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Earmarking conservation: further inquiry on scope effects in stated preference methods applied to nature-based tourism

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Abstract. The way people assign value to nature conservation policies has important implications for management choices. Economic valuation surveys are affected by individual behavioural patterns that are not exhaustively explained by traditional sources of bias such as embedding, flagship species, fixed-budget, commodity misspecification and warm glows. Through a Contingent Valuation study of Alpine wildlife, we use an external scope test to evaluate the difference in willingness to pay among tourists for conservation policies targeted either to the ibex alone, or to the four ungulates populating the Gran Paradiso National Park in Northwest Italy (ibex, red deer, roe deer, chamois). We find that park users are willing to contribute significantly more to policies protecting one of the four ungulates than all four of them, a result that we argue should be ascribed to pure aversion to less specific policy objectives, i.e. to a preference for punctual earmarking of resources devoted to conservation.

Keywords. Earmarking · Embedding · Flagship species · External scope test · Contingent valuation · Wildlife valuation · Natural resource recreation · Ungulates

1. Introduction

The value people assign to natural heritage and the quality of nature-based recreational opportunities exerts influence on the allocation of resources to conservation and management of parks and protected areas. Not surprisingly, substantial research has been devoted to assessing the recreational value of different natural assets, including threatened species (see Richardson and Loomis 2009 for a broad meta-analysis), natural reserves (Baral et al. 2008), coastal ecosystems (Ghermandi and Nunes 2013) and marine protected areas (Brander et al. 2007, Asafu-Adjaye and Tapsuwan 2008).

Stated preferences techniques play an important role within that literature, due to their capacity to estimate total economic value rather than just use value sub-components (e.g. Lee and Han 2002, Lee et al. 2010, Guimarães et al. 2015). They are also, however, exposed to a number of potential biases inherent in the behaviour of respondents when facing hypothetical markets. Several studies, for example, report that respondents frequently state the same willingness to pay (WTP) for goods that differ significantly in scope or inclusiveness: Toronto residents were found to be willing to pay similar amounts to clean up all polluted lakes in Ontario or a subset of them (Kahneman 1986); independent samples of respondents showed no statistically significant difference in their WTP to prevent the death of 2,000, 20,000 or 200,000 migratory birds (Boyle et al. 1994); interviewed U.S. residents appeared to be willing to pay only 28 percent more to protect all 57 wilderness areas present in their states than to protect only one of them (McFadden and Leonard 1993), and so on. This phenomenon, labelled 'scope insensitivity', is generally recognized (using the words of the NOAA panel[1]) as 'perhaps the most important internal argument against the reliability of the contingent valuation (CV) approach' (Arrow et al., 1993, p. 4607), and as such has been object of extensive attention in the stated preferences literature. A three decades debate, started with Kahneman's (1986) first discussion of insensitivity to scope, is well described for instance in Lew and Wallmo (2011).

[1] A committee of high profile economists appointed in 1993 by the National Oceanic and Atmospheric Administration (an American scientific agency focusing on the conditions of ocean and atmospheric resources) to elaborate recommendations on the design of contingent valuation studies.

Many explanations of why willingness to pay may not behave as expected when we increase the scale of the object of environmental valuation have been explored: embedding (Kahneman and Knetsch 1992); flagship species (Kontoleon and Swanson 2003) and, more generally, label effects (Czajkowski and Hanley 2009); commodity misspecification (Carson and Mitchell 1995); fixed-budget effects (Randall and Hoehn 1996); and warm glows (Cooper et al. 2004).

The purpose of this paper is to further investigate the potential determinants of scope insensitivity in stated preference studies, in contexts relevant to nature-based recreational values. Scope insensitivity is generally investigated through scope tests, which consist in 'examining the prediction that respondents should be willing to pay more as the amount or quality of the environmental good to be provided increases' (Czajkowski and Hanley 2009, p. 522; Giraud et al. 1999). Results of stated preference evaluation studies that, showing insufficient sensitivity to scope, do not confirm this basic prediction of economic theory are seen as failing to pass the test. Through a case study of Alpine wildlife, we evaluate the difference in willingness to pay (WTP) for conservation policies targeted either to the ibex alone, or to the four ungulates populating the Gran Paradiso National Park in Northwest Italy (ibex, red deer, roe deer, chamois).

We find that people are willing to contribute less to conservation policies aimed at the four ungulates than to those aimed at one of them. This is a counterintuitive result, stronger than the typical failures of scope tests previously detected, which rules out, in our case study, the embedding effect as the reason of failure. Nor can the extra value stated for the single species program be attributed to a flagship species premium or to the other previously studied causes: since the protection of ibex is present in both policy options, all of the well-known sources of bias could at best induce an equivalent valuation for the two alternative policies. Our experiment reveals instead that respondents attach a significant *higher* value to programmes targeted to one specific species, with respect to programmes targeted to protect that same species plus several others. None of the other three ungulates selected for this exercise can be suspected to be considered a 'nuisance' species whose presence could be attached a negative value by respondents: red deer, roe deer and chamois are also considered valuable wildlife attractions by the National Park and are not source of damage (e.g. depredation losses) for any existing activity.

We therefore argue that existing explanations of scope insensitivity do not exhaustively deal with the question. We suggest that an important factor, rooted in individuals' utility function, could be a preference for well-defined and circumscribed policies as opposite to interventions aimed at composite objectives – a preference for earmarking of resources devoted to conservation.

2. Potential sources of scope insensitivity

Embedding is generally recognised as the classic source of insensitivity to scope. Many individuals appear to find it difficult to identify the specific value they attach to one specific thing which is embedded in a set of similar things: one protected area vs. many of them, one endangered species vs. many, a small vs. large number of individuals to be protected, and so on. This effect is also called 'part-whole bias'. The literature abounds of examples in which the elicited WTP is the same for (or not sufficiently differentiated between) preserving environmental commodities that differ from each other in their quantities or qualities (e.g. Svedsäter 2000, Kahneman and Knetsch 1992, Boyle et al. 1994; Mitchell and Carson 1989). These studies typically find that the value assigned by people to more and more inclusive goods increases less than we would expect on the ground of rational behaviour: respondents appear to be willing to pay only marginally larger amounts (or even the same amount) to protect larger and larger areas, more and more individuals of an endangered species, or more species rather than just one.

Kontoleon and Swanson (2003) focus on the issue of flagship species. Meta-analyses of the WTP for individual species have found that there exist preferences for a few charismatic species as compared to the vast number of less well-known species (Metrick and Weitzman 1996; Loomis and White 1996; Leader-Williams and Dublin 2000). In stated preferences studies, these effects may limit the sensitivity to scope, as they may raise the relative value of bids to conserve single flagship species with respect to those aimed at more inclusive conservation programs. If individuals were willing to pay *only* for conserving flagship species, with zero value attached to the less well-known ones, we would observe a limit case in which an equal WTP is elicited for a single charismatic species and for a bundle of species including the charismatic one.

The representative status of the flagship species plays a key role in conservation. Conservation NGOs and natural parks often focus their appeals for funding around threatened charismatic species – an approach that, if a flagship species bias is widespread in individual preferences, could in principle also be functional to general conservation objectives. However, governmental agencies have also been shown to allocate disproportionate amounts of conservation funds to a handful of popular species (Kontoleon and Swanson 2003), which raises important policy questions on the flagship species approach as an instrument for biodiversity conservation and motivates an interest for detailed investigation of the nature of individual preferences in this field.

A related potential source of insufficient sensitivity to scope are the so-called label effects, that is the fact that part of the estimated value of a good may be related to the label or brand under which it is presented to the respondents. In the context of nature conservation, Czajkowski and Hanley (2009) showed, for example, that a forest biodiversity protection policy involving the designation of the area under protection as national park, a 'label' which is recognized by the respondents as desirable, would elicit a substantially higher WTP with respect to an alternative policy involving the same level of protection but without the label.

Diminishing marginal values of successive extents of environmental protection and income effects, whereby CV respondents allocate limited budgets or sub-budgets for spending on nature conservation, are a further potential explanation for observed scope insensitivity (Randall and Hoehn 1993, 1996; Veisten et al. 2004).

Also a misspecification in the survey design of the amenities being valued can induce scope insensitivity (e.g. Carson and Mitchell 1995). The bias may arise, for example, when a vague specification leads respondents to interpret the object of valuation in its general symbolic meaning rather than to consider its specific level of provision.

Finally, low sensitivity to scope may arise when individuals' WTP for nature protection or for public goods in general, relates to the purchase of moral satisfaction. In these cases, once the 'warm glow', in Andreoni (1990)'s terminology, from contributing to a good cause is satisfied, WTP ceases to increase with the extent of conservation (e.g. the number of species included in the conservation program).

All of these sources of bias, when present in individuals' utility functions or in the survey design, may induce a valuation for the 'part' not sufficiently smaller than for the 'whole' to satisfy a consistency requirement; or, at the limit, as large for the former as for the latter. The possibility of a statistically significant higher WTP for the part (single species conservation programs) with respect to the whole (larger conservation programs including also the former single species) that emerges in this study, a phenomenon to which we could refer as 'over-embedding', points however to the fact that more research is required before we consider the issue of scope insensitivity fully understood.

3. Method

Suppose (following Whitehead et al. 1998's methodological approach) that respondents of the CV survey define their WTP as the one maximizing their utility (*u*) function:

$$u(x_{i,}q_i,z) \qquad [1]$$

with x_i ($i=1, \ldots, N$) representing the basket of goods being evaluated, q_i the quality of good x_i and z a composite good. In this case, x stands for the four species of ungulates and q for the corresponding level of protection. Dual to the utility maximization problem is the minimization of the expenditure function, so that we can reformulate utility maximization as the problem of minimizing the following expenditure (*e*) function:

$$e(p_iq_i,u)$$

subject to the budget constraint:

$$m = \sum_{i=1}^{N} p_i x_i + z \quad [2]$$

with *m* the individual disposable income, p_i the price to protect species x_i (here, i= 1, .., 4) and *z* the consumption of the composite or residual good (with its price normalized to 1).

We use an external scope test (that is, a scope test performed submitting the same WTP question to different samples of respondents). The alternative would have been an internal scope test, run on a paired sample, where both WTP questions are asked to the same respondents. We choose to adopt a split sample design because of its prevalence in seminal studies on scope effects (e.g. Loomis et al. 1993, Carson and Mitchell, 1995; Smith et al. 1997), so as to perform a test as closely comparable as possible to those in the literature.

Thus, two versions of the CV were randomly assigned to respondents in order to test insensitivity to scope in people's evaluation of protection policies. One version of the survey asks respondents to state their WTP to protect the four ungulate wildlife species present in the national park. The WTP for the four ungulates protection program is:

$$WTP_{1,2,3,4} = e(p_1, p_2, p_3, p_4, q_1, q_2, q_3, q_4, u) - e(p_1, p_2, p_3, p_4, q_1^*, q_2^*, q_3^*, q_4^*, u) \quad [3]$$

where q_i^* is a protection level higher than the status quo q_i.

If we substitute the indirect utility function evaluated at q_i^*, $u(p_1, p_2, p_3, p_4, q_1^*, q_2^*, q_3^*, q_4^*, m)$, the variation function becomes:

$$WTP_{1,2,3,4} = S_{1,2,3,4}(p_1, p_2, p_3, p_4, q_1, q_2, q_3, q_4, q_1^*, q_2^*, q_3^*, q_4^*, m). \quad [4]$$

The other version asks respondents their WTP to protect just species 1, the ibex. The stated WTP is:

$$WTP_1 = e(p_1, p_2, p_3, p_4, q_1, q_2, q_3, q_4, u) - e(p_1, p_2, p_3, p_4, q_1^*, q_2, q_3, q_4, u) \quad [5]$$

and the variation function is:

$$WTP_1 = S_1(p_1, p_2, p_3, p_4, q_1, q_1^*, q_2, q_3, q_4, m) \quad [6]$$

which is increasing in income *m* and protection level q_1, decreasing in own price p_1 and increasing or decreasing in cross price.

We can thus write the difference between the two WTPs as:

$$WTP_{1,2,3,4} - WTP_1 = \Delta WTP = S_{1,2,3,4}(p_1, p_2, p_3, p_4, q_1, q_2, q_3, q_4, q_1^*, q_2^*, q_3^*, q_4^*, m) - S_1(p_1, p_2, p_3, p_4, q_1, q_1^*, q_2, q_3, q_4, m) \quad [7]$$

Insensitivity to scope is a "weak test of economic theory": if we assume well-behaved preferences for a normal good, we expect that an increase in quantities is reflected in higher WTPs (Boyle et al., 1994; Carson and Mitchell; 1995).[2] In our case, rationality would require that a policy offering the same level of protection to additional species is always preferred by respondents (unless we deal with nuisance species to which respondents associate a negative value). We thus test the null hypothesis of local non-satiation, $\Delta WTP < 0$, and hence of maximizing behaviour.

The test over the sign of ΔWTP is performed using the complete combinatorial convolution method (Poe et al. 2005), an empirical numeric procedure used to measure the differences between independent distributions, often employed in monetary evaluation studies (e.g. Gonzales et al. 2008).[3] We generate and compare 1,000 random draws (bootstrapped vectors) from the empirical distributions of the estimated WTP for the 'Ibex alone' program (WTP_1) and the 'four ungulates' program ($WTP_{1,2,3,4}$). The number of times that, in the 10,000 combinatorial comparisons, the difference between $WTP_{1,2,3,4}$ and WTP_1 turns out negative defines the probability to accept the null hypothesis.

[2] Individual preferences are considered well-behaved when they respect the basic axioms of completeness, reflexivity, transitivity, continuity, convexity and monotonicity (Mas-Colell et al., 1995).

[3] One of the desirable features of this method is that it does not require the assumption of normality for the difference parameter obtained. In addition, it avoids the sampling errors that could arise from using random sampling, and it does not overstate significance, as it may happen when using non-overlapping confidence intervals.

4. Contingent valuation of wildlife in the Gran Paradiso National Park

The Gran Paradiso National Park was established in 1922 over an area that since 1856 had been designated as a royal hunting reserve, and is the first and one among the largest Italian national protected areas. One aim of the hunting reserve before and, later, of the National Park was to preserve the only Alpine ibex population left, otherwise extinct from the rest of Europe. Thanks to protected species status, establishment of protected areas, reintroductions and other conservation efforts, none of the four ungulates present in the National Park (ibex, chamois, red deer and roe deer) faces risks of extinction, with varying but always increasing population trends since the 1960s. Ibex and chamois live on high altitude grasslands and rocky cliffs, while red and roe deer are typically forest species. The range and estimated population size of ibex are somewhat smaller than those of the other three ungulates, although the evocative red deer, extremely wary of humans, is more difficult to view. All the four ungulates are appealing species (with ibex and red deer generally perceived as the most charismatic) and the possibility of encountering them in their natural habitat is a strong attraction that provides focus and incentive to park visits. The Park management is planning to intensify monitoring and research programmes targeted to all the four species and introduce further protection measures.

4.1 The survey

Actual and potential nature tourists compose our reference population and hence the target of the survey. We therefore invited to an online questionnaire all subscribers to the Park's mailing list, Facebook account and Twitter account. Since the objective of this analysis is not to estimate an aggregate willingness to pay of the overall population in a given region or country, but rather to investigate perceptions and response patterns of natural park users, potential sample biases with respect to national population averages (e.g. in terms of age, income or education) are not a relevant concern.

Respondents were asked their willingness to contribute to financing extra conservation policies for the ibex and the rest of the ungulate wildlife present in the park through a parking fee. Private automobiles are by far the most common transport mean used to reach the Gran Paradiso National Park (about 90 percent of visitors reach the area by car, according to PNGP, 2012) and parking fees are a widespread and familiar revenue raising method for natural heritage sites. The questionnaire clearly explained that the proposed parking fee was simply a hypothetical payment vector to contribute to wildlife conservation policies:

> *In this section, we will ask you to state the economic value that you place on policies fostering the conservation of the ibex/four ungulates. We will propose a hypothetical option to offer a financial contribution to such polices.*
>
> *Would you be favourable to the introduction of x* Euro daily fee for parking at the base of hiking trails, devoted to finance the extra ibex/ungulates protection measures?*

According to a split sample design, as explained above, we conducted two separate surveys investigating the WTP for the ibex alone (hereafter Ibex Questionnaire) and for the four alpine ungulates, including the ibex (hereafter Ungulates Questionnaire). We considered the ibex being "the part" and the four ungulates being "the whole". Following Mitchell and Carson (1989)'s recommendations, in the Ibex Questionnaire scenario we included a description of the ungulate wildlife in the park, with a warning not to confuse the larger conservation objective being valued with the changes pertaining one species. Moreover, complying with the NOAA panel recommendations (Arrow et al., 1993), we avoided asking first a valuation of the "part" and subsequently a valuation of the "whole" to the same respondent, since this mechanism would probably eliminate embedding in an artificial way. Each respondent received randomly either the Ibex Questionnaire or the Ungulates Questionnaire.

We implemented the two questionnaires through the Uniquest platform of the University of Torino, which in turn utilizes the open source structure of Limesurvey. Each respondent received randomly one out of five bids pertaining his or her WTP to sustain policies aimed at the conservation of the target species: 3, 5, 7, 9 and 30 Euro. These amounts were chosen considering the actual existing daily parking fees of natural parks in Northern Italy, varying between 0 and 8.80 Euro.[4] The upper end of the bid

[4] We considered daily car park fees of the main Italian naturalistic parks: Parco Nazionale del Pollino (free), Parco Naturale del Marguareis (3€), Parchi della Val di Cornia (€8.80), Parco Naturale Adamello (4-6€), Parco Naturale Dolomiti Friulane (free), Parco Naturale Regionale dei Castelli Romani (free), Area marina Protetta Torre Guaceto (4€), Parco Nazionale d'Abruzzo, Lazio e Molise (free), Parco Nazionale della Sila (free), Parco Nazionale del Circeo (free), Parco Nazionale dello Stelvio (free), Parco Naturale La Mandria (free), Parco Nazionale delle Cinque Terre (free), Parco Naturale Paneveggio Pale di

interval served the purpose of overstepping the limit of realistic tourist parking fees of natural parks and thus observing WTP converging to zero. The above values were also consistent with the mean WTP found in the only previous research on protection programs for the alpine ibex, conducted in the Hohe Tauern Nationalpark in Austria (Bednar-Friedl et al. 2009).

4.2 Data and descriptive statistics

The surveys remained online for two months. We obtained 790 completed responses, 433 to the Ibex Questionnaire and 357 to the Ungulates Questionnaire. From the Ibex Questionnaire we observe that a large majority of respondents thinks that nature and wildlife protection are extremely important, and is ready to contribute to a conservation program even if most other people would not. Almost half of respondents (44%) thinks that environmental protection should be provided by public agencies, while 41% do not agree with this statement.

We register a high percentage of relatively frequent users of the Park among respondents: 42% of respondents visit the Park three or more times per year, 14% visit the Park twice a year, 15% once a year, and 29% less that once a year. A positive response in terms of willingness to pay appears however to be independent from the frequency of visits, and also the majority of sporadic users is willing to contribute to conservation. This may indicate that some respondents also attach existence value to alpine ungulates, besides their personal benefit from wildlife viewing. The latter turns out to be a realistic occurrence: 32% of respondents reported to have seen ibex three or more times in the past year, 30% once or twice, 24% did not see any ibex (16% did not remember). Almost 49% of respondents saw at least one of the four ungulates three or more times in the past year; 23% once or twice, 14% did not spot any ungulate (14% did not remember). Socio-demographic characteristics of the sample are presented in Table 1.

San Martino (4€), Parco naturale del Gran Bosco di Salbertrand (5€), Parco Natura Viva di Bussolengo (2€).

Table 1. Socio-demographic characteristics

	Ibex questionnaire	Ungulates questionnaire
Age [mean (years)]	43.65 (13.24)	42.03 (13.71)
Gender (% male)	61.56	55.05
Net monthly income (€)		
< 1000	18.94	19.61
between 1,000 and 2,000	39.72	36.69
between 2,000 and 4,000	12.93	12.32
>4,000	2.31	1.68
no answer	26.10	29.69
Respondents	443	357

5. Estimation results

We test our hypothesis using the results of discrete choice econometric models based on Random Utility theory. The models are built to elicit the dichotomous answer from individual *j* stating if his or her willingness to pay is equal, greater or less than the randomly assigned bid amount ($y_j = 1 \; if \; BID_j \leq WTP_j; y_j = 0 \; otherwise$).

The estimation models (presented in detail in the Appendix) have been estimated on different specifications: single bounded (SB) and double bounded (DB), both unconditional and conditioning the dependent on covariates. In the double bounded CV, a follow-up question is proposed with a second bid increased or decreased according to the first answer. In our questionnaires, respondents who answered 'yes' at the first question received a second bid with the closest higher amount along the vector, while 'no' responses received a second bid with the closest lower amount. The DB model has been demonstrated to be more efficient in capturing and using information (Scarpa and Bateman, 2000) without imposing an excessive cognitive burden on the respondent, and complies with the recommendations of the NOAA panel (Arrow et al., 1993).

The assumption of normality for the error component leads to models in the Probit form. The results, reported in Table 2, suggest a strong robustness of the estimates, which remain stable and consistent in all models.

The coefficient associated with the bid vector, which represents the slope of the demand function, is negative in all models and confirms, as expected from standard economic theory, a decreasing WTP as the proposed bid increases. The conditional models, for both the ibex and ungulates samples, include two more independent variables: number of visits respondents state to have made in a year, and households' income. Other determinants have been investigated (i.e. age, gender, education, household size, attitudes towards conservation policies), but where excluded from the final models either because of missing values that would have substantially reduced the number of observations, or because they did not result statistically significant.

We expect a standard behaviour of the household income variable, namely a positive coefficient suggesting that richer people are willing to pay higher amounts. The effect of the number of visits is less easily predictable. This covariate conveys two pieces of information that can lead to opposite signs for the estimated coefficient. The number of visits identifies park users vs. non-users; through this channel, we would expect frequency of visits to impact on WTP with a positive sign. At the same time, since the payment vehicle is a daily parking fee, respondents could weigh their total WTPs by the frequency of visits, so that frequent users would state a lower WTP per day. Our prior was that the latter effect would prevail and the number of visits would display a negative coefficient.

Both the covariates behave as expected and according to economic theory. The number of visits reduces WTP in all the models, whereas household income increases WTP. The covariates (except stated income in the Ungulates subsample) are statistical significant in all models. Lower values of the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), which we use to compare conditional and unconditional versions of our models, confirm that models including income and number of visits per year are more efficient, with respect to unconditional models, in describing the data generating process.

Table 2. Estimation Results of the Probit Models

	Ibex		Ungulates	
	Estimate	*T*-value	Estimate	*T*-value
Single bounded (unconditional)				
Intercept	0.7112	6.419	0.4666	3.873
Bid	-0.0542	-6.060	-0.0484	-5.528
AIC	379.68		316.90	
BIC	387.13		323.95	
Single bounded (conditional)				
Intercept	0.7818	4.088	0.7825	3.902
Bid	-0.0565	-6.161	-0.0513	-5.703
Visits	-0.1920	-3.081	-0.2321	-3.418
Income (x1000 €)	0.1897	2.206	0.0334	0.389
AIC	370.50		308.92	
BIC	385.39		323.02	
Double bounded (unconditional)				
Intercept	0.9068	10.75	0.5802	6.354
Bid	-0.1049	-14.92	-0.0852	-12.168
AIC	930.81		710.22	
BIC	938.26		717.27	
Double bounded (conditional)				
Intercept	1.0263	6.672	0.8477	5.1806
Bid	-0.1076	-14.867	-0.0878	-12.230
Visits	-0.1748	-3.349	-0.2238	-3.816
Income (x1000 €)	0.1325	2.056	0.0449	0.559
AIC	920.45		699.49	
BIC	935.36		713.59	
Sample Size*	306		251	

*The sample size of estimation results is lower than that reported in the descriptive statistics due to missing values for some covariates, as reported in Table 2.

6. Welfare measures and scope tests

6.1 Estimated WTP and revenue maximising parking fees

Assuming constant marginal utility of money, the expected WTP for a change from the *status quo* to an alternative status is $E[WTP] = (-\frac{1}{\beta})(V^1 - V^2)$, with β the coefficient of the cost variable, V^1 the indirect utility for the alternative scenario and V^0 the indirect utility at the *status quo*. The WTPs for the ibex and the ungulates samples are calculated using the Krinsky Robb simulation procedure (Krinsky and Robb, 1986).[5]

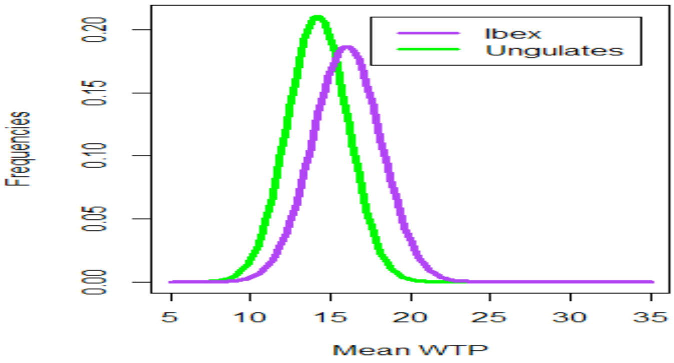
The estimates in Table 2 have been used to calculate the mean WTPs reported in Table 3. The diagrams show the empirical frequency distributions for the mean WTP stated by respondents. Their shape visualises that in all models the estimated mean WTPs are larger for the conservation program targeted to the ibex alone than for the conservation program aimed at the four ungulates as a whole. The DB model increases the efficiency of the WTPs measures with respect to the SB ones, as evidenced by the lower standard errors – the selection criterion that allows us to compare models estimated on two different datasets. Moreover, the follow-up question provides information that allows us to better identify the average WTPs, which are smaller and more concentrated around the mean in the DB model than in the SB one. This is particularly evident with respect to the WTPs to protect the ibex alone.

[5] This procedure is superior to alternatives such as Delta Methods (*inter alia* Haab and McConnell, 2002) because it provides non-symmetric confidence intervals for WTPs that are a nonlinear function of estimated parameters.

Table 3. Estimated mean WTP distributions

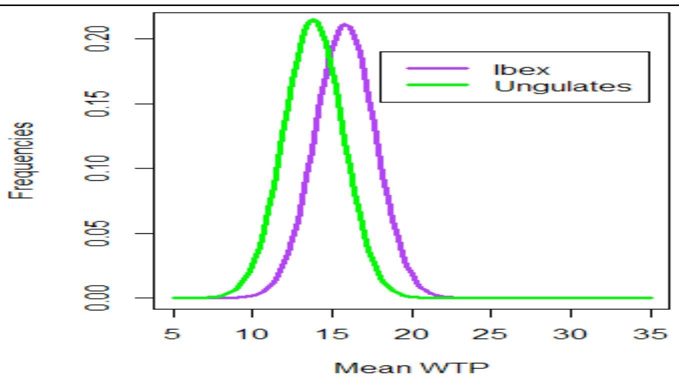
Single Bounded (unconditional)

		Ibex	Four Ungulates
Lower Bound	95% CI	15.870	14.076
	90% CI	15.891	14.095
Mean WTP		16.002	14.193
Upper Bound	95% CI	16.135	14.311
	90% CI	16.113	14.292
Stand. Error		2.13	1.89



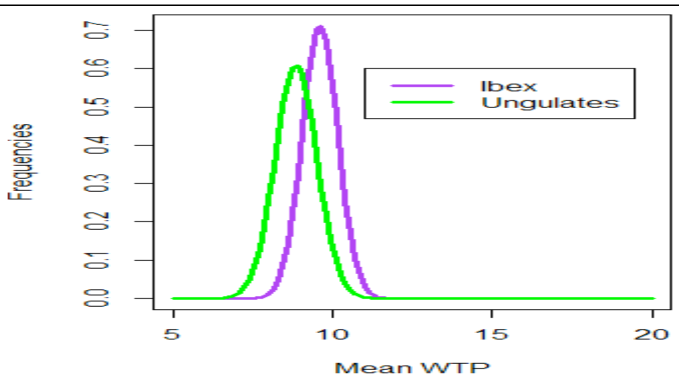
Single Bounded (conditional)

		Ibex	Four Ungulates
Lower Bound	95% CI	15.689	13.697
	90% CI	15.707	13.716
Mean WTP		15.805	13.812
Upper Bound	95% CI	15.868	13.927
	90% CI	15.922	13.908
Stand. Error		1.88	1.85



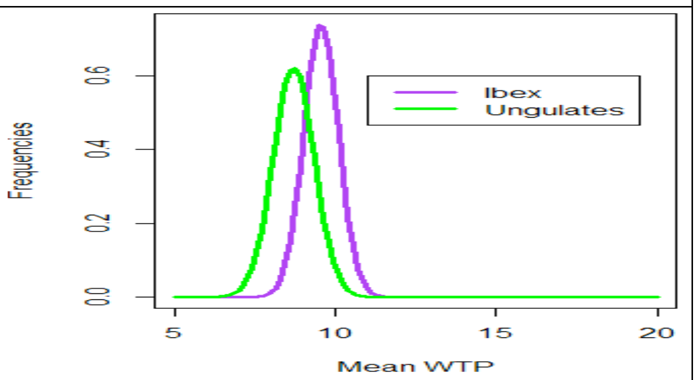
Double Bounded (unconditional)

		Ibex	Four Ungulates
Lower Bound	95% CI	9.575	8.817
	90% CI	9.642	8.903
Mean WTP		9.608	8.860
Upper Bound	95% CI	9.580	8.896
	90% CI	9.580	8.824
Stand. Error		0.53	0.68



Double Bounded (conditional)

		Ibex	Four Ungulates
Lower Bound	95% CI	9.524	8.668
	90% CI	9.529	8.674
Mean WTP		9.557	8.708
Upper Bound	95% CI	9.591	8.748
	90% CI	9.585	8.741
Stand. Error		0.53	0.64



The estimated mean WTPs could also be used to calculate the hypothetical parking fee that would maximise the fundraising capacity. We consider five values around the median WTP as candidate parking fee, and using data on the approximate number of vehicles used to reach the park per year we calculate the expected gross revenues for the two alternative policies.[6] The results indicate that revenues would be maximised with an approximate daily parking fee of 8.5 Euro, according to the results of the ibex alone survey. A daily fee of 8 Euro would maximise the revenues for the alternative conservation policy targeted to all four ungulates. Potential proceeds would range between 4.5 and 5.3 million Euro per year. Attention should be paid to the fact that these do not represent generic WTPs to use parking facilities and access the park: they were explicitly elicited as a mere payment vehicle to contribute to wildlife conservation policies. Adequate accompanying communication strategies would be advisable to complement the use of this fundraising channel.

Table 4. A revenue-maximising parking fee

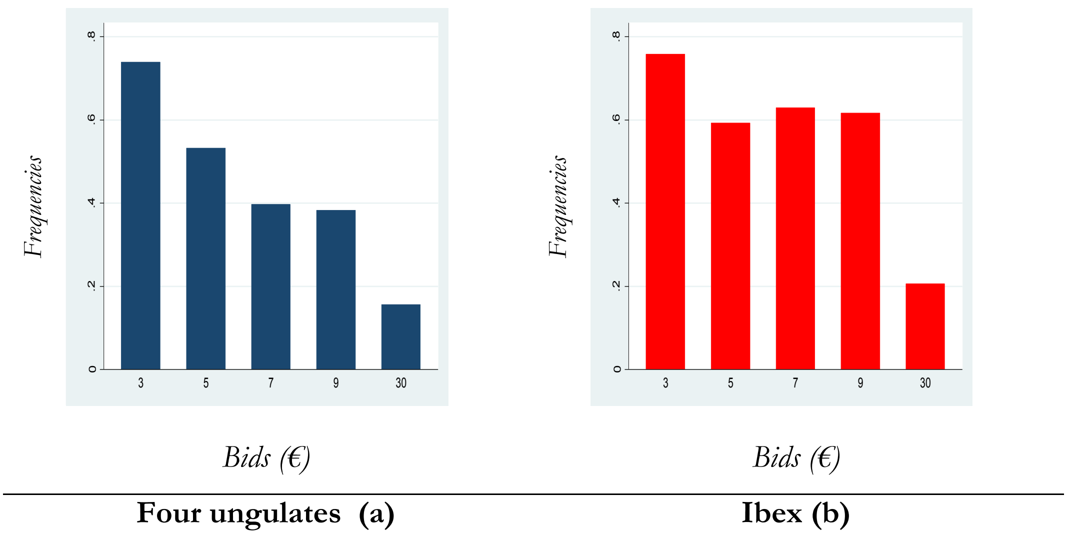
	Candidate parking fee (€)	% of respondents willing to pay	Expected paying vehicles per year	Expected revenues (€/y)
Ibex	8	99.8	646,704	5,173,632
	8.5	98	635,040	5,397,840
	9	84.6	548,208	4,933,872
	9.5	52.4	339,552	3,225,744
	10	20.8	134,784	1,347,840
Ungulates	8	88	570,240	4,561,920
	8.5	61.3	397,224	3,376,404
	9	33	213,840	1,924,560
	9.5	12.1	78,408	744,876
	10	3.1	20,088	200,880

[6] The number of vehicles is estimated considering that, according to a 2012 survey run by the Gran Paradiso National Park, about 90 percent of the 1,800,000 average annual visitors reaches the Park by private car. We hypothesize an average number of 2.5 passengers per car, considering that the average occupancy rates of passenger vehicles (1.5 for Italy, according to the European Environment Agency) raises for weekend tourism (source: http://www.eea.europa.eu/data-and-maps/indicators/occupancy-rates-of-passenger-vehicles/occupancy-rates-of-passenger-vehicles-1).

6.2 Scope test

A first test of the consistency of results from stated preference studies with rational behaviour as predicted by economic theory refers to the decrease in demand when price increases. In dichotomous choice CV designs, this means that the proportion of respondents who answer 'yes' to a bid should decrease with increases in the bid amount. The expected decreasing pattern is confirmed in both samples, but appears more regular in responses to the Ungulates Questionnaire (Figure 1a) than to the one pertaining the ibex alone (Figure 1b), where the proportion of 'yes' responses decreases less as respondents are faced with higher bids.

Figure 1. Proportion of 'yes' responses to different bids in the two questionnaires



A second test consists in examining the prior that respondents should be willing to pay more as the amount or quality of the environmental good to be provided increases – the scope test. Finding a scope effect means rejecting the null hypothesis that the mean WTP for the low provision scenario is equal to the mean WTP for the high provision scenario. In this context, the mean WTP for policies protecting the ungulates as a whole ought to be larger than for the ibex alone. Figure 1, however, suggests that the Ibex Questionnaire receives a higher percentage of 'yes' responses than the Ungulates Questionnaire, on all bids. Table 5 reports the results of the convolution test over the sign of ΔWTP (equation 7) implemented according to the procedure described in section 3.

Table 5. Convolutions confidence intervals of differences in WTP distributions

			H0: $\Delta WTP < 0$			
			H1: $\Delta WTP \geq 0$			
		Mean WTP	95% Confidence Interval		90% Confidence Interval	
			Lower bound	Upper bound	Lower bound	Upper bound
Single bounded (unconditional)	Ibex	16.002	*-€1.8613*	*-€1.8502*	*-€1.8604*	*-€1.8611*
	Four Ungulates	14.193				
Single bounded (conditional)	Ibex	15.805	*-€2.0716*	*-€2.0613*	*-€2.0707*	*-€2.0621*
	Four Ungulates	13.812				
Double bounded (unconditional)	Ibex	9.602	*-€0.7499*	*-€0.7465*	*-€0.7496*	*-€0.7467*
	Four Ungulates	8.856				
Double bounded (conditional)	Ibex	9.557	*-€0.8702*	*-€0.8669*	*-€0.8699*	*-€0.8672*
	Four Ungulates	8.708				

All the comparisons among models show strictly negative confidence intervals for the difference in mean WTPs (equation 7). In all models, the null hypothesis of $\Delta WTP < 0$, namely that the average WTP for policies protecting the four Ungulates is lower than the one for the ibex alone, cannot be rejected. These results provide strong evidence that the respondents associate higher WTP to policies targeted to protect the ibex alone compared to policies aimed at protecting the whole group of ungulate wildlife, ibex included, populating the Park. The difference is small in nominal terms but important in relative terms: in the order of 13 percent in the SB model and about 9 percent in the DB model. The difference is highly statistically significant, and is confirmed across all model specifications.

7. Conclusions

The fact that both the percentage of 'yes' responses and the stated WTP in the single species case turn out to be not just as high, but consistently higher than those in the case of a more inclusive conservation objective indicates that the cause behind the registered scope insensitivity cannot be a traditional embedding effect: if our experiment were affected by a difficulty for individuals of identifying the specific value they attach to one particular good which is embedded in a collection of similar goods we would observe a stated WTP to invest in the conservation of the ibex and the other three ungulates not much larger, or at the limit equal, to the stated WTP to conserve the ibex alone. Nor can the extra value assigned to protecting the ibex alone with respect to protecting the ibex within the whole ungulates group derive simply from a symbolic and charismatic role assigned to the former by Park users, since, again, as thoroughly discussed in sections 1 and 2, this could lead at the most to an equal valuation of the two policies. None of the other species considered possesses, in fact, features that may motivate a negative WTP on the part of tourists.

In this study, supported by a large respondent sample, what emerges appears to be a statistically significant, stable preference of park users for a well-defined and exclusive destination of the revenues raised for conservation purposes. We argue that the most plausible explanation for this is a preference for earmarking of resources devoted to conservation: a perception by respondents that a more specific and circumscribed destination of revenues generates superior outcomes, and is hence worth a higher WTP.

Earmarking, although inefficient from the point of view of economic theory, has been shown in several previous studies to substantially increase public acceptability of taxation (Schade and Schlag, 2003, Thalmann, 2004, Dresner et al., 2006, Steg et al., 2006, Globescan and PIPA, 2007, Schuitema and Steg, 2008, Hsu et al., 2008, Kallbekken and Aasen 2010, among others). The main reason appears to be that earmarking reassures individuals – citizens and voters – that the resources they are willing to devote to a specific objective will not be diverted to other uses. In addition, the more identified and circumscribed the destination is, the easier is to control the impact of the adopted measures and evaluate their effectiveness, and the more acceptable the policy appears to be. A related question is probably the perception that individual WTPs channelled towards a more limited objective avoid dispersion across a number of interventions and is perceived as more likely to 'make a difference'.

The results in this paper suggest, for the first time, that the same argument appears to also extend to individual WTP for conservation policies and natural parks management. If confirmed, this finding would have interesting implications in environmental governance, conservation and nature-based tourism policy design. Taking it into account could make a substantial difference in terms of popular support and mobilisation of financial resources for conservation policies. While an integrated ecosystem approach is superior, in most circumstances, from an ecological viewpoint, focusing communication and fundraising on single-issue conservation initiatives may turn out to be a more effective strategy, as suggested already by previous research on flagship species effects.

This study, however, indicates that charismatic or flagship features of the object of conservation may not be a necessary condition for eliciting individuals WTP. Maximising consensus on conservation policies may rather require focusing on the design of well-defined and specific allocations of resources capable of reassuring the public on the effectiveness of nature protection expenditures.

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APPENDIX: The estimation models

We test our hypothesis using the results of discrete choice econometric models based on Random Utility theory. The models are built to elicit the dichotomous answer from individual *j* stating if his or her willingness to pay is equal, greater or less than the randomly assigned bid amount ($y_j = 1 \; if \; BID_j \leq WTP_j; y_j = 0 \; otherwise$). If we assume a linear structure for the WTP, we can write:

$$WTP_j(z_j, \varepsilon_j) = z_j\beta + \varepsilon_j \qquad [8]$$

where z_j is the vector of individual characteristics and environmental quality, β is the vector of unknown parameters and ε_i the vector of unobservable components. The conditional probability to observe a positive answer to the elicitation question is:

$$\begin{aligned} Pr(y_j = 1 | \; z_j) &= Pr(WTP_j > BID_j) \\ &= Pr(z_j\beta + \varepsilon_j > \; BID_j) \\ &= Pr(\varepsilon_j > BID_j - z_j\beta) \end{aligned} \qquad [9]$$

Assuming $\varepsilon_j \sim (0, \sigma^2)$, the probability that the respondent accepts the proposed bid is:

$$Pr(y_j = 1 | \; z_j) = Pr(\varepsilon_j > BID_j - z_j\beta) = 1 - \Phi\left(\frac{BID_j - z_j'\beta}{\sigma}\right) =$$

$$= \Phi\left(z_j'\frac{\beta}{\sigma} - BID_j\frac{1}{\sigma}\right) \; , \qquad [10]$$

a Probit Model where Φ is the standard cumulative normal.

The probabilities of each combination of responses in the DB models are, assuming standard normal cumulative density function for the error component, the following:

$$Pr^{yy}\left(BID_j, BID_j^U\right) = Pr\left(WTP_j > BID_j^U\right) = 1 - \Phi\left(\frac{BID_j^U - z'_j\beta}{\sigma}\right)$$

$$Pr^{nn}\left(BID_j, BID_j^L\right) = Pr\left(WTP_j < BID_j^L\right) = \Phi\left(\frac{BID_j^L - z'_j\beta}{\sigma}\right)$$

$$Pr^{yn}\left(BID_j, BID_j^U\right) = Pr\left(BID_j < WTP_j < BID_j^U\right) = \Phi\left(\frac{BID_j^U - z'_j\beta}{\sigma}\right) - \Phi\left(\frac{BID_j - z'_j\beta}{\sigma}\right)$$

$$Pr^{ny}\left(BID_j, BID_j^U\right) = Pr\left(BID_j^L < WTP_j < BID_j\right) = \Phi\left(\frac{BID_j - z'_j\beta}{\sigma}\right) - \Phi\left(\frac{BID_j^L - z'_j\beta}{\sigma}\right)$$

[11]

For a sample of *J* individuals the log-likelihood function is:

$$lnL = \sum_{j=1}^{J}[I_j I_j^H ln(Pr^{yy}) + I_j(1 - I_j^H) ln(Pr^{yn}) + I_j^L(1 - I_j) ln(Pr^{ny}) + (1 - I_j)(1 - I_j^L ln(Pr^{nn})$$

[12]

We use equations [10] and [11] to retrieve parameters β and σ via maximum likelihood estimation for both SB and DB models.