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EVALUATION OF NON-NARKET GOODS:

THE RELEVANCE OF CONSIDERING *"BEHAVIOURAL ANOMALIES"*

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ABSTRACT. Environmental valuation techniques are intended to provide valuable insights in helping scientists and decision-makers to make informed choices about the trade-offs that are inherent to the scarcity restrictions of our daily decisions. However, among other limitations, values obtained on the assumption of a rational behaviour may only be of use for policy guidance if people make consistent and systematic choices. This research embraces the challenge of contributing to organize the complexities of valuation of non-market goods, rather than just ignoring them. We address the ongoing debate on symptoms of bounded rationality in studies applying stated or revealed preferences methods by examining the theoretically consistency of preferences using observed and intended behaviour without monetary values being directly asked. The environmental good considered in our empirical approach is a national wood (Mata do Bussaco), located in a European country (Portugal). Overall, the results reveal that visitors are sensitive to both price and quality changes. In the deterioration scenario, the intended number of trips would be seriously reduced and respondents would suffer an important welfare loss. Another key finding is the apparent inconsistency between preferences expressed by revealed and observed behaviour. As inconsistencies are detected for changes resulting from manager's action, it is argued that they are likely the outcome of strategic behaviour.

KEYWORDS: Hypothetical changes; Behavioural anomalies; Preferences inconsistencies; Hypothetical bias; Strategic behaviour.

1. INTRODUCTION

Environmental valuation techniques aim to ease a problem that troubles both economists and ecological economics practitioners: the misallocation of resources. In pure economic terms, what might appear beneficial usually does so because the profits are mainly privately retained, while the problems are spread out across society. Much of the effort in environmental economics is expended in disclosing the prices that approach the full environmental costs of production and consumption. But efforts to put a price on nature have limits that must be considered. Nature goods are often complex, unfamiliar and multidimensional, involving a broad range of scientific, aesthetic, life support, religious, recreational and ecological values. Some think that environmental valuation is an affront to those who place cultural, spiritual or aesthetic value on biodiversity for its own sake. We consider that it would be a mistake to act this way. While full environmental costing is not itself sufficient to meet the goals of ecological economics, it certainly does not exhaust the reasons for preserving “the groves where the dryads play”. Environmental valuation techniques can have a positive contribute in valuing a particular set of environmental services – such as the value of a national wood – which can be quantified with a reasonable degree of certainty. When properly done and understood, valuation helps society to make informed choices about the trade-offs that are inherent to the scarcity restrictions of our daily decisions.

One of the basic premises of economic analysis is that people live in a world of scarcity where resources tend to be insufficient to produce all the goods and services which would be necessary to satisfy increasing human needs. Among these scarce resources there are the natural ones from which individuals depend on to satisfy a set of needs and wants. This set includes a wide range which goes from the most basic, such as breathing pure air, to others much more complexes, like recreation and evasion. For their satisfaction, people must interact with nature and will necessarily affect it. At the same time, changes in the natural resources will possibly alter the production possibilities, the quantity and quality of goods/services available, their relative values and so the set of available choices in the future. Some of those changes might be irreversible.

If markets are supposed as functioning close to the theoretical conditions of perfect information and where there is no public intervention, the efficient allocation of resources is likely to be assured. The market-price is the outcome from the interaction of demand and supply and might be interpreted as one measure of the value assigned by consumers and of the costs hold by producers.

The idea of environmental values' incommensurability (Martinez-Alier *et al.*, 1998) and that monetization of some non-market environmental values is socially unacceptable (Kumar and Kant, 2007: 517) differs from our view. On the contrary, we consider, as Tacconi (1995: 229), that "*is indisputable that valuation is a necessary step in the decision making process regarding the use of resources"* and we accept the use of a common (monetary) measure through which values can be traded off. At the same time, we recognize that evaluation of passive use values (option and non-use values) is complex independently of the metric chosen.

Monetization is not the perfect way of measuring the worth of everything, but probably it is, for now, the best measure available and "better than nothing". We are not arguing that *some number is better than no number,* but that monetary estimates derived in rigorous studies might be extremely helpful in decision making processes, even if one must acknowledge that these values should be integrated in a more pluralistic and multi-scalar framework (Norton and Noonan, 2007).

Economic valuation of environmental goods has been extensively performed over a number of decades through the separate or joint application of stated preferences (SP) and revealed preferences (RP) techniques (Whitehead *et al.*, 2008; Zandersen and Tol, 2009). As these valuation exercises are part of the neoclassical approach, the standard assumptions are implicit: the individual is the fundamental unit of decision-making;

individual actions are utility maximization oriented; and agents involved adopt a rational behaviour (Tacconi, 1995). It means that individuals are able to make consistent and stable/systematic choices (List, 2005). Accordingly, the values obtained are expected to be reliable and therefore useful for policy guidance.

Nevertheless, *behaviour anomalies* have been detected in laboratory experiments and also in studies applying non-market valuation techniques. These anomalies are systematic deviations between behaviour and predictions of the economic theory and not merely random noises (Sugden, 2005). Disparities between willingness to pay (WTP) and willingness to accept (WTA), scale insensitivity, preferences reversal, information problems, hypothetical market bias, preference construction and preference uncertainty are among the most cited (Hanley and Shogren, 2005; Horowitz and McConnell, 2002). These *behaviour anomalies* had been interpreted as symptoms of bounded rationality.

In the context of environmental non-market valuation, behavioural anomalies have been reported mainly regarding contingent valuation studies. However, the use of this or other SP method is frequently mandatory because RP techniques are more limited in scope. Besides their inability to estimate the passive use value[1], valuation outside the range of historically observed values is not possible. Frequently, the analysis respects not only to the observed conditions, but also to the impact of changes in quality/price which are relevant for policy purposes, but have not been experienced (Rosenberger and Loomis, 1999). These impacts must be assessed using more flexible methods, based on stated behaviour.

In this research, RP and SP data, regarding the recreational visitation of a wood in observed and hypothetical conditions, is combined. The contingent behaviour (CB) and the travel cost method (TCM) are the non-market valuation methods jointly applied. Hence, some of the most usual behavioural anomalies (WTP/WTA gap and preference

[1] In our conception it includes non-use and option values.

reversal) are not likely to be observable or detectable. Information problems are considered improbable since the environmental good and the decision context are quite familiar to the respondents. The overall aim is to explore the TCM-CB framework, addressing three main research questions. First, it is studied whether visitors are responsive to entrance fee and to environmental quality changes (due to a forest fire). Second, it is assessed whether observed and stated behaviour are consistent or, similarly, if there is convergent validity among RP and SP data. Finally, behavioural anomalies are analysed.

The context of our investigation is a study on recreational visits to Bussaco wood, located in the Centro Region of Portugal. It covers 105 hectares, has walking trails, fountains and small lakes, picnic areas and religious patrimony. The wood was first settled by Benedictine monks in the 6th century but, since the 19th century, has been managed by the Portuguese central administration. Management decisions taken over the centuries promoted a rich natural patrimony which is nowadays considered to be one of the best dendrological collections in Europe. Among the autochthones species, Cedar of Bussaco (*Cupressus Lusitanico*) is the most emblematic.

The remainder of this paper is structured as follows. Section 2 is devoted to data analysis. It explains the main aspects of the survey, presents the econometric models and describes the results. Section 3 discusses the main results and concludes.

2. DATA ANALYSIS

2.1. SURVEY

The data used in this study was obtained by means of an on-site survey administered to Bussaco wood visitors. Respondents were intercepted on arrival and asked to fill the questionnaire and to return it before leaving the wood. In order to avoid interviewer bias, the questionnaire was answered without interviewer participation.

The questionnaire comprises thirty three questions and is structured into four sections. The first section refers to perceptions concerning environmental protection and to free time occupation. The second section asks for the actual behaviour, the reasons motivating the visits and opinion concerning Bussaco wood. The following section refers to the actual behaviour in current conditions and intended behaviour under the hypothetical scenarios. The final section is devoted to socioeconomic data.

CB was scrutinized considering two sources of variation and four questions referring to the number of visits in the following year. Thus, each respondent was asked to provide data concerning five situations. The scenarios are:

- The number of trips made in the preceding year (scenario 1).
- The anticipated number of trips in the following year, assuming that actual conditions will remain unchanged (scenario 2).
- The anticipated number of trips in the following year, considering two possible changes in the entrance fee. The values were chosen from three alternative variations (a decrease of 50%, an increase of 50% or an increase of 100%) randomly distributed among questionnaires[2] (scenarios 3 and 4).
- The anticipated number of trips in the following year, if a forest fire damages one fourth of the wood (scenario 5).

The two requirements pointed by Ward (1987: 385) so that the change in environmental values resulting from a quality change can be measured using TCM, are fulfilled. Indeed, the recreational site is uncongested[3] and the quality change is exogenous to the individual.

When the hypothetical change refers to an improvement in current conditions and the questionnaire is administered on-site, there is the problem of excluding potential

[2] A question similar to the one used by Englin and Cameron (1996) would provide a greater variability in travel costs. However, we believe that respondents would be more reluctant in accepting the scenario.
[3] This aspect was checked in question 10 of the questionnaire and respondents classify the wood as uncongested.

visitors which would visit the site in enhanced conditions. Therefore, welfare gains are probably underestimated. Conversely, when deterioration is considered, as in the present study, the probability that non-users become users is low. Hence, the estimated welfare change related with use value is likely to embrace a low deviation from the true value.

The questionnaire was administered from July 2010 to June 2011. From the 1055 individuals approached, 311 returned the questionnaire for an overall response rate of 29%. Response rate is low, although comparable to other studies adopting similar procedures (Mendes and Proença, 2011). This is typical of long questionnaires (Martínez-Espiñeira and Amoako-Tuffour, 2008) and is aggravated by the impossibility of using reminders. From those, 9% were excluded because some crucial questions were unanswered. Those reporting more than 52 visits per year or stating unfeasible high travel costs for a single site visit were, as well, excluded from the analysis. For CB responses, when the number of intended trips and the entrance fee varied in the same way, answers were classified as protest and excluded. This study is based on the remaining 272 questionnaires.

Data structure corresponds to a short pseudo-panel. The panel is, however, unbalanced. Respondents who entered in the park walking or in bicycle did not pay the entrance fee and so the question concerning a change in its value was formulated differently. These individuals were instead asked if they would park their cars in the wood if the entrance fee was half of the actual value. Further, there is no complete information for some individuals who answered "*I do not know*" to some hypothetical questions.

Table 1 reports some informative comparisons taking the scenario 2 as reference. As the number of observations varies among scenarios, values for the scenario 2 are also computed for each sub-sample.

Table 1: Stated trips in different scenarios

Scenarios	Min	Max	Std. Dev.	Mean	Δ% Mean	Obs.
1	1	30	3.27	1.73	---	272
1	1	30	3.30	1.74	39%	266
2	0	40	4.15	2.41		
2	0	30	2.98	2.07	53%	179
3	0	30	3.23	3.16		
2	0	40	4.48	2.66	-41%	160
$4_{a)}$	0	20	2.57	1.57		
2	0	40	3.95	2.28	-57%	149
$4_{b)}$	0	20	2.20	0.97		
2	0	40	4.25	2.48	-47%	251
5	0	30	2.35	1.32		

Scenario 3 respects to a price reduction to half of the current price; $4_{a)}$ respects to an increase of 50% in the entrance fee and $4_{b)}$ to an entrance fee duplication.

The average number of trips during the year prior to the survey was 1.73. The answers to the *status quo* CB question show that if conditions remain unchanged, the average number of intended trips in the following year would be 2.41, corresponding to an increase of 39%. It is not new to find statistically significant differences among the observed and the intended number of trips when actual conditions are kept (Huang *et al.*, 1997; Jeon and Herriges, 2010). The main reason pointed for this difference is hypothetical bias. The number of visits in the future is probably inflated by the respondent's good intentions (Whitehead *et al.*, 2000). A 50% reduction of the entrance fee would lead to an increase in the average intended number of visits of 53%, while an increase of the same magnitude, would lead to a decrease of 41%. A duplication of the entrance fee would imply a reduction in intended visits of 57%. Accordingly, visitors seem more responsive to price reductions than to increases. The damage of part of the wood by a forest fire would lead to a decrease in the average number of intended visits to 1.32. Comparing to the *status quo*, the reduction is of 47%, while comparing with observed average, the reduction is of 24%. In general, respondents seem to be sensitive to changes in price and in conservation conditions.

2.2. ECONOMETRIC MODELS

Two econometric approaches are applied in this study to combine observed and contingent behaviour. One is based on pooled data and the other on panel data models with random effects. Since the number of trips is a non-negative integer, count data models from the Poisson family are used in both specifications.

The probability function of the Poisson regression model is:

$$f\left(t_{ij} \middle| x_{ij}\right) = \frac{\exp\left(-\mu_{ij}\right)\mu_{ij}^{t_{ij}}}{t_{ij}!}, \quad t_i = 0, 1, 2, ...; \tag{1}$$

Where $i = 1, 2, ..., n$ denotes the respondent; $j = 1, ..., 5$ denotes the scenario; t_{ij} is the number of observed or intended trips per year; x_{ij} is the vector of explanatory variables.

The pooled Poisson estimator assumes that t_{ij} is Poisson distributed:

$$t_{ij} \middle| x_{it}, \beta \sim Poisson\left[\exp\left(x_{ij}^{'}\beta\right)\right] \tag{2}$$

$$E\left[t_{ij} \middle| x_{ij}^{'}\right] = \exp\left(x_{ij}^{'}\beta\right) \tag{3}$$

Observations are independent across individuals but not necessarily within the same individual. Hence, regression disturbances may be clustered at the individual level correcting for the possible non-independence of repeated observations for the same individual. This makes the measures of statistical significance robust and control for overdispersion and correlation over j for a given i. The cluster of disturbances affects the variance co-variance matrix of the estimators, but not the coefficients (StataCorp, 2009: 20).

The Poisson model for panel data, considering the individual specific term multiplicative, as defined by Hausman *et al.* (1984), is expressed as:

$$t_{ij} \middle| x_{ij}, \beta, \alpha_i \sim Poisson\left[\mu_{ij} = \alpha_i \lambda_{ij}\right] \tag{4}$$

where, $\lambda_{ij} = \exp(x_{ij}^{'}\beta) > 0$ and α_i is an unobserved individual specific effect not correlated with x_{ij}, otherwise estimations would be inconsistent.

Alternatively, if the individual specific term is assumed additive, the Poisson model for panel data is expressed as:

$$t_{ij} | x_{ij}, \beta, \alpha_i \sim Poisson \left[\mu_{ij} = \exp(\ln(\alpha_i) + x_{ij}^{'}\beta)\right] \tag{5}$$

In the RE specification α_i are independent and identically distributed (iid) random variables.

The model most often applied in empirical work has been the RE Poisson-Gamma (RE-Pois-G) resulting from the assumption that the α_i parameter is iid Gamma (δ,δ) (Bhat, 2003; Whitehead et al., 2000). Alternatively, the $\ln(\alpha_i)$ may be assumed iid Normal (1, σ_α^2), given rise to the RE Poisson-Normal (RE-Pois-N). In both cases:

$$E\left[t_{ij} | x_{ij}^{'}, \beta\right] = \exp(x_{ij}^{'}\beta) \ . \tag{6}$$

The Poisson model for panel data has the same properties, in terms of robustness, that when applied to cross-section data. It is consistent as long as the conditional mean is correctly specified, even though data does not exactly follows a Poisson distribution (Cameron and Trivedi, 2009: 620).

The RE-NB model is an alternative to the RE Poisson as the NB estimator is designed to explicitly handle overdispersion. Assuming that $t_{ij} | \gamma_{ij} \sim Poisson\ (\gamma_{ij})$ and $\gamma_{ij} | \delta_i \sim Gamma\ (\lambda_{ij}, \delta_i)$, with $\lambda_{ij} = \exp(x_{ij}^{'}\beta)$, the corresponding probability function is given by:

$$f(t_{ij} | x_{ij}, \delta_i) = \frac{\Gamma(\lambda_{ij} + t_{ij})}{\Gamma(\lambda_{ij})\,\Gamma(t_{ij} + 1)} \left(\frac{\delta_i}{1+\delta_i}\right)^{\lambda_{ij}} \left(\frac{1}{1+\delta_i}\right)^{t_{ij}}, \tag{7}$$

$t_{ij} = 0,1,2,...; \quad i = 1, 2, ..., n; \quad j = 1, 2,.., J$

In the RE-NB, the dispersion is assumed to vary randomly across individuals and $\left(\frac{\delta_i}{1+\delta_i}\right) \sim Beta(r,s)$. Integrating (7) using the Beta density, and after some algebra, the probability function is expressed by:

$$f\left(t_i \middle| X_i, \beta, r, s\right) = \frac{\Gamma(r+s)\Gamma\left(r+\sum_{j=1}^{n_i}\lambda_{ij}\right)\Gamma\left(s+\sum_{j=1}^{n_i}t_{ij}\right)}{\Gamma(r)\Gamma(s)\Gamma\left(r+s+\sum_{j=1}^{n_i}\lambda_{ij}+\sum_{j=1}^{n_i}t_{ij}\right)}\prod_{j=1}^{n_i}\frac{\Gamma\left(\lambda_{ij}+t_{ij}\right)}{\Gamma\left(\lambda_{ij}\right)\Gamma\left(t_{ij}+1\right)} \quad (8)$$

In our sample, observations for the dependent variable concerning observed behaviour take only strictly positive values due to the on-site data collection. If those observations were to be analysed alone, a model correcting for truncation and endogenous stratification should be applied (Englin and Shonkwiler, 1995; Shaw, 1988). However, since observations concerning the CB framework can take null values, the standard models are applied. In these circumstances inferences to the overall population cannot be made (Lienhoop and Ansmann, 2011: 1255)[4].

2.3. TCM-CB RESULTS

The basic idea behind the individual version of the TCM is that the number of recreational trips decreases as the travel cost to the recreation site increases, *ceteris paribus*. Travel cost is the proxy used for the price. The price for each individual is constant, but observing individuals living at different distances and facing different costs makes possible to trace out the demand curve. Quantity demanded is the result of a utility maximization problem subject to budget and time constraints. Hence, besides travel cost, standard variables influencing demand, such as the price of related goods and individual tastes are included in the set of candidate explanatory variables.

A number of studies have applied two non-market valuation techniques in the same research analysis. TCM data has been jointly analyzed mainly with data obtained

[4] If CB data was not affected by incidental truncation and endogenous stratification and the Poisson model was used, the correction for the endogenous stratification proposed by Shaw (1988) could be applied to the RP data. However, it is not possible to assure that those who visited the wood in the past have a higher or equal probability of visiting it in the future, compared to the general population.

through the application of a SP method. In the context of outdoor nature-based recreation, contingent valuation and CB have been the methods most often chosen (Alberini et al., 2007; Eom and Larson, 2006).

While contingent valuation directly elicits willingness to pay/accept, the CB method enquires about behaviour in hypothetical circumstances. Two main formats have been applied. The difference among them is associated with the reference period for the CB. In one of the formats, respondents are asked about how they would have behaved in the past if some hypothetical quality/price level had been observed. That is, respondents are asked whether they would still have done the same number of trips if visits had occurred in different conditions. We name this *reassessed contingent behaviour* because respondents are asked to reassess their trip behaviour observed during the previous season/year (see, e.g., Azevedo et al., 2003; Bhat, 2003; Grossmann, 2011). Alternatively, respondents might be asked about their intended trip behaviour in the future, in reaction to some proposed change. Instead of reassessing their previous behaviour, respondents are asked to predict how they would behave in future proposed conditions (Christie *et al.*, 2007). Therefore, we name this other format as *intended contingent behaviour* (see, e.g., Egan and Herriges, 2006; Landry and Liu, 2009; Lienhoop and Ansmann, 2011). As explained in section 2.1, in this research this second format was the one selected.

The set of candidate explanatory variables common to the three models is displayed in Table 2. Summary statistics are reported with reference to the 272 individuals. Models include, further, specific slope and intercept shift parameters that distinguishes among scenarios.

Table 2: Variables identification and descriptive statistics

Variable	Description	Mean	Std D	Min	Max
TC	Travel cost per person	30.99	27.10	0.22	118.42
TC_S	Travel cost to the substitute site	35.32	26.23	0.51	168
M	Household monthly disposable income	1 813	805	475	3 000
Age	Age	36.53	12.22	16	71
Gen	Gender (1=female)	0.50	0.57	0	1
Educ	Years of formal education	13.59	3.58	4	18
DD	1 if walking/ contact with nature are main visit motives	0.14	0.35	0	1
Ep	Importance of environmental protection	4.76	0.34	3.25	5
hrs	On-site time	3.02	1.50	1	7

Travel cost was defined as:

$$TC1 = \frac{Km * 2 * 0.36€ * c + ef}{group\ size} + 3.6€ * 2 * h_{rt} * c, \qquad 0 < c \leq 1 \tag{9}$$

Where, ef is the entrance fee, Km is the one way distance, measured in kilometres, between each survey respondent's home zip code and Bussaco wood zip code. The one way travel time, measured in hours, is h_{rt}. Travel distance and time were computed using Google Maps application and assuming the recommended itinerary. Group size is the number of persons travelling together. The c is a correction factor adjusting travel cost for multiple destination trips. Hence, it equals one for single destination trips. The mathematical expression includes two monetary values. The cost per kilometre is 0.36€, which is the reimbursement rate paid by Portuguese government[5] and 3.6€ is the hourly wage rate considering the minimum monthly salary in Portugal in 2010[6].

In the questionnaire respondents are asked to point: a place similar to Bussaco wood, the place they visit more often and the place they would visit if they had not come to visit the Bussaco wood. The substitute was defined as the place nearest respondents

[5] Defined by the Portuguese governmental order n.º 137/2010, published at 28/12/2010.

[6] The minimum monthly salary (MMS) in 2010 was of 475€. Hourly salary is 3.6€ because there are fourteen "months" of payment, eleven months of work, with an average of twenty one working days and eight hours of work per day $\left(3.6 = (14 \times 475)/(11 \times 21 \times 8)\right)$. This is intended to be a conservative choice as workers cannot freely adjust the number of working hours.

home, considering the three alternatives. Construction of the remaining variables is straightforward.

Econometric computations were performed using the Stata 11.2. Three complementary models (A, B and C) were estimated. Model A evaluates the change in the use value if a forest fire damages the wood. It deals with observations from scenarios 2 and 5. Model B is intended to verify visitors' price sensitivity. It works with observations from scenarios 2 to 4. Hence, the three contingent scenarios differ only in travel cost since environmental conditions remain unchanged. Model C is the most general as it deals with the full set of observations. It takes in the RP observation, not included in neither of the other models. Consequently, for this version, pooled and pseudo-panel models require that the two data sources (RP and SP) have the same structure in terms of dependent and explanatory variables.

For each model, three specifications were computed, the pooled NB[7] with cluster-robust errors, the RE-Pois[8] and the RE-NB. All the models were estimated using balanced panels. Panel data specifications accommodate unobserved heterogeneity that here refers to the possibility that unmeasured differences among individuals observationally equivalent affect the number of visits.

Table 3 reports estimated coefficients and the log (pseudo)likelihood values for the alternative specifications of each model. Besides the indicator variables for the RP data and fire scenario, models differ in two other explanatory variables. Opinion concerning environmental protection was found statistically significant only in Model A; while age squared was found statistically significant in Model B. Other demographic variables, such as, gender, formal education and income, were not significant in any of the models and were left out because literature does not identify a standard effect.

[7] Poisson and a NB specification were computed, but statistical fit favoured the NB model.
[8] For Poisson model two RE specifications were computed, assuming Gamma and Normal distributions.

Table 3: Demand models

	Model A (quality change)			Model B (price change)			Model C (RP-SP)		
	Pooled NB	**RE-Pois-G**	**RE NB**	**Pooled NB**	**RE-Pois-G**	**RE NB**	**Pooled NB**	**RE-Pois-G**	**RE NB**
TC (Travel cost per person)	- 0.0094 (0.0008)	- 0.0097 (0.0033)	- 0.0083 (0.0027)	- 0.0050 (0.0015)	- 0.0067 [a)] (0.0026)	- 0.0059 (0.0022)	- 0.0062 (0.0019)	- 0.0074 (0.0027)	- 0.0062 (0.0021)
TC_s (Travel cost to substitute)	0.0075 (0.0013)	0.0074 (0.0027)	0.0054 [a)] (0.0023)	0.0099 (0.0006)	0.0091 (0.0029)	0.0078 (0.0022)	0.0081 (0.0015)	0.0074 (0.0028)	0.0059 (0.0020)
DD (Walking/contacting with nature)	0.5341 (0.0806)	0.5464 (0.2087)	0.4467 (0.1557)	0.4926 (0.0508)	0.4884 [a)] (0.1914)	0.4827 (0.1597)	0.4440 (0.1046)	0.4320 [a)] (0.1871)	0.4220 (0.1415)
hrs (On-site time)	0.1901 (0.0097)	0.1851 (0.0443)	0.1694 (0.0381)	0.1936 (0.3061)	0.1947 (0.0375)	0.1793 (0.0385)	0.1979 (0.0232)	0.1959 (0.0382)	0.1567 (0.0341)
Ep (Environmental protection)	0.4411 (0.0456)	0.3998 [a)] (0.1915)	0.2963 [b)] (0.1792)	---	---	---	---	---	---
Age2 (Age squared)	---	---	---	0.0002 (0.0000)	0.0001 [a)] (0.0001)	0.0002 (0.0001)	---	---	---
D_{fire}	- 0.6790 (0.0077)	-0.7127 (0.1653)	-0.6437 (0.1130)	---	---	---	-0.4148 (0.1483)	-0.4325 (0.1444)	-0.4125 (0.0975)
TC_D_{fire}	0.0022 (0.0002)	0.0034 [c)] (0.0038)	0.0021 [c)] (0.0033)	---	---	---	- 0.0013 [c)] (0.0038)	-0.0007 [c)] (0.0034)	-0.0009 [c)] (0.0028)
D_{rp}	---	---	---	---	---	---	-0.3053 [b)] (0.1735)	-0.3160 [a)] (0.1564)	-0.3260 (0.0912)
TC_D_{rp}	---	---	---	---	---	---	0.0022 [c)] (0.0037)	0.0021 (0.0033)	0.0030 [c)] (0.0024)
Const	- 1.9975 (0.1608)	- 1.7726 [b)] (0.9329)	0.4726 [c)] (0.9029)	- 0.4846 [c)] (0.3715)	- 0.3902 [a)] (0.1769)	1.7218 (0.4558)	-0.1461 [c)] (0.1160)	-0.0678 [c)] (0.1658)	2.1986 (0.3013)
α	0.5230 (0.1092)	0.5041 (0.0987)	---	0.6592 (0.2074)	0.5752 (0.1027)	---	0.5314 (0.0612)	0.4597 (0.0666)	---
Log (pseudo)likelihood	- 856.6129	- 842.2450	- 835.1928	- 1 342.5557	- 1 263.0758	- 1 258.5889	- 2 032.4211	- 1 881.9303	- 1 872.7159
Observations		502			732			1 170	
Price demand elasticity	- 0.2907 (0.0232)	- 0.2997 (0.1008)	- 0.2555 (0.0844)	- 0.1556 (0.0458)	-0.2101 [b)] (0.0829)	- 0.1852 (0.0695)	- 0.1915 (0.0596)	- 0.2316 (0.0829)	- 0.1921 (0.0647)

Standard errors are reported in parentheses. For pooled models they are cluster-robust standard errors and for the Pois-RE models values were estimated using bootstrap robust methods. Significance: [a)] $0.01<p\leq 0.05$; [b)] $0.05<p\leq 0.1$; [c)] $p>0.1$; in blank if significant at 0.01 or lower p level.

Comparing the results along the econometric models, we come to three main conclusions. First, the coefficient signals of the significant variables never change, with a single exception for the constant. It is negative in the pooled NB and RE-Pois, while in the RE-NB it is always positive. Second, the RE-Pois produce the higher absolute values for the TC coefficient. Consequently, it generates the lowest consumer surplus[9]. Third, the coefficient of the substitute price is always statistically significant at the 0.05 level and has the expected positive signal. As the travel cost to a substitute site increases, *ceteris paribus*, visits to the wood also increase.

The coefficient for the travel cost has the expected negative signal and is statistically significant at the 0.01 level in eight out of the nine specifications. Hence, demand is downwards sloping in conformity with demand law. On the other hand, the interaction variable among TC and the dummy indicator of the fire wood scenario, included in models A and C, is not significant, meaning that demand slopes remain unchanged across scenarios. Consequently, in the fire wood scenario the consumer surplus per trip is not statistically different from the *status quo* and price elasticity does not change either. Further, in Model C, the slope interaction variable among TC and the dummy indicator of the RP data, while having a negative signal, is not statistically significant in either of the specifications.

The dummy DD has a positive signal and is also significant in the three models. Accordingly, respondents who visit the wood for walking and whose main visit motivation is to contact with nature, will visit the wood more often in any scenario. It is possibly related with the positive and statistically significant coefficient of on-site time. If so, visits and time on-site are complements.

Respondents' opinion about the importance of environmental protection was included only in Model A, where the fire wood scenario is in view. It is significant, with a positive

[9] When applying the Poisson or the NB models, the Marshallian consumer surplus per trip is given by the inverse of the travel cost coefficient (Hellerstein and Mendelsohn, 1993).

effect along the three specifications. Accordingly, those more concerned with environmental protection intend to visit the wood more often.

The dummy variable for the fire wood scenario is statistically significant and has a negative signal in both models, A and C. Hence, it acts as a demand shifter and the effect is the expected. If part of the wood was damaged by a fire, holding other variables constant, the number of visits will decrease and a part of the use value shall be lost[10].

Model C includes another dummy variable (D_{RP}) which distinguishes contingent from observed behaviour. The high statistical significance of this variable in the pseudo-panel specifications indicates that the two data sources are not statistically equivalent. If so, there is no consistency among revealed and stated preferences and RP and SP data should not be combined.

Fit statistics indicate that the RE models are a more efficient choice than the pooled models as likelihood values are lower. The likelihood-ratio test also rejects the pooled model. Accordingly, the RE parameter is significant in all the models meaning that there is common variance in individual responses across scenarios. Cameron and Trivedi's (2009: 627) argue that the RE-Pois estimator with cluster-robust standard errors is likely to be more robust and a better choice than the NB estimator because it is based on weaker distributional assumptions. For that reason, predicted values are computed using the results from the RE-Pois. Table 4 reports the estimates of the conditional mean, after integrating out the RE, and the observed/stated values.

[10] When administering the pre-test some respondents stated that if the wood was damaged by a forest fire they would be likely to maintain, or even increase, the number of visits in order to help the recovery through the payment of the entrance fee. Hence, this coefficient may be less expressive because of this potential effect, not related with use value.

Table 4: Observed and predicted number of trips

Model	A		B			
Scenario	**2**	**5**	**2**	**3**	**4a)**	**4b)**
Observed trips	2.48 (4.25)	1.32 (2.35)	2.32 (3.83)	3.16 (3.23)	1.57 (2.57)	0.97 (2.20)
Predicted trips	2.45 (1.48)	1.30 (0.74)	2.10 (1.37)	2.16 (1.41)	2.21 (1.50)	1.90 (1.11)
Observations [a)]	251		244	179	160	149

[a)] Concerning Model B, note that (179+160+149)/2=244 because each respondent was asked about the number of future expected trips considering two price changes.

The average number of predicted trips by Model A is very close to the number of stated trips, for both scenarios. In accordance with both, stated and predicted values, the planned number of trips would be reduced in about 47%, in the following year, if a fire damages 25% of the wood. On the contrary, in Model B, the difference among stated and predicted values is very expressive. The difference is particularly high in the entrance fee duplication scenario. The mean for model predictions is about the double of the stated. The difference is also meaningful in the entrance fee reduction scenario, where the predicted mean is 32% lower than the stated.

Paradoxical results are, hence, observed concerning the reaction of current users to price changes. At one hand, descriptive statistics (reported in Table 1) show an expressive reduction in the number of intended trips if the entrance fee increases in 50% or if it doubles. The reduction would be of 41% and 56%, respectively. On the other hand, econometric model predictions point a much lower reaction of visitors to entrance fee changes. Further, price demand elasticity is quite low (-0.21, in Model B), showing an inelastic demand.

3. Discussion and conclusions

This paper illustrates the potential of non-market valuation to supplement ecological economics and contribute to a more sustainable decision making process. We have analysed the effects of two distinct and independent changes on recreational wood visitation. One refers to price variations due to changes in the entrance fee. The other embraces a novel aspect because, instead of site improvements on forest conditions, deterioration due to a fire wood is considered. Econometric results are theoretically valid as the price of the good, substitutes' price and preferences are statistically significant in demand explanation. However, two behavioural anomalies are identified: lack of RP-SP consistency and hypothetical and strategic bias.

Two possible explanations are envisaged for the contradictory results. The first is related with an old issue discussed in TCM analysis which is the difference between the trip price perceived by visitors and the proxy constructed by the researcher for that price (Layman *et al.*, 1996). In this case, it is possible that respondents do not consider all the implicit costs and pay disproportionate attention to a single explicit cost related with the visit, the entrance fee. The second possibility we envisage is that the stated number of intended trips expresses agreement or disagreement with the proposed change. Hence, the increase (reduction) in the number of visits would be exaggerated in the entrance fee reduction (increase) scenario. If so, we are dealing with hypothetical and strategic bias resulting from the hypothetical nature of the question. Respondents may be in opposition to this unpopular payment vehicle (Hanley, 1989).

It is difficult to affirm whether these paradoxical results are due to specificities of our research. An analysis similar to the one that conducted us to these results has been seldom provided in literature, especially when price changes are in view. Lienhoop and Ansmann (2011) is one of the sparse examples contrasting econometric model predictions with the stated number of trips. Their results, based on hypothetical quality changes, are in line with ours as model predictions are very close to the observed number of trips. Our results are also in line with Whitehead *et al.* (2010: 107) conclusions: *"trip overstatement tends to occur in baseline forecasts of behaviour and not in changes in forecast behaviour as quality/conditions change".* The most stricky question refers to CB in response to price changes. Unconsistencies among RP and SP data seem to be more frequent when price changes are considered than when quality changes are in view (Azevedo et al., 2003; Englin and Cameron, 1996; Whitehead et al., 2010).

Hanley and Shogren (2005: 14) state "*when institutions rewarding reliable choice and punishing the unreliable ones do not exist, a person can act as if his choices and stated values will go uncontested since he need not be accountable to other*" (adapted). Our interpretation differs from this idea. While we agree that the lack of such institution justifies the apparent untruth answers, we also admit that agents act rationally[11]. We believe they are trying to influence decision makers' action in a way that would enhance their well-being. A possible interpretation of our results is that if there is a quality change which escapes from the decision-makers control (as in this particular case), stated and revealed behaviour will look consistent because there is no incentive to a strategic response. Conversely, stated and revealed behaviour will probably seem inconsistent when decision-makers are responsible for the proposed change because respondents try to influence the decision. This is a question that certainly deserves future research.

A larger sample (this study works with 272 observations/individuals) would be valuable as it could increase the confidence of results. Economic laws are probabilistic and not deterministic, therefore larger samples can increase the confidence in results in spite of those showing or not rational behaviours. Another constraint related with the sample is the survey mode. While on-site sample has the advantage of ensuring that respondents are familiar with the recreation site, in spite of being asked to deal with hypothetical scenarios, it imposes endogenous stratification and truncation which is likely a limitation of this research.

[11] Assuming, as Gintis (2000), that a rational agent: "is one who draws conclusions logically from given premises, who premises are defensible by reasonable argument, who uses evidence dispassionately in evaluating factual assertions, and more technically, who optimizes subject to constraints under conditions of limited information and costly decision making."

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