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Summary

Practitioners of outdoor sports, such as rock-climbers, are likely to exhibit preference heterogeneity that depends on the ‘keenness’ with which such sports are practiced. Such an intuition is born out in at least one study using latent class discrete choice modelling (Provencher et al. 2002). Preference heterogeneity has a reflection on the population’s structure of recreational values assigned to rock-climbing destinations, to their attributes and ultimately to land management policies addressing such attributes.

In this study such hypothesis is tested on a panel of destination choices by a sample of rock-climbers members of the Veneto Chapter of the Italian Alpine Club. Preliminary estimates of latent-class (finite-mixing) specifications provided evidence that intensity of participation explained heterogeneity in taste. This motivated our splitting of the sample in a ‘high’ and a ‘low’ intensity of participation sub-samples, each of which is in turn analysed for the presence of endogenous preference classes using latent-class random utility based approaches. We find evidence in support of the hypothesis that there are at least four statistically well-defined classes in each sub-sample, thereby revealing a considerable richness in the structure of preference, which would otherwise be unobservable in more conventional approaches. From the model estimates, we first focus on the derivation of posterior individual specific welfare measures for some key destination attributes, and then for a welfare neutral land management policy. One emerging feature is the strong evidence of multi-modal distribution of values, a feature that is more difficult to capture when preference heterogeneity is modelled by other means. The results also show how the proposed policy is progressive in terms of benefit distribution in the sample, and that the distribution of individual welfare changes shows markedly different patterns between high and low demand sub-samples.

Keywords: Travel cost model, Preference heterogeneity, Non-market valuation, Random utility model, Latent class analysis, Rock-climbing, Destination choice modelling

JEL Classification: Q26, H41

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1. Introduction

Investigations of taste heterogeneity in destination choice models of recreation have shown the presence of substantial taste variation amongst natural resource users. The modelling of such taste distributions has relied on continuous distributions (Train 1998, Chen and Cosslett 1998, Breffle and Morey 2000) or finite ones (Provencher *et al.* 2002, Shonkwiler and Shaw 2003). While mixed logit affords an undoubtedly elegant approach to the representation of preference variation, it is not without shortcomings in terms of complexity of both, modelling choices and estimation. For example, it is often difficult to identify an empirically tractable distribution of taste adequate for treating “lumpy” preferences. Such preferences manifest themselves via multi-modal empirical distribution of taste intensities (see Hensher and Greene 2002 for a discussion of other shortcomings). However, some progress has been made towards the treatment of indifference using more flexible continuous forms, (e.g. in the work by Train and Sonnier 2003). The finite-mixture (or latent class) approach based on endogenous segmentation appears promising for its ease of estimation and for its intuitive interpretation and communication to policy makers. This approach endogenously assigns individuals to classes with identical preferences and estimates the probability of membership to each class along with their respective preference weights. The definition of the correct number of classes, however, is somewhat arbitrary as there are no exact statistical tests capable of discriminating across competing hypotheses.

Other applications of finite mixing/latent class models (LCM) in environmental economics include a number of papers in which authors report on the use of the technique on stated-preference data (Boxall and Adamovicz 2002, Scarpa *et al.* 2003, Scarpa *et al.* 2004).

In this paper we report on our use of the latent class approach to identify the number of classes with homogeneous preference in a large sample of destination choices by rock-climbers, and their relative probability of membership to each class. Rock climbing is a rapidly expanding outdoor activity and has been the focus of recent recreation demand studies in the U.S. and the U.K. (Shaw and Jakus 1996, Hanley *et al.* 2001, 2002, Grijalva *et al.* 2002a, 2002b, Hanley and Wright 2003). This is the first study, as far as we know, that uses finite mixing approaches to model discrete-choices of destination in mountain recreation. Because such an approach generates parameter estimates for the utility function of each latent class, we only present a selection of estimates, to avoid overwhelming the reader with too much information without a straightforward interpretation. We are careful, however, to describe the relevant details of our analytical approach. More details on the broad strategy behind the results presented here are available from the authors.

In this study we found posterior welfare measures of high policy interest, hence we focus on their derivation and on their distribution in the sample at hand. In particular, we have two objectives. First, to examine the richness of patterns of posterior marginal benefit distributions associated with each attribute in the destination choice models, and contrast such patterns across the two sub-samples with some common sense expectations. The second objective is to illustrate the consequences of preference heterogeneity in the distribution of benefits and costs associated with a policy aimed at changing the current availability of climbing routes as well as the quality of access to the single climbs by charging an access fee that counter-balances the beneficial effects in the sample. In particular, we focus on a policy that would be easily implemented by the local authorities in the Alps. The analysis illustrates how incorporating preference heterogeneity in the model allows clear identification of losers and winners in the sample. In our application it emerges that the policy is progressive, redistributing benefits from high income to low-income members of the sample. This also is a novel focus, since with few exceptions (e.g. Hutchinson *et al.* 2003), travel cost applications tend to ignore equity effects, and concentrate on efficiency issues.

The remainder of the paper is divided as follows. In the next section we briefly review the use of finite mixing random utility models in environmental economics. Section 3 describes the data and the behavioural rationale for taste heterogeneity underpinning and motivating this study. Section 4 addresses some econometric issues, while the results of the analysis are discussed in section 5. Section 6 concludes.

2 Finite-mixing in random utility models

2.1 Travel cost applications

Recent applications of finite-mixing include two travel cost studies of recreational site choice (Provencher *et al.* 2002 and Shonkwiler and Shaw 2003). Provencher *et al.* 2002 assumed class membership to be conditional on individual characteristics (age and experience) and captured the dynamic of choice by means of a serially correlated error structure across the sequence of one individual's choices. They concluded that there was some evidence of time dependence across choices and that finite-mixing (as they called it) is a convenient and intuitive alternative to mixed logit, especially in terms of computational cost. They found evidence for three separate preference groups, but they did not find evidence of a group of "seasoned veterans" that behave differently from others, which had been their expectation at the outset.

Shonkwiler and Shaw 2003, also assumed class membership to be conditional on individual characteristics, and emphasized how the two-group models they estimated displayed different marginal utility of income, which is otherwise more cumbersome to account for. They suggested that this could be an elegant, yet uncomplicated way to allow for non-linear preferences for money. This has implications in the valuation of attributes, which differ across groups. They also, like us in this paper, discussed the potential use of posterior probabilities, although they did not use them in the derivation of their welfare estimates.

2.2 Choice model applications

A number of recent stated-preference applications used LCMs. These, amongst others, include Boxall and Adamovicz (2002), who investigated using factor analysis to determine the motivational determinants of trips to wilderness, and built individual-specific factor loadings that were then used as determinants in the class membership equation. Their analysis supported the existence of four classes with homogeneous preferences and consequently a much richer interpretation than a conventional multinomial logit model.

Hensher and Greene (2003) used a dataset on choice of road types in New Zealand and systematically contrasted the merits of mixed logit with those of latent class modelling. Comparisons were carried out in terms of choice elasticities, distributions of predicted choice probabilities and changes in absolute choice shares. Based on their results they concluded that no unambiguous recommendation could be made as to the superiority of any of the two approaches, although they found strong statistical support for the LCM approach with three preference classes.

Scarpa *et al.* 2003, used LCM analysis as an accessory to a more conventional conditional heterogeneity multinomial logit analysis of the choice of piglet breeds, in an effort to value an indigenous pig breed in Yucatan on a sample of households. They found evidence for two distinct preference groups, using membership probability equations including various individual specific co-variates.

None of the stated or revealed preference studies above focussed on the derivation of individual welfare measures conditional on the observed pattern of choice. This, we feel, is a useful feature to expand upon in this study, because it further adds to the merits and additional insights that finite mixing can contribute to the treatment of taste heterogeneity.

3 Alpine rock climbing: the data and rationale for taste heterogeneity

3.1 The North-East Alps.

We investigate destination choices of one-day trips across eighteen mountain groups in the North-East Alps (Figure 1), which are quite diverse from both a morphological and rock-climbing perspective.

The destinations include the following:

1. Vette Feltrine, M. Sole,
2. P. Dolomiti Pasubio
3. Consiglio-Alpago
4. Altipiano Asiago
5. M.Grappa
6. Lessini-M.Baldo
7. Antelio
8. Pelmo
9. Tofane-Cristallo
10. Duranno-Cima Preti
11. Sorapiss
12. Agner-Pale San Lucano
13. Tamer-S.Sebastiano
14. Marmarole
15. Tre Cime-Cadini
16. Civetta-Moiazza
17. Pale di S.Martino
18. Marmolada

Within this list two broad geographically determined groups have been generally distinguished. Destinations 1-6 belong to the pre-Alps, which are mountains with gentler slopes and lower peaks separating the plane from the proper Alps. Because of their closeness to the main urban centres, and the presence of relatively difficult hiking routes – even though the length of the access paths is limited – the pre-Alps are the final destination of many local day trips.

Destinations 7-18 are in the North-East Alps, in the mountain chain of the Dolomites, which is an extended rocky area mostly made of dolomite rocks. This rare and distinguished rock type is geologically well-defined as it originates from coral reefs. Mountains made of this rock are scenically attractive, as they tend to show orange-pink reflections at sunset and under cloudy skies. These create those dramatic scenes for which the Dolomites are well-known the world over.

3.2 Sample and its characteristics.

Because a great fraction of the Italian rock-climbers belong to the CAI[1], and our interest was to characterize preferences of local users able to take day-trips, rather than longer holidays, the sampling frame was based on the list of members of the Veneto chapter of CAI. This type of membership is quite popular across regular mountain users, such as the like of rock-climbers,

[1] Some previous studies highlighted that about 25% of the day trips in the studied area were completed by CAI members.

as the Club provides a great deal of locally relevant services, such as training courses, activity maps, regularly updated guides, rescue services etc.

The data for the study was collected with a survey from a sample of 528 members who reported on their mountain visits for the year 1999. The total number of climbing day-trips the sample reported upon is 8,787. Figure 2 reports a histogram of trip distribution in the sample.

Data were collected using a questionnaire. Typically a group of respondents were handed the questionnaire during a debriefing session in which they were given an explanation of how to interpret several questions. Then, each member of the group would fill in the questionnaire on their own. Respondents were asked questions about their mountaineering abilities and experience, whether they attended mountaineering training courses; regularly trained in cliffs and indoor climbing walls; inception of their hiking activities in the Alps; other activities practised such as ski-mountaineering etc.

They were also asked the total number of day trips made in the last twelve months to each of the abovementioned 18 sites. Finally, they provided socio-economic information about the state of their households. Round-trip distances from place of residence to each of the destinations in the choice set were calculated using the software package "Strade d'Italia e d'Europa". This data were used to estimate the individual travel cost for each trip. Because of the high potential for recall errors, the notion of asking the sequence of choices was foregone.

Distance costs were converted into monetary values in euros (€). Each reported visit was a "one day trip", as customary for this form of local outdoor recreation. Usually in Italy, there is no cost attributed to travel time, mainly because the opportunity to produce extra-income during spare time is very limited. So, the opportunity cost of time is assumed to be zero. This may well be one of the main limitations of this study, which can be improved upon by using a framework similar to that developed by Shaw (1992), or by Feather and Shaw (1999).

The definition of a complete set of substitute destinations for this kind of recreation is a thorny issue to resolve. However, in this instance, because of the proximity of these sites to the place of residence of the interviewed sample, as well as the relatively similar nature of the climbs available at each site, we believe it is safe to assume that all the 18 destinations are substitutes. Although this choice set is certainly not exhaustive, experts estimate that less than five percent of climbing trips are taken to other non-listed destinations.

Only 13.41 percent of the respondents are women, the sample average of age is 37.63 (st. dev. 14), and that of years of experience in climbing is 10 (st. dev. 9.8). Most of respondents ended education at the high-school level (56%) and almost 13% graduated from university programs. The average income is in excess of 22,500 €. The average family size is 3.1 people.

3.3 Attributes of destinations.

The attributes included in the estimation were mostly coded according to expert knowledge of the climbing features offered by the above destinations. These included:

1. Severity of the mountain environment

This index represents the degree of severity of the alpine environment on the climbs of the mountain group. It ranges from 1 to 3.

2. Difficulty of the climbing routes (df_climbs)

This is an index ranging from 1 to 4 and related to the technical difficulty of the climbs. By and large each destination offers the opportunity to climb at various degrees of difficulty. This index reflects the prevalence of a particular degree over another.

3. Number of equipped alpine shelters (shelters)

This is the number of alpine shelters available at each destination. Alpine shelters are equipped to protect ramblers from the sudden changes in weather that are often experienced in the Alps and to allow them to sleep overnight. They are also used as landmarks and reference points for rescue teams. The number of shelters varies from a minimum of 2 shelters (Site 10) and a maximum of 26 (Site 18).

4. Presence of climbing routes (P_climbs)

This is an index ranging from 1 to 5 and reflective of the relative density of viable climbing routes accessible at each destination.

5. Quality of access to the climbing site (access)

This attempts to capture not only the time between parking places and the climbs at a given mountain group, but also the difficulty in terms of the terrain over which climbers need to walk before reaching the climbs. The index ranges from 1 (poorly accessible) to 3 (very accessible), with 2 as intermediate.

Finally, estimated round trip travel cost (cost) from place of residence to destination was also included in the indirect utility function.

3.4 Rationale for taste heterogeneity.

After a preliminary data analysis it was decided that the econometric analysis would be focussed on two sub-samples, one with high demand intensity (D-high) and another with low demand intensity (D-low). It is hence worthwhile developing some rationale for the expected differences in taste amongst these groups and within them, at least for some features. Independent of the intensity of demand, two broad categories of climbers can be identified:

1) traditional alpine climbers
2) and free-climbers.

The first broad group of climbers tend to go climbing in classic routes and quite often at the end of a tracking trip, which is an integral part of the alpine “experience”. Such climbs are relatively more difficult from the technical perspective with few fixed bolts, in relatively unmarked climbs, and require good experience and intuition to guess the best way up. Independent of the destination of choice, traditional alpine climbers also tend to choose longer climbs, which exposes them for longer periods to potential weather changes and overall represent higher risk ventures.

The second broad group includes climbers more inclined to develop a different category of techniques. Free-climbers have a lower risk aversion and tend to choose much better marked and shorter climbs. These are in some respect analogous to outdoor climbing gyms. This group tends to shun high severity climbs.

In both groups there are various degrees of experience, ranging from beginners to veterans, as well as different degrees of keenness and hence intensity of demand.

From discussion in focus groups and with experts some further relevant remarks were collected. Keen rock-climbers are more frequently found in D-high, but within this group co-exist at least two distinct attitudes to climbing. Many high demand climbers, such as free climbers, may just want to reach a given climb and engage in climbing. To them this activity is similar to going to the gym or the swimming pool: they want to reach the chosen destination, perform the climb, to enjoy it and then return. For lack of a better term, we call this group *focussed* D-high, because they focus on the climbing experience alone, with relative disregard of other alpine activities.

However, it is well-known that other keen climbers see climbing quite differently. Some, perhaps a minority, regard it as an integral part of an old-fashioned trip to the Alps, which inevitably includes a long stroll to get away from the crowds, to submerge oneself in the beauty of the alpine experience and to enjoy the solitude that this affords. We refer to this group as *alpine* D-high.

The members of the D-low group are more difficult to separate a-priori into distinct sub-groups. The consensus seems to be that all the above-mentioned forms of behaviour co-exist in this group, but in a less polarised fashion, and accompanied by many others, so as to altogether form a more heterogeneous group of "less-keen" climbers.

3.5 Attributes of climbing destinations.

In what follows we outline the attributes of the destinations employed in the LCM as determinant of choice.

Severity of the environment and difficulty of climbs.

Generally speaking, in both D-high and D-low groups these attributes should be perceived as undesirable, although it is expected that in the former group there should be more variation in taste for both attributes. Such variation would accommodate the adjustment to severity brought about by the frequent practice distinguishing this group, as well as the keenness to increasingly – or occasionally – challenge oneself with unusually difficult climbs. This is expected from specialised demand by members of the *focused* D-high group, such as keen free-climbers or extreme alpine climbers. D-low free-climbers, however, include climbers with a large variation of skills, some of whom will shun high difficulty climbs, and others who actively seek them. This makes the development of a clear-cut expectation on taste controversial, and reduces it to a matter of empirical investigation.

Numbers of alpine shelters.

Alpine shelters are important protection points and should generally be regarded as a non-negative attribute in the indirect utility from the choice of destination for climbing trips by all climbers, regardless of the activity they wish to undertake in the mountains. They are quite valuable to traditional alpine climbers, who often need a good day's walk to get closer to classic climbing routes, and hence sleep in shelters overnight. However, for free-climbers in both the D-high and the D-low groups the presence of shelters is totally irrelevant, or even not appealing to those who want to escape crowds, as the presence of shelters inevitably attracts other alpine visitors apart from climbers.

Ease of access and number of climbs.

These attributes are likely to be perceived differently by both sub-samples, but also by their subgroups for a variety of reasons. Both D-high and D-low climbers may have good reasons to find the number of climbs at a destination either desirable or undesirable. To free-climbers ease of access, as well as the number of climbs accessible from a given destination are valuable features. However, alpine climbers may choose more frequently sites with difficult access to the climbs to get away from congestion. To this type of climbers the experience of getting to the pinnacle of the climb is as enjoyable as the walk to the base of it, and ease of access may be perceived as a "bad" because of its association with potential congestion.

A benefit-neutral policy for the sample.

The Italian Alps have a long history of management, which results in a very high level of local knowledge and traditional use of the land for recreation. Traditionally, the troops recruitment of the Italian Alpine Corp was based on the national draft and conscripts during the draft period had to maintain many of the Alpine tracking routes and pathways. Other local organisations, such as CAI, have been also in charge of maintenance of climbing routes for example. With the recent abolition of the national military service it is envisaged that the cost and logistics of maintenance will be shifted to local authorities that in turn, will need extra revenue for the up-keep. For such a reason it is of interest to obtain estimates of welfare change from recreationists of all types, including climbers. In this study we focus on increasing the number of climbing routes in those few destinations with very low current supply (P_climbs = 1). We also focus on increasing the ease of access to climbing routes, so as to bring all sites to an index value of 3 for this attribute.

Both actions are a realistic target for local authorities. The first policy component will provide more local supply of routes, thereby diversifying the attraction of each destination; the second policy component will make it easier to reach currently less accessible climbing locations by providing closer parking sites and better mountain tracks.

4 Econometric issues

The derivation of the latent class logit model is based on a membership probability equation, and on a alternative choice probability equation, both of which turn out to have a convenient logit formulation when two independent Gumbel-distributed error components are used.

The membership equation explains the probabilistic assignment into a number of *C* classes, where *C* is exogenously defined and outside the space of estimable parameters. Given membership to class *c*, the choice probability equation explaining the mechanics of probabilistic choice across alternatives in each choice occasion is based on a conventional random utility framework of the multinomial logit:

$$\Pr(i \mid c) = \frac{\exp(v_i)}{\sum_{j \in J} \exp(v_j)} = \frac{\exp(\mathbf{x}_i \boldsymbol{\beta})}{\sum_{j \in J} \exp(\mathbf{x}_j \boldsymbol{\beta})}$$

where the scale parameter of the Gumbel error distribution is normalised and omitted.

In the results we choose to present here, we have adopted the approach documented in Hensher and Greene (2003), which is conveniently applicable using Nlogit version 3.

Briefly, the specification we present does not include any socio-economic covariate as a determinant of the membership probability specification. Indeed, the whole range of socio-economic covariates available was used and none was found of them to be significant at the conventional values for the membership equation. The only variable that did play a statistically significant role was the number of trips taken, which also had a quadratic effect. So, for the *C* membership probabilities a semi-parametric logit format is assumed:

$$\Pr(n \in c) = \begin{cases} Q_c = \dfrac{\exp(\alpha_c)}{1 + \sum_{c=2}^{C} \exp(\alpha_c)}, \forall c \neq 1 \\ Q_1 = \dfrac{1}{1 + \sum_{c=2}^{C} \exp(\alpha_c)}, c = 1. \end{cases}$$

This suggested another avenue of investigation. Since the number of rock-climbing trips taken was detected as a significant determinant in membership probabilities, we stratified the sample into two sub-samples with an equivalent number of choices on the basis of the number of trips taken. As threshold value for the definition of the two sub-samples we used 20 trips per year. At this threshold the significance of “trips taken” disappeared as a determinant of class membership in each sub-sample. The low demand intensity group (D-low) contains

379 rock climbers with a total of 4,124 rock-climbing trips in 1999 (sub-sample average 13.11, st. dev. 4.49). The high demand intensity group (D-high) includes 149 rock-climbers with a total of 4,663 rock-climbing trips in 1999 (sub-sample average 33.21, st. dev. 8.07). In all other measurable socio-economic characteristics the two groups are very similar. The D-high have an average of only 2 years more experience in rock-climbing, 11.13 percent of whom are women, versus 16 percent of the D-low group.

We therefore proceeded by estimating a series of models in each sub-sample, focussing on a set of destination attributes that we assessed to be of relevance to this type of mountain recreation.

4.1 Number of groups with different preferences

The number of groups with different preferences is not part of the maximization process from which the parameter estimates are derived. In other words it is outside the space of the estimable parameters. The conventional specification tests used for maximum likelihood estimates (likelihood ratio, Lagrange multipliers and Wald tests) are not valid in this context because they do not satisfy the regularity conditions for a limiting chi-square distribution under the null. This because the parameter values under the null are at the boundary of the parameter space.

Resampling from the empirical distribution is feasible but very impractical because of the computational complexity it involves (p. 91 Wedel and Kamakura 2000). As a guidance some authors have used a variety of information criteria $C = -2\ln L + J\kappa$ where $\ln L$ is the log-likelihood of the model at convergence, J is the number of estimated parameters in the model, and κ is a penalty constant.

For $\kappa = 2$ we obtain the Akaike Information Criteria (AIC); for $\kappa = \ln(N+1)$ we obtain the *consistent* AIC (cnAIC); for $\kappa = \ln(N)$ we obtain the Bayesian Information Criteria (BIC), which by construction is very similar to the cnAIC. Finally, for $\kappa = 2+2(J+1)(J+2)/(N-J-2)$ we have the *corrected* AIC (crAIC) (Hurvich and Tsai 1989), which increases the penalty for the number of extra parameters estimated.

However, these criteria also fail some of the regularity conditions under the null for a valid test under the null (Leroux, 1992). The AIC is reported to over-estimate the number of groups, while the BIC does not do this, asymptotically, although in small sample sizes it tends to favour too few groups (McLachlan and Peel 2000).

Furthermore, as the number of classes increases the significance of parameter estimates in the utility function gradually decreases, especially in classes with low probability of membership. Therefore the chosen number of classes must also account for significance of parameter estimates and be tempered by the analyst's own judgment on the meaningfulness of the parameter signs.

4.2 Derivation of posterior estimates from LCM models

Consider a population with C preference classes and a sequence of T observed choices per individual n over J destination alternatives. Given a sequence of choices by the same individual and conditional on belonging to a given preference group or class c, say for example class A, the joint logit probability of a sequence of destination choices $T(n)$ is:

1)
$$P_{T(n)} \mid A = \prod_{t(n)=1}^{T(n)} \frac{\exp(\mathbf{x}_{t(n)}\boldsymbol{\beta}_A)}{\sum_{j=1}^{18}\exp(\mathbf{x}_j\boldsymbol{\beta}_A)}$$

With the individual probability of membership to a group c defined as Q_c one can derive the unconditional probability of the sequence of destination choices $T(n)$ for the individual n by taking the expectation over all the c classes:

2) $$\Pr(T(n)) = \sum_{c=1}^{C} Q_c P_{T(n)} \mid A = \sum_{c=1}^{C} Q_c \prod_{t(n)=1}^{T(n)} \frac{\exp(\mathbf{x}_{t(n)}\boldsymbol{\beta}_c)}{\sum_{j=1}^{18}\exp(\mathbf{x}_j\boldsymbol{\beta}_c)},$$

where in this study the C = 2, 3, 4 and 5.

A posterior estimate of the individual-specific class probability can be obtained given the observed sequence of $T(n)$ choices and using Bayes' formula:

3) $$Q_c^* = \Pr(n \in c) \mid y_{T(n)},\ \mathbf{x}_{T(n)} = \frac{Q_c \prod_{t(n)=1}^{T(n)} \Pr_{jtm} \mid c}{\sum_{c=1}^{C} Q_c \prod_{t(n)=1}^{T(n)} \Pr_{jtm} \mid c} = \frac{Q_c \prod_{t(n)=1}^{T(n)} \frac{\exp(\mathbf{x}_{t(n)}\boldsymbol{\beta}_c)}{\sum_{j=1}^{18}\exp(\mathbf{x}_j\boldsymbol{\beta}_c)}}{\sum_{c=1}^{C} Q_c \prod_{t(n)=1}^{T(n)} \frac{\exp(\mathbf{x}_{t(n)}\boldsymbol{\beta}_c)}{\sum_{j=1}^{18}\exp(\mathbf{x}_j\boldsymbol{\beta}_c)}},$$

where $y_{T(n)}$ and $\mathbf{x}_{T(n)}$ are, respectively, the observed choices and the attributes of the chosen climbing destinations.

Given this set of individual-specific probabilities of membership in each preference-group c, one can derive individual-specific posterior estimates of the marginal *WTP* for attribute k (Haab and McConnell 2000) as:

4) $$\widehat{WTP}_n = \sum_{c=1}^{C} Q_{nc}^* \left(-\tfrac{\beta_k}{\beta_€}\right)_c,$$

where $\beta_€$ is the marginal utility of money, as measured by the travel cost parameter estimate.

Similarly, posterior estimates of welfare changes from policies aimed at improving some of the destination attributes from the status-quo $\mathbf{x}^0$ to some ex-post $\mathbf{x}^1$ condition can be derived as:

5) $$\widehat{CS}_n = \sum_{c=1}^{C} Q_{nc}^* \frac{1}{\beta_{c€}} \left\{ \ln\left[\sum_{j=1}^{18}\exp(\boldsymbol{\beta}_c{}'\mathbf{x}^1)\right] - \ln\left[\sum_{j=1}^{18}\exp(\boldsymbol{\beta}_c{}'\mathbf{x}^0)\right] \right\}$$

In our case we find it of interest to focus on the sample distribution of welfare changes for what we define a "sample-sustained" policy. This is a policy which brings about some changes in terms of destination attributes, but also paid for by an access fee for climbing h^* such that the following condition is satisfied:

6) $$\sum_{n=1}^{N} \widehat{CS}_n = 0$$

This value is found by employing a root-searching algorithm over the space of h, and it represents the "optimal" entrance fee, in the sense that at the sample level benefits are perfectly balanced by costs. A kernel plot of this distribution of estimates is then readily interpretable as a means to identify winners and losers in the policy in question, because it is centred on zero.

4.3 Reporting and explaining posterior welfare estimates for the sample

We illustrate the differences across the sample distribution of welfare estimates by means of kernel plots. The kernel smoothing techniques are often used for this purpose and provide a means to visually compare distributions. We use a normal kernel with optimal bandwidth using the SM routine in the free-source statistical software R, which is documented in Bowman and Azzalini (1997).

Further, we use simple OLS regressions to explore how the posterior welfare estimates obtained are related to socio-economic covariates. Note that the same covariates were used as determinants of probability of group memberships in the preliminary analysis and failed to show significance. We expected to find some effects that validate the approach, at least in terms of some important determinant of value, such as income, and years of experience as climbers.

5 Results and discussion

The values for selected information criteria of different preference-groups are reported in Table 1 and are consistent with the hypothesis that there are at least 4 classes with satisfactory parameter estimates, in both statistical and theoretical terms. The model with 5 classes is statistically preferred according to the various information criteria in either sub-group, but the pattern of estimates it produces is difficult to interpret in the high demand sub-sample, along with many statistically insignificant estimates in the low demand sub-samples. We hence decide to present and discuss the models with 4 classes, which we call *HA, HB, HC* and *HD* in the high demand sub-sample, and *LA*, *LB*, *LC* and *LD* in the low demand sub-sample. Such estimates are presented in Tables 2 and 3. Notice that because only difference matters in RUMs, to ease comparisons across groups preferences we report the marginal rates of substitution (part-worths) with respect to travel cost in squared brackets below the asymptotic *z*-value of each parameter estimates.

$$MRS(k, Cost) = \gamma = -\frac{\beta_k}{\beta_{€}},$$

in some cases this is also a measure of WTP for a unit change in the attribute (Haab and McConnell, 2002; page 223).

Further, to ease comparison across the utility estimates of sub-samples we define two measures of immediate interpretability:

1) The weighted average of the MRS:

$$\gamma_w = \sum_{c=1}^{4} \gamma_c Q_c$$

We propose to interpret this measure as a central tendency measure for the intensity of preferences in the sub-sample for the given site attribute.

2) And a measure of absolute diversity across *MRS* values of groups:

$$\Omega = \sum_{c=1}^{4} |\gamma_c - \gamma_w|$$

We propose to interpret this measure as one of dispersion of the intensity of preferences in the sub-sample for the given site attribute.

5.1 Preference classes for D-high

As discussed above, we expected the D-high sub-sample (keen climbers) to show a structure of preference markedly different from that observed in the D-low one. These are hardened climbers, real enthusiasts, who dedicate much of their leisure time to climbing and related activities. The estimates for this sub-sample are reported in Table 2.

The proportions across the four preference classes are fairly balanced. The two largest are *HA* and *HB* with each representing about 30%, followed by a quarter of the sample in *HC* and the remainder (15.7%) in *HD*.

All classes dislike sites with high indices for the severity of the environment, although they show quite a range of intensities of taste (between –0.04 and –0.57), with a weighted value for the part-worth of –0.317.

With the exception of *HC*, whose members mildly dislike it, all classes are quite uniformly attracted to challenging destinations.

Two classes (*HB* and *HD*) find the presence of equipped shelters similarly attractive, while a third (*HD*) is nearly indifferent to it and members of *HA* show mild dislike. Free-climbers do not make a great use of these sheds, which are mainly there for ramblers and trekkers. It is not surprising that – especially in the high demand sub-sample – these play a little role in the utility function, with a weighted average of part-worth of only 0.008.

The preference intensity for the number of climbing routes varies a great deal across classes, with the lowest probability class showing lack of significance for this attribute. It would seem that some types of keen climbers want more choice than others, when it comes down to routes.

Finally, access is quite important to all classes, again with the exception of the smallest class *HD*. Incidentally, this is the same class in which we find indifference for the number of climbs and for the severity of the climbing environment, along with high values for alpine shelters. We speculate that this small class (only 16%) is perhaps representative of the old-fashioned, hard-way alpine climbers, for whom a relatively challenging climb is often seen as the prize at the end of an arduous walk, during which shelters are welcome, in case the weather takes a bad turn, or simply as a convenient logistic for an overnight stay.

The other classes are more difficult to identify with a given stereotype, although perhaps they tend to conform more with the “free-climbing” type, yet they clearly show marked differences in preference intensity for site attributes and marginal utility of income.

5.2 Preference classes for the D-low sub-sample

The estimates for this sub-sample are reported in Table 3. We do not have clear expectations for the structure of preferences, except that we think they should be quite different across classes, and on average, also from the weighted values of the high-demand sub-sample. Members of the low-demand sub-sample are not necessarily novices to climbing, but they certainly are much less committed and perhaps more diverse in the way they choose destinations, which should reflect in the trade-off of attributes.

All classes seem to have a low appreciation for the number of shelters, with a weighted *MRS* of 0.005 and a dispersion factor of only 0.05. No class enjoys severe environment, but the range of intensities varies from a –0.22 to 1.46, by a factor of nearly seven. Preferences for all other attributes are quite varied too. On average, numbers of shelters and ease of access matter less than in the D-high sub-sample, while aversion to severe environment is stronger and the presence of climbs matters more. Notice that with regards to the difficulty of climbs the D-low results show a higher averaged part-worth value than the D-high, albeit with a higher dispersion parameter. This is consistent with the hypothesis that higher demand does not necessarily imply greater climbing expertise and/or proficiency.

The shares of the four preference classes of this sub-sample are not as balanced as in the high-demand one. The largest group is *LA* with a membership probability of 37%, followed by *LB* with a quarter of the sample, about 23% is in *LC*, and 15% in *LD*. The latter is the class showing highest aversion to severity of the environment and indifference to the difficulty of climbs. This is the only class showing aversion to the number of shelters, along with the highest appreciation for both the number of climbs and ease of access to climbing sites. We speculate that such a distinctive combination of taste intensities sets this class apart as a group of climbers who like climbing as a separate activity from the enjoyment of the alpine environment. Members of this class seem to travel to a site and delve into climbing, and prefer to do this efficiently, possibly in sites with many alternative climbing routes and with unchallenging alpine environment.

Members of class *LB* seem to enjoy more than any other class the challenge of difficult climbs, but they quite strongly dislike severe environments, and – similarly to members in class *LA*, the largest class – are indifferent to ease of access and number of shelters, while they find the number of climbs in the destination site quite attractive. In contrast, class *LA* object least to the severity of environment and show indifference to the difficulty of the climbs.

Finally, in class *LC* members seem to mildly object to severity and feel quite attracted to the difficulty of the climbs, but are virtually indifferent to other site attributes.

5.3 Posterior distribution of marginal welfare changes

Figures 3 to 7 report the kernel plots of these distributions of values, contrasting the D-high and the D-low results. It is apparent from the plots in Figure 3 that there is substantial sample heterogeneity in the distribution of values for the severity of climbing environment. D-low climbers (continuous line) have a much greater concentration of values around €2, with other modal values with much lower densities at €1 and €3.40, revealing a quite homogeneous set of values. On the other hand, D-high climbers (dashed line) have a much wider spread of values, with the highest modal values around €3, followed by a slightly lower mode around €1.80 and another much lower density mode proximate to zero. Such a distribution is consistent with the presence of many free-climbers who typically avoid climbs in severe alpine environments.

A similar contrast is found when comparing the distribution plots in Figure 4, pertaining to the difficulty of the climb. The D-low sub-sample has a much homogeneous distribution of values centred on €1, with another low-density mode around €3. More heterogeneity is found in the D-high sub-sample and with better separated clusters, the smaller of which shows a small negative value, indicating that a sizeable component of climbers in this sub-sample do not like sites with challenging climbs. Perhaps these are climbers with low technical skills, such as beginners.

The distribution of values that best shows the difference in patterns between the two sub-samples is perhaps the one concerning the presence of Alpine shelters (Figure 5) and the ease of access to climbs (Figure 7). While both samples includes groups who both like and dislike shelters and ease of access, the D-high group shows a strongly bi-modal distribution, which is consistent with the co-existence of two separate sets of preferences within this sub-sample: traditional alpine climbers and free-climbers.

The number of climbs available at the destination site has a similar value distribution in both sub-samples, as evident from Figure 6.

5.4 Posterior distribution of discrete welfare changes from a local policy

The policy described in section 3.4 involves the raising of attributes valuable to climbers in sites with low values for number of climbs and ease of access. It is therefore to be expected that the overall distribution of values in the two sub-samples is reflective of the patterns in the individual distributions of each attribute (Figure 6 and 7). This is confirmed in Figure 8, where we note that the degree of heterogeneity of preferences in the D-high sub-sample is still quite strong.

In order for the total sample benefits to be zero, the per day-trip access fee h^* was found to be equal to €2.44 in sub-sample D-low and a significantly higher €2.83 in sub-sample D-high. Despite the relative homogeneity of values in D-low, marked multi-modality is a common feature of the two distributions. Furthermore, the plot in Figure 8 highlights how the distribution of losses and benefits differs across sub-samples. Welfare changes span a restricted range in D-low, while for D-high losses seem substantial and clustered around €3, while benefits are more spread out, with a modal value of less than €1.

In table 4 we present the results of a regression of the estimated posterior values for this policy on a selection of socio-economic covariates, so as to check the theoretical validity of the obtained estimates. As can be seen, the dummy variable for low demand is not significant, while the welfare estimates respond negatively and significantly to an increase in the log of income, and to the number of years of experience in climbing, which also show a significant quadratic effect. No significant effect is found for years of experience of outdoor activities in the Alps. We take these results to be consistent with the hypothesis that the proposed policy would be progressive in this sample, providing more benefits to lower income groups; and that experienced climbers would get higher benefits than inexperienced ones, with a decreasing rate (the net effect is positive up to 44 years of experience).

6 Conclusions

In this paper we reported selected results from an extensive data analysis aimed at capturing and rationalising heterogeneity of taste and its consequences in a destination choice model for climbers in the North-East Alps. We used random utility models based on latent class (finite mixing) modelling, a less restrictive preference structure than the one implied by the use of mixed logit models.

We failed to associate class membership with measurable socio-economic co-variates. Only the number of visits (demand intensity) was found to play a statistically significant role in explaining membership to preference classes. Hence, an arbitrary threshold of 20 trips per year was used to separate the large sample into low- and high demand-intensity sub-samples. Each of these was then used to estimate latent class models where as determinants of site selection we used site attributes relevant for climbers. In each sub-sample we found evidence of 4 classes of statistically well-defined preferences. The signs of the taste parameters made coherent sense within each class, and altogether quite an amount of taste variation was found. Such heterogeneity implied a complex and rich pattern of information in terms of distributions of the posterior individual welfare estimates for climbing attributes of alpine destinations, as well as for policy evaluation.

Some findings are relevant for the wider literature on travel cost models with preference heterogeneity. Firstly, we found evidence that preference heterogeneity takes up substantially different forms between high and low demand users.

Secondly, by focussing on the posterior distribution of welfare measures we found evidence of multi-modality consistent with a-priory expectations. For example, the parameter estimates in the preference classes seem to be consistent with those expected of free-climbers and more traditional alpine climbers. Multi-modal taste distributions are not easily captured by conventional logit models and latent class specifications are instead instrumental to highlight these features.

Thirdly, by focussing on the effects of a policy with neutral welfare change at the sample level we identified winners and losers in the sample and highlighted how the proposed policy package is progressive, with few losers with relatively high welfare losses per choice occasion and many winners, with relatively low losses. Our proposed approach focused on the distributional consequences, rather than simply on efficiency outcomes. When equity matters to policy makers – like in the local authorities managing the North-East Alps – an approach capable of identifying regressive policy outcomes might be deemed superior to one that only dwells on the potential compensation criterion.

Finally, in direct contrast with other approaches accommodating heterogeneous preferences, such as mixed logit, latent class modelling (LCM) does not require any distributional assumptions about the mixing variable: in a sense LCMs 'let the data speak', thereby providing more robust insights into the data by identifying groups of customers who have high or low preferences for particular 'bundled goods'; and the share of climbers each class represents. Availability of such segmented information is potentially very useful to natural resource managers with high use value for a wide range of purposes.

7 References

Bowman, A.W. and Azzalini, A. 1997. *Applied Smoothing Techniques for Data Analysis: the Kernel Approach with S-Plus Illustrations.* Oxford University Press, Oxford.

Boxall, P.C., Adamowicz V. L. 2002. Understanding Heterogeneous Preferences in Random Utility Models: The Use of Latent Class Analysis, *Environmental and Resource Economics*, 23(4), 421-446.

Breffle, W. and E.R. Morey. 2000. Investigating preference heterogeneity in a repeated discrete choice recreation demand model of Atlantic salmon fishing. *Marine Resource Economics*, 15(spring 2000):1-20.

Chen, H.Z., and S.R. Cosslett. 1998. Environmental quality preference and benefit estimation in multinomial probit models: a simulation approach. *American Journal of Agricultural Economics*, 80(August):512-20

Feather, P., and Shaw, D. 1999. Estimating the cost of leisure time for recreation demand models. *Journal of Environmental Economics and Management,* 38:49-65.

Grijalva, T.C., Berrens R.P., Bohara A.K., and Shaw W.D. 2002a. Testing the validity of contingent behaviour trip responses, *American Journal of Agricultural Economics,* 84:401-414.

Grijalva, T. C. Robert P. Berrens, Alok K. Bohara, Paul M. Jakus; W. Douglass Shaw. 2002b. Valuing the Loss of Rock Climbing Access in Wilderness Areas: A National-Level, Random-Utility Model. *Land Economics*, 78(1):103-120

Haab, T.C. and McConnell, K. E. 2002. *Valuing environmental and natural resources*, Edward Elgar Publisher.

Hanley, N. and Wright R. 2003. Valuing recreational resources using choice experiments: mountaineering in Scotland, Chapter 4 in *The New Economics of Outdoor Recreation.* Edited by N. Hanley, D. Shaw and R. Wright. Pages 59-73. Edward Elgar publisher.

Hanley, N. Koop, G. Wright R. and Alvarez-Farizo B. 2001. Go climb a mountain: an application of recreation demand models to rock-climbing in Scotland, *Journal of Agricultural Economics*, 52(1):36-51.

Hanley, N., Alvarez-Farizo B. and Shaw, D. W. 2002. Using economic instruments to manage access to rock-climbing sites in the Scottish Highlands, *Land Use Policy*, 19:167-76.

Hensher, D. and Greene W. 2003. A Latent Class Model for Discrete Choice Analysis: Contrasts with Mixed Logit, *Transportation Research* Part B 37, 681−698.

Hurvich, M., and Tsai, C. 1989. Regression and time series model selection in small samples. *Biometrika*, 76 (2):297-307.

Leroux, B.G. 1992. 'Consistent estimation of mixing distribution', *Annal of Statistics*, 20, 1350-1360.

McLachlan, G. and Peel D. 2000. *Finite mixture models*, New York, Jon Wiley and Sons.

Provencher, B., Barenklau, K. Bishop R. C. 2002. A finite mixture logit model of recreational angling with serially correlated random utility, *American Journal of Agricultural Economics*, November 2002, 1066-1075.

Scarpa, R., A. Drucker, S. Anderson, N. Ferraes-Ehuan, V. Gomez, C. R. Risopatron and Rubio-Leonel O. 2003. Valuing Animal Genetic Resources in Peasant Economies: The Case of the Box Keken Creole Pig in Yucatan. *Ecological Economics*, 45(3), 427-443.

Scarpa, R., K.G. Willis, and Acutt M. 2004. Individual-specific welfare measures for public goods: a latent class approach to residential customers of Yorkshire Water. Chapter 14 in: *Econometrics Informing Natural Resource Management*, by Phoebe Koundouri, Edward Elgar Publisher

Shaw, D. W. 1992. Searching for the opportunity cost of an individual's time, *Land Economics*, 68:107-15.

Shaw, D. W., and P. Jakus. 1996. Travel cost models of the demand for rock climbing, Agricultural and Resource Economics Review, October, 25(2)133-142.

Shonkwiler, J. S. and Shaw W. D. 2003. A finite mixture approach to analyzing income effects in random utility models: reservoir recreation along the Columbia River, Chapter 13 in *The New Economics of Outdoor Recreation*. Edited by N. Hanley, D. Shaw and R. Wright. Pages 242-268. Edward Elgar publisher.

Train, K. 2003. *Discrete Choice Methods with Simulation*, Cambridge University Press.

Train, K. 1998. Recreation demand models with taste differences over people, *Land Economics*, 74(2):230-39.

Train, K. and Sonnier G. 2003. *Mixed logit with bounded distribution of part-worths*. Working Paper, Department of Economics, University of California, Berkeley. Forthcoming in *Applications of simulation methods in Environmental and Resource Economics*, Springer, A. Alberini and R. Scarpa editors.

8 Tables

Low demand intensity			N = 379		
LCM groups	Log-lik.	Parameters	AIC	cnAIC	crAIC
1	-10719	6	21450	21474	21450
2	-10477	14	20982	21037	20983
3	-10341	21	20724	20807	20727
4	-10287	28	20630	20740	20635
5	-10252	35	20574	20712	20582

High demand intensity			N = 149		
LCM groups	Log-lik.	Parameters	AIC	cnAIC	crAIC
1	-11194	6	22400	22418	22401
2	-10699	14	21426	21468	21430
3	-10522	21	21086	21149	21094
4	-10443	28	20942	21026	20957
5	-10365	35	20800	20905	20824

Table 1. Tests for group numbers in latent class models

Table 2. Model estimates for high demand intensity sample

N= 149 choices= 4,663	4-classes high demand intensity lnL = -10,433, Adj.R^2=0.224					
	$\hat{\beta}_{LA}$	$\hat{\beta}_{LB}$	$\hat{\beta}_{LC}$	$\hat{\beta}_{LD}$	$\hat{\gamma}_{w}$	$\hat{\Omega}$
Cost	-2.157 (-33.61)	-1.958 (-62.75)	-0.616 (-20.58)	-2.131 (-37.39)		
Severity	-1.226 (-15.22) [-0.57]	-0.698 (-9.55) [-0.32]	-0.402 (-6.62) [-0.19]	-0.085 (-1.09) [-0.04]	-0.317	0.666
Df_Climbs	0.951 (10.24) [0.44]	0.292 (5.06) [0.13]	-0.100 (-2.37) [-0.05]	0.771 (7.56) [0.36]	0.215	0.709
Shelters	-0.015 (-2.97) [-0.007]	0.042 (14.46) [0.02]	0.00086 (0.75) [4e-4]	0.059 (18.98) [0.03]	0.008	0.053
P_ Climbs	0.728 (14.50) [0.34]	0.170 (7.31) [0.08]	0.519 (21.09) [0.24]	-0.060 (-1.51) [-0.03]	0.179	0.527
Access	0.490 (-9.01) [0.23]	0.561 (16.39) [0.26]	0.207 (6.53) [0.10]	-0.700 (-13.54) [-0.32]	0.117	0.716
Group Probability	0.297 (7.53)	0.294 (7.49)	0.250 (6.62)	0.157 (4.83)		

Asymptotic *z*-values in round brackets, marginal rates of substitution with money in squared brackets

Table 3. Model estimates for low demand intensity sample

N = 379, choices = 4,124	4-classes low demand intensity lnL = -10,287, Adj.R^2=0.137					
	$\hat{\beta}_{LA}$	$\hat{\beta}_{LB}$	$\hat{\beta}_{LC}$	$\hat{\beta}_{LD}$	$\hat{\gamma}_W$	$\hat{\Omega}$
Cost	-0.518 (-15.77)	-2.305 (-31.97)	-1.922 (-34.96)	-2.119 (-16.35)		
Severity	-0.225 (-3.78) [-0.10]	-0.761 (-10.68) [-0.35]	-0.335 (-4.06) [-0.15]	-1.455 (-8.47) [-0.67]	-0.359	0.781
Df_Climbs	0.105 (2.13) [0.05]	1.465 (16.78) [0.68]	0.466 (6.17) [0.22]	0.004 (0.40) [0.002]	0.262	0.936
Shelters	0.008 (2.98) [0.004]	0.010 (2.12) [0.0046]	0.069 (15.13) [0.03]	-0.036 (-4.26) [-0.017]	0.005	0.050
P_ Climbs	0.348 (12.82) [0.16]	0.378 (8.67) [0.17]	0.027 (0.79) [0.01]	0.732 (11.12) [0.34]	0.181	0.352
Access	0.115 (3.71) [0.05]	0.049 (1.03) [0.023]	0.191 (4.80) [0.09]	0.290 (3.48) [0.13]	0.077	0.147
Group Probability	0.368 (11.37)	0.246 (8.73)	0.229 (7.64)	0.155 (6.09)		

Asymptotic *z*-values in round brackets, marginal rates of substitution with money in squared brackets

Table 4. OLS estimates for posterior discrete welfare changes from policy implementation on select co-variates

	estimate	*t*-value	*p*-value
Constant	1.790	2.05	0.040
lnINC	-0.505	-2.137	0.033
AlpYrs	-0.012	-0.778	0.437
AlpYrs_SQ	0.00018	0.569	0.570
ClimbYrs	0.037	2.473	0.013
ClimbYrs_SQ	-0.00082	-1.874	0.061
Low-Demand dummy	0.042	0.469	0.639

N= 528, R^2=0.023

9 Figures

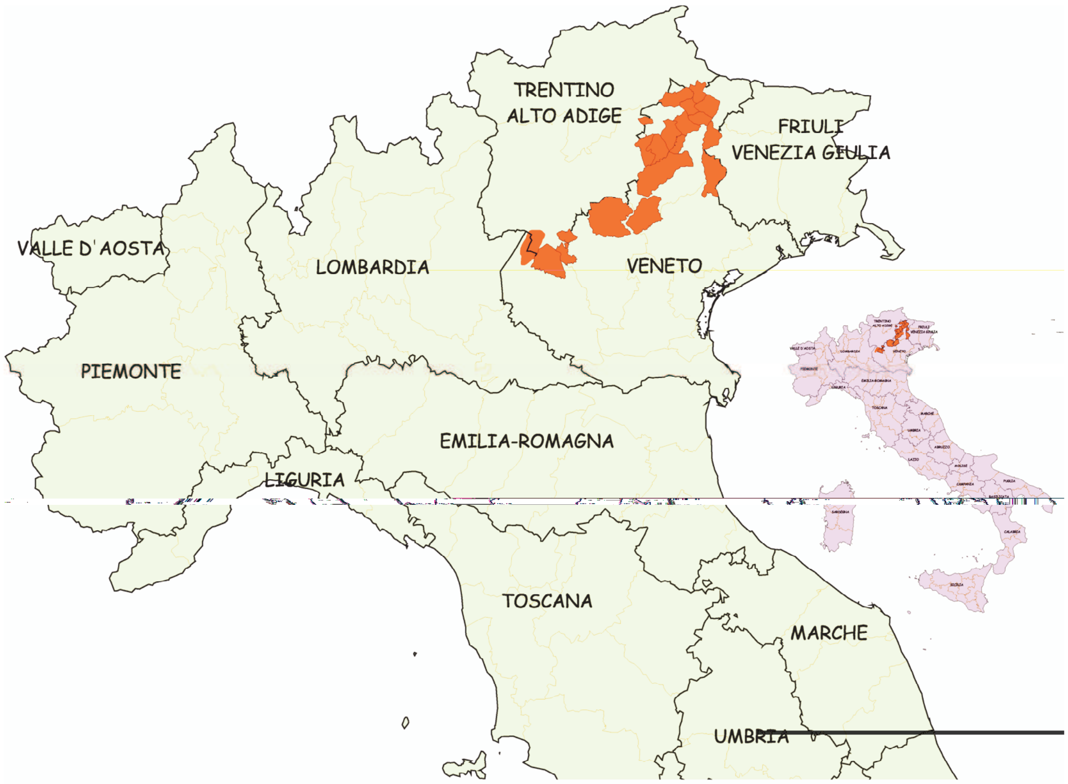

Figure 1.

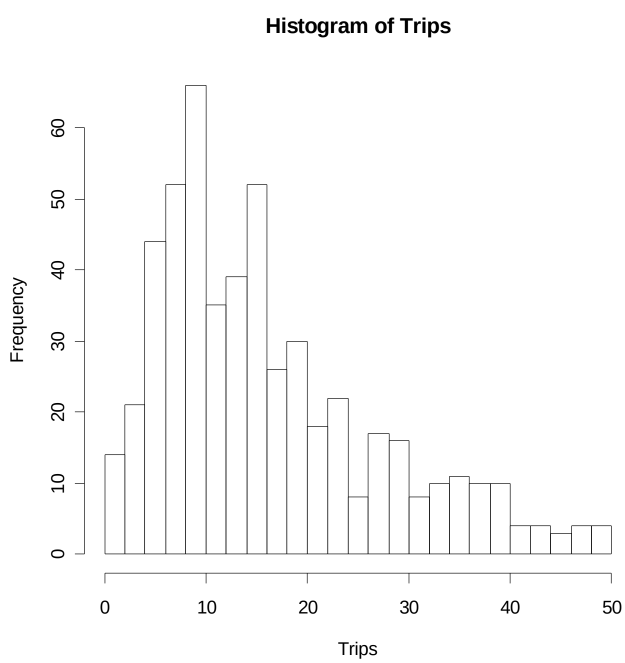

Figure 2.

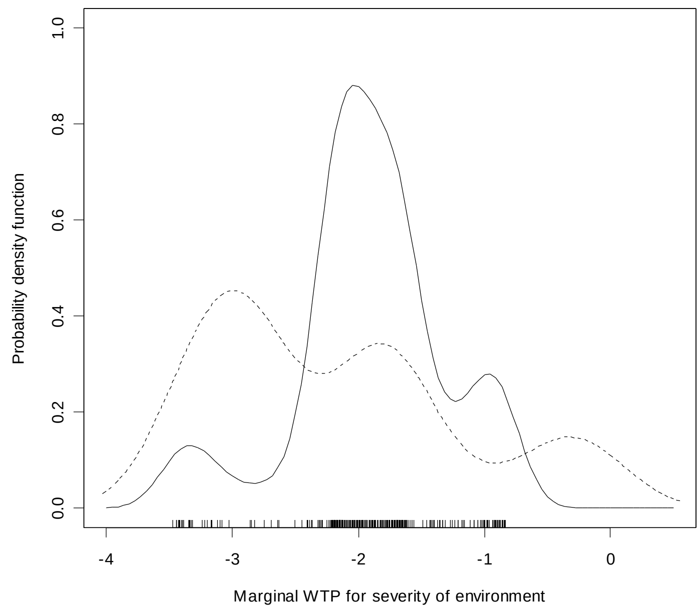

Figure 3. Continuous line: LOW demand.
Dashed line: HIGH demand.

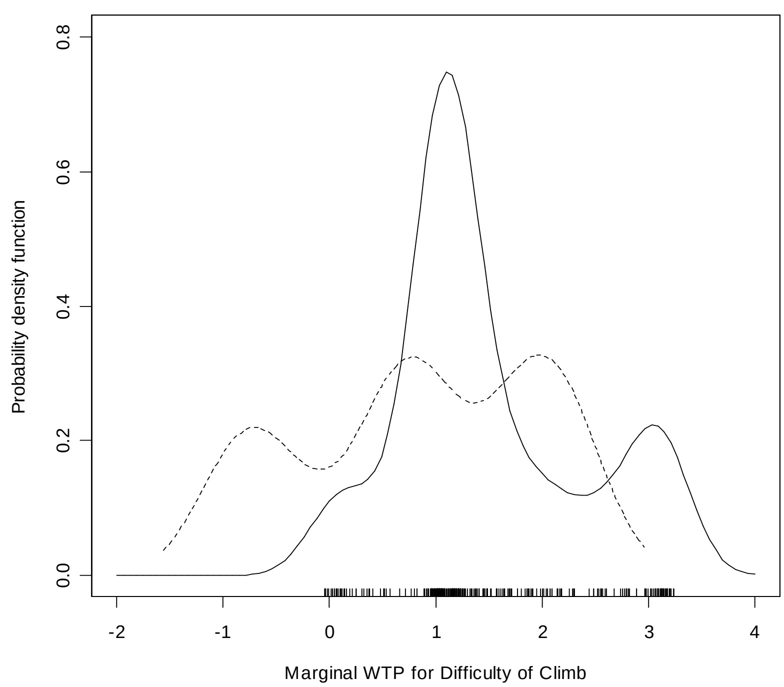

Figure 4. Continuous line: LOW demand.
Dashed line: HIGH demand.

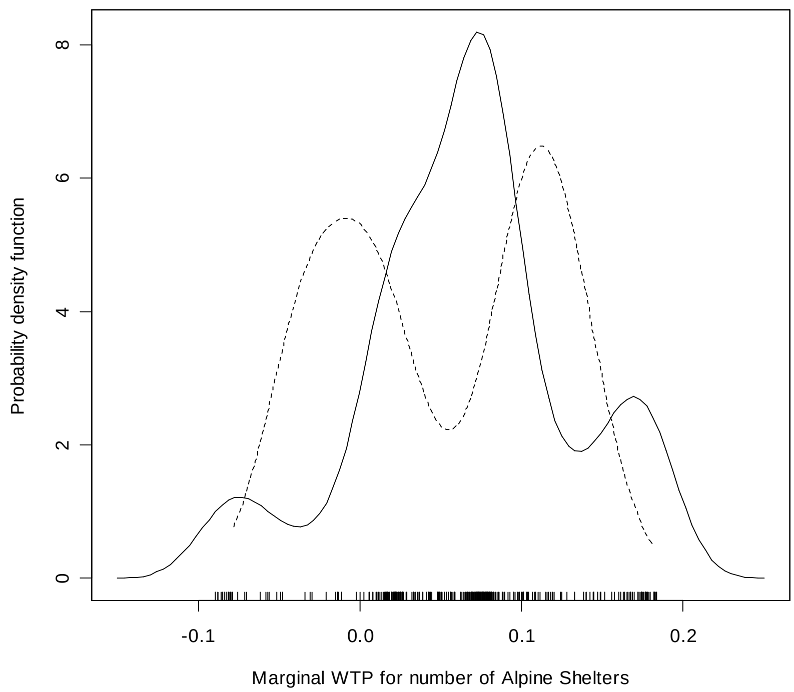

Figure 5. Continuous line: LOW demand.
Dashed line: HIGH demand.

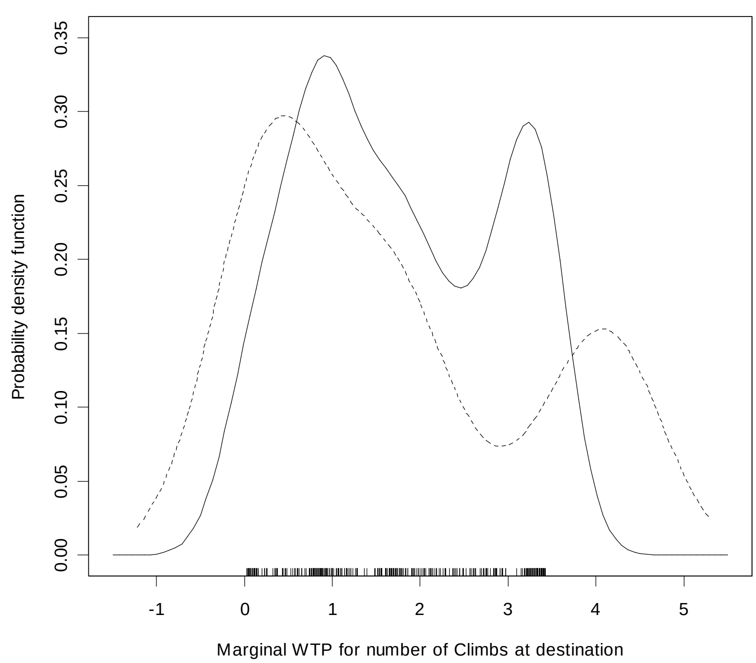

Figure 6. Continuous line: LOW demand.
Dashed line: HIGH demand.

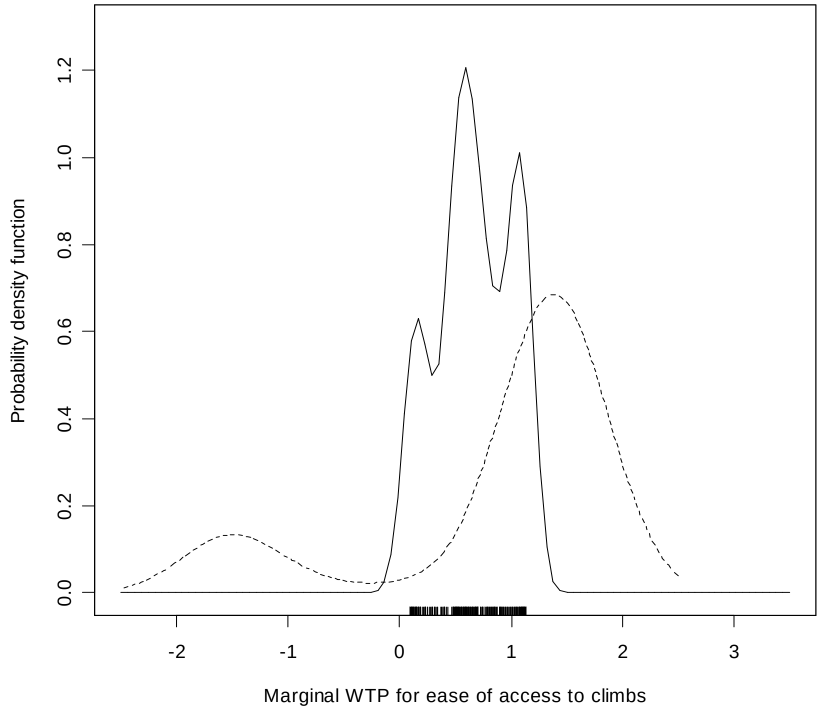

Figure 7. Continuous line: LOW demand.
Dashed line: HIGH demand.

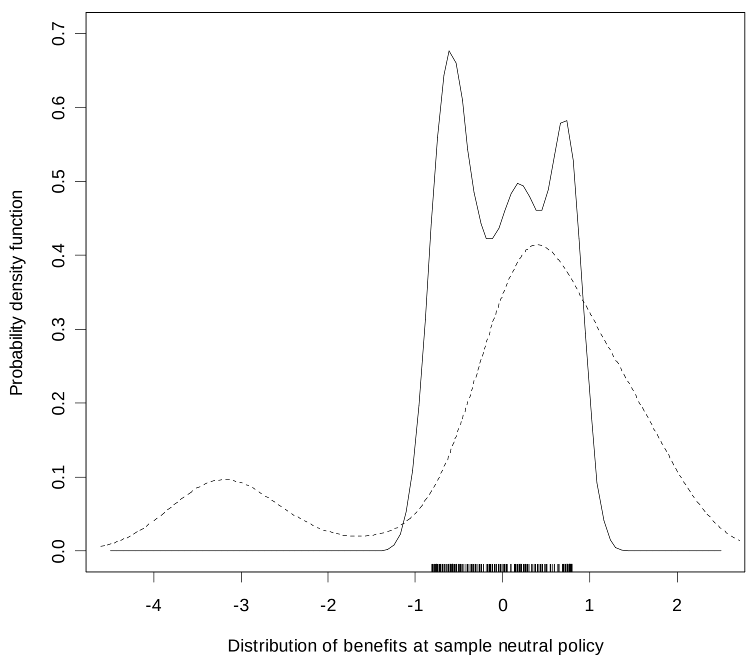

Figure 8. Continuous line: LOW demand.
Dashed line: HIGH demand.

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(lix) This paper was presented at the ENGIME Workshop on "Mapping Diversity", Leuven, May 16-17, 2002
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(lxv) This paper was presented at the EuroConference on "Auctions and Market Design: Theory, Evidence and Applications" organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
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(lxvii) This paper has been presented at the international conference on "Tourism and Sustainable Economic Development – Macro and Micro Economic Issues" jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
(lxviii) This paper was presented at the ENGIME Workshop on "Governance and Policies in Multicultural Cities", Rome, June 5-6, 2003
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(lxx) This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

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