Testing Significance of Multi-Destination and Multi-Purpose Trip Effects in a Travel Cost Method Demand Model for Whale Watching Trips

John Loomis, Shizuka Yorizane, and Douglas Larson

Inclusion of multi-destination and multi-purpose visitors has an appreciable influence on a standard count data travel cost model derived estimate of willingness to pay but the differences are not statistically significant. We adapt a more general travel cost model (TCM) of Parsons and Wilson (1997) that allows for inclusion of multi-destination visitors as incidental demand to allow estimation of an unbiased measure of single and multi-destination willingness to pay for whale viewing using a single pooled equation. The primary purpose trip values from the standard TCM and simple generalized TCM model are identical at $43 per person per day and neither are significantly different from the $50 day value from a generalized model that distinguishes between joint and incidental trips. The general models avoid underestimation of total recreation site benefits that would result from omitting the consumer surplus of multi-destination visitors.

The Travel Cost Method (TCM) is a commonly used method to value non-market goods such as open-access areas or publicly provided outdoor recreation opportunities. While there are several types of TCM models, traditional TCM models estimate a demand function for the number of trips using the cost of traveling to the site as a proxy for price. Economic benefits are derived from this demand curve by integrating under this demand curve between the current price and a choke price. Our focus in this paper is to investigate an empirical problem that arises when one of the key assumptions of the TCM demand model is violated: interpretation of travel costs as the price of an outdoor recreation trip.

A standard assumption for interpreting travel costs as a valid proxy for the price of a trip is that the travel cost be incurred exclusively to visit the site, and nothing else. Such a single destination trip involves the individual going directly to the recreation site, and then returning directly to his or her home. Therefore all out-of-pocket cost and travel time are used to visit the site in question for the recreation activity being modeled. In contrast, a multi-destination trip is such that an individual has another destination on the way to the recreation site, nearby the recreation site or on the way back home. In this case we cannot interpret the entire trip cost as the price paid for visiting anyone particular site. If these multi-destination observations are treated in the same way as single destination trips, Haspel and Johnson (1982) claim the TCM will overestimate the benefits of a trip to the particular study site. Related to the multi-destination problem is the multi-purpose trip problem. Here, some proportion of his or her total trip travel cost and travel time are incurred for other trip purposes that may not be related to the natural resource based outdoor recreation activity we are trying to model. The other purposes may occur at basically

---

John Loomis is a professor, and Shizuka Yorizane is a graduate student, both with the Department of Agricultural and Resource Economics at Colorado State University.

Douglas Larson is a Professor with the Department of Agricultural and Resource Economics at the University of California, Davis.

We would like to thank Sabina Shaikh of UC Davis for comments and guidance on our demand model specification. We would to thank three referees for their valuable suggestions.

Agricultural and Resource Economics Review 29/2 (October 2000) 183–191

the same destination or at destinations en route. If we are interested in estimating the economic value of the particular outdoor recreation activity, we may have a misspecification problem as we observe only the overall multi-purpose trip demand function, not the specific activity trip demand function. That is, we observe the total trip price, but know little about the price for the individual site or activity we wish to value. Ignoring the distinction of different trip purposes or different destinations is likely to result in a bias estimate of the site price coefficient and hence yield a difference in consumer surplus. However, whether this difference is statistically significant has not been tested in most previous papers on this topic.

Of course the multi-destination or multi-purpose trip is a classic joint cost problem. One way of dealing with this problem is simply to identify from survey questions or statistical analyses (Smith and Kopp 1980) such individuals and drop them from the sample. However, this could lead to an underestimate of total recreation site benefits. To partially overcome this problem, the single destination visitor's consumer surplus per trip might then be applied as an approximation of the benefits received by these multi-destination visitors. Other approaches include retaining the multi-destination individuals using different procedures to deal with the joint cost. For example, in the previous literature, there are suggestions to identify the cost share of each destination (Gum and Martin 1975). For example, one might disaggregate travel cost by directly asking the people what proportion of their travel cost is allocated to each destination, or dividing up total trip cost by length of stay at each destination. Mendelsohn et al. (1992) have suggested treating multi-destination visitors as demanding a bundle of sites. It is this bundle of sites that is valued. A recent approach to deal with multi-destination trips was published in this Journal by Parsons and Wilson (1997). They treat the incidental visits to other recreation sites as complements to the study site, and include multi-destination trips in the demand estimation. These multi-destination (MD) trips are distinguished from single destination or primary purpose (PP) trips by a dummy variable in the regression. The dummy variable and its interaction with price captures the shift and rotation of the demand function, respectively, due to the existence of complement activities and/or sites (Parsons and Wilson 1997:3). In essence the dummy variable is correcting or modifying the reported total trip cost for the multi-destination or multi-purpose nature of the trip (Parsons and Wilson 1997:5).

This paper uses a case study of whale watching to investigate:

(1) The extent of difference in consumer surplus per day by including varying degrees of multi-destination visitors when estimating a negative binomial count data TCM.
(2) Whether the difference between consumer surplus for primary purpose trips (CS_{pp}) and consumer surplus for all trip purposes (CS_{pp+MD}) is statistically significant by comparing confidence intervals of the estimates (i.e. $CS_{PP} = CS_{pp+MD}$).
(3) Whether the consumer surplus from Parsons and Wilson (CS^{PW}) approach of incorporating multi-destination visitors in the TCM demand specification will allow for calculating a separate but valid measure of consumer surplus for single purpose visitors. We test whether $CS_{PP} = CS^{PW}{}_{PP}$.

Specification of the TCM Demand Model

The basic specification of a TCM demand curve arising from a standard utility maximization subject to a full income budget constraint involves travel cost as a measure of price, price of visiting substitute sites and income. Ideally one would want the "full" income budget constraint, which for time intensive activities would include the opportunity cost of time. However, if individuals are at a disequilibrium in the labor market (e.g., 40 hours a week or nothing job offers) such that they cannot trade time and money at their wage rate, then Bockstael et al. show that we cannot collapse the time constraint into the money income constraint to form a full income budget constraint. Instead, individuals must maximize utility subject to both the money and time constraints. In this case we must include the travel time price and total time budget as arguments in the demand function. However, even if there are some workers in equilibrium with their wage rate, McConnell and Strand (1981) and Wilman (1980) show that the wage rate is not always a good proxy for the value of travel time due to taxes and disutility of travel. As long as there is not a perfect correlation between travel cost and travel time, one can adopt the approach of McConnell and Strand and avoid reliance on the fraction of the wage rate by controlling for differences in travel time by including a separate variable in the demand function. When calculating consumer surplus it is not necessary to account for the value of travel time explicitly, since its affect on the price variable is controlled for by the separate travel time variable. For this paper, our stylized demand function is of the form:

(1) *Q (trips) = f (travel cost, travel time, price of substitutes, tastes, income, total time budget)*

Count Data TCM

The next issue that arises is the specification of the functional form of this demand function. As discussed by Hellerstein and Mendelshon (1993), there are both conceptual and econometric reasons for choosing a count data form. Specifically, because the number of trips is a non-negative integer, using a distribution restricted to this domain will lead to increased estimation efficiency and can avoid potential biases. The Poisson or negative binomial distribution assigns positive probabilities only to non-negative integers so are candidate distributional assumptions. Further, Hellerstein and Mendelsohn (1993) discuss that the count data model can be consistent with a utility maximization process involving repeated choices.

Count data models such as Poisson and Negative Binomial employ an exponential form of the quantity of trips (λ) for the demand function such as:

$$\lambda = exp\ (P, Z; \beta): \tag{2}$$

where:

λ; the mean of Q
P; travel cost variable
Z; the demand shift variables
β; a vector of parameters

The Negative Binomial is a more generalized form of the Poisson count data distribution that results when the Poisson parameter is distributed as a gamma random variable $\Gamma(\lambda;\ \mu,\ v)$ such that:

$$Prob\ (Q = n;\ n = 0,1,2,\,.\,.) = [\Gamma(n+\nu)/\Gamma(n+1)\Gamma(\nu)]\,[\nu/(\nu+\mu)]^{\nu}\,[\mu/(\nu+\mu)]^{n} \tag{3a}$$

$$E(Q) = \mu \tag{3b}$$

$$Variance\ (Q) = \mu + [\mu^2/\nu] \tag{3c}$$

With the Negative Binomial, the Poisson model requirement of identical mean-variance relation is relaxed (Hellerstein 1991). In this study, the Negative Binomial count model will be performed for estimating the demand function.

Consumer Surplus and CI Calculation

Since the objective of this paper is to investigate the effect of multi-destination trip bias on consumer surplus, we must be able to estimate the mean consumer surplus, and more importantly the confidence interval around the mean. In the count data model, consumer surplus (CS) per trip is calculated as the reciprocal of the coefficient on the travel cost variable, expressed as $1/\beta_{TC}$ (Creel and Loomis 1990). This simple expression for consumer surplus makes calculation of the confidence intervals around the average consumer surplus more straightforward. A simulation approach involving the variance-covariance matrix can be used to estimate the confidence intervals on consumer surplus (Creel and Loomis 1991). If the confidence intervals of consumer surplus calculated from demand curves estimated with and without inclusion of multi-destination trips do not overlap, then we can conclude there is a statistically significant multi-destination trip bias. This is a significant step forward over past investigations of multi-destination trip bias as these past studies performed no formal statistical tests to see if the differences in consumer surplus were significantly different. Thus we use the hypothesis: CSpp = CS.

Parsons and Wilson Joint Consumption and Incidental Demand Approach

Rather than dropping individuals who take multipurpose or multi-destination trips, Parsons and Wilson (1997) develop a model that incorporates these trips into the demand specification. They define joint consumption (JC) trips as "trips taken for dual purposes" (Parsons and Wilson 1997:1). In this case the trip is viewed as a bundle of visits to related (in the individual's mind) nearby sites. Parson and Wilson suggest this is consistent with Mendelsohn et al.'s treatment of multi-destination trips by redefinition of the "site" into a group of sites. Some other visitors take what Parsons and Wilson call "incidental trips," which are trips for a secondary or more minor, but related purpose to the primary recreation trips. Parsons and Wilson appear not to distinguish between these different types of multi-purpose trips, using the same dummy variable indicator (= 1) for both types of trips. They acknowledge this does not capture the distinctions between the joint and incidental trips, nor across different motivations for taking the two different types of trips as compared to primary purpose trips. We address this limitation by including two separate price slope variables for joint consumption trips and incidental trips and compare this model to results from Parson and Wilson's original model.

The Parsons and Wilson TCM demand model of multi-purpose and multi-destination trips can also be used to allow inclusion of different types of trips and yet calculate separate estimates of consumer surplus for each group. This is an especially attractive feature, where there are small sample sizes, such that separate models for each group cannot be estimated. This particular application of the Parsons and Wilson model seems to have been overlooked by the authors in their original application. To see how this can be done we start with the fully saturated specification of their model that interacts the indicator variable for multi-destination trips with the price variable.

$$(4)\quad Q = exp\,(\beta_0 + \beta_1\, travelcost + \beta_2\, traveltime + \beta_3\, income + \beta_4\, PriceSubs + \beta_5\, totaltimebudget + \beta_6\, JIDummy + \beta_7\, JIDtravelcost + \beta_8\, JIDtraveltime)$$

where:

JIDummy = 1 *if trip is multi-purpose* (*joint*) ***or*** *multi-destination* (*incidental*) and *zero if primary purpose.*

JIDtravelcost = *JIDummy* ∗ *travelcost* and
JIDtraveltime = *JIDummy* ∗ *traveltime*

Parsons and Wilson argue that inclusion of the intercept dummy variable is expected to capture the average shift of recreation demand function for different trip reason groups. Statistical significance on differential intercept, β_6, implies that the intercepts for two trip reason groups are different, and positive coefficient means that incidental visits work as a complements. Statistical significance on differential slope coefficient, β_7, indicates that the slope for different trip reason groups are different, and therefore, the consumer surplus of two sample groups are different. The consumer surplus for single purpose trips is $|1/\beta_1|$, while counterpart of multi-purpose trips is $|1/(\beta_1 + \beta_7)|$. Parsons and Wilson (1997:2–4) note that the consumer surplus from the multi-purpose trips is legitimate part of the total site consumer surplus and it would be lost if the site were closed.

We generalize the Parson and Wilson model to three trip reasons by distinguishing between joint consumption trips (i.e., several equally important purposes) coded as JCDummy and incidental consumption trips (i.e., multi-destination) coded as ICDummy. Thus we estimate a separate price slope coefficient for each trip type and use each in the formula for consumer surplus. We test whether $CS_{JC} = CS_{IC}$ using confidence intervals. As pointed out by a reviewer, even this differentiation of joint consumption and incidental consumption trips is a simplification of the underlying demand system if there are numerous trip itineraries. That is, if people living in different cities have different opportunities for combining whale watching with other activities, ideally one would use a separate dummy for each trip type. Proxying this with two dummies can result in an errors in variables problem as well. However, if one could obtain complete trip itineraries from each visitor, then the approach of Mendelsohn et al. could be applied which defines different trip itineraries as different goods. Given our lack of trip itineraries, our case study will only allow us to test if one obtains the same estimate of consumer surplus for single destination trips from a model estimated based solely on data from single destination trips and one estimated using two dummy variables as suggested by Parsons and Wilson.

Data Sources

Our case study involves estimating the demand for whale watching activity. The sample was visitors to the California coast in 1993. The sample frame was drawn from four locations along the California coast; San Diego (Point Loma National Seashore), Monterey, Half Moon Bay (both south of San Francisco), and Point Reyes National Seashore (north of San Francisco). At Point Loma and Point Reyes, people view whales from the shore. At Monterey and Half Moon Bay, people take boat cruises run by commercial operators, although whale watching from shore is possible.

The survey was conducted over the period of the gray whale migration along the California coast. Whales are first seen from the coast in late November to early December in northern California, mid-December in San Francisco, and around Christmas in San Diego. In February, they migrate back to the north and pass through the northern California by late March. Many people visit the coast to enjoy whale watching rather than other ocean activities in this season. For cost effectiveness in sampling, the survey was conducted on randomly chosen Saturdays or Sundays.

The survey was designed as a combined form of in-person-interview and mail questionnaires, which can be expected to have advantages of both direct interview and mailing approach: high response rate and less expense. Individuals age sixteen or older, completing trips were asked to take a survey booklet home with them.

The survey included questions on number of trips to the site where they were intercepted, travel time, gas cost and boat costs, etc. Demographic information such as income, age, gender, education, etc. was also asked at the end of survey. Seventy one percent of the surveys handed out, were returned.

A question on whether whale watching was the primary purpose of their trip or not was also asked in order to separate the sample by trip purpose. The specific question is: *"Was viewing whales at this location your: (a) Sole or major purpose of your trip from home; (b) one of many equally important reasons; (c) just an incidental stop or spur of the moment decision."* About 45% of the total sample answered that whale watching was the sole or primary purpose of their trips. Ideally, we would want to have truly single purpose trips separated from those in which whale watching was the major purpose but some incidental non-whale watching activities may have been undertaken. To fully implement the Parsons and Wilson model, future surveys should make this distinction. About one-third answered that whale watching is one of several equally important purposes of the trip. This category we consider as Parson and Wilson's joint consumption trips. The remaining 21% answered that whale watching was an incidental stop. This last category fits the multi-destination problem, as the whale viewing was by no means the reason they took the trip, and they may have been just passing through the area to and from another destination. This will be treated as Parsons and Wilson's incidental consumption type trips. About half the sample took one whale watching trip a year, while 25% took two trips. Nearly 20% took 3–6 trips annually. This distribution of the dependent variable suggests the appropriateness of the count data specification (Hellerstein 1992) and for generality we employ the negative binomial version.[1] An implicit assumption used in this paper is that if the person reported their most recent trip on which they were intercepted was a primary purpose whale watching trip, all of their trips to that site were assumed to be primary purpose and correspondingly if they reported the most recent trip was a multi-purpose or incidental trip.[2] This assumption is strictly accurate for the half of the sample taking only one trip per year to the site at they were intercepted, but possibly introduces some degree of unknown error for the other half of the sample that take multiple trips to the site each year.

Travel Cost Model Specification

The standard travel cost model is specified in (5a) as follows:

$$\text{(5a)}\quad Q = exp\,(\beta_0 + \beta_1\, GasBoat + \beta_2\, traveltime + \beta_3\, (traveltime)^2 + \beta_4\, income + \beta_5\, sex + \beta_6\, viewimp + \beta_7\, PriceSubs + \beta_8\, totimebudget)$$

Equation (5b) presents the original Parsons and Wilson model which does not distinguish between joint and incidental trip types:

$$\text{(5b)}\quad Q = exp\,(\beta_0 + \beta_1\, GasBoat + \beta_2\, traveltime + \beta_3\, (traveltime)^2 + \beta_4\, (income) + \beta_5\, sex + \beta_6\, viewimp + \beta_7\, PriceSubs + \beta_8\, totimebudget + \beta_9\, JIDummy + \beta_{10}\, JIDGasBoat + \beta_{11}\, JIDtraveltime)$$

where: JIDummy = 1 if trip is multi-purpose (joint) or multi-destination (incidental) and zero if primary purpose. JIDGasBoat = JIDummy*GasBoat, etc. Equation (5c) presents our extended version of Parsons and Wilson's model that does distinguish between joint and incidental trips:

$$\text{(5c)}\quad Q = exp\,(\beta_0 + \beta_1\, Gas\ Boat + \beta_2\, traveltime + \beta_3\, (traveltime)^2 + \beta_4\, (income) + \beta_5\, sex + \beta_6\, viewimp + \beta_7\, PriceSubs + \beta_8\, totimebudget + \beta_9\, JDummy + \beta_{10}\, JDGasBoat + \beta_{11}\, JDtraveltime\ \beta_{12}\, ICDummy + \beta_{13}\, ICDGasBoat + \beta_{14}\, ICDtraveltime)$$

where JDummy = 1 if trip is multi-purpose (joint) and zero if primary purpose or incidental and JDGasBoat = JDummy*GasBoat, etc. ICDummy = 1 if trip is incidental and zero if primary purpose or joint consumption and ICDGasBoat = ICDummy*GasBoat.

---

[1] Not only is the negative binomial more general, but the statistical significance of the overdispersion parameter in table 1, suggests this is the appropriate specification to avoid over-inflated t-statistics. However, the use of the negative binomial model makes correcting for endogenous stratification associated with on-site sampling far more difficult. At present even advanced econometric packages do not provide routines to perform such a correction in the negative binomial model. Thus, there may be a slight upward bias in all our model consumer surplus estimates due to oversampling more frequent visitors. This should not affect our comparison between models, however.

[2] We appreciate an anonymous reviewer making this implicit assumption in our empirical analysis, explicit.

The travel costs (GasBoat) were defined as the reported gasoline costs to drive to the viewing site plus the reported costs of the whale watching boat trip. Boat trips were an option at three of the four sites, although common at only two of the sites due to our sampling scheme. Boat costs are essentially exogenous to the individual and not correlated with travel distances (i.e., the cost of the boat trip is the same for all individuals). While individuals who reported they were on category #3 trips (i.e., whale viewing was just an incidental stop) would still have their full boat costs, they were instructed to report just the extra travel time and travel distance for traveling to the whale watching area.

Consumer demand theory suggests other variables should be present in the demand function. For example, income and gender (sex) as socioeconomic variables. Distance to the closest substitute whale watching site was included as the price of substitutes (PriceSubs). Importance of whale viewing (Viewimp) as a taste variable was considered as candidate taste/preference variable. In this equation, only the distance to the closest substitute site was used even though there were two alternative whale watching sites for participants visiting the northern California sites. The reason was that there was high collinearity between distances to the other substitute sites. Models estimated with the two substitute site prices had no additional explanatory power. Totimebud was the total time budget available for recreation (paid vacations plus weekends) and Traveltime was the travel time to the whale viewing area. These variables reflected the disequilibrium nature of the labor-leisure tradeoff for most workers.

Three sample groups were (1) single destination trip or Primary Purpose (PP), (2) single destination trip plus multi destination (MD) trips, which treated whale watching as one of equally important purpose of trip (PP + MD) and (3) all observations including incidental visits (ALL). The number of observations for each trip purpose is reported at the bottom of table 1.

Results

Statistical Results for Standard TCM

Table 1 presents the negative binomial count data regression results. The coefficients on the travel cost variables (GasBoat) are statistically significant at the 1% level. The estimated coefficients of Traveltime are statistically significant at the 1% level for the combined PP + MD model and ALL model and significant at the 5% level for the PP model.

The importance of viewing whales, ViewImp, has a significant positive effect on the number of trips. Participants who rate the importance of viewing opportunity highly tend to visit more often. The income variable has significant negative effect on number of trips in all three models. The negative income coefficient is often encountered with travel cost models (Creel and Loomis 1990). The negative coefficients of gender variable, Sex, is statistically significant for the primary purpose (PP) model, but decrease in significance as multi-destination observations are included.

The coefficient on the price of substitutes variable is expected to have a positive sign. However, in this study, price of substitutes has negative sign, but is not significant at conventional levels. It implies that for the whale-watching sample, alternative sites are neither substitutes nor complements. The total time budget variable performs poorly and is not statistically significant. It was, however, retained in the regression to reflect the time budget constraint.

Benefit Estimates of Standard TCM

Consumer surplus per day per person is in the last row of the table. Consumer surplus was calculated using the reciprocal of the GasBoat coefficient and divided by 2.5, which is the sample average group size. Per person consumer surplus varies from $43.50 for primary purpose trips to $75 when all trips are used. The large variability in consumer surplus suggests that TCM derived benefit estimates are somewhat sensitive to inclusion of multi-destination visitors. Following the single destination assumption, unbiased average consumer surplus is $43.50 per person per day. When the equal purpose multi-destination observations are included in the estimate, average consumer surplus increases by $8.50, or 19.5%. When all observations are used, including incidental trips, in the demand estimation, average consumer surplus is $75. This is $31.50, or 72.4% larger than the single destination trip consumer surplus. These size disparities have often been interpreted as existence of multi-destination trip bias in the previous studies.

However, comparing the 95% confidence intervals of per day consumer surplus at the bottom of table 1 suggests that these three estimates are not statistically different. Confidence intervals of three models overlap and mean value of PP + MD model is within the confidence intervals of PP and ALL models.

While the change in consumer surplus is not statistically significant there may be times the large difference in benefits is policy relevant. Thus it is

Table 1. Negative Binomial Count Data TCM Demand Equation

	Primary Purpose (PP)	Primary & Equal (PP&MD)	All Trip Purposes (ALL)	Parsons & Wilson Combined Model	Parsons & Wilson Joint, Incidental Consumption
C	0.4129	0.9533	1.1225	1.5183	.9097
	(0.11)	(0.32)	(0.39)	(.52)	(.313)
GasBoat	−0.0092	−0.0077	−0.0053	−.0093	−.00804
	(−4.79)***	(−5.32)***	(−4.05)***	(−4.87)***	(−4.86)***
Travel Time	−0.1415	−0.1310	−0.1101	−.0984	−.1189
	(−2.34)**	(−3.63)***	(−3.38)***	(−2.91)***	(−3.64)***
Travel Time SQ	0.0047	0.0033	0.0027	0.030	.0026
	(2.15)**	(3.77)***	(3.40)***	(3.50)***	(3.42)***
ViewImp	0.2179	0.1793	0.1659	0.1800	.1735
	(3.56)***	(3.89)***	(3.93)***	(4.23)***	(4.08)***
Income	−3.20E-06	−3.55E-06	−3.43E-06	−2.96E-06	−3.14E-06
	(−2.23)**	(−3.26)***	(−3.39)***	(−2.91)***	(−3.09)***
Sex	−0.2907	−0.1552	−0.1257	−0.2800	−.1189
	(−3.05)***	(−2.10)**	(−1.80)*	(−2.66)***	(−1.70)*
PriceSubs	−0.00016	−0.00012	−0.00010	−0.0001	−.000137
	(−1.35)	(−1.54)	(−1.46)	(−1.89)*	(−1.92)*
Total Time Budget	0.000109	2.23E-05	−2.31E-05	−4.88E-05	5.12E-06
	(0.20)	(0.05)	(−0.05)	(−0.11)	(.01)
Joint & Incidental Trip Dummy (JID)				−0.5172 (−2.20)**	
JID*GasBoat				0.0078	
				(3.29)***	
ICD*GasBoat					.0058
					(2.42)**
JCD*GasBoat					.0055
					(2.33)**
JID*Travel Time				−0.0451	
				(−1.30)	
JID*Sex				0.3128	
				(2.27)**	
Overdispersion Parameter	−1.958 (−8.15)***	−1.761 (−10.27)***	−1.622 (−10.51)***	−1.66 (−10.59)***	−1.62 (−10.55)***
N	287	469	565	565	565
Adj. R sq.	0.0920	0.0895	0.0708	0.0758	.070
CS/group/day	$108.6	$130.0	$187.4	PP = $107.5; JID = $666.7	PP = $124.40 IC = $449 JC = $398
CS/person/day (95% Conf. Interval)	$43.5 ($31–74)	$52.0 ($38–82)	$75.0 ($50–145)	PP = $43 (31–72) JID = $267 (160–756)	PP = $50 (35–83) IC = $179 (107–526) JC = $159 (102–362)

Notes: z-statistics are presented in parentheses.
Significance levels: ***(1%), **(5%), *(10%).

important to include specific questions in a TCM survey asking the nature of the trip being taken. If such information on the nature of the trip is collected from visitors, a TCM model that explicitly accounts for this information may be an improvement over the standard TCM.

Results of the Parsons and Wilson Model

The fourth regression result column of table 1 presents the estimation results of the Parsons and Wilson model that combines the joint and incidental trips and codes these with one dummy variable (JID). As shown in table 1, this multi-destination trip differential price slope coefficient, β_8 JIDGasBoat, is statistically significant. The positive sign on the differential slope coefficient of JIDGasBoat implies that the demand curve of multi-destination trips is rotated by the magnitude of the slope coefficient on JIDGasBoat. The statistically significant negative intercept coefficient (JID) shifts the multi-destination demand curve inward by the magnitude of the dummy variable coefficient. The extreme right hand column of table 1 presents the Parson and Wilson model with two separate multi-destination price slope variables, one for joint consumption trips (JCDGasBoat) and one for incidental consumption trips (ICDGasBoat). As can be seen these two price slopes are nearly identical at .0058 and .0055, respectively. Thus for this data set it appears not to make any difference if these two types of complementary trips are distinguished from one another in the demand function.[3]

The Parsons and Wilson models also allow for separate calculation of the benefits of single and multi-destination/multi-purpose trips. Consumer surplus per person per day is in the last row of table 1. These estimates are based on the coefficients of GasBoat for the single destination trips and GasBoat + JIDGasBoat for multi-destination trips. In the Parson and Wilson model the consumer surplus of a single purpose trip is $43, nearly identical to the unbiased estimate of $43.50 from the single purpose trip specification. The extreme right hand column presents the results of applying the Parson and Wilson model for three trip types. The primary purpose day trips have a value per person of $50. With a confidence interval of $35–83, this is not statistically different from the $43 of the other two models estimate of the value of primary purpose trips.

Another attractive feature of the Parsons and Wilson model is that it allows one to estimate the consumer surplus for the multi-destination (i.e., joint and incidental) trips. For the model that combines joint and incidental trips into one variable, the consumer surplus for these types of trips is $266.70 per person per day. As shown at the bottom of table 1, the confidence intervals of the single and multi-destination trip values do not overlap, indicating that one obtains statistically significant differences in trip values. As can be seen in the extreme right hand column of table 1, there are statistically significant price slope interaction terms for joint consumption (JC) trips and the incidental consumption (IC) trips. Using these individual coefficients in the calculation of consumer surplus yields value per person per day of $159 for the joint trips and $179 for the incidental trips. Comparing confidence intervals of these trips to the primary purpose trips indicates both these values are significantly higher than the $50 primary purpose trip value. However, the joint and incidental trip values are not significantly different from each other.

The higher consumer surplus per day for the joint and incidental trips than primary purpose trips is consistent with Parsons and Wilson's view that such multi-destination trips would be more valuable because of the joint consumption nature of those trips. As Parsons and Wilson (1997:4) point out, the multi-destination/multi-purpose trip value is the willingness to pay for the primary and secondary sites and/or activities together. Thus it is not just the value of the whale watching activity. The attractive feature of their model is that one can get separate estimates of consumer surplus for both single and multi-destination trips, rather than having to omit multi-destination trips for fear of biasing the estimate of consumer surplus on the single destination (primary purpose) trips. As Parsons and Wilson note, omission of the multi-destination visitor benefits would underestimate the total recreation value of the recreation site.

Conclusion

Like past TCM studies, our study finds mixing primary and multi-destination trip visitors increases the estimated consumer surplus per trip. In our study this increase is at least 20% to as much as 70%. However, unlike past studies we tested to see if these multi-destination trip value differences were statistically significant. They were not. While the different consumer surplus estimates were not significantly different, they could be policy relevant differences. Omitting multi-destination trip users will yield an unbiased estimate of *per trip* consumer surplus, but omission of these multi-destination trip users will result in an underestimate of *total site* benefits. Therefore we took an incidental trip demand approach of Parsons and Wilson one step further. This allowed us to include single destination and multi-destination visitors, but calculate separate estimates of consumer surplus for each type of visitor. Comparison of the single-destination only TCM consumer surplus and the calculated Parsons-Wilson consumer surplus for these same single-destination visitors indicates we have an unbiased estimate of consumer surplus per trip at $43 per person per day. By estimating a separate consumer surplus for the multi-destination users from this model, we have a more accurate estimate of total site benefits than would occur if these multi-destination visitors were excluded. If these results are replicated in other studies, this adaptation of the Parsons and Wilson model may provide another practical solution to the multi-destination trip problem in travel cost demand modeling.

---

[3] This model does not include separate intercept shifters for joint and incidental trips, but only the price slope interaction terms. This is due in part to the intercept dummy for joint trips being insignificant. A model with just the incidental trip intercept dummy, resulted in the estimated consumer surplus for incidental trips being implausibly large (e.g., an order of magnitude larger than any other trip consumer surplus). The model with just the slope interaction terms was much more plausible.

References

Bockstael, N.I. Strand and M. Hanemann. 1987. "Time and The Recreation Demand Model." *American Journal of Agricultural Economics* 69(2):293–302.

Creel, M. and J. Loomis. 1990. "Theoretical and Empirical Advantages of Truncated Count Data Estimators for Analysis of Deer Hunting in California." *American Journal of Agricultural Economics* 72(2):434–441.

Creel, M. and J. Loomis. 1991. "Confidence Intervals for Welfare Measures with Application to a Problem of Truncated Counts." *Review of Economics and Statistics* 73(2):370–373.

Gum, R.L. and W.E. Martin. 1975. "Problems and Solutions in Estimating the Demand for and Value of Rural Outdoor Recreation." *American Journal of Agricultural Economics* 57(4):558–566.

Haspel Abraham E. and F. Reed Johnson. 1982. "Multiple Destination Trip Bias in Recreation Benefit Estimation." *Land Economics* 58(3):364–372.

Hellerstein, Daniel. 1991. "Using Count Data models in Travel Cost Analysis with Aggregate Data." *American Journal of Agricultural Economics* 73(3):860–867.

Hellerstein, Daniel. 1992. "The Treatment of Nonparticipants in Travel Cost Analysis and Other Demand Models." *Water Resources Research* 28(8):1999–2004.

Hellerstein, Daniel and Robert Mendelsohn. 1993. "Theoretical Foundations for Count Data Models." *American Journal of Agricultural Economics* 75(3):604–611.

McConnell, Kenneth and Ivar Strand. 1981. "Measuring the Cost of Time in Recreation Demand Analysis: Application to Sportfishing." *American Journal of Agricultural Economics* 61:153–156.

Mendelsohn, R.J. Hof, G. Peterson and R. Johnson. 1992. "Measuring Recreation Values with Multiple Destination Trips." *American Journal of Agricultural Economics* 74: 926–933.

Parsons, G.R. and Aaron J. Wilson. 1997. "Incidental and Joint Consumption in Recreation Demand." *Agricultural and Resource Economics Review* April 1–6.

Smith, V.K. and R. Kopp. 1980. "The Spatial Limits of the Travel Cost Recreational Demand Model." *Land Economics* 56:64–72.

Wilman, Elizabeth. 1980. "The Value of Time in Recreation Benefit Studies." *Journal of Environmental Economics and Management* 7:272–286.