose direct effects satisfy tangible needs [47].

Maintaining traditional agriculture with extensive livestock farming allows for further biodiversity conservation [31]. The interest in BIO is illustrated by coefficients of "increase in existing floristic species" (BIO_3) and "increase in existing floristic species and diffusion in several areas" (BIO_4), both parameters being significant and positive. This is quite surprising as other studies [48] have claimed that people prefer ESs with an immediately obvious impact on human well-being.

Concerning the results of interactions between level of attributes and socio-demographic characteristics tested in Model B, young people (AGE_1=18-24 years) chose the SQ condition of "pastures and grazing" and "water and land management" attributes. This is probably because they have less money to spend and cannot afford the more expensive options in the choice sets. Moreover, with regard to "PAST_1", the increase in spontaneous wood can be understood as natural and positive. This was found in a previous work [49], which confirmed that certain groups of mountain tourists (such as outdoor enthusiasts and athletes) believe that mountain economies should rely more on tourism and housing infrastructures rather than on agriculture. In contrast, people between 50 and 64 years old (AGE_4), who are generally richer than young people, chose the "PAST_4" parameter.

Women's sensitivity to ethical and environmental issues is widely documented in the literature [50] so it is not surprising that the "SEX_F" variable has a negative relationship with the SQ levels of PAST and WAT.

EDU_2 is the level of secondary education in the sample. The negative interaction with BIO_1 can be explained because, as is the case of the entire sample, biodiversity conservation has become an important public issue for this group of respondents. In fact, in terms of political indications, the publication of the EU's "Biodiversity Strategy for 2030", recently included in the Green Deal, disseminated this theme among the public, as it is an ambitious and long-term plan to protect ecosystems.

The KNOW_1, representing the SQ level of the "Knowledge of the issue" attribute, interacts positively with the SQ level of the PAST variable. As often found in behavioral economics studies the knowledge of an issue is considered one of the main drivers of public awareness. Similarly, poor knowledge could influence the choice of the SQ condition in the "PAST" attribute.

According to this discussion some highlights about the sustainability of mountains resources' exploitation can be noted. Mountain regions are fundamental in supporting a large part of the global population thanks to their natural re-sources, for example by regulating hydrological cycles and mitigating climate extremes [51]. Moreover, mountains sustain humanity needs through farming, agricultural products, meadows and pasture, biodiversity richness. However, this fragile ecosystem is often threatened by factors such as anthropic pressure and climate change. Its resilience mainly depends on the natural resources' exploitation. Thus, the economic estimation of the value of these resources is an issue of peculiar importance, also in terms of we argue. In fact, the 2022 has been proclaimed as the International Year of Mountain Sustainable Development, in order to stimulate the international community to reflect on the sustainability of mountain resources' exploitation and trying to adopt adequate protection policies. The target 1 of the

Sustainable Development Goal (SDG) 15, that focuses on the needs to protect and promote sustainable use of ecosystems resources, explicitly cites mountains as ecosystems that have to be conserved and protected as decided through international policies and agreements. In particular the paragraph 15.4 better explain the final aim: "By 2030 ensure the conservation of mountain ecosystems including their biodiversity in order to enhance their capacity to provide benefits that are essential to sustainable development". The attention for mountain areas also emerged in Rio+20 with the document "The Future We Want", which recommended the cooperation among States to include in their national sustainable development plans specific policies related to mountain regions resilience.

This study suffers from some limitations. We used an online questionnaire, which cannot ensure that the respondents have the means to complete the questionnaire correctly, because there was no interviewer with them. Qualitative research leaves doubt about the quality of the respondents and their consistency. Further steps may include more in-depth analysis with other attributes related to the ESs framework, possibly employing other econometric models for a more accurate understanding of WTP for ESs. Moreover, the study was conducted in April 2020, in the first phase of the Covid-19 pandemic period; it would be interesting to compare the results of this work with similar interviews collected in other periods, to investigate the potential impact of the first period of the pandemic Covid-19 on people's behaviour and beliefs.

6. Conclusions

In our work a tourists' sample was considered and their preferences in mountain agriculture ESs have been evidenced and their value have been estimated. Tourists' respondents represent people that do not live in mountain regions but benefit from their ESs. Thus, the study highlights some results that can be employed by policymakers to value some characteristics of mountain agriculture ESs, to try to ameliorate the resilience and sustainability of mountain agriculture. Firstly, our survey revealed that the ESs of mountain farms related to environmental management and protection are particularly valued by tourists, who showed a strong willingness to pay for these ESs. More in detail, the protection against hydrogeological instability through the maintenance of the traditional irrigation and water management system seems to be the most important attribute for tourists. This result is probably linked to tourists' concern for landslides and floods, particularly in fragile mountain areas, for which the functions performed by agriculture become fundamental to restore the hydrogeological balance. Another function of agriculture linked to a cultural ES as landscape maintenance is the management of the local area through meadows and pastures and, in general, through the traditional extensive livestock system. Indeed, this ES is especially appreciated for its visual impact; moreover, people tend to value more those ESs that directly respond to tangible needs.

Secondly, the ES of biodiversity conservation was found to be popular with tourists because in recent years this is an issue often discussed both by academics and by the public. Finally, certain personal characteristics of the respondents may influence their purchasing choices, also in the context of the evaluation of public goods and ESs.

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