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Incorporating Beliefs and Experiences into Choice Experiment Analysis: Implications for the National Park Service

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# Abstract

We show that respondents' beliefs about future outcomes and prior recreational experiences affect policy recommendations from choice experiments. For New England residents, we find that willingness to pay for a new national park in Maine differs based on respondents' stated beliefs about the status quo long-term land use. We also find that respondents who do (do not) hunt or snowmobile would pay significantly more (less) for a park allowing these activities. Land managers may find a two-park solution (one allowing the activities and one prohibiting them) would be best; this insight would be missed when neglecting to model conflicting recreational preferences.

# Introduction

There has been considerable discussion in public arenas concerning how to manage our existing wilderness areas. Citizens and representatives hold widely varying opinions about what types of recreation should be permitted on public lands. Examples of debates about how to manage recreation include whether there should be a ban on snowmobiles in Yellowstone National Park, or if we should expand motorized boating access in the Boundary Waters Canoe Area Wilderness (BWCAW)***1***. Many previous studies estimate consumers' preferences for recreational sites and examine how recreational activity responds to changes in environmental quality.***2*** However, relatively little work examines preferences for land management when recreational uses conflict. Likewise, researchers typically give little attention to citizens' beliefs about future land use outcomes in the absence of an intervention. We address these issues with an application to the creation of a national park in Maine.

Maine is currently home to one national park, Acadia. Over the last few decades, there have been multiple efforts to introduce a second national park in the Maine Northwoods. While many have supported the effort, others have stated opposition to the creation of a national park because it is viewed as too restrictive. Many would prefer a national recreation area, which could allow hunting and snowmobiling. But the counterargument is that these activities impose externalities, which would diminish the value of a park. To investigate these potentially competing preferences among respondents from seven greater New England states***3***, we conduct a discrete choice experiment (DCE) with snowmobiling and hunting as attributes. We estimate respondent's preferences and willingness to pay (WTP) for the proposed park/recreation area and analyze how engaging in snowmobiling and hunting impact the preferences and WTP.

As our first contribution to the literature, we incorporate extensive information about respondents' past engagement with snowmobiling and hunting and show that we can gain policy insights into options that could improve welfare by modeling heterogeneity in recreational preferences. In our application on park design, ignoring past recreational engagement in the analysis leads to a recommendation for the creation of a homogenous park that prohibits snowmobiling and hunting. By allowing preferences to vary according to past recreational experiences, we find that respondents would be better off if they could sort into a park with recreational attributes matching their experience. These results show that land managers should pay attention to how various forms of recreation may be in conflict and think about potential solutions to alleviate the conflict.

Secondly, stated preference researchers traditionally treat environmental or resource outcomes as certain. However, environmental improvements seldom have scientifically certain outcomes and future states of natural resources are often unknown in the real world. In response, the nonmarket valuation literature has begun to acknowledge the importance of incorporating uncertainty into econometric models. For example, Glenk and Colombo (**2011**, **2013**), Lundhede et al. (**2015**), and Roberts, Boyer, and Lusk (**2008**) all address uncertainty in the outcome of an environmental improvement. We build on this line of research but take a slightly different approach. Rather than addressing uncertainty in the outcome of some intervention, we address the uncertainty over future outcomes in the absence of an intervention. Thus, as our second contribution to the literature, we incorporate respondents' stated beliefs about the status quo long-term land use.***4*** A number of recent papers have argued that valuation studies should include individual perceptions/beliefs in the analysis (Whitehead **2006**; Glenk **2011**; Marsh, Mkwara, and Scarpa **2011**; Kataria et al. **2012**; Artell, Ahtiainen, and Pouta **2013**; Ahtiainen, Pouta, and Artell **2015**). Johnston et al. (**2017**) specifically state “both objective information and subjective (respondent) perceptions of this (baseline) information should be considered”. We show that for our application, the potential creation of a new park in Maine, WTP differs based upon \respondents' stated beliefs of what will happen to the land in absence of the creation of a park.

Our survey data collection was conducted among residents of New England using an online survey and resulted in 532 completed surveys. In a prior policy report using this data, we show that (i) the standard approach of analyzing the data using a main effects specification leads to the conclusion that allowing fishing and emphasizing job creation increase a respondents' WTP for the proposed park and that allowing hunting and snowmobile access decreases the overall respondents' WTP (Matsuura, Dissanayake, and Meyer **2016**), and (ii) expanding to analysis to include hunting and snowmobiling leads to the recommendation of creating both a park that does allow hunting and snowmobiling and a one that does not allow hunting and snowmobiling.

In this paper, we first replicate the above analysis across multiple estimation methods and show that prior experience with hunting or snowmobiling is important for determining support for a park that does not allow hunting and snowmobiling versus a park that does allow hunting and snowmobiling. We then analyze the above finding in detail by quantifying welfare effects and expanding the analysis to incorporate belief heterogeneity. Specifically, we extend the analysis to include information on respondents' beliefs about future outcomes for the status quo. We find that individuals who believe the land will be developed are willing to pay significantly more than individuals who believe the land will be left as is. This demonstrates the practical importance of modeling systematic heterogeneity in recreational preferences and beliefs about future land use.

# Related Literature

There is a long-standing literature that examines cases of recreational conflict and attempts to explain reasons for the conflicts. Dating to at least Knopp and Tyger (**1973**), researchers have correlated attitudes with a proclivity to participate in different types of recreation. Knopp and Tyger (**1973**) and Jackson and Wong (**1982**) identify differing environmental attitudes and motivations for participating in recreation between cross-country skiers and snowmobilers. Vail and Heldt (**2004**) and Vittersø et al. (**2004**) also document conflict between these two groups of recreationists. However, conflict is not limited to motorized versus nonmotorized recreationists. Many studies find that recreationists of the same activity can negatively affect one another via crowding.***5*** Moreover, Absher and Lee (**1981**) suggest that personal and experiential motive factors can affect the degree to which crowding negatively affects a recreationist. These studies all imply that heterogeneity in experiences and beliefs can be important when using nonmarket valuation methods for the valuation of a resource.

We are not the first to recognize this potential policy importance of incorporating heterogeneity when conducting nonmarket valuation studies. For example, Hanley et al. (**2009**) allow for opposing preferences for prospective changes in UK national parks. Also, many DCEs find evidence of significant heterogeneity in preferences.***6*** What sets our work apart from most other DCEs exploring heterogeneity, therefore, are two main factors. First, we focus on the welfare implications of previous recreational experience and show why this heterogeneity is important for policy. Second, we investigate heterogeneity in WTP based on status quo beliefs about future land use, which, to our knowledge, has not previously been done in the literature.

Typically, the status quo option in choice experiments is specified as either the current situation or a projection of what would happen given the current trend, but this does not vary across the individual respondent. A few previous studies do model the status quo option as varying across individuals. Johnston, Swallow, and Bauer (**2002**) and Johnston et al. (**2003**) treat the status quo option as part of the survey design and assign different attribute levels of the status quo option to different respondents. This approach is attractive because it reduces concerns about the endogeneity of an individual's perceived status quo, can improve model efficiency, and facilitates testing of the effects of status quo on choice behavior. The limitation is that the assigned status quo attribute levels may not represent reality or the beliefs of the respondents. A group of papers code the status quo option according to observed characteristics of respondents, which vary across respondents (Birol, Rayn Villalba, and Smale **2009**; Barton and Bergland **2010**; Glenk **2011**; Uwera and Stage **2016**). These papers establish the importance of considering observed heterogeneity in the status quo, but they do not address heterogeneity in respondent beliefs about what will happen in absence of intervention.

Several papers also incorporate status quo beliefs. Ahtiainen, Pouta, and Artell (**2015**) elicit respondents' perceptions on current water-quality attributes and expectations of how each water-quality attribute will change over the next 10 years (improve, stay the same, or deteriorate). The authors then code the status quo according to a combination of current perceptions and future expectations. Similarly, Domínguez-Torreiro and Soliño (**2011**) estimate a model using information on respondents' perceived status quo levels of attributes of rural areas. Respondents choose predefined levels of attributes that best match their perceptions. Likewise, Marsh, Mkwara, and Scarpa (**2011**) instruct respondents to indicate their perceived status quo levels of attributes in New Zealand streams. These studies are therefore useful because they incorporate respondent beliefs about changes to the status quo quality. However, we investigate a somewhat different issue because we allow for a wider range of beliefs on the future use of a parcel of land and collect respondents' answers to an open-ended status quo belief question. Many respondents in our application believe that the land will change in nonmarginal ways; for example, in response to our question about what will be the status of the land 25 years in the future, many believe that the land will be entirely developed.

Within the vast nonmarket valuation literature, studies value conservation in settings including (but not limited to) marine protected areas (e.g. Wallmo and Edwards 2008), coastal wetlands (e.g. Petrolia et al. 2014), grassland (Dissanayake and Ando **2014**), biological diversity in a national reserve (e.g. Cerda et al. 2013), and birding sites (e.g. Steven et al. 2017). The valuation of National Parks may differ from the valuation of conservation areas in general because uses are typically more restricted in National Parks. Moreover, relatively few previous studies specifically address the valuation of National Parks using stated preference methods. Legget et al. (**2003**) uses the contingent valuation (CV) method to value Fort Sumter National Monument in the United States, focusing on how the survey mode affects estimated WTP. Several others utilize CV surveys to estimate WTP for national parks in countries other than the United States. White and Lovett (**1999**) estimate WTP for recreation and conservation in a UK national park, Bateman and Langford (**1997**) estimate nonvisitors' WTP for the Norfolk Broads National Park in the UK, and Hadker et al. (**1997**) estimate Bombay residents' WTP for India's Borivli National Park. In addition to Matsuura, Dissanayake, and Meyer (**2016**) we are aware of only one other DCE that focuses on competing recreational uses of public lands; Mansfield et al. (**2008**) use a DCE to investigate welfare changes for snowmobilers and nonsnowmobilers under various snowmobile policies in Yellowstone National Park. They find evidence that policies to restrict snowmobile use, which reduce welfare for snowmobilers, may result in welfare gains to nonsnowmobilers. Whether the net effects of snowmobile restrictions are positive or negative depends upon the details of the policy and the relative sizes of the two groups.

We also ask a policy relevant research question; outside of this research project, there have been no attempts to date to understand the preferences of out-of-state New England residents for the proposed park. It is important to understand the preferences of New England residents as out-of-state visitors to the proposed national park may constitute a significant portion of total visitors and have the potential to contribute to economic growth in the region and in Maine. Therefore the results from this study on preferences of out-of-state visitors provide valuable information as Maine's policymakers and residents discuss and debate the costs and benefits of a new national park. We next discuss the historical context of the proposed park and describe the survey instrument.***7***

# Background and Survey Description

## Historical Context

Starting from the 1980's onwards, there have been multiple efforts to introduce a second national park in Maine. These efforts started when ownership of the forests started to shift from timber companies to investment firms in the 1980s due to the availability of cheap overseas timber and the decrease in the demand for paper (Bell **2007**; Clark and Howell **2007**; LeVert, Colgan, and Lawton **2007**). A new National Park was presented as both a way to protect the land and as a way to create additional economic opportunities beyond the timber industry (Lilieholm **2007**; Vail **2007**). Supporters of a national park argue that the park would increase tourism and provide a vital injection to the economy of central Maine that has been in decline with the downturn in the paper and lumber industries. A study done by Headwaters Economics found that a park would generate 400 to 1,000 jobs for the local economy. Supporters further believe that a park will diversify the regional economy while supporting traditional industries and preserving the area's recreational heritage (Sambides Jr. **2015a**).

At the same time there was a strong opposition to the creation of a national park from some members of the local communities that hindered these early efforts to create a national park. Those opposed to a national park see it as a federal intrusion into Maine land. Maine has the least amount of federally owned and operated property than any other state, which is a point of pride for many residents (Miller **2015**; Sambides Jr. **2015b**). Further, those opposed to the park also believe that a park would create only seasonal, lower-paying jobs and hurt traditional industries such as forest product and paper industries. Opponents also include some hunters and snowmobilers, who believe that hunting, snowmobiling, and other activities would be limited and restricted if a national park is created (Miller **2015**; Sambides Jr. **2015b**; Matsuura, Dissanayake, and Meyer **2016**).

Over the last few years there has been a renewed interest in creating a new national park in Northern Maine. These efforts initially focused on creating both a national park and a national recreation area in the Maine Northwoods as a way to mitigate some of the concerns about access limitations; national recreation areas often allow hunting and off-road vehicles. The recent efforts were spear headed by the Elliotsville Plantation Inc. (EPI), a nonprofit foundation, which offered to donate about 150,000 acres of land and to create a $40 million endowment to pay for the management.***8*** (Sambides Jr. **2015c**; Harrison **2016**). These efforts culminated in the declaration of a new national monument in August 2016 and ongoing efforts focus on maintaining the status and encouraging an upgrade in the declaration to a national park and recreation area.

## Design of the Choice Experiment

The survey design allowed respondents to express their preferences over pairs of hypothetical parks that have the following attributes: types of access (fishing and hunting), types of trails (hiking and ATV/snowmobile), economic impact (expected number of jobs), and entrance fee.***9***,***10*** The attributes and the levels, which are shown in figure **1**, were identified and finalized after informal discussions with the public, researchers, and policy makers, conducting multiple formal focus groups, and a pilot survey of out-of-state residents. Johnston et al. (**2017**) state that “a payment vehicle should be selected to be realistic, credible, familiar, and binding for all respondents to as great an extent as possible and to ensure that payments are viewed as fixed and nonmalleable.” Given that we are seeking to elicit the preferences and WTP of out-of-state visitors to a national park in Maine, we use the entrance fee—a realistic, credible, familiar, and binding option—as the payment vehicle (it is not possible in this context to consider alternate payment options such as taxes).***11*** It is important to note that the entrance fee is only binding to visitors and therefore the results should neither be generalized to nonvisitors nor extrapolated to the population.

|  |  |
| --- | --- |
| Benefits | Definition |
| Types of Access | Types of Access: refers to the types of recreational activities that will be permitted within the park boundaries   * No Fishing & No Hunting * Fishing but No Hunting * Fishing & Hunting Permitted |
| Expected Economic Impact | Expected Economic Impact: refers to the total contribution to the Maine economy from the National Park from visiting tourists, new jobs being created, and local industry surrounding the park.   * 400 New Permanent Jobs (about $10 million added to the economy) * 800 New Permanent Jobs (about $20 million added to the economy) * 1200 New Permanent Jobs (about $30 million added to the economy) |
| Types of Trails | Types of Trails: refers to the types of trails that will run through the park boundaries. Different trails will promote/allow different modes of transportation.   * Only Hiking, Biking, and Cross-Country Skiing * ATV/Snowmobile Access & Hiking/Biking/Cross-Country Skiing |
| Cost to Households | Cost to Visitors: refers to the entrance fee to visitors of the new park. Entrance fee (per vehicle)   * $10 * $20 * $30 * $40 * $50 * $60 |

**Figure 1** Attributes and levels

The attribute levels for each choice for the final survey were determined using a 100% D-efficient experimental design generated using Kuhfeld's SAS macro (Kuhfeld, 2005). The experimental design resulted in 42 choice sets that were separated into blocks of six choice profiles, yielding seven unique survey versions with six questions each. An example of one choice question is shown in figure **2**. As represented in figure **2**, each choice question presented two potential park options and a status quo option. Respondents could choose the status quo option if they preferred no national park (with its associated $0 cost) over either of the potential parks.

[Sample choice question. Reads:

Suppose Option A and Option B were the only hypothetical national park projects you could choose. Which one would you choose? Please read all the features of each option and then check the box that represents your choice. If you do not like either option A or option B, then please choose the box marked "No National Park" which is Option C. 

Option A and B show different options of types of access, types of trails, economic impact, and entrance fee. Option C indicates no national park.](https://onlinelibrary.wiley.com/cms/asset/52f0f8f2-8330-4b49-b0cb-ea4a0a2efa2a/aepp13039-fig-0002-m.jpg)

**Figure 2** Sample choice question

In addition to the choice scenarios, the survey included a sociodemographic questionnaire and multiple questions inquiring about the respondents' involvement in hunting and snowmobiling and beliefs about future use of the land. Regarding future land use, the survey inquired, “If the land were to not be approved as a national park, how do you think the land will be used in 25 years?” We categorize the free-form responses into the following mutually exclusive categories: “developed,” “left as is,” “not sure,” and “other.”***12*** We then use the responses to this question as a measure of individual beliefs about the status quo.

## Survey Sample Description

The survey was conducted online by Qualtrics, a professional survey firm, using an online panel in October 2015 and was completed by 532 randomly selected respondents from New England (excluding Maine). Table **1** provides summary statistics for our sample. As seen in table **1**, approximately 39.5% of the respondents have bachelor's degrees (or higher) whereas 36% of the population in the seven states has college degrees (Census **2014**). Approximately 70% of the sample is female while 51.4% of the corresponding population is female. The highest number of respondents fall into the $50,000–$74,999 income category and the median income for the population of the seven states is $64,071 (Census **2014**). More than half the respondents are younger than 35 years, whereas the median age for the population of the seven states is 39 (Census **2014**). In summary, the sample is similar to the population on income and educational distribution but is younger and comprises more female participants.***13***

**Table 1.**Sample Summary Statistics

|  |  |
| --- | --- |
| **Variables** | **Percentage** |
| Female | 68.8% |
| BA or higher | 39.5% |
| Fisher | 50.2% |
| Hunter | 9.59% |
| Snowmobiler | 8.65% |
| Income |  |
| Less than $25,000 | 16.79% |
| $25,000 to $34,999 | 14.72% |
| $35,000 to $49,999 | 13.58% |
| $50,000 to $74,999 | 20.19% |
| $75,000 to $99,999 | 13.77% |
| $100,000 or more | 14.34% |
| Prefer not to answer | 6.60% |
| Age |  |
| 18–25 years | 18.37% |
| 26–35 years | 34.47% |
| 36–45 years | 17.23% |
| 46–55 years | 10.42% |
| 56–65 years | 14.02% |
| 6+ years | 5.49% |
| SQ beliefs |  |
| Not sure | 62.0% |
| Left As Is | 6.95% |
| Developed | 19.4% |
| Other | 11.7% |
| State |  |
| Connecticut | 14.29% |
| Massachusetts | 14.29% |
| New Hampshire | 14.47% |
| New Jersey | 14.10% |
| New York | 14.29% |
| Rhode Island | 14.47% |
| Vermont | 14.10% |

Note: All variables except Income and Age are reported for all 532 respondents. Five hundred and thirty individuals report income and 528 individuals report age.

Table **1** also summarizes the percentage of respondents who participate in the recreational activities of fishing, hunting, and snowmobiling. Finally, table **1** summarizes the status quo beliefs on land use. While the majority of the sample falls into the “not sure” category, sizeable minorities state that they believe the land will remain as is (7%) or be developed in some way (19%). An approximate equal number of completed surveys come from each of the included states. Next, we present our empirical estimation strategy for evaluating the survey.

# Empirical Strategy

To analyze the DCE data, we utilize a random utility model (RUM) (McFadden **1974**). The RUM assumes that the utility of a choice alternative depends on the attributes of the alternative, individual specific characteristics, and an error draw. Choice alternative attributes and some individual specific characteristics are observable to the researcher, whereas the error draw represents factors that affect choice but are unobservable to the researcher. Individuals choose the alternative from a choice set that delivers the highest utility level.

One alternative in each choice set is designated as the “status quo” option. A respondent chooses the status quo option if they prefer no park over either of the two proposed park alternatives. Typically, researchers model the status quo option with an alternative-specific constant (ASC), where the ASC takes on a value of 1 if the alternative represents a scenario creating a park and takes on a 0 if the alternative represents the status quo option. The coefficient on the ASC can therefore be thought of as the marginal utility of creating a park relative to the status quo. We express the utility for individual *i* from choice alternative *j* as:

where  is a vector of alternative attributes and  is a vector of parameters.

In the RUM, the level of any individual characteristic such as hunting experience will fall out of the analysis. However, we can identify how the marginal utilities of attributes differ across individuals by interacting choice attributes with individual characteristics. Our first hypothesis is that the marginal utility of allowing hunting or snowmobiling will depend on whether an individual engages in these activities. We expect that these recreational activities provide positive marginal utility to individuals who participate but deliver negative marginal utility to individuals who do not participate because these recreational uses can conflict with wilderness preservation. Thus, we create the interaction terms of *hunterXhunting\_allowed* and *snowbXsnowb\_allowed*. Our second hypothesis is that the marginal utility of creating a park relative to the status quo may depend on whether an individual engages in hunting or snowmobiling; we therefore interact *hunter* and *snowb* with the ASC producing our second model*14*:

(2)

Furthermore, we argue in our third hypothesis that the marginal utility of creating a park likely depends on what a respondent believes will happen to the land in absence of a park. Therefore, we interact the ASC with status quo beliefs. Status quo beliefs are measured by asking respondents how they believe the land will be used in 25 years absent the creation of a park. We categorize respondents' stated beliefs into the following mutually exclusive categories: not sure (NS), left as is (LI), developed (DV), and other (OT). We include these beliefs as a set of indicator variables, with “developed” serving as the omitted category; this leads to our full model:

(3)

We first estimate equations 1–3 with a standard conditional logit model, which assumes that the error terms are independently and identically distributed extreme value. In the conditional logit model, the probability that individual *i* chooses alternative *j* under utility specification 1*15* is

(4)

We estimate the model *via* maximum likelihood; the log-likelihood function is

(5)

where  if individual i chose alternative j and 0 otherwise.

We are most interested in systematic differences in respondents' WTP for different types of parks based upon observable characteristics so we consider the conditional logit estimates a useful baseline. However, it is well known that the conditional logit model can imply overly restrictive substitution patterns across alternatives, so we also estimate random parameters (mixed) logit models for comparison. The random parameters logit model allows for random taste variation by specifying a cumulative density function  for selected model parameters. If one specifies normal distributions for price and nonprice attributes, the resulting WTP expression is the ratio of two normal distributions, which has undefined moments. Specifying a log-normal distribution for the price attribute and normal distributions for the nonprice attributes results in a WTP expression that is the ratio of normal and log-normal distributions. Moments exist but there is no closed form solution for the mean or variance. As such, this inconvenient distribution then requires one to use the estimated distribution of coefficients to find the mean and variance of the WTP distribution, typically resulting in estimated distributions with unreasonably large variance (Train and Weeks **2005**).***16*** One practical approach in the literature is to model the price coefficient as a constant (Karlström **2014**). This allows one to easily calculate the WTP distributions for nonprice coefficients, but sacrifices some realism because individuals likely vary in their marginal (dis)utility of price.

Another approach is to follow Train and Weeks (2005) and parameterize the model in WTP space.*17* The WTP-Space specification recasts each nonprice coefficient from equation 3 as the product of WTP and the price coefficient.*18*

(6)

where .

We specify normal distributions for WTP associated with the attributes of fishing access, hunting access, snowmobiling access, job creation, and the interactions of hunting access with hunter and snowmobiling access with snowmobiler. The price coefficient is given a log-normal distribution. Each individual is assumed to have fixed coefficients across choice scenarios, *t*, but coefficients vary across individuals. In this way, the random parameters model can address correlation in unobserved factors across choice scenarios for a given individual. We estimate means and standard deviations for WTP coefficients on these four park attributes and two interaction variables. We model the WTP coefficients on the ASC and the recreation interaction terms as constants given that our research questions and policy contribution focuses on understanding the systematic heterogeneity in recreation behavior. As derived in Train (2003), random parameters unconditional choice probabilities for the sequence of observed choices, , are given by*19*

(7)

We estimate the model using simulated maximum likelihood.***20***

# Results

We focus our discussion of the results on the WTP values obtained from the conditional logit, random parameter logit, and WTP-Space models. Table **2** presents the MWTP results for all three specifications (main effects, activity interactions and all interactions) using the WTP-Space model. The preference-space coefficient estimates for the conditional logit model and for the random parameter logit model are provided in Appendix A. Table **3** presents average marginal WTP for each attribute for specification 1 (no interactions) for the preference-space conditional logit model, the preference-space random parameter logit model (with a fixed price parameter), and the WTP-Space model (with a random price parameter). We note that estimated average WTP values are similar across all three models. We compare the coefficient estimates across the three models in figure **3** and find that there is no statistically significant difference between the coefficient estimates (with 95% confidence intervals). Given that we see strong evidence of unobserved taste heterogeneity (table **2** and table **A2**), we focus our discussion on the results from WTP-Space model.

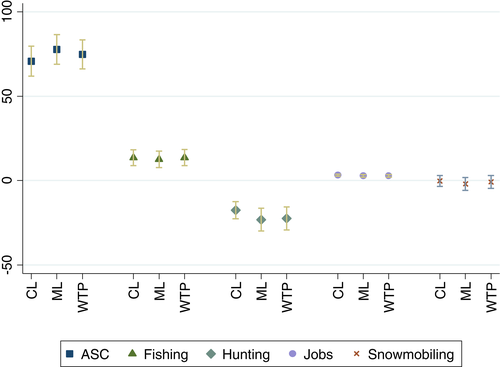
**Table 2.**WTP-Space Mixed Logit Results

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** |
| **Variables** | **Base** | **Activity interactions** | **All interactions** |
| ASC | 74.75\*\*\* (4.405) | 74.42\*\*\* (4.241) | 97.45\*\*\* (8.190) |
| Fishing access | 13.59\*\*\* (2.431) | 13.00\*\*\* (2.360) | 13.96\*\*\* (2.357) |
| Hunting Access | −22.43\*\*\* (3.481) | −26.17\*\*\* (3.547) | −28.36\*\*\* (3.031) |
| Jobs created (x100) | 2.798\*\*\* (0.380) | 2.603\*\*\* (0.392) | 2.921\*\*\* (0.374) |
| Smb allowed | −0.792 (1.937) | −2.655 (1.932) | −2.948 (1.846) |
| Hunter × hunting allowed |  | 71.47\*\*\* (10.18) | 66.43\*\*\* (11.95) |
| Smb × Smb allowed |  | 16.68\*\* (6.969) | 13.46\*\* (6.205) |
| ASC × hunter |  | −51.93\*\*\* (7.412) | −44.51\*\*\* (7.463) |
| ASC × smb |  | 25.28\*\*\* (9.592) | 18.82\* (10.69) |
| ASC × not sure |  |  | 97.45\*\*\* (8.190) |
| ASC × left as is |  |  | −28.14\*\*\* (7.748) |
| ASC × other |  |  | −57.42\*\*\* (11.20) |
| Cost | −2.914\*\*\* (0.106) | −2.821\*\*\* (0.129) | −2.754\*\*\* (0.142) |
| SD (fishing access) | −35.57\*\*\* (3.592) | 34.50\*\*\* (3.045) | −35.91\*\*\* (2.681) |
| SD (hunting access) | 57.89\*\*\* (4.698) | 50.21\*\*\* (4.127) | −52.42\*\*\* (3.711) |
| SD (jobs created (×100)) | −6.189\*\*\* (0.464) | 5.775\*\*\* (0.456) | 5.967\*\*\* (0.434) |
| SD (Smb allowed) | −27.51\*\*\* (2.623) | 27.45\*\*\* (2.381) | −25.62\*\*\* (2.597) |
| SD (Hunter × hunting allowed) |  | −45.92\*\*\* (8.712) | 32.87\*\*\* (10.39) |
| SD (Smb × Smb allowed) |  | 29.38\*\*\* (7.484) | 20.44\*\*\* (5.842) |
| SD (cost) | 0.614\*\*\* (0.132) | 0.725\*\*\* (0.153) | 0.845\*\*\* (0.192) |
| Observations | 9,576 | 9,576 | 9,576 |
| Simulated log-likelihood | −2368.1578 | −2334.6676 | −2324.361 |
| LR chi2 | 862.00\*\*\* | 634.51\*\*\* | 697.66\*\*\* |

Note: Standard errors in parentheses \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1 Smb = snowmobiling, SD = standard deviation.

**Table 3.**Average Marginal Willingness to Pay for Park Attributes

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** |
| **Attribute** | **Conditional logit** | **Random parameters logit** | **WTP-space** |
| ASC | 70.79\*\*\* (4.57) | 77.69\*\*\* (4.48) | 74.75\*\*\* (4.405) |
| Fishing access | 13.55\*\*\* (2.37) | 12.59\*\*\* (2.51) | 13.59\*\*\* (2.431) |
| Hunting Access | −17.57\*\*\* (2.55) | −23.23\*\*\* (3.45) | −22.43\*\*\* (3.481) |
| Jobs created (x100) | 3.20\*\*\* (0.334) | 2.75\*\*\* (0.424) | 2.798\*\*\* (0.380) |
| Snowmobiling allowed | −0.267 (1.68) | −2.08 (1.96) | −0.792 (1.937) |

[](https://onlinelibrary.wiley.com/cms/asset/84c795b2-441f-4f4b-b304-a76c58647c96/aepp13039-fig-0003-m.jpg)

**Figure 3** Marginal WTP for attributes by model (Bars indicate 95% confidence interval)

The results support our Hypothesis 1, that the marginal utility of permitting hunting or snowmobiling depends on whether an individual engages in these activities. Focusing on the full specification, Specification 3 (all interactions) of table **2**, we see that marginal WTP for allowing hunting is -$28.36 for individuals who do not hunt, whereas individuals who do engage in hunting are willing to pay an $66.43 more (total of $38.07) for a park that allows hunting. Similarly, by including information about individuals' activities, we see that allowing snowmobiling increases average WTP by $13.46 (to $10.51) for those who do snowmobile. These results suggest that hunting and snowmobiling conflict with other forms of recreation that individuals envision for this proposed park.

Next, in support of Hypothesis 2, we see that hunters are willing to pay significantly less for the creation of a National Park relative to other individuals. Specifically, Column 3 in table **2** shows that hunters are willing to pay approximately $44 less for the creation of a national park relative to nonhunters.

Lastly, regarding Hypothesis 3, we find evidence that status quo beliefs are important for explaining WTP for the creation of a park. Individuals who believe the land would be developed in 25 years if no park were created would be willing to pay $28.14 more than individuals who believe the land would be left as is. It is intuitive that individuals who believe the land is more threatened would be willing to pay more to protect it. One issue is that beliefs are potentially endogenous. There may be omitted variables that are correlated with beliefs and with choice behavior. For example, perhaps more environmentally friendly individuals also tend to be more pessimistic about the future of the land and are more likely to think that the land would be developed in 25 years. Thus, we cannot necessarily claim, for example, that public policies aiming to alter beliefs would significantly alter WTP. We discuss this further in the conclusion. However, the large differences in WTP based on beliefs suggest this issue is deserving of attention in future work.

# Policy Implications and Conclusion

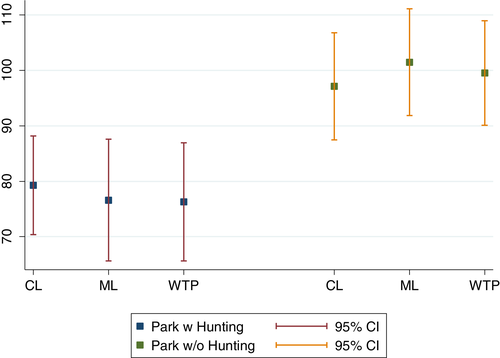
We have shown in Section V that (i) prior experience with hunting and snowmobiling and (ii) respondent beliefs about the status quo of the land affect how respondents value the corresponding park attributes of allowing hunting and snowmobiling. In this section, we explore the policy implications of these heterogeneous preferences. Specifically, we show how the creation of two distinct recreational areas, one which allows hunting and snowmobiling and one which does not, leads to substantially larger welfare gains as compared to one large homogenous area.

Consider two potential policy options for new parks. Both potential parks will allow fishing and create 400 new jobs. In Policy Option 1, the proposed park will allow both snowmobiling and hunting. In Policy Option 2, the proposed park will not allow snowmobiling nor hunting. If we ignore the heterogeneity interactions, we can use the results from specification 1 to calculate average WTP for Policy Options 1 and 2. Table **4** shows the average WTP for each proposed park for all three models. As shown in figure **4**, the results are consistent across all three models. The results show that Park Option 2 delivers a higher average WTP. Therefore, when ignoring heterogeneity of use, one would likely conclude that we should create a park that does not permit snowmobiling or hunting. Indeed, if constrained to one type of park, one without hunting or snowmobiling would be welfare-maximizing.

**Table 4.**Average Willingness to Pay for Proposed Park Options 1 and 2

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** |
| **Park option** | **Conditional logit** | **Random parameters logit** | **WTP-space** |
| 1. Allows hunting and snowmobiling | 79.29 (70.40, 88.19) | 76.60 (65.62, 87.59) | 76.31 (65.64, 86.97) |
| 2. Does not allow hunting and snowmobiling | 97.13 (87.45, 106.80) | 101.48 (91.85, 111.10) | 99.53 (90.10, 108.96) |

Note: 95% confidence intervals in parentheses are calculated with the Delta Method.

[](https://onlinelibrary.wiley.com/cms/asset/a75aed15-496e-4d91-849c-9e34bb7961c2/aepp13039-fig-0004-m.jpg)

**Figure 4** Marginal WTP for park options by model (Bars indicate 95% confidence interval)

Next, we consider the same two proposed parks and acknowledge preference heterogeneity. Table **5** shows the average WTP for each proposed park by recreational group for the WTP estimation. We focus our discussion on the WTP-Space estimation but note that the conditional logit and random parameter logit estimates are quite similar. (Table **A3** and **A4** report the corresponding results for conditional logit estimates and random parameters logit estimates). The first column represents hunters and snowmobilers and the second column represents individuals who do not participate in either of these activities. First, concentrating on the results from specification 2 (Activity Interactions where the status quo beliefs are ignored), we see that individuals who hunt and snowmobile would be willing to pay an estimated $71.18 for a park that does not allow these activities, whereas they would be willing to pay an estimated $130.50 for a park that does permit these activities. Therefore, the average individual who engages in hunting and snowmobiling would gain almost $60 in welfare with the creation of a park that allows these activities relative to a park that does not allow them.***21*** Individuals who do not hunt or snowmobile display the opposite pattern in their WTP; on average, they are willing to pay $69 for a park that does allow hunting and snowmobiling but $97.83 for a park that does not allow these activities. As such, the average individual who does not hunt or snowmobile gains approximately $30 in welfare from the creation of a park that does not allow these activities relative to a park that does allow hunting and snowmobiling.

**Table 5.**Willingness to Pay for Policy Options 1 and 2 by Recreational Group (WTP-Space)

|  |  |  |
| --- | --- | --- |
| **Panel A: Willingness to pay for option 1 (Park allowing hunting and snowmobiling)** |  |  |
| **Specification** | **Hunter/snowmobiler** | **Nonhunter/nonsnowmobiler** |
| 2. (SQ beliefs not included) | 130.50 (102.34, 158.66) | 69.00 (58.06, 79.95) |
| 3. (SQ beliefs included) |  |  |
| Belief |  |  |
| Not sure | 117.84 (86.54, 149.14) | 63.64 (52.87, 71.42) |
| Left as is | 88.57 (54.58, 122.56) | 34.37 (16.40, 52.35) |
| Developed | 145.99 (110.80, 181.17) | 91.79 (75.38, 108.20) |
| Other | 122.64 (88.65, 156.63) | 68.44 (53.34, 83.56) |
| **Panel B: Willingness to pay for option 2 (Park not allowing hunting or snowmobiling)** |  |  |
| **Specification** | **Hunter/snowmobiler** | **Nonhunter/nonsnowmobiler** |
| 2. (SQ beliefs not included) | 71.18 (49.50, 92.86) | 97.83 (88.54, 107.12) |
| 3. (SQ beliefs included) |  |  |
| Belief |  |  |
| Not sure | 69.26 (46.51, 92.01) | 94.95 (85.50, 104.40) |
| Left as is | 39.99 (14.31, 65.66) | 65.68 (48.38, 82.98) |
| Developed | 97.40 (70.88, 123.92) | 123.10 (105.95, 139.25) |
| Other | 74.12 (49.02, 99.10) | 99.60 (85.03, 114.47) |

Note: 95% confidence intervals in parentheses are calculated with the delta method.

Finally, we also calculate average WTP for the two park options according to status quo beliefs within both activity groups (hunter/snowmobiler *versus* nonhunter/nonsnowmobiler). Although there are suggestive differences in the point estimates of average WTP, we see overlapping confidence intervals within the hunter/snowmobiler category. The status quo beliefs are most important for nonhunter/nonsnowmobilers. Looking within this recreational group, we see that the average nonhunter/nonsnowmobiler who believes the land will be developed is willing to pay approximately $57 more than one who believes the land will be left as is, both for parks that do and do not allow hunting and snowmobiling. The differences are statistically significant.

One potential issue with our findings is that estimated WTP exceeds the highest entrance fee level from the survey. While it is not possible to test using data from one survey, it is feasible that these WTP values include some hypothetical bias. As discussed by Loomis (2011, 2014), hypothetical bias arises in many stated preference exercises, but there is no widely accepted theory for the underlying causes of the hypothetical bias. Various ex ante and ex post techniques are used to address potential hypothetical bias, but the evidence is mixed on the effectiveness of these fixes. In general, it is desirable to make the survey as consequential as possible. Although discrete choice experiments are useful for studying tradeoffs between attributes of a public good, they may not be incentive compatible (Carson and Groves 2007; Loomis 2014; Howard et al. 2017; Johnston et al. **2017**).

It is also best to use a compulsory payment vehicle whenever possible (Loomis 2014; Johnston et al. **2017**). “Voluntary and other nonbinding payment mechanisms are not recommended due to a lack of incentive compatibility and the associated tendency of subjects to free ride, although these mechanisms may be unavoidable in some contexts” (Johnston et al. **2017**). In our context, it was not possible to use a state or local tax payment vehicle because we are interested in understanding preferences of out-of-state respondents in neighboring states. For example, a state income tax in Maine would not affect residents of Vermont.***22*** A federal income tax increase to pay for a national park also seemed implausible in the current political climate. Focus groups indicated that respondents viewed visitor fees as being the most plausible form of payment vehicle. Therefore, we acknowledge that this could result in an overall upward bias of estimated WTP values.***23*** A further caveat is that these results are best applied to likely park users because of the visitor fee payment vehicle. For example, when scaling up the WTP values to estimate the total benefits of a park, we would suggest including only the percentage of the population that would likely visit and focusing on the use-value of the park. Other nonvisitors may hold nonuse values, but these could be less reliable because of the lower consequentiality of a visitor-fee payment vehicle.***24*** Nonetheless, our focus of the present study is the importance of addressing heterogeneity in beliefs and past experiences when making recommendations on which type of park would be most desirable. So long as hypothetical bias does not differentially change based on beliefs and/or past experiences, our conclusions on the relative desirability of parks with different attributes should hold.

Moreover, we did not provide information on camping and possibilities of multiple-day/monthly/yearly entrance fee packages that would have permitted a more nuanced and detailed analysis of visitor preferences. Many respondents also stated that they would be interested in visiting the park for multiple days. This would require paying the entrance fee multiple times, which could also contribute to the estimated WTP exceeding the highest entrance fee in the survey.

As previously mentioned, status quo beliefs are potentially endogenous because there may be omitted variables that are correlated with beliefs and choice behavior.***25*** There are several approaches in the literature to address endogeneity in discrete choice models (Guevara **2015**). One method is the latent-variables approach (Walker and Ben-Akiva **2002**). This approach is more common in the transportation and choice-modeling literatures, although there are some recent examples in the environmental literature.***26*** A Full Information Maximum Likelihood method, the latent-variables approach includes a latent variable that can affect both choice outcomes and the endogenous explanatory variable—in our context, beliefs. One typically writes the latent variable in a structural equation as a function of observable individual characteristics. As emphasized by Guevara (**2015**), causal identification requires that we can write the latent variable as a function of exogenous variables. It is not clear that many socioeconomic variables, such as education or income, are truly exogenous. A second approach is the control function method (Petrin and Train **2010**), which requires an instrumental variable. One first obtains the residuals from an OLS regression of the endogenous variable on one or more instruments, and then estimates the choice model including these residuals.***27***

Thus, to establish the causal effect of beliefs on WTP, we would need a variable that plausibly impacts beliefs but has no direct effect on choice behavior. We do not have any variables meeting this description on our survey. However, given the large association between beliefs about development and WTP, this would be a worthwhile issue to investigate in future work. One potential approach would be to experimentally vary information presented to individuals about future development prospects.

We have implicitly assumed that individuals would choose to visit the park that maximizes their welfare. That is, hunters and snowmobilers would visit the park allowing those activities and others would visit the park that prohibits those activities. In this scenario, overall average WTP across the two parks exceeds average WTP for a homogenous park that does not allow hunting or snowmobiling. One issue that we leave for future work is whether there may be a disutility associated with the creation of a park that does not provide one's preferred amenities, even if one does not actually visit that park. For example, would hunters and snowmobilers experience significant disutility from the existence of a national park prohibiting hunting and snowmobiling, even with the simultaneous creation of another park that does allow these activities? We acknowledge therefore that other nonuse values beyond the scope of this study may play a role.

In conclusion, we focus this paper on understanding how past engagement with recreational activities and beliefs about future use of the land impacts preferences and support for land management, especially when recreational uses conflict. We show that for our application, the potential creation of a new national park in Maine, WTP differs based upon respondents' stated beliefs of what will happen to the land in absence of the creation of a park. These results suggest that land managers may be able to increase overall welfare by providing heterogenous recreational areas so that users can sort into their preferred park. For example, one area of the park prohibiting snowmobiling and hunting and another area allowing these activities could increase overall welfare relative to a park with a homogenous recreational profile. This insight would be lost if one neglected to model recreational preferences as a function of past experiences.

# Acknowledgements

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# Endnotes

1 See Shogren (2013) for a summary of the Yellowstone snowmobile debate and Draker (2014) for a history of conflict in the BWCAW.

2 For examples, see Alvarez et al. (2014), Bockstael, Hanemann, and Kling (1987), Hanley, Wright, and Koop (2002), Hanley, Shaw, and Wright (2003), and Whitehead, Haab, and Huang (2000).

3 The survey was conducted in Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont as the most number of tourists to Maine come from these states.

4 Several other recent papers have modeled a variable status quo option and we discuss them in more detail in section II. We are not aware of any previous papers considering varied beliefs about future outcomes/land use.

5 See, for example, Bakhtiari, Jacobsen, and Jensen (2014), Kleiber (2001), and Tratalos et al. (2013). For a comprehensive review of crowding and recreational conflict, see Manning (2010).

6 Several examples that discuss heterogeneity in the context of DCEs are Birol, Karousakis, and Koundouri (2006), Broch and Vedel (2012), Kosenius (2010), and Zander and Straton (2010).

7 See Matsuura, Dissanayake, and Meyer (2016), Lilieholm (2007), and Vail (2007) for further historical details and Matsuura, Dissanayake, and Meyer (2016) for additional survey details.

8 The total area was initially proposed to be demarcated as 75,000 acres for a national park and about 75,000 acres for a national recreation area.

9 We include jobs as an attribute as there is evidence in the nonmarket valuation literature that employment impacts are important to respondents when valuing conservation and other environmental policies (Morrison, Bennett, and Blamey 1999). Further in this particular application, creating a new park, one of the key benefits that has been put forth is the increase in jobs (with the downturn in the timber industry there is increasing unemployment and a lack of economic opportunities in northern Maine).

10 The particular application that we model, the creation of a federal park in the Maine Northwoods, involves the use of significant amount of donated private land. As such the use of the land for any type of recreation in the absence of the park would be limited legally. In practice some local residents use this land, but for the purposes of our survey, which focuses on out-of-state visitors' preferences, we treat the status quo option as no access, including no hiking.

11 We further address potential implications of this payment vehicle choice in the conclusion.

12 Respondents either indicate “not sure” or provide a free-form response. We initially categorize the free-form responses about the status quo into the following mutually exclusive categories: left as is, developed (no specifics), developed (multiple uses cited), developed into housing, developed into commercial, developed for industrial use, and other. We hypothesize that beliefs about how the future land will be developed are important for explaining willingness to pay so we construct our belief categories to contrast a baseline where things basically remain the same versus a baseline where the land drastically changes. However, some responses do not fit neatly into either “developed” or “left as is.” Examples of these responses that do not clearly indicate whether the respondent believes land use will change are “hunting,” “logging,” and “for wildlife.” There is already some hunting, logging, and wildlife in the area, but these answers could imply the respondent believes more of these activities will happen in the future absent a park. As such, we arrive at the following four mutually exclusive categories: not sure, left as is, developed, and other.

13 In previous work (Matsuura et al. 2016) we account for all these demographic variables and find that age and gender do not significantly influence preferences.

14 We also initially investigated a model including analogous interaction terms for fishing and fishers. These interaction terms are statistically insignificant. We therefore omit them from our analysis to focus on hunting and snowmobiling; these two activities have generated the most controversy in the discussions surrounding the potential creation of this park.

15 We show choice probabilities for specification 1 in the interest of clarity and brevity. Choice probabilities for specifications 2 and 3 are obtained analogously by substituting the deterministic portions of utility.

16 Several other papers investigate differences in estimated WTP distributions from models estimated in WTP space versus preference space (Sonnier, Ainslie, and Otter 2007; Scarpa, Thiene, and Train 2008; Hole and Kolstad 2012).

17 We thank an anonymous reviewer for the suggestion to expand our analysis to focus on WTP-Space results.

18 We also present results from the mixed logit model, estimated in preference space, that assumes normal distributions for nonprice attributes and a fixed price attribute.

19 For clarity, this is the formula for the mixed logit probability estimated in preference space. The formula for the model estimated in WTP space would simply require coefficients on nonprice attributes to be rewritten as the product of the price coefficient and WTP as given in equation (6).

20 Specifically, we use the mixlogitwtp routine written for Stata to estimate the model in WTP space (Hole 2015). We use the mixlogit routine to estimate the model in preference space (Hole 2007). In each case, we use 500 Halton draws for each simulation. Bhat (2001) concludes that 100 Halton draws generates less simulation error than 1,000 normal draws. Train (2003) discusses several other papers that find similar results.

21 95% confidence intervals of WTP for the two park options do not overlap for this group indicating this is a statistically significant difference.

22 Furthermore, New Hampshire only has an income tax on interest and dividends.

23 As discussed by Loomis (2011, 2014), several meta-analyses investigate the extent of status quo bias in stated preference studies. These studies find mean calibration factors (hypothetical payment divided by actual payment) of 3 (List and Gallet 2001), 3.13 (Little and Berrens 2004), and 2.6 (Murphy et al. 2005). In a recent meta-analysis, Penn and Hu (2018) find a mean calibration factor of 2.29 and find that choice experiments lower the calibration factor by approximately 60% relative to dichotomous choice methods. Thus, a conservative WTP point estimate for the creation of a new park would be between $25 and $35 (dividing estimates from Table 4 by three).

24 We note, however, that in analyzing the subgroup of respondents who indicate that they are unlikely to visit the park, we see a slightly lower average WTP relative to the subgroup who are likely to visit. If we can believe the answer to this question about likelihood of visiting, it does not appear that likely nonvisitors were engaging in strategic behavior to drastically drive up the inferred value of the park.

25 We note that most of the papers reviewed in Section II that allow for a variable status quo based on observable characteristics or respondent beliefs are likewise subject to endogeneity concerns. Nonetheless, these papers all point to the importance of addressing heterogeneity in the status quo. Whitehead (2006) addresses the endogeneity by assuming that several demographic variables directly influence perceived quality and do not directly impact willingness to pay.

26 Hess and Beharry-Borg (2012) and Lundhede et al. (2015) estimate integrated choice and latent variable (ICLV) models. An additional benefit of a latent-variables approach such as an ICLV model is that it can deal with measurement error inherent in latent variables (Ashok, Dillon, and Yuan 2002; Daly et al. 2012).

27 Lusk, Schroeder, and Tonsor (2014) provide an example of the control function method in the context of steak choice. They do not find evidence of belief endogeneity, although they caution that the chosen knowledge instruments may not be completely exogenous and note that randomizing information could be useful.

# Appendix

Table **A1** presents conditional logit results and Table **A2** shows random parameters logit results for the models estimated in preference-space. The first column in both tables are the results for main effects specification (no interaction terms). The results for both the conditional logit and the random parameter logit models suggest that, on average, individuals view fishing access and job creation as desirable attributes whereas hunting access is viewed a negative park attribute. As expected, the cost coefficient has a negative sign indicating that individuals would prefer the park to have lower entrance fees. Also, the positive coefficient on ASC indicates that average individuals prefer the creation of a park relative to the status quo. Taking the negative of the ratio of each attribute's coefficient to the coefficient on cost yields average marginal willingness to pay for the attribute.

**Table A1.**Conditional Logit Results—Preference Space

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** |
| **Variables** | **Base** | **Activity interactions** | **All interactions** |
| ASC | 1.681\*\*\* (0.0980) | 1.791\*\*\* (0.103) | 2.357\*\*\* (0.194) |
| Fishing access | 0.322\*\*\* (0.0556) | 0.330\*\*\* (0.0564) | 0.330\*\*\* (0.0564) |
| Hunting access | −0.417\*\*\* (0.0579) | −0.563\*\*\* (0.0609) | −0.564\*\*\* (0.0609) |
| Jobs created (x100) | 0.0759\*\*\* (0.00704) | 0.0811\*\*\* (0.00717) | 0.0814\*\*\* (0.00718) |
| Smb allowed | −0.00634 (0.0400) | −0.0518 (0.0425) | −0.0525 (0.0425) |
| Cost | −0.0237\*\*\* (0.00143) | −0.0244\*\*\* (0.00145) | −0.0244\*\*\* (0.00145) |
| Hunter × hunting allowed |  | 1.529\*\*\* (0.180) | 1.534\*\*\* (0.181) |
| Smb × Smb allowed |  | 0.385\*\*\* (0.144) | 0.387\*\*\* (0.144) |
| ASC × hunter |  | −1.502\*\*\* (0.184) | −1.482\*\*\* (0.188) |
| ASC × Smb |  | 0.559\*\* (0.283) | 0.520\* (0.284) |
| ASC × not sure |  |  | −0.582\*\*\* (0.191) |
| ASC × left as is |  |  | −1.221\*\*\* (0.248) |
| ASC × other |  |  | −0.731\*\*\* (0.242) |
| Observations | 9,576 | 9,576 | 9,576 |
| Log-likelihood | −2,782.5 | −2,724.7 | −2,712.1 |

Note: Standard errors in parentheses \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1 Smb = snowmobiling.

**Table A2.**Mixed Logit Results—Preference Space

|  |  |  |  |
| --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** |
| **Variables** | **Base** | **Activity interactions** | **All interactions** |
| ASC | 3.316\*\*\* (0.185) | 3.418\*\*\* (0.193) | 4.307\*\*\* (0.368) |
| Fishing access | 0.580\*\*\* (0.112) | 0.573\*\*\* (0.112) | 0.578\*\*\* (0.114) |
| Hunting access | −0.995\*\*\* (0.155) | −1.201\*\*\* (0.157) | −1.214\*\*\* (0.159) |
| Jobs created (x100) | 0.128\*\*\* (0.0183) | 0.125\*\*\* (0.0179) | 0.127\*\*\* (0.0181) |
| Smb allowed | −0.0854 (0.0864) | −0.138 (0.0885) | −0.134 (0.0894) |
| Cost | −0.0434\*\*\* (0.00277) | −0.0433\*\*\* (0.00275) | −0.0438\*\*\* (0.00279) |
| Hunter × hunting allowed |  | 2.989\*\*\* (0.637) | 3.108\*\*\* (0.651) |
| Smb × Smb allowed |  | 0.748\*\* (0.339) | 0.746\*\* (0.340) |
| ASC × hunter |  | 2.989\*\*\* (0.637) | 3.108\*\*\* (0.651) |
| ASC × Smb |  | 0.748\*\* (0.339) | 0.746\*\* (0.340) |
| ASC × not sure |  |  | −0.947\*\*\* (0.363) |
| ASC × Left As Is |  |  | −2.251\*\*\* (0.509) |
| ASC × other |  |  | −0.761 (0.468) |
| SD (fishing access) | 1.535\*\*\* (0.142) | 1.560\*\*\* (0.141) | 1.604\*\*\* (0.145) |
| SD (hunting access) | 2.504\*\*\* (0.202) | 2.304\*\*\* (0.208) | 2.320\*\*\* (0.204) |
| SD (jobs created (x100)) | 0.280\*\*\* (0.0195) | 0.267\*\*\* (0.0193) | 0.266\*\*\* (0.0193) |
| SD (Smb allowed) | −1.234\*\*\* (0.118) | 1.197\*\*\* (0.119) | 1.213\*\*\* (0.120) |
| SD (Hunter × hunting allowed) |  | −2.326\* (1.255) | −2.400\*\* (1.118) |
| SD (Smb × Smb allowed) |  | 1.029\* (0.550) | 1.009\* (0.570) |
| Observations | 9,576 | 9,576 | 9,576 |
| Simulated log-likelihood | −2375.8177 | −2342.8461 | −2332.871 |
| LR chi2 | 813.46\*\*\* | 763.79\*\*\* | 758.36\*\*\* |

Note: Standard errors in parentheses \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1 Smb = snowmobiling, SD = standard deviation

**Table A3.**Willingness to Pay for Policy Options 1 and 2 by Recreational Group (Conditional Logit, Preference Space Estimation)

|  |  |  |
| --- | --- | --- |
| **Panel A: Willingness to pay for option 1 (Park allowing hunting and snowmobiling)** |  |  |
| **Specification** | **Hunter/snowmobiler** | **Nonhunter/nonsnowmobiler** |
| 2. (SQ beliefs not included) | 114.95 (88.53, 141.36) | 75.11 (66.22, 84.00) |
| 3. (SQ beliefs included) |  |  |
| Belief |  |  |
| Not sure | 113.78 (86.52, 141.04) | 74.45 (64.90, 83.99) |
| Left as is | 87.55 (58.64, 116.47) | 48.22 (32.73, 63.70) |
| Developed | 137.66 (107.42, 167.90) | 98.32 (81.33, 115.32) |
| Other | 107.67 (79.32, 136.01) | 68.33 (52.78, 83.88) |
| **Panel B: Willingness to pay for option 2 (Park not allowing hunting or snowmobiling)** |  |  |
| **Specification** | **Hunter/snowmobiler** | **Nonhunter/nonsnowmobiler** |
| 2. (SQ beliefs not included) | 61.64 (37.21, 86.08) | 100.31 (90.31, 110.32) |
| 3. (SQ beliefs included) |  |  |
| Belief |  |  |
| Not sure | 60.24 (34.88, 85.60) | 99.72 (89.14, 110.30) |
| Left as is | 34.01 (6.13, 61.88) | 73.49 (57.74, 89.24) |
| Developed | 84.12 (56.15, 112.08) | 123.60 (105.67, 141.52) |
| Other | 54.12 (27.39, 80.85) | 93.60 (77.52, 109.69) |

Note: 95% confidence intervals in parentheses are calculated with the Delta Method.

**Table A4.**Willingness to Pay for Policy Options 1 and 2 by Recreational Group (Random Parameters Logit, Preference Space Estimation)

|  |  |  |
| --- | --- | --- |
| **Panel A: Willingness to pay for option 1 (Park allowing hunting and snowmobiling)** |  |  |
| **Specification** | **Hunter/snowmobiler** | **Nonhunter/nonsnowmobiler** |
| 2. (SQ beliefs not included) | 131.47 (91.51, 171.42) | 72.76 (61.57, 83.95) |
| 3. (SQ beliefs included) |  |  |
| Belief |  |  |
| Not sure | 133.47 (92.85, 174.09) | 70.83 (58.96, 82.70) |
| Left as is | 103.66 (61.46, 145.86) | 41.03 (21.90, 60.15) |
| Developed | 155.10 (111.89, 198.31) | 92.46 (74.16,110.76) |
| Other | 137.72 (96.05, 179.38) | 75.08 (56.97, 93.20) |
| **Panel B: Willingness to pay for option 2 (Park not allowing hunting or snowmobiling)** |  |  |
| **Specification** | **Hunter/snowmobiler** | **Nonhunter/nonsnowmobiler** |
| 2. (SQ beliefs not included) | 76.08 (49.41, 102.75) | 103.68 (93.66, 113.70) |
| 3. (SQ Beliefs included) |  |  |
| Belief |  |  |
| Not Sure | 76.20 (48.59,103.81) | 101.62 (90.90, 112,35) |
| Left as is | 46.390 (15.85,76.94) | 71.82 (53.65, 89.99) |
| Developed | 97.83 (67.23, 128.42) | 123.25 (105.69, 140.91) |
| Other | 80.45 (51.95, 108.95) | 105.88 (88.39, 123.36) |

Note: 95% confidence intervals in parentheses are calculated with the Delta Method.

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