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Measuring the demand for nature-based tourism in Africa:

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Abstract
Integrated Conservation and Development Plans (ICDPs) have been put forward as means of reconciling wildlife conservation in developing countries with improvements in community incomes. In this paper, we use the Choice Experiment approach to quantify overseas tourists' willingness to pay for attributes of nature-based tourism as part of an ICDP, focussing on visits to mountain gorilla areas in Rwanda. Contributions to community incomes are included as one attribute of the design. Methodologically, we employ a "cut-offs" approach to choice modelling to filter inconsistent responses and to reduce hypothetical market bias. Three major findings are that (i) many people choose options which violate their stated maximum trip price (ii) the cut-offs approach changes parameter estimates and thus willingness to pay estimates; and that (ii) that tourists do not have a significant demand for how much of tourism spending is channelled to local communities.

Keywords: nature-based tourism, choice experiments, cut-offs, Rwanda, mountain gorillas, hypothetical market bias.

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1. Introduction

In many developing countries, tourism is providing an increasingly important source of foreign revenues and direct investment (Wunder, 2000). In Rwanda, nature tourism is a particularly dynamic sub-sector, thanks to the charismatic mountain gorilla *Gorilla beringei beringei* found in the Volcanoes National Park (VNP) in the north-west of the country. VNP consists of about 160km^2 of montane forest which, until Rwanda's independence in 1962, was part of Africa's first national park, the *Parc National Albert*, created in 1925 with an intention of protecting the great apes (ORTPN, 2004). Both the mountain gorillas and the VNP as a tourist destination became internationally renowned through the work of the conservationist Dian Fossey whose biography was later turned into the popular movie "*Gorillas in the Mist*". By the early 1980's Rwanda was receiving up to 22,000 visits to the national parks annually. However, visits collapsed during the genocide, civil war and subsequent period of insecurity from 1994 to 1998 (ORTPN, 2004). Despite recent serious threats to the gorillas from illegal hunting, today the park is well protected, and numbers of the great apes are increasing (Gray et al, 2005).

Since the park was re-opened in 1999 its tourism industry has seen an incredible rebound from 417 park visits in that year to around 30,000 park visits in 2006. Tourism is currently ranked as the third highest foreign revenue earner for Rwanda, generating around $35.7 million of income in 2006 (Republic of Rwanda, 2007). To understand the national significance of the sector, annual non-tourism exports per capita were just $18 in 2005 – far below the sub-Saharan African average of $145 (Republic of Rwanda, 2005a: ix). Likewise, the share of exports in GDP is one of the lowest in the world at 5.3% (Republic of Rwanda, 2005). Rwanda relies heavily on imports for consumer, intermediate and capital goods. Tourism is thus one of Rwanda's priority sectors for economic development, so that understanding international demand for tourism is an important task. Economic valuation methods can help us identify how much tourists are willing to pay for the opportunity to visit national parks (Scultze et al, 1998).

In this paper, we use a choice experiment approach to quantify the relative importance of factors of the "nature-based tourism experience" from the perspective of overseas visitors participating in gorilla watching trips, and estimate their willingness to pay for changes in national park management. We are particularly interested in whether foreign tourists are willing to pay additional sums for trips as the fraction of earnings returned to local people increases. Methodologically, the "cut-offs" model of partially non-compensatory choice proposed by Swait (2001) is employed, as a means of identifying both discontinuities in visitors' utility functions with respect to gorilla-based tourism, and inconsistent responses where an accepted choice violates a stated upper limit on willingness to pay. Allowing for discontinuities and controlling for inconsistencies turns out to be important for WTP measures, but raises some interesting questions about whether "all choices should count".

2. Nature-based tourism in Rwanda – a case study.

Rwanda's tourism industry currently relies almost wholly on mountain gorillas as the main draw for international tourists to the country, and in recognition of this pivotal role conservation is currently high on the government's economic development agenda. Mountain gorilla tourism has also long been seen as a valuable conservation tool. An economic incentive to conserve the mountain gorilla is provided by international tourists paying large sums of money to spend a little time with these magnificent and enigmatic animals. Since its conception, organized gorilla tourism has provided funds to the park authorities to assist with conservation activities. Nature-based tourism has thus been enthusiastically accepted and supported by governments, conservationists and tourists alike and has been acknowledged as playing a crucial role in the continuing success of mountain gorilla conservation in the VNP.

The Virunga mountain gorilla (*Gorilla beringei beringei*) is a highly endangered African ape subspecies, with a total estimated population of 380 existing only in the Virunga Conservation Area encompassing Rwanda, Democratic Republic of Congo and Uganda (Homsey, 1999; Fawcett et al, 2004) . The distribution of the Virunga mountain gorillas is limited to an approximate area of 447 km^2, which encompasses the Mgahinga Gorilla National Park in Uganda, the Parc National des Volcans of Rwanda and the Mikeno sector of the Parc National des Virunga of the Democratic Republic of Congo. The current population size of 380 individuals represents a 17% increase from 1989, when a complete census estimated 324 individuals (Sholley 1991).

The Virunga mountain gorilla represents an isolated island population in an upland area surrounded by a sea of humanity at some of the highest human densities found on the African continent (some areas reach 820 people per km^2) with extremely poor, agricultural-based local economies (Plumptre et al, 2004). Gorillas are severely threatened by anthropogenic disturbance such as agricultural conversion and illegal extraction of resources (for example, snare setting for smaller mammals that entrap young gorillas). While the gorillas are no longer hunted for their meat in this region, they are however, the focus of illegal animal trafficking. This threat, in which members of a group are killed and wounded (with the group sometimes disintegrating as a result) in an effort to trap infants for the black market, is an ongoing threat in the Virunga. Illegal hunting is mainly focused on meeting subsistence needs for the poorest people around the VNP (Plumptre et al 2004) and this pressure presently represents the greatest threat to the survival of the mountain gorilla and the integrity of their habitat.

A key focus of contemporary conservation strategies is on local communities in order to address local welfare needs to mitigate some of these poverty-related conservation threats (Hulme and Murphee, 2001). Integrating conservation with local development through integrated conservation and development projects (ICDP) is now a standard approach in many developing countries (Barrett and Arcese, 1995). The importance of local community participation in achieving positive results for wildlife conservation and management has been widely acknowledged (Leach et al., 1997, 1999; Noss, 1997; Naughton-Treves and Sanderson, 1995). However, despite the recognition of the pivotal role that communities play in sustainable development, the practical implementation of ICDPs have frequently fallen short of expectations (Leach et al, 1999; Noss, 1997; Barrett & Arcese 1995; Hackel, 1999; Salafsky & Margoluis, 1999; Chapin, 2004). Nature based tourism, as a non-consumptive use of wildlife and the natural environment is a key component of ICDP in developing countries. However quantitative assessments of ICDP strategies are rare (Naidoo & Adamowicz, 2005) and schemes have shown variable results in terms of environmental and economic achievements, whilst little empirical research has been conducted to support the community welfare argument. In this study, contributions to community welfare from tourism are used as a choice attribute: this allows a test of whether overseas tourists will value this aspect of nature-based tourism if it is used to promote conservation sites as tourist destinations.

Nature-based or eco-tourism as an approach to promoting both environmental and social development goals falls within the broad scope of ICDP strategies. Eco-tourism is a rather obtuse term because it has no strict definition, however the International Ecotourism Society (TIES) defines it as "responsible travel to natural areas that conserves the environment and sustains the well-being of local people" (TIES, 2007). Thus it is implied that eco-tourists are in some way different from other tourists and that part of their utility from the tourism experience comes not just from visiting a wildlife or spectacular wilderness, but from the fact that their visit also contributes to its conservation and the welfare of local communities. If this is so, then contributions to community well-being should matter to visitors.Currently, however, there is little evidence to suggest that tourists are interested in community development *per se*, rather than seeing charismatic species such as the mountain gorilla, having an adventure, and enjoying attractive accommodation and spectacular landscapes (Naidoo & Adamowicz, 2005).

The client base for gorilla tourism in Rwanda is broad, the gorillas being visited by independent traveller, over-landers and high-end tours (ORTPN, 2004). Tourism development strategies based on market differentiation are being developed regionally. If a high-end niche is targeted, we need to understand what that niche in the market wants, and what they are willing to pay for their nature based tourism experience. Distinct pressures exist on national parks authorities to maximize their revenues in order to be able to finance their conservation and tourism activities. There is thus a critical balance to be achieved between exploitation of theses resources through tourism, and their conservation.

3. Choice modelling approach: the "cut-offs" model

In this paper, we make use of the "cutoffs" choice experiment approach proposed by Swait (2001) to model demand for nature-based tourism in Rwanda, in order to identify those attributes of the nature-based tourism experience which are most valued by users. This allows identification of those factors important in determining demand for conservation via nature-based tourism, and in quantifying tourists' Willingness to Pay for changes in national park management.

The cut-offs approach attempts to deal with two limitations of standard choice experiment approaches (Louviere et al, 2000). These limitations relate to the ability to handle (i) non-compensatory preferences and (ii) choice inconsistencies. *Non-compensatory preferences* imply that consumers can no longer be assumed to have smooth, continuous indifference curves, such that any change in environmental quality – such as gorilla numbers - can be compensated for by a finite change in some numeraire good, such as income. The type of *choice inconsistency* of interest here is respondents who choose options which have prices greater than their stated upper limit on their willingness to pay for the good in question. This maximum willingness to pay is elicited from respondents either just before or just after they make their choices between alternative nature-based tourism packages. An idea suggested here is that respondents who violate their stated cut-offs (maximum willingness to pay) by "large enough" amounts are guilty of hypothetical market bias. For instance, a respondent may say that they would never pay more than £200 for a trip, but then subsequently selects a choice option with a cost of £300. An interesting exercise is then to compare choice model estimates under different assumptions about what constitutes a "large enough" violation of stated maximum willingness to pay. This, we suggest, is a way of moderating hypothetical market bias in stated choice data which has yet to be explored in the literature.

A framework for analysis

In choice modelling, we typically assume respondents to be rational individuals who maximise their utility by always choosing alternatives from a finite choice set that brings them the highest utility. Following the theoretical framework of Swait (2001), a typical formulation of the choice problem is:

$$\begin{aligned} &[Max]\ \ U = \sum_{i \in C} \delta_i U(X_i) \\ &s.t.\ \ \sum_{i \in C} \delta_i = 1;\ \ \sum_{i \in C} \delta_i p_i \leq Y;\ \ \delta \in \{0,1\}\ \ \forall i \in C. \end{aligned} \tag{1}$$

where U is the utility, C is the set of substitute alternatives such as alternative nature-based tourism experiences, δ_i is a choice indicator equal to 1 if respondents choose alternative *i* and 0 otherwise, p_i is the price of alternative *i,* X_i is the *k* dimensional vector that describes the good, and Y is respondents' income.

In this context, respondent *n* is typically assumed to consistently evaluate all the attribute tradeoffs between competing alternatives. However, many other decisions rules may be used by respondents in the choice experiment depending on factors such as the difficulty of the choice task, their knowledge about the goods under study, and the environmental and social conditions in which the choice is carried out. According to authors such as Ford (1989), respondents may use heuristics to simplify these choices. Cut-offs are a non-compensatory choice heuristic thought to simplify choices in a world of costly decision-making (Svenson, 1996). Alternatively, they can be seen as representing limits to acceptable trade-offs between the attributes of goods (in the extreme, this could include lexicographic preferences).

Swait notes that cut-offs may be thought of as "hard" or "soft". Hard cut-offs are attribute levels that must be reached, or alternatively not breached, before a choice is allowed (Tversky, 1972; Manrai and Sinha, 1989). Including hard cutoffs into the choice modelling framework requires adding additional constraints that impede respondents from choosing an alternative that violates any of their stated cutoffs. For example, if respondent *n* stated that he would not pay more than *x*[1] for a good, the utility maximization process only considers all the alternatives with a cost less than x^1. Equation (1) is then rewritten as:

$$
\begin{aligned}
&[Max]\ \ U = \sum_{i \in C} \delta_i U(X_i) \\
&s.t.\ \ \sum_{i \in C} \delta_i = 1;\ \ \sum_{i \in C} \delta_i p_i \le Y;\ \ \delta \in \{0,1\}\ \ \forall i \in C; \qquad (2) \\
&\delta_i \theta^L \le \delta_i Z_i\ ;\ \ \delta_i \theta^U \ge \delta_i Z_i\ ;\ \ \ \ \delta \in \{0,1\}\ \ \forall i \in C.
\end{aligned}
$$

[1] The same would apply in case of a lower limit cutoffs, for instance if respondent declares he/she would not select any alternative cheaper than *x*.

where $\theta^L = [l_1\, l_2 \,.....\, l_k\, l_p]'$ is the vector of lower limits and price (l_p) cutoffs; and $\theta^U = [u_1\, u_2 \,.....\, u_k\, u_p]'$ is the vector of upper limits and price (u_p) cutoffs and Z_i is a *k+1* dimensional vector that describes alternative *i* (X_{ik}) where the additional dimension is the price (i.e., $Z_{i(k+1)} = p_i$).

However, cutoffs need not be hard: consumers can choose to violate them if the benefits are great enough (that is, once the opportunity costs of self-imposed cut-offs are recognised). This approach, first proposed by Huber and Klein (1991), was incorporated into a discrete choice setting by Swait (2001). Soft cut-offs can also be used to represent non-linearities and discontinuities in the deterministic portion of the utility function. Preferences are thus viewed as compensatory, but with a discontinuity which represents the penalties for violating these stated limits in any choice situation. Swait claimed, and showed for his data on rental car choices, that use of a soft cut-offs model would provide a significantly better fit to stated choice data; this was also found by Amaya-Amaya and Ryan (2006) for two stated choice data sets for health care options. Swait also notes that ignoring the presence of soft cutoffs where these are in fact present in peoples' decision making will lead to biased estimates of marginal utilities. This implies finding evidence of statistically-significant cut-offs should indicate that a conventional choice model is mis-specified.

Making the cutoffs "soft" requires adding to the utility function a *penalty function* associated with cutoff violations:

$$
\begin{aligned}
&[Max]\;\; U = \sum_{i\in C}\delta_i U(X_i) + \sum_{i\in C}\sum_{k}\delta_i(w_k\lambda_{ik} + v_k\kappa_{ik}) \\
&s.t.\;\; \sum_{i\in C}\delta_i = 1;\;\; \sum_{i\in C}\delta_i p_i \le Y;\quad \delta\in\{0,1\}\quad \forall i\in C; \\
&\delta_i(\theta^L - Z_i) - \lambda_i \le 0 \qquad \delta\in\{0,1\}\quad \forall i\in C; \\
&\delta_i(Z_i - \theta^U) - \kappa_i \le 0 \qquad \delta\in\{0,1\}\quad \forall i\in C; \\
&\lambda_i \ge 0; \kappa_i \ge 0;\quad \forall i\in C.
\end{aligned}
\tag{3}
$$

where w_k is the marginal disutility of violating the lower cutoff for attribute k (k=1...K+1); v_k is the marginal disutility of violating the upper cutoff for attribute k (k=1...K+1); λ_{ik} is a cutoff constraint variable for the lower limit cutoffs and κ_{ik} is a cutoff constraint variable for the upper limit cutoffs. The coding of such cutoffs constraints is straightforward. For quantitative attributes $\lambda_{ik} = \max(0, \theta^L{}_k\text{-}Z_{ik})$, $\kappa_{ik} = \max(0, Z_{ik}\text{-}\ \theta^U{}_k)$ where (k=1...K+1); for qualitative attributes λ_{ik} and κ_{ik} are equal to 0 or 1 depending if the stated cutoffs have been violated or not. Note that if a choice alternative satisfies all cutoffs, the optimal solution has all λ_{ik} and κ_{ik} equal to zero, thus the utility maximization problems reduces to equation (1).

In this model specification, if we consider a linear utility function in which the marginal utility of each attribute can depend on penalties for cut-off violation:

$$\frac{\partial U_i}{\partial Z_{ik}} = \begin{cases} \beta_k - w_k & if\ \ Z_{ik} < \theta_k^L \\ \beta_k & if\ \theta_k^L \le Z_{ik} \le \theta_k^U \\ \beta_k + v_k & if\ \ Z_{ik} > \theta_k^U \end{cases} \qquad (4)$$

The suggestion made in this paper is that attribute cutoffs can also be used as a way to reduce hypothetical market bias. This is an important issue in stated preference surveys, since choice experiment data may over-state true WTP values (Harrison, 2006). This can happen because respondents do not fully understand the choice task or because they do not act as if they actually had to pay the amount attached to each alternative. Using cutoffs we can test for hypothetical market bias in a simple way by specifying hard cutoffs constraints when respondents violate their upper price stated cutoffs by more than an exogenously specified value. For instance, if respondent n declared that he/she would not be willing to pay more than €100 for an alternative, the "soft" cutoffs approach allows him/her to pay more (say €120, for example) when the alternative offers him/her some compensating features that give him/her greater benefits than the marginal cost above the cutoff, albeit with a utility penalty for violating the soft cut-off. However, this can only be true up to a specific level of cutoff violation. In our study, this information is revealed by the upper price cutoff, namely the most an individual says they would be willing to pay for any combination of attributes – that is, for any design of gorilla trip within the experimental design parameters. A constraint can then be added to the maximization problem by requiring that the cutoffs violations for price cannot be greater than a percentage of the stated respondents' cutoff values;

$$
\begin{aligned}
&[Max]\;\; U = \sum_{i\in C} \delta_i U(X_i) + \sum_{i\in C}\sum_{k} \delta_i (w_k \lambda_{ik} + v_k \kappa_{ik}) \\
&s.t. \;\; \sum_{i\in C} \delta_i = 1; \;\; \sum_{i\in C} \delta_i p_i \le Y; \quad \delta \in \{0,1\} \;\; \forall i \in C; \\
&\delta_i(\theta^L - Z_i) - \lambda_i \le 0 \qquad \delta \in \{0,1\} \;\; \forall i \in C; \\
&\delta_i(Z_i - \theta^U) - \kappa_i \le 0 \qquad \delta \in \{0,1\} \;\; \forall i \in C; \\
&\delta_i \kappa_{ip} \le \gamma\, \theta_p^U \;\; \forall i \in C \qquad \gamma \in R^+ \\
&\lambda_i \ge 0; \;\; \kappa_i \ge 0 \;\; \forall i \in C;
\end{aligned}
\tag{5}
$$

where γ is an exogenous value set by the analyst. This value represents the amount of the violation (as a percentage relative to upper price cutoff) that the *analyst* is willing to accept. To respondents whose preferred alternatives cost more than the upper price cutoffs (maximum WTP) and lower than the value of γ, then the "soft" cutoffs approach will be applied. Respondents whose ratio κ_{ip} / θ^U_p is greater than the γ value (i.e., the price violation is too large with respect to what can be considered "acceptable") are then treated as if they chose the zero-cost opt-out option[2]. In the case of nature-based tourism, for example if a respondent declares that he is willing to pay as maximum 100 € to take a trip and later chooses an alternative that costs 200 €, there are clues to think that his choice is inconsistent. If the analyst is willing to accept a violation of the upper price cutoffs of 50% as a maximum (i.e.

[2] As Swait (2001) pointed out, the set C must have a null alternative (i.e. the possibility of not choosing), otherwise the utility maximization problem might not have a feasible solution for particular configuration of attributes and cutoffs. An alternative approach would be to allocate zero utility to attributes in choices where this upper limit is violated – rather than re-classifying choices as "stay at home".

150 €) this respondent would be treated as they had chosen the "no trip" choice. Which value to use as an acceptable limit is an empirical question that the analyst has to address by undertaking a sensitivity analysis using different "γ values". We explored the use of alternative "γ values" extending over the interval [0.04-1.5]. For conciseness, we only describe models estimated using a rule which re-classifies choices which violate the upper price cut-off by more than 50%, and compare this to models with (i) no cut-offs and (ii) soft-cutoffs with no re-classification of choices. It is worth mentioning that this approach is very flexible and can be applied using standard software for any model specification.

4. Study Design

To aid questionnaire design, focus group interviews were conducted in June and July 2005 with groups of visiting tourists in Volcanoes National Park (VNP), to identify the key attributes that visitors to the gorillas were concerned about. Collection of the main survey data ran from August 2005 until January 2006. In total 426 surveys were administered, of which 419 were returned complete and useable. This represented a 98% success rate in completion. Respondents were identified at random each morning when they arrived for gorilla trekking at the VNP and asked if they would participate later that day in the survey. They were later approached in their accommodation, in and around Ruhengeri Town and Kinigi Village to fill out the questionnaires on 1) personal socio-economic and demographic characteristics, related tourism activities and interests, 2) the choice task (with nine sets/cards per respondent) and 3) the cut offs.

A total of 18 different choice sets were developed which were separated into two different blocks. Choice attributes included in the design were trek group size, length of trek, possibility of seeing other wildlife, community benefits from tourism and a price parameter representing possible future increases in current trekking fees (see Table 1). Trek group size is seen as important since respondents may prefer to travel in smaller groups for a more "intimate" gorilla encounter. Length of trek could impact either positively or negatively on utility; longer trips offering more nature-viewing opportunities, but also being more tiring, Possibility of seeing other wildlife may likewise be positively valued, although not if this wildlife is threatening! Community benefits as a % of tourism earnings are included since our policy focus is on the promotion of ICDPs. Finally, tourists already pay quite high fees for gorilla treks (US $375 at the time of the survey, a cost which has since risen to $475).

The design followed the Street/Burgess/Louviere technique and was 94% efficient. The attribute levels were balanced and each choice set un-dominated. We experimented with cut-offs presented both before and after the choice experiment in order to assess the impact of cut-off questions on the completion of the choice task. Cut-offs were identified as for maximum trek group size, the minimum length of trek, the maximum length of trek and the level of community benefit from tourisms receipts, and maximum willingness to pay over current permit price specified by each respondent (see Table 2), leading to a total of 6 cutoff parameters to be estimated.

5. Econometric Approach

Random utility theory, in which consumers make discrete choices from a set of alternatives, underpins the choice experiment approach (Mcfadden, 1973). In random utility theory, the consumer is said to obtain utility *U* (conditional on their choice) from an alternative *i.* This conditional indirect utility function of respondent *n* is composed of a deterministic component (V_{in}), and a stochastic component (ε_{in}).

$$U_{in} = \mathrm{V}_{in} + \varepsilon_{in} \tag{6}$$

An alternative i will be chosen if it has greater utility than an alternative j. The probability of choosing i over j is thus

$$p(i|\mathrm{C}) = p\{\mathrm{V}_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn};\ \mathrm{j} \in \mathrm{C}\} \tag{7}$$

where C is the complete choice set. For analytical convenience, it is often assumed that the error terms of the utility function are independently and identically distributed following a Gumbel distribution. Under this assumption the probability of choosing i is given by,

$$p(i) = \frac{\exp^{\mu V_i}}{\sum_{j \in C} \exp^{\mu V_j}} \tag{8}$$

The cutoffs framework described above modifies the deterministic part of the utility function to incorporate a penalty when soft cutoffs have been violated. To the V_i in equation (8) we have to add the cutoffs violations λ_{ik} and κ_{ik} with their coefficients w_k and v_k.. Considering a linear-in-utility function ($V_{in} = \sum_k \beta_k X_{ink}$) the deterministic part of utility becomes

$$V_{in} = \sum_k (\beta_k X_{ink} + w_k \lambda_{ink} + v_k \kappa_{ink}) \tag{9}$$

Econometrically, the assumption of independent and identically-distributed errors is often not fulfilled, since one might actually expect errors to be correlated across the repeated choices made by individual decision-makers. Moreover, in the model set out in (6), (7), (8) and (9) coefficients for each attribute are assumed to be the same for all respondents in a choice experiment, whereas in reality there may be substantial variability amongst people (Train, 2003). Because of this, we use a random parameter modelling framework where the utility attached to each attribute is allow to vary over individuals:

$$V_{in} = \sum_k (\beta_k X_{ink} + \eta_{kn} X_{ink} + w_k \lambda_{ink} + v_k \kappa_{ink}) \qquad (10)$$

where η_{kn} is a vector of k deviation parameters which represents an individual's tastes relative to the sample average (β), ($\beta_{kn} = \beta_k + \eta_{kn}$). The η terms, as they represent personal tastes, are assumed constant for a given individual across all the choices they make, but not constant across people. Random parameter logit probabilities are weighted averages of the logit formula evaluated at different values of β, with the weights given by the density f(β) (Train, 2003). The probability that respondent *n* chooses alternative *i* is given by:

$$P_{ni} = \int L_{ni}(\beta) f(\beta) d(\beta) \qquad (11)$$

where L_{ni} (β) is the logit probability (equation 8) evaluated at parameters β. Since this integral has no closed form, parameters are estimated through simulation and maximising the simulated log-likelihood function. In order to estimate the model it is necessary to make an assumption over how the β coefficients are distributed over the population. Here we assume that preferences for all the attributes follow a normal distribution[3]. The price parameter is assumed not to vary across respondents, to aid estimation and welfare measurement.

6. Results

Table 3 shows detail on cut-off violations in terms of the actual choices made by the respondents compared to their individually-stated cutoffs: as may be seen, the greatest number of violations occurred for the *price* and the *community benefit* attributes, with just under half

[3] Note that this may not be the best choice of distribution for all attributes; we are experimenting with alternative assumptions, especially with regard to CB.

of respondents choosing options which violated their stated cut-offs. Violations were lowest for *tour group size*. (Note that we found no significant difference in terms of the parameters for the choice model between asking respondents to state their cut-offs before choices were made, as compared with stating cut-offs after choices were made.)

6.1 Using all the choice data: soft cut-offs versus no cut-offs

This is the comparison closest to the Swait (2001) paper. Table 4, panel A, shows the no cut-offs results compared to the results with soft cut-offs. Model fitting improves between columns 1 and 2 to a significant degree (at 99%). However, the price attribute has a positive parameter in both cases – which is counter-intuitive- whilst the parameter on the upper price cutoff is not statistically significant. The whole choice set, even with cutoffs, thus seems to exhibit some problems, in that higher prices make people more likely to choose a treking option. It is possible that respondents viewed price as signalling desirable trip attributes which were not included in the experimental design ("a more expensive trip must be a better one"). However, choice inconsistencies might also lie behind this result. To investigate this we now re-code trip choices that violate γ by 50% to "no trip" choices .

6.2 Removing inconsistent responses

Setting γ such that any choice which violates a person's stated maximum WTP in terms of its price level by more than 50% is reclassified as a stay-at-home choice produces big effects. Model fitting again improves significantly both with and without cut-offs (Table 4, Panel B). The parameter on price becomes negative (in other words, corresponds to expectations) in the no cutoffs version, whilst in the cutoffs version the cutoff parameter on price is also now significant, and 10 times bigger than the price coefficient. This implies a steep kink in the marginal disutility of higher prices above the upper soft cutoff. Adding soft cutoffs to this edited data set of choices produces, in itself, a significant improvement in the model's explanatory power: compare, for example, the t statistics on the random parameters in the utility function.

6.3 Attribute values and preference heterogeneity in the preferred model

The best fitting model is a model with soft cutoffs which re-classifies those choosing options which violate their stated upper price cutoff by more than 50% as "stay at home" choices (Table 4, panel B). Looking at these results, it may be seen that visitors prefer smaller tour groups; prefer a length of trek between 1 and 3 hours to either shorter or longer treks; and prefer to see greater numbers of other wildlife as well as gorillas. However, there is no evidence of a significant effect for what percentage of park revenues are recycled to local communities in the national park. In terms of preference heterogeneity, we find significant evidence of this for tour group size, seeing other wildlife, and community benefits. This can be seen by observing the statistically significant standard deviation parameters in Table 4.

Focussing on results in Table 4, Panel B, it is possible to examine the effects on implicit prices (marginal willingness to pay amounts) of including cutoffs in the choice model. There are four possible cases for defining implicit prices with cutoffs:

(1) no cutoffs are violated. The implicit price for an attribute such as *tour group size (Tgs)* is equal to ($-\beta$ tgs/ β price).

(2) the cutoff for any attribute is violated, but not the cutoff for price. In this case, the implicit price for *tgs* = - (β tgs + β cutoff tgs) / β price

(3) the cutoff for price is violated but not the cutoffs for the other attributes. In this case, the implicit price for *tgs* = - (β tgs)/ (β price + β cutoff price)

(4) both sets of cutoffs are violated: Implicit price = - (β tgs + β cutoff tgs) / (β price + β cutoffs price)

In Table 5, we present implicit prices for each of the attributes evaluated using (3) above, since the effect of violating the price cutoff turns out to be most important for this data, and compare these to implicit prices evaluated assuming that no cut-offs are violated as in (1) above. The effects on the implicit prices are significant. For example, looking at tour group size, willingness to pay for a one person reduction in the number of people in the tour group falls from £63 in the no cutoffs version to £15 in the price cutoffs version. That is, mean WTP falls significantly once we take into account the soft cutoff penalty on the price of a trip. Importantly for this paper, however, the implicit price on the community benefit attribute is never significantly different from zero: gorilla visitors in this on-site sample do not seem to value the community benefits of nature-based tourism.

7. Discussion and Conclusions

This paper has employed the choice experiment method to investigate the determinants of demand for nature tourism in Rwanda based on mountain gorillas. The results show that tourists are willing to pay for biodiversity conservation, both in terms of gorillas and for other wildlife seen during a trip. Tourists prefer to be in smaller tour groups in terms of the number of people in the group, and prefer a length of trek between 1 and 3 hours to either shorter or longer treks. These two findings could be seen as showing that tourists support the eco tourism principle of minimising ecological impact, since more people taking longer trips will increase adverse ecological impacts.

In the broader context of tourism and conservation in Rwanda, international tourists that visit the mountain gorillas comprise the majority of tourists that visit the two other national parks in Rwanda. Tourists' support for biodiversity conservation provides evidence that management practices which promote species density and diversity can have an economic return. This is of particular importance in Rwanda where there are acute constraints on land due to the unusually high population density. In other sub Saharan African countries with lower population densities than Rwanda, much of the nation's biodiversity assets are found out-with of the protected area system, for example Kenya where an estimated 90% of the nation's biodiversity found on land out-with of the national parks system (Mwanjala, 2005). In contrast, Rwanda shows a concentration of natural flora and fauna within the three national parks due to extensive conversion to arable or livestock agricultural systems outside these areas. Protected areas must continue to be at the forefront of conservation efforts and nature-based tourism is the key means of paying for them.

However, we found no significant effect on tourism demand for what percentage of park revenues are recycled to enhance local community developments within the national park. Whilst respondents feel that it is right that local communities should benefit more from tourism (as shown by their stated cut off- values), they are not willing to pay for it. This is in itself no reason to abandon ICDP policies that contribute to improving local social welfare, but suggests that promoting revenue-sharing as a marketing device is unlikely to be effective in boosting demand. Nature-based tourism, though, remains an important tool as part of an ICDP strategy, since in principle it provides a means for local people to benefit from the public good of wildlife and habitat conservation.

Methodologically, this paper has used a cut-offs approach to choice modelling to address two issues. The first is that peoples' preferences may exhibit discontinuities, which we represent as penalties for cut-off violations. The second is that of hypothetical market bias. We used violations of the stated price cut-off as a way of moderating this bias. Swait (2001) states that since breaks in the utility function are person-specific, and since the cutoffs approach is one way of dealing with heterogeneity in preferences, that *"..fit improvements over models without (cutoffs) should be, and are, striking"* (p914). We also find an improvement in model fitting by incorporating cut-offs; although not to the extent found by Swait. We find that only a minority of penalty function parameters are significant, but that the parameter on the penalty function for the price attribute was much bigger than that on the price attribute itself, and that the same relationship held for length of trek. This is evidence of marked non-linearities in demand. Finally, we note that re-coding choices as "stay at home" (take no trip) is only one option that could be implemented if we wish to re-code choices, and the fact that many visitors come to Rwanda mainly to visit the Mountain Gorilla is problematic in this regard.

Overall, it would seem that the cutoffs approach is a useful way of modelling choices in a world of partially non-compensatory decision-making. We have also suggested that the approach could be useful in investigating hypothetical market bias in stated preference data. However, there is clearly an issue here of what value of γ to use in doing this, since the values we use are arbitrary. There is also an issue over whether respondents would wish to re-evaluate their choices once a cut-off violation is pointed out to them, or indeed would wish to re-evaluate their stated cut-offs: on-going work in Rwanda with a new sample of gorilla visitors is currently addressing this issue of preference learning.

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Table 1 Attributes and their levels

Attribute	Description	Level
Tour Group Size	The number of tourists in a group. Currently limited to a maximum of 8 for conservation reasons	Small-4 Medium-6 Large-8
Length of trek	The amount of time taken to reach the gorillas.	Short, <1hour Medium, >1 but <3 hours Long, > 3hours
Community Benefit	Currently 20% of gate gross park revenues is diverted towards financing development activities in communities adjacent to the national park. To some visitors it is important that local communities receive greater benefits from tourist spending.	No change 10% more 20% more 30% more
Other wildlife	The ability of tourists to see other flora and fauna. For some tourist this is not so important: for others can be almost as important as seeing the gorillas themselves.	High Medium Low
Permit price increase	Price *increase* on gorilla trek permit and implied new total (including park entry fee)	$25 (400) $50 (425) $75 (450) $100 (475) $150 (525) $200 (575)

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Table 2 Cut off frequencies for the sample

Cut off		% respondents stating cut off
Max. people on tour/trekking group to gorillas		
	1	0.5
	2	1.2
	3	1.7
	4	6.2
	5	6.4
	6	31.7
	7	4.3
	8	47.7
Min. hours (round trip) to trek gorillas		
	SHORT	51.3
	MEDIUM	21.2
	LONG	27.4
Max. hours to trek gorillas		
	SHORT	20.0
	MEDIUM	27.2
	LONG	52.7
Lowest % of revenues to local communities		
	2	0.5
	5	6.7
	10	38.9
	20	32.5
	30	17.9
	35	0.2
	40	0.5
	48	0.2
	50	2.4
	100	0.2
Maximum payment above current permit price ($)		
	0	33.3
	25	11.1
	50	11.0
	75	11.1
	100	11.2
	150	11.1
	200	11.1
Mean		$95.55
Standard Error		6.63
Median		50
Mode		0
Minimum		$0.00
Maximum		$500.00

Table 3 Frequency of cut off violations

Attribute	**Number of people violating their stated cut-offs for any of their choices**
Maximum length of trek	82
Minimum length of trek	79
Permit price	194
Community benefit	190
Tour group size	76

Table 4 Random Parameter Logit Model results

A. **All data**, no cutoffs versus cutoffs

	No Cut-offs		**With soft cutoffs**	
	Parameter	T stat	Parameter	t-stat
Random parameters in utility function				
TGS	-0.129	-5.66	-0.133	-5.51
LOT1	0.200	6.21	0.157	3.55
LOT2	-0.13	-0.41	-0.139	-3.10
CB	-0.007	-2.62	-0.004	-0.84
OW1	0.197	6.12	0.192	5.92
OW2	-0.31	-0.99	-0.023	-0.74
Non-random parameters in utility function				
Constant	1.237	10.56	1.139	6.87
Price	0.003	7.87	0.003	4.71
TG cutoff			0.21	0.56
CB cutoff			-0.002	-0.42
Price cutoff			0.001	1.55
LOT cutoff 1			-0.158	-1.41
LOT cutoff 2			0.437	5.23
Standard deviations for parameter distributions				
σTGS	0.34	19.30	0.341	19.24
σLOT1	0.022	0.08	0.116	1.01
σLOT2	0.172	2.17	0.091	0.62
σCB	0.000	0.03	0.002	0.11
σOW1	0.001	0.01	0.000	0.00
σOW2	0.012	0.15	0.006	0.07
Log Lik	-3524		-3506	
Pseudo r2	0.14		0.15	
N (people, choices)	419, 3771		419, 3771	

Notes: We used 100 replications and Halton draws.

TGS = total group size; LOT1 = length of trek between 1 and 3 hours (the reference is less than 1 hour); LOT2 = length of trek more than 3 hours; CB = community benefits OW1 = prob of seeing other wildlife = medium (the reference is low); OW2 = prob of seeing other wildlife : high.

The attributes TGS and price have upper cutoffs; CB has a lower cutoffs; LOT has both lower (LOT1) and Upper (LOT2) cutoffs.

Table 4. continued.

B. Choices violating upper price cutoff by 50% are re-classified as “stay at home”

	No Cut-offs		**With soft cutoffs**	
	Parameter	T stat	Parameter	t-stat
Random parameters in utility function				
TGS	-0.611	-13.17	-0.400	-9.20
LOT1	0.069	1.37	0.172	2.65
LOT2	0.039	0.80	-0.106	-1.67
CB	0.005	1.24	0.010	1.23
OW1	0.088	1.72	0.126	2.42
OW2	0.087	1.77	0.105	2.04
Non-random parameters in utility function				
Constant	1.46	8.68	0.856	3.58
Price	-0.009	-12.34	-0.002	-2.86
TG cutoff			-0.016	-0.31
CB cutoff			-0.006	-0.79
Price cutoff			-0.023	-12.98
LOT cutoff 1			0.019	0.12
LOT cutoff 2			0.386	3.34
Standard deviations for parameter distributions				
σTGS	0.63	16.61	0.417	13.29
σLOT1	0.228	2.72	0.163	1.56
σLOT2	0.129	0.77	0.095	0.66
σCB	0.022	2.70	0.021	2.42
σOW1	0.281	3.70	0.291	3.83
σOW2	0.093	1.03	0.113	1.16
Log Lik	-2380		-2266	
Pseudo r2	0.42		0.45	
N (people, choices)	419, 3771		419, 3771	

Notes: We used 100 replications and Halton draws.

TGS = total group size; LOT1 = length of trek between 1 and 3 hours (the reference is less than 1 hour); LOT2 = length of trek more than 3 hours; CB = community benefits OW1 = prob of seeing other wildlife = medium (the reference is low); OW2 = prob of seeing other wildlife : high.

The attributes TGS and price have upper cutoffs; CB has a lower cutoffs; LOT has both lower (LOT1) and Upper (LOT2) cutoffs.

Table 5 Implicit prices and 95% confidence intervals (US $ per person per trip)

Attributes	Implicit Price No cutoffs	Implicit Price Including cutoffs on price attribute
Tour Group Size (per person)	-63.5 (-78.4; -51.3)	-15.3 (- 19.6; -11.5)
Length of trek: increase from < 1 hour to 2-3 hrs	7.2 (-2.5; 16.8)	6.6 (2.15; 11.5)
Length of trek: increase from <1 hour to > 3 hours.	4.1 (-5.3; 13.8)	-4.1 (- 8.7; 0.4)
Community benefit (% increase)	0.6 (-0.4; 1.5)	0.4 (-0.2; 1.0)
Other wildlife: probability increases from low to medium	9.2 (-1.5;19.3)	4.8 (0.9; 8.7)
Other wildlife: probability increases from low to high	9.1 (-0.8; 18.8)	4.0 (0.1; 8.1)