Modelling attribute non-attendance in best-worst rank ordered choice data to estimate tourism benefits from Alpine pasture heritage

RICCARDO SCARPA, SANDRA NOTARO, ROBERTA RAFFAELLI, JORDAN LOUVIERE

Riccardo Scarpa,
Department of Economics, Waikato Management School, Hamilton, New Zealand

Sandra Notaro, Roberta Raffaelli,
Department of Economics, University of Trento, Trento, Italy

Jordan Louviere
School of Marketing, University of Technology Sydney, Sydney,
New South Wales, Australia

Paper prepared for presentation at the EAAE 2011 Congress
Change and Uncertainty
Challenges for Agriculture,
Food and Natural Resources

August 30 to September 2, 2011
ETH Zurich, Zurich, Switzerland

I. INTRODUCTION

For centuries common property was the preferred form of land management for grazing across the Alpine arch (Stevenson 1991). Grazing commons in the subalpine and alpine areas are relic of ancient organization forms which are still working in Switzerland (Stevenson 1991), in the southernmost part of Bavaria (Gueydon and Hoffmann 2006), and on the Italian side of the Alps where they are identified either with the term “malga” or “alpe”. The “cultural alpine pasture heritage” ‐ seen as a complex of tangible (pastures, rural buildings, animals, typical products) and non-tangible elements (knowledge related to pastoral and dairy activities, linguistic heritage, traditions) – represents a resource for the whole population of mountain regions (Battaglini et al. 2010) and in many cases a tourist attraction that may work as economic engines underpinning sustainable mountain settlements.

The management of these grazing commons is nowadays under threat (Niemeyer and Riseth 2004). The continued utilisation of these grazing commons crucially depends on the competitiveness of the involved production systems (Roeder et al. 2010). Farmers cease to use land associated with high costs due to remoteness, difficult access, poor quality land, steep slopes or high labour requirements (MacDonald et al. 2000). And remote grazing carried out on rented or community-owned land is the first to be abandoned. As a result, in some regions of the Alps, common grazing land areas are not actually grazed any more and one can observe the effects of different degrees of abandonment. They include natural repopulation of pastures by shrubs and trees or reforestation (Tasser and Tappeiner 2002), a general decline in the complex biodiversity (Dullinger et al 2003) and the loss of open space and landscape attractiveness (Hunziker and Kienasts 1999). In addition to these declines, abandonment increases the probability of wild-fires and hydrologic disorders (Romero-Calcerrada and Perry 2004). Moreover, abandonment also threatens local communities and visitors with loss of cultural heritage elements, and traditional knowledge of dairy practices (Conti and Fagarazzi 2004).

The economic sustainability of alpine grazing depends today on a variety of financial measures (Roeder et al. 2010) among which agri-environmental payments are the most relevant. As agreed by the EU with the WTO (Matthews 2006), these agri-enviromental payments have to be designed only on income foregone or additional cost and, where necessary, ‘transaction costs’ (Article 39.4 of Regulation 1698/2005). In most cases they are not enough to attract people to work in what is a strenuous time-consuming and often poorly rewarded occupation.

As concerns the future, it is difficult to envisage the design of the EU post-2013 Common Agricultural Policy. Even if “the enhanced provision of environmental public goods” generated through agriculture is a declared objective of the future CAP (European Commission 2010, 7), agri-enviromental payments for mountain grazing might dwindle under the pressure of other priorities.

Hence, local authorities are exploring other sources of revenue to contribute to maintain these areas and the associated features, such as contributions from tourists and visitors. For example, in Austria several tourist-intensive municipalities provide farmers with additional compensation payments granted by local tourist associations of hotel-keepers and communities for the provision of landscape services (Hackl, Halla and Pruckner 2007). It is unlikely that the volume of such contributions will be such as to effectively support the maintenance of the whole system of existing grazing commons, but currently there is no data available to guide policy. Because a large part of the benefits produced by grazing on Alpine pasture is enjoyed by visitors, the issue of adequate estimation of WTP for access to these alpine areas is of policy relevance.

Multi-attribute stated choice surveys are particularly useful in these contexts as they can guide priority settings across different desirable outputs associated with maintenance of grazing commons. The remoteness of these areas and the low frequencies of visitation put a very high premium on the information content of surveys since practical sample sizes inevitably are very small. To deal with these issues, we decided to do more in-depth surveys with fewer respondents asking them to rank-order (Hausman and Ruud 1987) the choice alternatives. This preference elicitation approach should provide more information than simply asking respondents to select only their favourite (most preferred) alternative. Moreover, following recent advances in applied conjoint analysis and discrete choice experiments (Flynn et al. 2007; Louviere and Islam 2008), we instructed respondents to rank the proposed alternatives by successive identification of best and worst alternatives. This approach appears to deliver cognitive advantages even in the context of discrete choice modeling (Scarpa et al. forthcoming).

The present study reports the results of a multi-attribute stated choice survey of visitors of a well-known valley located in the province of Trento, Val Genova, which was chosen because distinct stages of abandonment of grazing commons can be experienced by visitors along the valley. The purpose of the survey is to estimate willingness to pay for access to the grazing areas, and decompose this into different conservation actions to prioritize spending on differential management practices. On the methodological side we explore the issue of non-attendance to each proposed attribute in the survey. We focus on two important aspects linked to attribute non-attendance (ANA). The first is its effect on welfare estimates. The second aspect is more novel, and concerns the internal consistency of inferred non-attendance from different stages of a rank-ordered best/worst elicitation method. This second aspect is of interest to validate both the statistical model of inferred non-attendance and its relationship with statements of attribute non-attendance reported by respondents. The latter aspect should cast some light on the debate as to whether non-attendance to specific attributes should be inferred from a pattern of choices, or be reported by respondents; and if respondents are asked to report non-attendance, what is the best way to do this.

II. ATTRIBUTE NON-ATTENDANCE IN CHOICE EXPERIMENTS

Attribute non-attendance in choice experiments (CE) has recently been the subject of much investigation (see e.g., Hensher, Rose, and Greene 2005; Hensher 2008; Campbell, Hutchinson, and Scarpa 2008; Carlsson, Mitesh, and Lampi 2010; Scarpa et al. 2009; and Hensher, Scarpa, and Campbell (forthcoming)). The cited studies conclude that ANA matters in applied choice analysis for policy purposes. However, there is no general agreement about the magnitude and direction of the effects of non-attendance on welfare estimates.

Two approaches have been used so far to identify and quantify attribute non attendance, namely respondent-reported non-attendance and analytical (or inferred) non-attendance. The first approach relies on asking respondents debriefing questions; in most cases these questions are asked at the end of the entire CE, which may capture the so-called serial non attendance and they can be phrased and directed towards identifying non-attendance and, or they can be directed towards identifying the degree of attendance. Most recent work focus on collecting information on attendance for each choice-task, such as Puckett and Hensher (2008); Meyerhoff and Liebe (2009); and Scarpa Thiene, and Hensher (2010), who confirm the importance of including this information in the model specifications because it significantly improves model fit and marginal WTPs are more plausible.

The second approach infers non-attendance from the actual pattern of choices made by respondents and can be applied only with panels of choices. Prior work uses econometric models to address respondent ANA by inference from the whole sequence of a respondent's observed choices. This includes a rationally-adaptive model of DeShazo and Fermo (2004), a variable selection model of Gilbride, Allenby, and Brazell (2006), the equality constrained latent class model of Hess and Rose (2007) and the procedural approach of Kaye-Blake, Abell and Zellman (2009).

The consistency between self-reported ANA and ANA inferred by statistical models is not yet resolved. Campbell and Lorimer (2009) estimate models with separate attribute parameters for respondents who say they either considered or ignored each attribute, and conclude that there was some discrepancy, such that asking respondents about ANA may not adequately reflect heterogeneity. Hensher and Greene (2010) note that evidence suggests that the two ways to indentify attribute processing rules "do not map very well" and "the issue of supplementary question clarity is a topic for further research". Similar conclusions are reached by Hess and Hensher (2010) and Scarpa, Thiene, and Hensher (2010).

Work on teasing out drivers of non-attendance includes Hensher (2006), who focuses on the nature of the attribute information in the choice set or Cameron and DeShazo (forthcoming), who focus on similarity and dissimilarity in attribute levels. Others focus mainly on selected respondent characteristics (Kosenius 2008), or a mix of respondents characteristics and survey design characteristics (Scarpa, Thiene and Hensher 2010). All of these studies are based on first-choice elicitation procedures. The present study is the first to consider full rank-ordered data. As we will discuss later, this mode of preference elicitation offers particular insights and challenges, but also provides opportunities to examine consistencies across patterns of non attendance by the same respondents within the same choice set, because all alternatives are ranked, instead of observing only first choice (only one alternative is chosen from the set).

III. SURVEY DEVELOPMENT AND DATA

The study area Val Genova is a long glacial valley (about 20 km) in an area protected from development activities, the Adamello Brenta Nature Park. In the upper part of the valley three public owned grazing pastures are used for summer grazing by local stock-breeders who have the right to use them without paying any rent. Two of them (Malga Caret and Malga Bedole) are in good conditions while Malga Matarot is currently encroached by shrubs due to a low stocking rate.

The Park's authority controls access to the valley through a check point and administers an access fee for cars in the period from June to September. The majority of visitors do not reach the alpine pastures in the higher part of the valley. From June to September 2008 the Park's Management conservatively estimated the total number of visitors reaching the upper part of the valley to be 13,845 out of 128,000 entering the valley.

The relevant policy attributes designed to offset abandonment of grazing commons identified in the literature were tested in two focus groups. The final set includes: 1) alpine landscape (abbreviated as *ALPSCAPE*), 2) biodiversity conservation (*BIODIV*), 3) conservation of historical and cultural heritage features (*HISTCOL*) and 4) conservation of the traditional in-situ processing of milk into dairy products (butter and cheese, abbreviated as *DAIRYPR*). We used an "on-off" two-level policy description for each attribute except for access fee (Table 1). Different management options associated with specific attribute levels were determined by specialists. A third level was associated with the "abandonment" option (no action/no access fee) that was the status quo outcome. Amounts for the bid vector were derived from preliminary results of a repeated dichotomous choice CV study in which visitors to the valley were asked about their maximum and minimum WTP for both a maximum and a minimum combination of the attributes. The payment vehicle described to respondents was that of an access fee to be paid at the entrance of the valley by each person to continue the visit in the valley, and specifically designed to support maintenance of Alpine grazing commons.

Experimental design and sample

With one attribute at four levels and four with 2 levels each we have a $4{\times}2^4$ factorial structure for each policy profile. We constructed a design in 16 choice sets; each choice set had 4 alternatives, with the "abandonment" alternative as a fifth alternative. We used a design approach that allows us to estimate respondent-specific preferences (Louviere et al. 2008), which was 100% efficient for estimating only the main effects of a linear indirect utility function using a conditional logit model, under the null hypothesis of no information about the parameters, and other subsidiary assumptions as described in Street and Burgess (2007) and in Rose and Bliemer (2009) for designs optimal on differences. We opted for this approach because the a-priori efficiency of the design was difficult to evaluate, which is why we did not rely on priors, which would have suggested a Bayesian design approach, or a locally WTP-efficient design approach.

Profiles generated by the experimental design were grouped into 16 ranking tasks. The preference elicitation procedure was strictly controlled by the interviewers and was framed as a sequential choice process. Respondents were instructed to choose the most preferred alternative out of 5, then the least preferred out of 4, the second most preferred out of the remaining 3, and finally the second least preferred out of 2.

A preliminary pilot study of 15 randomly selected visitors was carried out on site to test the survey. Data for the final survey were collected from 1st August till 15th September 2008. Respondents were intercepted either as they arrived or left the valley, using a systematic sampling probabilistic design by drawing randomly at an approximate rate of one out of 5. The final sample for estimation included 107 completed questionnaires with a response rate of 74%.

IV. HYPOTHESES AND METHODS

In the case of data obtained with the twice repeated best-worst approach on a choice set with five alternatives denoted $\{A_1, A_2, A_3, A_4, SQ\}$ the analyst identifies four responses $\{y^{1b}, y^{1w}, y^{2b}, y^{2w}\}$, where the subscripts denotes first best, first worst, second best and second worst. These lead to the following preference ordering {

$y^{1b} \succ y^{2b} \succ y^{2w} \succ y^{1w} \succ y^{r}\}$, where the subscript r denotes the residual alternative. This ordering can be interpreted as observationally equivalent to as a sequence of four discrete choices from choice sets with a gradually decreasing number of alternatives. Such an interpretation gives rise to the so-called rank-ordered logit model:

$$\Pr(y^{1b} \succ y^{2b} \succ y^{2w} \succ y^{1w} \succ y^{r}) = \Pr(y^{1b} \mid y^{2b}, y^{2w}, y^{1w}, y^{r}) \Pr(y^{2b} \mid y^{2w}, y^{1w}, y^{r}) \times \Pr(y^{2w} \mid y^{1w}, y^{r}) \Pr(y^{1w} \mid y^{r})$$

invoking the typical assumptions of a sequence of independent logit choice probabilities each full ranking gives the following product of logits:

$$\Pr(y^{1b} \succ y^{2b} \succ y^{2w} \succ y^{1w} \succ y^{r}) = \frac{\exp(v^{1b})}{\sum\limits_{j \in 1b,2b,2w,1w,r} \exp(v^{j})} \times \frac{\exp(v^{2b})}{\sum\limits_{j \in 2b,2w,1w,r} \exp(v^{j})} \times \frac{\exp(v^{r})}{\sum\limits_{j \in 2w,1w,r} \exp(v^{j})} \times \frac{\exp(v^{2w})}{\sum\limits_{j \in 2w,1w} \exp(v^{j})}$$

where v denotes the indirect utilities of the relevant alternatives.

We want to explore differences in ANA across ranks and their link to statements of ANA by respondents. Formally, we want to explore the differences between Pr(ANA k |rank m) and Pr(ANA k |rank l), with m and l being different ranks, and k being a given attribute. As well as the function:

$$\Pr(\mathrm{ANA}_n\ k=1, \mathrm{ANA}_n\ k=2, \ldots\ \mathrm{ANA}_n\ k=5) = f(m,s,c)$$

where n denotes the respondent, m the rank, s a set of socio-economic covariates, and c a set of contextual variables (i.e. whether or not attribute k was already ignored in the previous ranking choice).

Both empirical questions require the development of a model that can estimate individual-specific probabilities of attribute non attendance. Panel models of discrete choice are therefore an obvious choice because they can be used to derive posterior estimates of class membership probability at the individual level (Scarpa and Thiene 2005). To keep things simple we followed Scarpa et al. (2009) and Hensher and Rose (2009) and focused on a modeling approach based on constrained latent classes. Given k choice attributes one can partition zero value constraints over attribute coefficients so as to obtain 2^k classes, each of which is associated with a specific pattern of ANA. As our model is explorative only of ANA probabilities and ignores heterogeneity of taste intensities, the best number of classes is not guided by the lowest BIC, AIC or AIC3 indicator, but by the ability to separate into sizeable class probabilities.

The unconditional probability of a sequence of T choices by a given respondent is therefore given by the law of total probability as:

$$\Pr(j_{t=1,\ldots t=T}) = \sum\nolimits_h \pi_h \prod_{t=1}^{t=T} \left[\frac{\exp(v_{jh})}{\sum\nolimits_{i \in J} \exp(v_{ih})} \right]^{y_{tj}},$$

where h denotes the class associated with the specific ANA constraints of certain utility coefficients being equal to zero, and y_{tj} is a binary indicator of choice. The probability of ANA for a given attribute k and individual n is then obtained by adding up all the posterior probabilities (i.e. derived conditionally on the pattern of choices of individual n) associated with a given coefficient attribute k being set to zero.

In our data we observe 107 respondents each of whom provides a sequence of 16 full rankings using the best/worst elicitation method. This provides with a panel of 16 × 4 × 107 = 6,848 choices. However, these are choices from choice tasks with different number of alternatives, to be precise one forth, or 1,712, from each of five, four, three and two alternatives, respectively. Because respondents' engagement in ANA is often explained as a choice heuristic used to decrease cognitive burden, and because the number of alternatives in choice tasks are believed to increase choice complexity (see, e.g., DeShazo and Fermo 2002, Caussade et al. 2005), it is plausible that the degree of ANA should vary across choices made from choice tasks with different numbers of alternatives. In turn, this leads to an expectation that relatively higher levels of ANA should be observed in choices from choice sets with five alternatives than in those with four and, respectively three and two alternatives. However, the whole purpose of providing specific instructions to elicit a ranking using an iterated best/worst approach is to take advantage of the fact that a respondent's task should be easier when identifying best and worst options from a given set, than left to their own devices to rank the alternatives. If best and worst options require less cognitive effort, and if the frequency of ANA is linked to such effort, one should observe lower ANA frequencies associated with first best and first worst choices. In our case these coincide, respectively, with five and four alternatives. So, the notion of non-attendance being motivated as a simplifying heuristic in the presence of a higher number of alternatives leads to different predictions in terms of observed probability of occurrence than the notion of best/worst elicitation reducing cognitive effort. Which of the two effects prevails is an empirical issue that we set out to explore in our data.

In order to do so we used a latent class panel model, which is fitted to each sequence of 16 choice tasks (balanced panel) with the same number of alternatives by each respondent. We conduct a specification search for an adequate latent class ANA model to fit the 107 sequences using the 16 × 107 = 1,712 first best, second best, and residual choices. In this way we can separately identify the frequency of ANA at three of the four decisions required for a full rank of the five alternatives. The omitted choice, which is out of the two worsts (first and second worst), were dropped because most of our sample chose abandonment as the first worst, which made choice analysis at this level uninformative with regards to ANA. The same procedure was used on the fully ranked data, which pooled all responses, and was hence estimated on 4×16×107 = 6,848 choices to obtain an ANA specification on the fully exploded ranked logit data (ranked-ordered ANA), grouped in a balanced panel of 4×16=64 choices.

Specification search

With 5 end-point policy attributes we have 2^5=32 classes of possible attribute non attendance. With only 107 respondents, a number of the 32 classes are likely to have very low frequency and some simplifications can be introduced to further restrict the number of classes of empirical interest. For example, we found no evidence of any respondent systematically ignoring 3 of our proposed five attributes, so our search started from $2^5-\binom{5}{3}=22$ classes, which included non attendance on 1, 2 and 4 out of five attributes, the latter group of classes is associated with lexicographic preferences, and we found some evidence of this in our sample. This highly heterogeneous specification for ANA was deemed a suitable starting point for a specification search. For each of the three data sequences we did a specification search using a "general-to-specific" approach. From the most general 22 ANA class specification we gradually eliminated all classes that estimation results suggested a predicted class membership probability of less than 3%. Posterior membership probabilities for each class can be derived for each of the final model, so the pattern of non attendance for each respondent can be inferred conditional on the model estimates and the specific pattern of choices faced by each respondent. The 16 choices made by each respondent allow relatively good inference on each person, and the inferred aggregate probability of ANA for each attribute can be derived by pooling together the membership probabilities of all classes that involve the non attendance of each attribute. In this fashion we obtained inferred ANA probabilities for each attribute and each respondent at each of the 3 stages of the best/worst ranking examined.

Determinants of ANA in sequentially ranked choice experiments

We use this information to examine the second issue of interest, which is whether a relationship exists between statements made by respondents about their own perception of what attributes they ignored during their decision-making and inferred non-attendance from statistical modeling.

To address this issue we use posterior ANA probabilities at the individual level, conditional on individual choice sequences, and for each respondent we define an indicator of ANA_k=1 for an attribute k when the sum of individual probabilities of membership over all classes ignoring k is greater than 0.5. Posteriors are often used for validation exercises of panel choice models. For example, Boxall and Admowicz (2002) explain class membership using factor analysis, Scarpa and Thiene (2005) use posterior segment probabilities to evaluate winners and losers of simulated policies for climbers, Hu et al. (2004) use posterior class probabilities to assess the explanatory power of a set of socio-economic covariates on class membership using Dirichlet regression, since the sum over all class membership probabilities adds to one.

In order to tease out the determinants of inferred ANA_k we use a five-variate probit to try to explain the inferred joint posterior probability of attendance to all five of our policy attributes, as obtained from the best fitting model from our various specification searches. This model is based on a set of simultaneous censored regressions, each explaining inferred ANA for one of the policy attributes, with a correlated error structure. Apart from a constant effect, candidate explanatory variables for ANA in each equation are the following.

1. The posterior probability individual n had ignored attribute k in the previous choice. This is a lagged term and it is inserted only for ANA inferred from second best (one lag labeled *LAG1*) and residual choices (two lags labeled *LAG2*). We term this the "own-lag" and justify this in terms of an underlying coherence with the pattern of non-attendance.
2. A dummy variable for the specific type of choice, using the first best as a baseline to identify the specific effect of second best (*2ND_BEST*) and residual choices (*RESIDUAL*). We call this "rank effect" and expect such an effect as evidence that ANA varies across ranks and to test empirically whether the best/worst "simplifying effect" dominates or is dominated by the number of alternatives "complicating effect". A negative effect indicates a lower ANA probability in those ranks with fewer alternatives and it is evidence in favour of the dominance of the complicating effect.
3. Dummy variables were created for both, respondents having stated that a given policy attribute "had been guiding their choices" (*GUIDING*) - implying attendance for the named attribute; as well as "having ignored the attribute in making choices". We name the first effect "guiding statement" and the second "ignoring statement". If any of these dummy variables has any informative value, then the expected sign of their coefficients on predicted ANA should be negative for the "guiding statement" (implying lower probability of predicting ANA) and positive for the "ignoring statement".
4. Various socio-economic covariates, that might affect the propensity to care more for certain policy attributes, such as sex, education and family status.

Taken together, a meaningful pattern of results of this analysis of posterior predictions should give evidence of internal validity for the estimates of ANA probabilities obtained with the method described above.

Effects of ANA on WTP estimates for marginal effects of policies

A third question often posed when accounting for ANA regards what effect it has on implied welfare estimates. This question is often framed around the hypothesis of the existence of a statistical difference between point estimates obtained from the models with ANA and those obtained from a conventional rank-ordered model. We test these differences using the Poe, Giraud, and Loomis (2005) combinatorial procedure based on the parametric bootstrap of the asymptotic sampling distributions of the *X-Y* difference. We focus on WTP for marginal effect of each single policy using the formula: $\hat{w}_k = 2\frac{\hat{\beta}_k}{-\hat{\alpha}}$, where symbols with hats are our maximum likelihood estimates, and α denotes the coefficient on access fee. The number two in front of the ratio is due to the effect coding used in the data to correctly identify the status-quo effect.

V. RESULTS AND DISCUSSION

Table 2 reports the coefficient estimates (β) and the implied aggregate probabilities (π) of ANA for each model, along with the model diagnostics and the implied point estimates of marginal WTP, w with respective confidence intervals. The rank ordered model estimates that disregard ANA on average are about 20 percent higher across all policy attributes than those from models that include ANA. When the consumer surplus point estimates for the 16 policy combinations are compared the differences between inference from rank order with and without ANA range from a minimum of Euro 0.83, when only biodiversity conservation is achieved, to Euro 4.70 when all four policy attributes are achieved. However, combinatorial tests on the *X-Y* difference across models (with 9 million draws) fails to reject the null of no difference across all models. We conclude that at this sample size accounting for ANA does not significantly affect point estimates. A stronger effect of ANA is to be identified on the values of more optimistic estimates of welfare change, which in the presence of ANA are 30 percent lower.

In terms of relative magnitude the conservation of milk transformation practices in the grazing commons is the most valued policy, followed by the conservation of the alpine landscape, while biodiversity preservation and the conservation of historical heritage induce similar values according to the ANA rank order model, while estimates ignoring ANA place the latter (Euro 5.37) in between alpine landscape (Euro 5.91) and biodiversity (Euro 4.50). More relative variations in point estimates can be found by examining the various ANA models estimated at the various ranks, provided that we address the question first posed by Hausman and Ruud (1986) regarding the internal consistency of these preference structures. We note that differences cannot be attributed to scale since the models of each rank were independently estimated, and hence endogenously fit a different scale for each rank.

The specification search for the ranked-ordered ANA model indicates that a 10 class model is best, but 11, 16 and 10 classes were best for the first best, second best and residual ANA models, respectively. In terms of model fit, it is clear from the mean log-likelihood values and those of the pseudo-R^2 that the ranked-ordered ANA vastly improves on the conventional rank-ordered and it implies lower point estimates for marginal WTPs but higher scale (more informative responses when ANA is dealt with). Focussing on the ANA probabilities as inferred from the rank ordered ANA model, the most frequently ignored attribute with 60 percent is the access fee, followed by *DAIRYPR* and *ALPSCAPE* with around 45 percent. *BIODIV* and *HISTCOL* are the least ignored with 0.36 and 0.28 ANA probability. These ANA frequencies follow the order *FEE* > *ALPSCAPE* >*DAIRYPR* > *BIODIV* > *HISTCOL* can be compared to those stated in the debriefing by respondents using the statements in which they indicated those policy attributes that guided their choices, and implied the following ranking in terms of decreasing ANA: *HISTCOL*> *DAIRYPR*> *BIODIV*> *FEE*> *ALPSCAPE*. It is interesting that the differences in stated and inferred ANA affect the most value laden attributes. Few choose to state they pay little attention to money, but do not mind stating they ignore the cultural heritage or the grazing landscape, yet their choice behaviour reveals that this is not so. Turning our attention to the models explaining choice at each rank, we notice that the order of ANA probabilities is quite stable across first best, second best and residual ANA models, with only two major inversions - *HISTCOL* and *DAIRYPR.* It seems obvious that comparing the inferred probability of ANA with that derived from the guiding statements is that the self-reports are very poor predictors of the rank of ANA to the *FEE*, whereas the rank *DAIRYPR*> *BIODIV*> *ALPSCAPE* is fairly stable across various models as well as statements and does not correlate much with implied point estimates of marginal WTPs, where the *ALPSCAPE* policy is always more valued than the *BIODIV* policy.

Let us now turn to the estimates of the multivariate probit model to have a better understanding of the values of ANA statement at the individual respondent's level. As can be seen the first lag effects are always positive across all 5 equations and show relatively high z-values, and hence significance. So, a higher probability of ANA in previous choices induces an increase in the probability of ANA in the present choice, which is coherent with a stable pattern of behaviour across ranking. The second lag effect is also positive, but significant only for the equation explaining ANA for *ALPSCAPE.* The coefficients for the dummies of choices made at the second best and residual level have mixed sign effects. *2ND_BEST* has a negative effect on the *ANA* on *FEE* and on *DAIRYPR* which also has a negative effect from *RESIDUAL*, which implies that ANA is reduced with respect to the level observed in the first best. On the other hand ANA for *HISTCOL* increases, on the margin, in the *2ND_BEST*, as noted earlier. Being a MAN reduces the probability of ANA for both *ALPSCAPE* and *BIODIV* but no other socio-economic variable had any effect (age, education, environmental affiliations, frequency of visits etc.). Perhaps the most salient result of this analysis is the consistent negative effect on inferred ANA that statements on guiding attributes displayed. The negative sign on the ANA equations across all attributes suggests that there is substantial validity and concordance between statements of ANA and inferred ANA measures. We note that we also collected statements expressed in terms of "identifying those attributes that were systematically neglected", and that as predictors, those statements were not significant. It would seem that asking respondents what attributes guided their choice is a better proxy for attendance, perhaps because of natural propensity to conceal "ignorance" or "neglect" of survey features deemed important.

Constraining these coefficients to zero in the model is significantly rejected. The correlation structure of the error terms of the 5 equations is significant (Table 4) and indicates weak negative correlation between the error for ANA equations regarding *FEE* and both *BIODIV* and *HISTCOL.* Most other correlations are positive and the highest is between ANA equations for *ALPSCAPE* and *BIODIV*, suggesting that these ANA tend to occur together in the same respondents.

VI. CONCLUSIONS

Public funding for the upkeep of alpine grazing might dwindle in the immediate future, so local authorities need to look for alternative sources of revenues, such as access fees. The traditional management of these grazing grounds produces different outcomes with distinct values to visitors and our multi-attribute stated choice survey focussed on four achievable policy dimensions: alpine landscape, pasture biodiversity, historical heritage and in situ milk processing. Our survey results indicate that the first and last seem to be the most valued and the remaining two have similar values. When the survey data were used to estimate models accounting for attribute non attendance we found lower point estimates for marginal WTPs of policy combinations, but combinatorial tests indicate that we cannot exclude that differences between these estimates might be due to sample variation. Importantly, though, models addressing attribute non attendance (ANA) fit the data much better and we conclude that accounting for ANA does affect interval estimates of welfare, especially the values of at the upper range of the confidence intervals, and this might be of consequence in the sensitivity of benefit-cost analysis.

A multivariate probit analysis of the individual respondent's pattern of inferred ANA behaviour finds important determinants that support the notion of some ANA coherence across ranks in the sequence of choice by the same respondent. These manifest themselves as a tendency at the respondent level to have the same or lower ANA probabilities in the second best with the exception of historical heritage. Importantly, we find that self reported ANA statements expressed in terms of "guiding attributes" correlate with inferred ANA probabilities in the expected direction. These results suggest that individual statements on ANA are informative, worth collecting in choice experiment surveys and incorporating in models of choice. Particularly, we find that framing the question around the identification of "guiding" attributes gives significant effects with plausible signs, while statements about ignored attributes do not. Our results reinforce the practice of framing ANA questions identifying the degree of attendance as in Hensher, Scarpa, and Campbell (forthcoming), Scarpa, Thiene, and. Hensher (2010), and Kosenius (2008), amongst others.

Overall the results also lend validity to our inference method for ANA. Finally, our approach is replicable and easy to adjust to other repeated choice setting data, thereby offering analysts an additional tool to validate results of hypothetical statements.

REFERENCES

Battaglini, Luca Maria, Manuela Renna, Marzia Verona, Miriam Lando, and Marcello Bianchi. 2010. "Alpine Pastures Without Borders and the Museum of Alpine Farming: Examples of sustainable rural tourism connecting Italian and Swiss Alps." Paper presented to the 9th European IFSA Symposium, Vienna, Austria, 4-7 July.

Boxall, Peter, and Wiktor Adamowicz. 2002. "Understanding Heterogeneous Preferences in Random Utility Models: A Latent Class Approach." *Environmental and Resource Economics* 23(4): 421-446.

Cameron, Trudy Ann, and J. R. DeShazo. "Differential Attention to Attributes in Utility-Theoretic Choice Models." *Journal of Choice Modelling* (forthcoming)

Campbell, Danny, and Victoria Lorimer. 2009. "Accommodating attribute processing strategies in stated choice analysis: do respondents do what they do?" Paper presented at 17th Annual Conference of the European Association of Environmental and Resource Economists, Amsterdam, Netherlands, 24-27 June.

Campbell, Danny, George W. Hutchinson, and Riccardo Scarpa. 2008. "Incorporating discontinuous preferences into the analysis of discrete choice experiments." *Environmental and Resource Economics*, 41(3):401-417.

Campbell, Danny. 2008. "Identification and analysis of discontinuous preferences in discrete choice experiments." Paper presented at the 16th Annual Conference of the European Association of Environmental and Resource Economists, Gothenburg, Sweden, 25-28 June.

Carlsson, Fredrik, Mitesh Kataria and Elina Lampi. 2010. "Dealing with ignored attributes in choice experiments on valuation of Sweden's environmental quality objectives" *Environmental and Resource Economics*, vol. 47(1): 65-89.

Caussade Sebastián, Juan de Dios Ortúzar, Luis I. Rizzi, and David A. Hensher. 2005. "Assessing the influence of design dimensions on stated choice experiment estimates." *Transportation Research Part B* 39:621-640.

Conti, Giorgio, and Laura Fagarazzi. 2004. "Sustainable Mountain Development and the key-issue of Abandonment of Marginal Rural Areas." *Planum* XI: 1-20.

DeShazo, J.R., and German Fermo. 2002. "Designing Choice Sets for Stated Preference Methods: The Effects of Complexity on Choice Consistency." *Journal of Environmental Economics and Management* 44:123-143.

DeShazo, J.R., and German Fermo. 2004. “Implications of Rationally-Adaptive Pre-choice Behaviour for the Design and Estimation of Choice Models.” Working paper, School of Public Policy and Social Research, University of California at Los Angeles.

Dullinger, Stefan, Thomas Dirnböck, Josef Greimler, and Georg Grabherr. 2003. “A resampling approach for evaluating effects of pasture abandonment on subalpine plant species diversity.” *Journal of Vegetation Science* 14 (2): 243-52,

European Commission. 2010. The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future, COM(2010) 672 final. Brussels.

Flynn, Terry N., Jordan J. Louviere, Tim J. Peters, and Joanna Coast. 2007. “Best-worst scaling: What it can do for health care research and how to do it.” *Journal of Health Economics* 26:171-189.

Gilbride, Timothy J., Greg M. Allenby, and Jeff D. Brazell. 2006. “Models for heterogeneous variable selection.” *Journal of Marketing Research* 43: 420-430.

Gueydon, Anne, und Helmut Hoffmann. 2006. “Collective alps in the alpine region of Germany.” Paper presented to IASCP Europe Regional Meeting: Building the European Commons. From Open Fields to Open Source. Brescia, Italy, 23-25 March. http://dlc.dlib.indiana.edu/archive/00001742/00/Gueydon.pdf,

Hackl, Franz, Martin Halla, and Gerald Pruckner. 2007. “Local compensation payments for agri-environmental externalities: a panel data analysis of bargaining outcomes.” *European Review of Agricultural Economics* 34(3):295-320.

Hausman, Jerry A., and Paul Ruud. 1987. “Specifying and Testing Econometric Models for Rank-Ordered Data.” *Journal of Econometrics* 34:83-103.

Hensher, David A. 2006. “How do respondents process stated choice experiments? Attribute consideration under varying information load.” *Journal of Applied Econometrics* 21: 861-878.

Hensher, David A. 2008. “Joint estimation of process and outcome in choice experiments and implications for willingness to pay.” *Journal of Transport Economics and Policy* 42 (2): 297-322.

Hensher, David A., and John M. Rose. 2009. “Simplifying Choice through Attribute Preservation or Non-Attendance: Implications for Willingness to Pay.” *Transportation Research E* 45:583-590.

Hensher, David A., and William H. Greene. 2010. “Non-attendance and dual processing of common-metric attributes in choice analysis: a latent class specification” *Empirical Economics* 39(2): 413-426.

Hensher, David A., John M. Rose, and William H. Greene. 2005. “The implications on willingness to pay of respondents ignoring specific attributes.” *Transportation* 32: 203-222.

Hensher, David A., Riccardo Scarpa, and Danny Campbell. “Non-attendance to attributes in environmental choice analysis: a latent class specification.” *Journal of Environmental Planning and Management.* (forthcoming)

Hess, Stephane and John M. Rose. 2007. “A latent class approach to modelling heterogeneous information processing strategies in SP studies.” Paper presented at the Oslo Workshop on Valuation Methods in Transport Planning, March 19-20.

Hess, Stephane, and David A. Hensher. 2010. “Using Conditioning on Observed Choices to Retrieve Individual-Specific Attribute Processing Strategies.” *Transportation Research B* 44 (6): 781-90.

Hu, Wuyang, Anne Hünnemeyer, Michele Veeman, Wiktor Adamowicz, and Lorie Srivastava. 2004. “Trading off health, environmental and genetic modification attributes in food.” *European Review of Agricultural Economics* 31(3):389-408.

Hunziker, Marcel, and Felix Kienast. 1999. “Potential impacts of changing agricultural activities on scenic beauty-a prototypical technique for automated rapid assessment.” *Landscape Ecology* 14**:**161-176.

Kaye-Blake, William. H., Walt L. Abell, and Eva Zellman. 2009. “Respondents' ignoring of attribute information in a choice modelling survey.” *Australian Journal of Agricultural and Resource Economics* 53(4):547-564.

Kosenius, Anna-Kaisa. 2008. “Incorporation of Information about Attribute Prioritizing into Willingness to Pay Estimation in Choice Experiment.” Paper presented at the 1st Workshop on Valuation Methods in Agro- food and Environmental Economics: State-of-the art and future challenges in Stated Choice Experiments. Barcelona, Spain, 3- 4 July.

Louviere, Jordan J., and Towhidul Islam. 2008. “A comparison of importance weights and willingness-to-pay measures derived from choice-based conjoint, constant sum scales and best-worst scaling.” *Journal of Business Research* 61:903-911.

Louviere, Jordan J., Deborah Street, Leonie Burgess, Nada Wasi, Towhidul Islam, and Anthony A.J. Marley. 2008. “Modeling the Choice of Single Individuals by Combining Efficient Choice Experiment Designs with Extra Preference Information.” *Journal of Choice Modelling* 1(1): 128-163.

MacDonald, Donna, Robert J. Crabtree, G. Wiesinger, Thomas Dax, N. Stamou, and P. Fleury. 2000. “Agricultural abandonment in mountain areas of Europe: Environmental consequences and policy response.” *Journal of Environmental Management* 59 (1):47-69.

Matthews, Alan. 2006. Decoupling and the Green Box: International Dimensions of the Reinstrumentation of Agricultural Support.” Paper presented at the 93rd EAAE Seminar Impacts of Decoupling and Cross Compliance on Agriculture in the Enlarged EU, Prague, 22-23 September.

Meyerhoff, Juergen, and Ulf Liebe. 2009. “Discontinuous preferences in choice experiments: Evidence at the choice task level.” Paper presented at 17th Annual Conference of the European Association of Environmental and Resource Economists, Amsterdam, Netherlands, 24-27 June.

Niemeyer, Katharina, and Jan Åge Riseth. 2004. “Impact Of Changing Socio-Economic And Cultural Factors On The Stability Of Co-Operative Large Scale Grazing Systems” Paper presented at the XI World Congress of Rural Sociology Trondheim, Norway, July 25-30.

Poe, Gregory L., Kelly L. Giraud, and John B. Loomis. 2005. “Simple computational methods for measuring the difference of empirical distributions: application to internal and external scope tests in contingent valuation.” *American Journal of Agricultural Economics*. 87:353-365.

Puckett, Sean M., and David A. Hensher. 2008. “The role of attribute processing strategies in estimating the preferences of road freight stakeholders.” *Transportation Research Part E* 44:379-395.

Roeder Norbert, Dirk Lederbogen, Juergen Trautner, Ariel Bergamini, Silvia Stofer, and Christoph Scheidegger. 2010. “The impact of changing agricultural policies on jointly used rough pastures in the Bavarian Pre-Alps: An economic and ecological scenario approach” *Ecological Economics* 69 (12): 2435-2447.

Romero-Calcerrada, Raúl, and George L.W. Perry. 2004. “The role of land abandonment in landscape dynamics in SPA ‘Encinares del río Alberche y Cofio’, Central Spain, 1984-1999.” *Landscape Urban Planning* 66 (4):217-232.

Rose, John M., and Michiel C.J. Bliemer. 2009. “Constructing Efficient Stated Choice Experimental Designs.” *Transport Reviews* 29(5):587-617.

Scarpa, Riccardo, and Mara Thiene. 2005. “Destination choice models for rock climbing in the Northeastern Alps: a latent-class approach based on intensity of preference.” *Land Economics* 81(3):426-44.

Scarpa, Riccardo, Mara Thiene, and David A. Hensher. 2010. “Monitoring Choice Task Attribute Attendance in Nonmarket Valuation of Multiple Park Management Services: Does It Matter?” *Land economics* 86(4):817-839.

Scarpa, Riccardo, Sandra Notaro, Jordan Louviere, and Roberta Raffaelli. “Exploring scale effects of best/worst rank ordered choice data to estimate benefits of tourism in alpine grazing commons” *American Journal of Agricultural Economics* (Forthcoming)

Scarpa, Riccardo, Timothy J. Gilbride, Danny Campbell, David A. Hensher. 2009. “Modeling attribute non-attendence in choice experiments: does it matter?” *European Journal of Agricultural Economics* 36(2):151-174

Stevenson, Glenn G. 1991. *Common property economics: a general theory and land use applications*, Cambridge, UK: Cambridge University Press.

Street, Deborah J., and Leonie Burgess. 2007. *The Construction of Optimal Stated Choice Experiments: Theory and Method*s, New York: Wiley.

Swait, Joffre D., and Jordan J. Louviere. 1993. “The Role of the Scale Parameter in the Estimation and Use of Multinomial Logit Models.” *Journal of Marketing Research* 30:305-314.

Tasser, Erich, and Ulrike Tappeiner. 2002. “Impact of land use changes on mountain vegetation.” *Applied Vegetation Science* 5(2):173-184.

Tables and figures

Table 1. Attributes and Levels

Attribute	Some policy action	Variable Name	Abandonment
Access fee €	12, 8, 5, 2	*FEE*	0
Landscape	Very tidy, quite tidy	*ALPSCAPE*	Abandoned to natural succession
Biodiversity	High, Medium	*BIODIV*	Low, typical of natural succession
Historical-cultural function	Visitable “Malga”, Not accessible Malga	*HISTCOL*	Abandoned Malga
Milk processing	In “Malga”, At the valley	*DAIRYPR*	Absent

Table 2. Estimation Results[a]

Attributes	ranked ordered MNL			ranked ordered ANA			First best ANA			Second Best ANA			Residual ANA		
	$\hat{\beta}$	|z-val.|	$\hat{\pi}$	$\hat{\beta}$	|z-val.|	$\hat{\pi}$	$\hat{\beta}$	|z-val.|	$\hat{\pi}$	$\hat{\beta}$	|z-val.|	$\hat{\pi}$	$\hat{\beta}$	|z-val.|	$\hat{\pi}$
FEE	-0.123	8.70	0	-0.343	11.13	0.60	-0.478	10.25	0.60	-0.325	9.23	0.48	-0.438	8.11	0.55
ALPSCAPE	0.362	10.96	0	0.798	11.53	0.45	0.845	10.42	0.26	0.766	6.68	0.32	0.980	5.48	0.45
BIODIV	0.276	8.44	0	0.628	11.53	0.36	0.771	9.21	0.34	0.635	5.80	0.47	0.868	7.73	0.50
HISTCOL	0.329	8.39	0	0.657	10.79	0.28	0.916	13.91	0.20	1.036	8.87	0.62	0.936	7.08	0.48
DAIRYPR	0.371	10.52	0	0.850	10.39	0.44	1.383	6.32	0.58	0.941	4.74	0.47	0.575	5.71	0.25
ST-QUO	-4.311	13.07		-7.728	10.64		-5.229	7.57		-6.617	9.11		-7.447	5.61	
N.Param.		6			15			16			21			15	
ρ^2		0.3202			0.4640			0.4703			0.4196			0.5236	
Mean ln$L$		-0.21803			-0.1811			-0.22014			-0.21008			-0.1889	
Classes		1			10			11			16			10	
	Marginal WTPs for attributes														
	2.50%	$\hat{w}$	97.50%	2.50%	$\hat{w}$	97.50%	2.50%	$\hat{w}$	97.50%	2.50%	$\hat{w}$	97.50%	2.50%	$\hat{w}$	97.50%
ALPSCAPE	4.44	5.91	7.78	3.90	4.66	5.65	2.83	3.54	4.43	3.30	4.72	6.25	3.30	4.47	6.25
BIODIV	3.19	4.50	6.22	2.98	3.67	4.51	2.55	3.23	4.11	2.76	3.91	5.85	2.76	3.96	5.85
HISTCOL	3.71	5.37	7.65	3.17	3.84	4.70	3.01	3.83	4.96	4.52	6.39	8.49	4.52	4.27	8.49
DAIRYPR	4.39	6.05	8.28	4.02	4.96	6.17	4.00	5.79	7.79	2.55	5.80	9.20	2.55	2.62	9.20

[a] Estimates are obtained by maximizing the sum of the sample log-likelihood over the parameter space by using the expectation-maximization algorithm and the Newton-Raphson procedure after selecting the best convergence from a large number of random starting values to reduce the probability of local maxima

Table 3 Estimates of Multivariate Probit model of posterior ANA

Variable	Estimate	|z-val.|	Estimate	|z-val.|	Estimate	|z-val.|	Estimate	|z-val.|	Estimate	|z-val.|
	FEE		*ALPSCAPE*		*BIODIV*		*HISTCOL*		*DAIRYPR.*	
Constant	0.396	2.68	-0.220	1.39	-0.192	1.29	-0.784	3.95	0.505	3.34
LAG1	0.936	4.67	0.383	1.52	0.801	3.38	0.576	1.9	0.426	1.86
LAG2	---	---	0.814	2.12	---	---	---	---	---	---
2ND_BEST	-0.699	3.20	---	---	---	---	1.077	4.69	-0.591	2.46
RESIDUAL	---	---	---	---	---	---	0.292	0.87	-1.305	5.09
MAN	---	---	-0.262	1.71	-0.300	2.06	---	---	---	---
GUIDING	-0.834	4.94	-0.311	2.11	-0.222	1.46	-0.298	1.56	-0.853	5.02

Table 4. Estimated error correlations in multivariate probit

ANA Equations	*FEE*		*ALPSCAPE*		*BIODIV*		*HISTCOL*	
	Estimate	|z-val.|	Estimate	|z-val.|	Estimate	|z-val.|	Estimate	|z-val.|
ALPSCAPE	0	---	1	---				
BIODIV	-0.315	2.82	0.595	7.38	1	---		
HISTCOL	-0.383	3.14	0.275	2.14	0.454	4.08	1	---
DAIRYPR	0	---	0.365	3.15	0.291	2.42	0.492	4.96