

VALUING WHITEWATER RAFTING
ON THE MIDDLE FORK
OF THE SALMON RIVER

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ABSTRACT

In this paper we measure consumer surplus for guided whitewater rafting on the Middle Fork of the Salmon River. We use the travel cost valuation method in its individual form and various empirical specifications. Our findings indicate that annual mean consumer surplus ranges from about \$3707 to \$2476 depending on the empirical model and specification chosen. On a per trip basis, the range is \$2083 to \$1548 which is approximately \$349 to \$258 per day. This information coupled with accurate visitation data should be useful to those concerned with future government decisions for dam relicensing on similar National Wild and Scenic Rivers.

INTRODUCTION

Increasing attention is being paid to nonpriced commodities or values in management decisions pertinent to public resources. The impetus for much of this attention is based on Executive Order 12291 through which President Reagan mandated the use of benefit-cost analysis to assess Federal regulatory actions.

The nations' wild and scenic rivers are an example of a public resource providing potentially large noncommodity benefits

to society. In many of these rivers recreation in the form of guided rafting is one of the predominant noncommodity uses. Such an activity is dependent on in-stream flow that may conflict with hydropower demands. Consequently, good information about the value of guided rafting on given rivers should be an important ingredient in management decisions dealing with these rivers.

Whitewater rafting is the major recreational activity on the Middle Fork of the Salmon River (MFKS) in Idaho with an estimated 4500 annual users in 1993 accounting for about 30,000 user days. In this paper, we estimate the value of guided whitewater rafting on the MFKS using the travel cost method (TCM).

METHODS

The travel cost method (TCM) of site valuation is well established in the recreation economics literature (Ward and Loomis 1986, Fletcher et al. 1990). In its various forms, TCM is predicated on the concept that consumers respond to travel costs necessary to visit a site in a like manner to site access fees. Hence, a researcher may use travel costs to develop an empirical model of site demand and derive economic surplus for site users.

The two most frequently used TCM approaches are the zonal or aggregate approach and the individual approach. The zonal model was the first to be developed and is still widely used. It is based on establishing a relationship between per capita participation rates at a site from various geographic origin zones and the costs incurred in travel from the origin zone to the given site. Most often the relationship is conditioned by socioeconomic variables characterizing the population in each zone and by indices accounting for substitution activities or prices.

The empirical procedure for the zonal approach is usually broken into two stages. First, zonal per capita participation rates are regressed on travel cost and other relevant socioeconomic variables. Stage one parameter estimates are then used to derive trip/travel costs functions for each zone which may in turn be summed across price intervals to obtain an aggregate or second stage demand function. The aggregate demand function may then be used as the basis for obtaining Marshallian consumer surplus estimates (Cooper and Loomis 1990). Alternatively, the individual trip/travel cost zonal functions may be used to obtain surplus measures for each zone which may then be aggregated to obtain total net economic surplus for the site.

The zonal model is statistically inefficient because it is based on grouped data as well as being theoretically compromised by relying on aggregate data to model individual behavior (Fletcher et al. 1990). In addition, the model may be quite sensitive to the way zones are determined. Nevertheless, the model incorporates valuable nonparticipant information, is less demanding in terms of information from site users, and is well-suited to situations where dispersion of the dependent variable (trips) is limited (Richards et al. 1990).

The major problem with the zonal model precluding its use in this study is that homogeneous travel costs are necessary from each geographic zone. In this situation, significant numbers of users use air travel at a different cost per mile than vehicular travel. In addition, air travel from a major hub to a given destination is often cheaper than air travel from a smaller city which is closer. Hence, the zonal model is quite limited.

The individual travel cost model is conceptually similar to the zonal model however the travel cost/trip relationship is based solely on individual observations. The approach has been used in recent literature by a number of researchers (Adamowicz et al. 1989, Creel and Loomis 1990, Wilman and Pauls 1987).

The general demand relationship for the individual model in this study is one where annual trips per household are a function of price-per-trip, household income, and two binary variables, willingness-to-substitute, and whether fishing was included as a trip activity:

$$\text{Trips}_i = f(\text{price}_i, \text{income}_i, \text{fish}_i, \text{subst}_i) \quad (1)$$

The price variable consists of the travel costs and guide fees per household member participating. Income is reported gross household income. The fishing variable was included to capture autonomous differences between the small percentage of the sample (7 percent) for whom fishing was a major portion of the trip. A binary variable was deemed appropriate given the small number of anglers precluded stratification.

The substitute variable was designed to indicate whether the individual would go to another site if the MFKS site was unavailable. For those indicating they would visit another site, very few answered a follow-up question as to where. Fifty-three percent of the sample indicated that they would stay home rather than opt for an alternate site. The stochastic portion is based on an assumed identical and independently distributed random error.

EMPIRICAL MODELS AND DATA

Recent literature has suggested the use of count data distributions and maximum likelihood estimation in modeling recreation demand when the dependent variable is individual trips (Shaw 1988, Creel and Loomis 1990, Grogger and Carson 1991). Depending on the dispersion of the dependent variable, the distribution usually chosen is either the Poisson or the Negative Binomial. These distributions can be quite suitable to modeling recreation demand when individual trips are not excessive.

In recreation applications, data are commonly truncated or censored. Censored data arise when a range of values for the dependent variable is collapsed into a single value, while truncated data result when values in certain range are not observed. Survey questions with wording like "more than (or fewer than) k trips" result in censoring, while sampling procedures targeted only to known users result in truncation at the zero-trip level for discrete distributions and at one for continuous distributions.

We employ zero-level truncated Poisson (TP) and truncated Negative Binomial (TNB) models as described in Creel and Loomis (1990) and Grogger and Carson (1991) to model household demand for rafting trips to the MFKS. We also use the estimated parameters to derive consumer surplus. In addition, we estimate linear models based on continuous distributions, uncensored (OLS) and censored (Tobit) for comparative purposes. A truncated continuous model was also attempted, however a large probability mass at one trip precluded convergence of the MLE estimator.

Data was collected using a two-stage sampling procedure. First, all guides on the MFKS provided names and addresses of rafters for the 1993 season. Names were then drawn at random to receive a survey questionnaire, one per household. Such a plan avoids the endogenous stratification problem often encountered in site-based sampling (Shaw 1988). A total of 993 surveys were mailed and 456 were returned. A subset of 292 responses was used to estimate parameters for the various TCM models.

The survey consisted of a number of questions designed to elicit detailed trip expenditures, activities, time on-site and in-travel, and total visits to the site over the course of the year. In addition a number of standard household demographic questions were included (details of the survey are available from the authors).

At a unique and expensive site like the MFKS, households that do participate typically make one trip per year. On a household basis, this provides little dispersion in the dependent variable. To circumvent this problem, the dependent variable used was total trips per household (number of household members

participating multiplied by the number of household outings). Price per trip was created by dividing total travel and outfitter costs by the number of people in the household participating in the activity.

RESULTS

Parameter estimates for the various empirical models are reported in Table 1. Signs of the coefficients appear consistent with theoretical priors in all cases. Interestingly, all coefficients except the one on the substitute variable are significant at the one-percent level. The lack of significance of the nuisance parameter on the TNB model suggests that the dispersion of the dependent variable is not excessive and that the TP model cannot be ruled out. In fact, the similarity of the coefficient estimates between the estimated count data models is striking.

Regarding the continuous models, the OLS model is clearly inferior based on comparative log-likelihood function values. In this case, where the sample average number of trips is 1.77 and the minimum number is one, the OLS model yields numerous predicted trips of between zero and one as well as prediction intervals bracketed on the left by negative numbers. The Tobit model appears to fit the data considerably better as indicated by the extreme significance of the Tobit "sigma" parameter. This is most likely due to its ability to account for the probability mass at one trip.

Price elasticities calculated at sample means for all models (Table 1), reflect the highly inelastic demand for this type of recreation, ranging from -0.29 (OLS) to -0.63 (TNB) with the differences between Tobit, TP, and TNB being minor.

Consumer surplus estimates (following Hellerstein (1992) for the continuous models and Creel and Loomis (1990) for the discrete models) are reported in Table 2. Consistent with the high price inelasticity, annual and per trip surpluses are quite large, ranging from \$2083 to \$1548 per trip. Interestingly the OLS model yields surplus estimates closer to the TP and TNB than does the Tobit. While appearing excessive, trip length is most commonly from 5 to 7 days implying a per day consumer surplus of around \$300.

Table 1. Regression parameter estimates (dep. var. = trips per household, n=292)

	OLS	TOBIT	TP	TNB
Constant (t-vals)	.956 (4.66)	-1.48 (-2.86)	-1.35 (-4.53)	-1.51 (-3.90)
Price	-.0004 (-4.15)	-.00097 (-4.09)	-.00048 (-4.46)	.00053 (-3.56)
Income	.011 (7.16)	.029 (7.32)	.017 (7.70)	0.18 (6.75)
Fish	1.29 (5.01)	1.93 (3.76)	.965 (5.58)	.998 (3.91)
Substitute	.208 (1.61)	.503 (1.83)	.241 (1.94)	.267 (1.79)
δ	--	1.97 (14.29)		.186 (1.25)
R ²	.23	.20	--	--
Log-likelihood	-439.9	-350.5	-312.9	-310.9
Price Elasticity	-.29	-.57	-.57	-.63

Table 2. Consumer Surplus Estimates

	OLS	TOBIT	TP	TNB
Annual	\$3604	2476	3707	3365
Per Trip	\$2036	1548	2083	1886

CONCLUSIONS

Rafting trips to unique and glamorous sites like the MFKS are expensive and likely available only to the wealthier element of our society (our sample household average income exceeds by double the national median). Nevertheless, the MFKS accounted for about 4500 individual guided rafting trips in 1993.

Using a random sample of users and current econometric techniques, we determined trip demand to be highly inelastic. Accordingly, we obtained rather high household net economic benefits estimates of at least \$2476 per year or \$258 per day. Aggregated, the consumer surplus for guided rafting on the MFKS is on the order of \$6.9 million per year.

The TP, TNB, and Tobit models appear to fit the data reasonably well and allow estimation of individual travel cost models when sample data are truncated. We feel comfortable that these models handle the truncation problem, but we would obviously hesitate to extend our models to society at large for prediction or inference. However, we do feel they are likely valid for the select population of wealthy users and are useful when combined with accurate visitation estimates to derive total net economic benefits to guided rafting on the MFKS.

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