Single Versus Multiple Objective Recreation Trips: A Split-Sample Multi-Site Analysis

2001 AAEA-CAES Annual Meeting
Aug. 5-8, 2001-Chicago

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Abstract

A random utility model of the choice over trip duration on multiple objective recreation trips is developed. We explore several methods for allocating trip expenses to estimate the welfare of single and multiple-objective trips. Preliminary results suggest that traditional methods for handling travel costs are inadequate in a multiple-objective setting.

Introduction

Although surveys often suggest that recreational trips involve overnight stays many recreational demand studies focus on single-day trips with a single purpose. This practice may be adequate for many resources where considering single day visits captures the relevant benefits for policy purposes. However, for many situations, ignoring multiple day trips in welfare estimation could ignore a large part of the benefits of improving environmental attributes. This could in turn bias estimates of the benefits of environmental improvements downward or it could ignore a substantial proportion of the value of a site (see for example Shaw and Ozog, 1999).

Unfortunately, estimating travel cost models that include multiple day trips invites a host of theoretical and empirical issues. One problem relates to the nonlinearity of income effects and the difficulties this creates for estimating compensating variation from small changes in attributes (Small and Rosen, 1981). Many single day studies consequently do not directly estimate an income effect, but this assumption is questionable when researchers consider multiple day trips. In recent years, researchers have adopted a range of methods to integrate consumer welfare when non-linear income effects are included in models (see Shaw and Ozog, 1999; Morey 1993; Morey and Rossman, 2000). These recent developments allow researchers to incorporate non-linear income effects, and they make it possible to consider longer duration trips along with shorter duration trips.

Another problem is that recreational trips may have a number of objectives, or purposes, rather than the primary recreational activity of interest to the researcher (see for example, Smith and Kopp, 1980; Bell and Leeworthy, 1990; Shaw and Ozog, 1999; and more recently, McConnell and Strand, 1999). In a recent example, Shaw and Ozog (1999) assume that the entire purpose of each trip is for fishing, so they allocate the entire set of costs associated with the multiple day trip (including overnight lodging costs) to fishing. While this may be adequate in many settings, it may bias estimates upwards in other settings (or for some visitors) if there are alternative objectives associated with the trip (McConnell and Strand, 1999).

Another issue is that the number of trips taken in a season will be affected both by the travel cost and by trip duration (McConnell and Strand,1999). Within the contexts of repeated RUM models, researchers often have to assign arbitrary sets of choice occasions, or blocks of time for each trip. These blocks of time vary across the trips, but most repeated models assume the same number of choice occasions for both single and multiple day visitors (see for example, Shaw and Ozog, 1999). Furthermore, McConnell and Strand (1999) point out that individuals should make single day trips within a shorter period than multiple day trips.

The theory and empirical structure for estimating models that include both single and multiple day trips in a RUM model context is only partially developed. This paper attempts to address one issue associated with models that explore duration, namely the question of how to value trip costs. We use a recent intercept survey of beach visitors along Lake Erie shoreline in Ohio (Murray, 1999) to value beach amenities. Estimating values for multiple day visitors is motivated in part by our survey findings which suggest that multiple day visitors represent 30% of the respondents to an intercept survey. Although a large number of multiple day visitors were found in this survey, multiple day visitors tended to spend significantly less of their trip time on the beach (29 % compared to 75% for single day visitors). For the purposes of estimation, this raises questions about how much of travel and on-site costs should be allocated to the recreational experience. We focus on this limited issue in this study, and explore several different methods for allocating trip expenses in a random utility model that allows for the choice of trip duration in addition to choice of site. The paper explores the sensitivity of the results to alternative valuations of trip costs, i.e. direct travel costs (time plus direct travel costs) versus total trip expenditures weighted by time spent on the beach.

The results of our nested multinomial logit model indicate that the site-choices of single and multiple-day beach users are correlated but that the two types of recreators value beach amenities differently. For example, increasing the number of water quality beach advisories decreases beach visits more significantly for multiple-day users than single-day. This suggests that improving beach water quality will generate greater welfare for multiple-day users. Perhaps of greater interest to practitioners, we find that increasing travel costs the site choice probabilities of multiple-day users less than single-day users. For multiple-day visitors, who spend more time on-site and incur higher lodging and other costs, travel costs are a relatively small proportion of their trip expenses. Thus, it is reasonable that their visitation decision is less depended on travel costs, and traditional methods for incorporating travel costs into random utility models may be inappropriate in a multiple-objective trip setting. Identical treatment of trip costs for single and multiple-day users can lead to biased estimates of the structural utility parameters and consequently biased measures of welfare.

MODELING SINGLE AND MULTIPLE DAY TRIPS

This study focuses on beach recreation in the Lake Erie region. A recent survey of beach users in this region found that 30% of the visitors in a random (intercept) survey were engaged in multiple day trips. Studies that explore only single day trips (Murray et al., 2000) may fail to capture a significant portion of the total value of beaches by ignoring the large proportion of individuals on multiple day trips. However, as discussed in the introduction, estimating a model that incorporates multiple day visitors contains difficult problems, particularly for random utility models. This paper attempts to control for one of these issues, although future papers will undoubtedly continue to improve the estimates.

We assume that on any choice occasion visitor i maximizes the utility of a visit of length k to site j, subject to a budget and time constraint. Given utility maximization, the following indirect utility function is specified:

$$(1) \qquad V_{i,k,j} = F(\text{ Travel Costs(TC), Onsite Costs(OC), Site Attributes(X)})$$

In choosing the duration of a trip, we propose that travel costs (TC), and onsite costs (OC) have important implications for the decision to take a long duration trip. Site attributes (X) affect this decision and the decision over which beach to visit. A two-level decision RUM is used to estimate this indirect utility function. Visitors are assumed to first choose whether to take a single - or multiple -day trip, and then they choose among the 15 alternative beach sites (figure 1). We hypothesize that individuals choose trip duration first, and then the site (figure 1), although it is possible that some individuals choose location first and then duration (particularly those who live further away). Table 1 lists the 15 beach sites along Lake Eire shoreline.

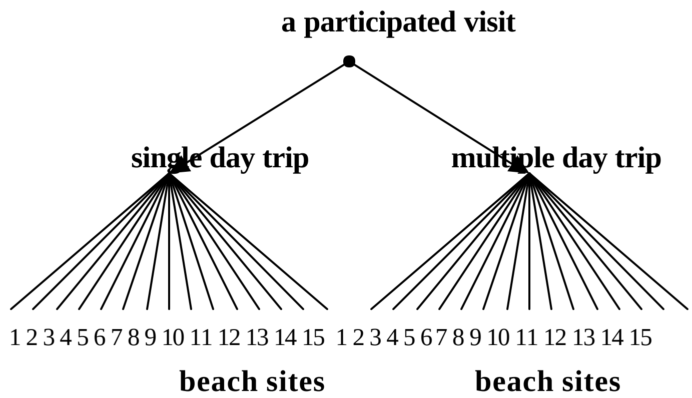

Figure 1. Two-level trip decision tree

Table 1. Alternative Beach Sites

Site	Name
1.	Crane Creek State Park (CC)
2.	Conneaut (CN)
3.	Camp Perry (CP)
4.	East Harbor State Park (EH)
5.	Euclid State Park (EU)
6.	Edgewater Park (EW)
7.	Fairport Harbor (FH)
8.	Geneva State Park (G)
9.	Headlands Beach State Park (HD)
10.	Huntington Res. (HT)
11.	Lakeshore Park (LS)
12.	Lakeview Park (LV)
13.	Port Clinton Beach (PC)
14.	Vermilion (V)
15.	Walnut Beach (W)

McFadden's conditional logit model is used to take account of both effects of choice attributes and individual characteristics is adopted in this study (Maddala,1983). With the assumption that the error term in the individual's utility function follows a generalized extreme value distributed, the nested multinomial logit (NMNL) model for the two-level decision process with k trip type groups of J_k site choices can be expressed as the probability function:

$$(2) \qquad P_{js} = \frac{e^{V_{js}/a_s}\left[\sum_{j=1}^{J_s} e^{V_{js}/a_s}\right]^{(a_s-1)}}{\sum_{k=1}^{K}\left[\sum_{j=1}^{J_k} e^{V_{ik}/a_k}\right]^{a_k}}$$

where $V_{js} = b_1 P_{js} + b_{2s} X_{js}$ is the utility associated with taking s type of trip to site j.

are the coefficients of all explanatory variables, where $_1$ denotes the marginal utility of income. a denotes the dissimilarity parameters representing the degree of substitution between subgroups.

The data for this study is taken from an intercept survey of visitors at the sites of 15 Lake Erie beaches, an on-site investigation of beach characteristics, and a survey of beach managers to determine site quality (Murray, 1998). The visitor survey determines the number of trips visitors take to each of the 15 beaches during the year, amount of time spent in different activities on the trip, trip expenditure, household demographics, beach perception, and willingness to pay for preventing the reduction in beach advisories. The on-site survey and beach manager survey generated information on beach infrastructure characteristics and water quality that are used as explanatory variables in this study.

Travel costs are estimated with direct travel expenses and opportunity costs of travel time:

TCOST = 2*? t*d/v+2*c*d/v

where d denotes the driving distance, v is the speed of traveling, c is the travel expenses per mile, and? t denotes the value of travel time with the assumptions that v=40mile/hr, c=$.30/mile, and ? t=30%*annual income/2040. Onsite costs include both onsite time costs and lodging costs:

ONSITE= w*? o*ot + bp*lc

where ot is onsite time, lc denotes lodge costs, w is work index, ? o denotes the value of onsite time, bp is the percentage of time spent on beach in whole trip with assumptions that ? o=30%*annual income/2040, and w=1 if any of household members is a worker, and 0 otherwise. However, we only have the information about the type of lodge place where visitors stay overnight. To transform the information into monetary scale, we have to treat the lodging costs by scaling the lodge place in the following order and multiple the scale by assumed $30/per scale as their lodging costs: 0: not overnight, 1:family, 2: camping, 3: resort, 4: hotel, 2.5: others. Full trip costs are then given as:

FCOST=TTCOST+ONSITE

To control for the fact that some visitors spend the full trip onsite and some spend only part of the trip onsite, we also weight the onsite costs by the proportion of time visitors report they spend on the beach. This weighting occurs both for single and for multiple day trips. Other variables included in the model are shown in Table 2.

Table 2. Variables of Choices

Explanatory Variables	***Definitions***
TCOST	Travel Costs (including monetary travel expenses and opportunity costs of travel time)
FCOST	Full Costs (including both travel costs and onsite costs)
WQ	Water Quality (96-98 average of e.coli)
ADVIS	Number of Advisories (96-98 average)
NPT	Number of Picnic Tables
GRAINSZ WHLZMN	Average Grain Size (microns) Number of Whole Zebra Mussel Shells
LFGDHRS	Lifeguard Hours per Week
AVCOB	Average Size of Cobble (m)
SLOPE	Slope of Beach (degrees)

RESULTS

Two models are thus estimated and compared. The first model includes only the direct costs of traveling to the site. The second model includes these direct costs and the onsite costs. Table 3 presents the results for the first model. For single day trips, five of nine estimates are significant within 5% significance level shown in table 3. Visitors' responses are very rational in behavior. To improve beach quality does attract more visits. The results show that lower e.coli index, less advisories, fewer zebra mussel shells, smaller size of cobble, and flatter beach slope will increase visitor's probability of visiting the site. For multiple day trips, all of the estimates are significant. However, the results are somewhat strange in that higher E. Coli counts increase the probability of visiting a site. One possible reason is that the e.coli index is not directly observable by the visitors. Despite this result, beach advisories reduce the probability of visiting for both single and multiple day visitors.

The size of the coefficient is larger for multiple day visitors than for single day visitors, suggesting that multiple day visitors are more sensitive to beach closings.

The coefficient of the inclusive value presents the correlation between the two choice sets. If γ is equal to 0, the two choice sets are independent so that IIA holds between the groups. If γ is equal to 1, the two choice sets are completely correlated, there is no necessity for the nested structure. In our case, the estimated γ is equal to 0.4338, showing that the nested structure does reduce IIA violation in MNL model. The estimate also suggests that the choices of single day and multiple day trips are correlated while people are making their trip decision.

The results differ for the model that includes onsite costs (Table 4). In particular, the results for the single day visitors make less sense than they do in the model in table 3. On the other hand, multiple day trips appear to be better explained when full trip costs are considered. The other important result from the full trip cost method is the reduced estimate of inclusive value from 0.4338 to 0.2499. The change also tells us the increasing independence of the decision of single day and multiple day trips, meaning that the nested structure has more power for this trip decision-making process with less violation of IIA property.

Table 3. Travel Costs Estimated Results of the Nested Multinomial Logit Model

(# of Obs.=1386)

Choice Set	Variables	Parameters	Estimates	Std. err.	Est./s.e.	Prob.
Single Day Trips	TCOST	β_{11}	-0.0975	0.0038	-25.4590	0.0000
	WQ	β_{12}	-0.0006	0.0007	-0.8680	0.1926
	ADVIS	β_{13}	-0.2754	0.0231	-11.9430	0.0000
	NPT	β_{14}	0.0018	0.0003	5.5770	0.0000
	GRAINSZ	β_{15}	-0.0534	0.0593	-0.9000	0.1841
	WHLZMN	β_{16}	-0.0224	0.0099	-2.2660	0.0117
	LFGDHRS	β_{17}	0.0022	0.0004	6.0460	0.0000
	AVCOB	β_{18}	-0.0046	0.0238	-0.1920	0.4238
	SLOPE	β_{19}	-0.0214	0.0350	-0.6100	0.2709
Multiple Day Trips	TCOST	β_{21}	-0.0200	0.0021	-9.3910	0.0000
	WQ	β_{22}	0.0027	0.0009	2.9860	0.0014
	ADVIS	β_{23}	-0.4542	0.0660	-6.8840	0.0000
	NPT	β_{24}	0.0033	0.0007	4.4910	0.0000
	GRAINSZ	β_{25}	-0.5984	0.0629	-9.5100	0.0000
	WHLZMN	β_{26}	-0.1022	0.0114	-8.9310	0.0000
	LFGDHRS	β_{27}	-0.0059	0.0009	-6.9550	0.0000
	AVCOB	β_{28}	-0.1636	0.0305	-5.3660	0.0000
	SLOPE	β_{29}	-0.3051	0.0529	-5.7700	0.0000
Trip Type	INCLUS	γ	0.4338	0.0353	12.2910	0.0000

Table 4. Full Costs Estimated Results of the Nested Multinomial Logit Model

(# of Obs.=1119)

Choice Set	Variables	Parameters	Estimates	Std. err.	Est./s.e.	Prob.
Single Day Trips	FCOST	β_{11}	-0.0773	0.0033	-23.2130	0.0000
	WQ	β_{12}	-0.0005	0.0007	-0.7210	0.2354
	ADVIS	β_{13}	-0.2321	0.0249	-9.3080	0.0000
	NPT	β_{14}	0.0019	0.0004	5.5470	0.0000
	GRAINSZ	β_{15}	0.1648	0.0796	2.0690	0.0193
	WHLZMN	β_{16}	0.0035	0.0126	0.2780	0.3906
	LFGDHRS	β_{17}	0.0031	0.0004	7.1940	0.0000
	AVCOB	β_{18}	0.0556	0.0331	1.6800	0.0465
	SLOPE	β_{19}	0.0542	0.0432	1.2560	0.1046
Multiple Day Trips	FCOST	β_{21}	-0.0312	0.0029	-10.7790	0.0000
	WQ	β_{22}	0.0018	0.0011	1.6790	0.0466
	ADVIS	β_{23}	-0.5940	0.0850	-6.9920	0.0000
	NPT	β_{24}	0.0043	0.0009	4.8200	0.0000
	GRAINSZ	β_{25}	-0.8660	0.0921	-9.3980	0.0000
	WHLZMN	β_{26}	-0.1470	0.0163	-9.0240	0.0000
	LFGDHRS	β_{27}	-0.0058	0.0010	-6.0920	0.0000
	AVCOB	β_{28}	-0.2846	0.0440	-6.4740	0.0000
	SLOPE	β_{29}	-0.4399	0.0635	-6.9330	0.0000
Trip Type	INCLUS	γ	0.2499	0.0250	10.0130	0.0000

Conclusion

The study develops a nested multinomial logit model to consider the decision over trip duration and site choice. Our sample of beach visitors in Ohio suggests that a large number of trips to the beach are taken by individuals who are on multiple day trips. Ignoring these trips could bias model estimates and welfare results. We thus estimate a model that includes decisions over both trip duration and site choice. Because trip duration is likely to be heavily influenced by onsite costs, we test the sensitivity of the results to alternative estimates of trip costs. One model considers only direct travel costs, and a second model considers travel costs and onsite costs, weighted by the proportion of time spent on site. This makes sense because individuals in our sample on multiple day trips reported spending a relatively small proportion of their time on the beach.

The results suggest that single day trips are mainly influenced by direct travel costs rather than onsite costs. This makes sense; onsite costs are a small proportion of the total costs of visiting a site for most local visitors (i.e. they do not have to spend money staying the night in a hotel). Multiple day trips, however, are better explained by including overnight costs. One of the problems with our approach is that we only group trip duration effects into single and multiple day trip choices. We do not distinguish actual trip duration, although other researchers have suggested categorizing trip length by choice of days. (McConnell & Strand, 1999).

In addition, it would be useful to consider alternative choice sets for multiple versus single day trips. Individuals on multiple day trips are likely to first choose a location to visit in general, and then choose a site once they are in that general area. It may be unreasonable to include all of the beaches in the choice set for multiple day trips. The argument of ignoring the number of trips in season arises because it fails to predict welfare changes under the possibility of reducing or increasing the number of trips undertaken. Although the number of seasonal trips is an important factor in recreation demand, it causes many internal difficulties for econometric estimation especially when trip duration is under consideration. First of all, the number of trips may have ambiguous or non-linear relationship with distance. It seems reasonable that the increase of distance will increase the probability of choosing multiple day trips (Bell & Leeworthy, 1990). But while the distance is largely increase, longer stay may not be a concern. Therefore, the number of trips may not be monotonically related to travel distance. If assuming trips number is linear related to distance, the obtained inclusive values will mislead the results. Secondly, the onsite time or the days spent at trips is related to the number of trips taken in a season, and vice versa. There is endogeneity problem between these two factors. Third of all, the different number of choice occasions is expected for different length of trips since people did not take multiple day trips as often as to spend one day out (McConnell & Strand, 1999).

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