Household Income and the Value of a Recreational Experience: Analysis of Wildlife Viewing in Denali National Park

Alexander Bujak
May 2002
Economics 199: Empirical Research
Supervising Faculty Member: Dr. William Boal

Introduction

This paper analyzes the influence of household income on the participants' willingness-to-pay (WTP) for a wildlife viewing experience. It uses the least-squared regression methodology on survey data from a priced good. According to demand theory, the level of income should affect an individual's valuation of that good. It should alter how much individuals value a particular outdoor recreation experiences.

To understand how income contributes to the protection of wildlife, I examine different income groups and their willingness-to-pay for a wildlife viewing experience. Dr. Daniel McCollum, a Forest Service economist, kindly provides the survey data. He had previously used the data in a Forest Service document that "demonstrated a link between the value placed on an outdoor recreation experience and the amount of wildlife seen on the trip."[1] Methods and procedures used to acquire this survey data are explained in appendices.

This paper and its conclusions differ from McCollum's because it examines how income contributes to the valuation of the wildlife viewing experience. The previous research examined only viewing influence willingness-to-pay parameters. Because household income establishes the budget constraint in consumer demand theory, this paper is investigates how an individual's income constraints his valuation of viewing wildlife.

Contingent valuation methodology is an economic research technique to measure an individual's willingness-to-pay (WTP) for a good. In this particular instance, the "good" is the wildlife viewing experience. It is a stated preference technique asking a

[1] McCollum et al., Pp. 1

respondent outright what they are willing to pay. The instrument used for its measurement is the open-ended survey (Survey Appendix).

Survey Data

This open-ended survey instrument elicits tourists regarding their highest ticket (Survey Appendix). Surveys were distributed after Alaska wildlife bus tours in Denali National Park during the summer of 1995. The tundra wildlife tour was specifically promoted for viewing wildlife (Figure 1) and cost $51 (half for children). While on the tour if someone spotted wildlife, the bus stopped and the driver filled out a log on specific wildlife seen (Driver's Log Appendix). Following the tour, each customer filled out the survey.

In preparing the data for this analysis, surveys with non-responses to the household income question were eliminated reducing the sample size, approximately ten percent. The variables involved in this study include binary income groups and "Big 5" animals seen: moose, brown bear, caribou, Dall sheep, and wolf. They are selected as important wildlife species for use in this research because they are the five largest animals in Denali National Park and the previous researchers used this variable in their analysis.

The mean of this wildlife variable (W_1) illustrates that the average number of "Big 5" animals seen is 12 (Table 1). The mean of each income group is its percentage of the survey. For example, the second income group (I_2) has a mean of .1 that means that 10% of the survey data falls into the category of $25,000 to $49,999. The median income of the dataset is the income group of $50,000 to $74,999.

Our sample size makes this analysis significant because it allows variation while its large size compensates for errors (Table 1). In preliminary analysis of the raw data at 1% significance, willingness-to-pay is correlated with the number of "Big 5" species seen at .174. However, regression analysis makes possible the analysis for multiple variables, number of animals sighted and income.

Methods

I use least squared regression to measure the effect of viewing the number of "Big 5" wildlife species seen and the level of household income on their willingness-to-pay for this wildlife bus tour. I use dummy variables for each income group:

I_1 for incomes under $25,000

I_2 for incomes from $25,000 to $34,999

I_3 for incomes from $35,000 to $49,999

I_4 for incomes from $50,000 to $74,999

I_5 for incomes from $75,000 to $99,999

I_6 for incomes from $100,000 to $149,999

I_7 for incomes for $150,000 to $199,999

I_8 for incomes over $200,000.

The income group variables ((I_i) are binary with values of 0 or 1. The wildlife (W_1) variable was used as the variable for the number of "Big 5" species seen on a trip.

The equations that I estimated were as follows:

i) $WTP=\beta_1+\beta_2 W_1$

ii) $WTP=\beta_1+\beta_2 W_1+ \beta_3 I_2+ \beta_4 I_3 + \beta_5 I_4 + \beta_6 I_5 + \beta_7 I_6 + \beta_8 I_7 + \beta_9 I_8$

iii) $WTP=\beta_1+\beta_2 W_1+ \beta_3 I_2+ \beta_4 I_3 + \beta_5 I_4 + \beta_6 I_5 + \beta_7 I_6 + \beta_8 I_7 + \beta_9 I_8 + \beta_{10}(I_2 * W_1) + \beta_{11}(I_3 * W_1) + \beta_{12}(I_4 * W_1) + \beta_{13}(I_5 * W_1) + \beta_{14}(I_6 * W_1) + \beta_{15}(I_7 * W_1) + \beta_{16}(I_8 * W_1)$

Based on demand theory, the coefficients should be positive. We also should expect a positive correlation between income groups and their coefficients. As a private good, wildlife viewing should exhibit the behavior of a normal good.

Results

Income levels and wildlife viewing significantly increase the willingness-to-pay for these bus tours in Denali National Park. The regression results are presented in Table 2. The low r^2 values do not alter this analysis because the survey data was cross-sectional.

Statistical procedure dictates that researchers test for the significance for additional dependent variables. I tested for the importance of using income coefficients and numbers of "Big 5" wildlife seen with an F-test. This F-statistic 5.86 is greater than the 2.64 critical point at 5% significance.

I suspect that income (I_i) and the "Big 5" animals seen (W_1) dependent variables interact to create higher willingness-to-pay. To check if this interaction is significant, I use equation 2 as the restricted equation for equation 3 for a F test. The F statistic of 1.09 is less than 2.64 critical value. The interaction of the number of "Big 5" species sighted and the different income groups is not significant at 5% significance.

This regression data supports the prediction that the good of wildlife viewing is "normal." Referring to equation 2, the intercept, mean number of animal seen multiplied by .921, and the coefficient from the respective income group is added together to predict a willingness-to-pay (Table 2). Relative to incomes under $25,000, on average an

individual with a household income between $35,000 and $49,999 ($I_2$) has a predicted willingness-to-pay of $53.34[2] where an individual with a household income over $200,000 ($I_7$) has predicted willingness-to-pay of $59.91[3]. Enhanced willingness-to-pay occurs as household income level swells – the anticipated outcome.

There is a clearly demonstrated upward pattern of increasing willingness-to-pay with larger household incomes (Graph 1). The dip in the bar graph between the $75,000 to $99,999 income group ($I_4$) and the $100,000 to $149,999 income group ($I_5$) is not significant and does not change the overall positive trend.

Conclusion

Household income adds an important element to describing willingness-to-pay for wildlife viewing. On average people with higher incomes expressed a higher willingness-to-pay for these tours. This analysis illustrates the positive effect of income on wildlife viewing valuation. It also shows the sightings of more wildlife on a bus tour increases a person's willingness to pay for the tour. Empirically, it supports the economic theory of normal goods.

Household income plays an important role in contingent valuation studies because as income rise, willingness-to-pay estimates will follow. This basic economic theoretical concept applies to environmental economics. Understanding this effect of income on viewing wildlife helps to design policies to protect national parks and wildlife in the coming years.

[2] WTP_2= 40.207 + .921*12 + 2.001
[3] WTP_7= 40.207 + .921*12 + 8.649

Bibliography

McCollum, D., M. Haefele and S. Miller. March 1998. “Attributes and the Value of a Recreation Experience: A Preliminary Analysis of Wildlife Viewing in Denali National Park,” USDA Forest Service, (internal document).

Data Appendix

In March 1998 Daniel McCollum collaborated with Michelle Haefele, Colorado State University's Dept. of Ag. & Resource Economics; and SuzAnne Miller, Alaska Department of Fish and Game, Division of Wildlife Conservation.

Data was collected in the summer of 1995. The Tundra Wildlife Tour was held twice a day and run by a private company. The bus drivers used a log (Driver's Log Appendix) to keep track of the wildlife seen on each tour. The tour would stop whenever wildlife was seen. "For each stop the driver recorded the time and location (by odometer reading) of the stop, species seen, number of animals, proximity of the animal(s), ease of seeing the animal(s), activities that were observed, and his or her own subjective rating of overall sighting quality."[4]

The tours were a controlled situation because people got on the bus in the beginning and did not leave until they filled out a survey. It was also not awkward asking people how much they would pay to gain access to this experience because they already had to pay $51 (half for children) to go on the tour. No people joined the tour enroute.

Six tour drivers participated in the study. The surveying and data collection was administered over a 5-week period with every tour participant filling out a survey. The surveys were 7 pages (Survey Appendix) and conducted by the Alaska Department of Fish and Game.

The number of people asked to fill out the survey was 4808 on 130 bus trips. Trips were defined as individual bus tours, each containing around 40 people. All individuals responded, but some did not fill out the entire survey. The drivers' log

[4] McCollum et al., Pp. 4

reports were matched with tourists' surveys by assigning each survey a six-digit number included a corresponding log number.

The survey data was originally used to study the link between the value placed on an outdoor recreation experience and the kind/amount/variety of wildlife seen on the trip. However, the investigation into the influence of the household income levels on willingness-to-pay has never been pursued with this data before this paper.

Table 1: Descriptive statistics of sample

	Mean	St. Dev.	Min	Max.
Highest Adult Price	54.86	22.523	0	581
# Of “Big 5” Animals Seen	12.07	4.161	2	24
Less than $25,000	0.08	0.275	0	1
$25,000 to $34,999	0.1	0.306	0	1
$35,000 to $49,999	0.17	0.371	0	1
$50,000 to $74,999	0.23	0.42	0	1
$75,000 to $99,999	0.15	0.358	0	1
$100,000 to $149,999	0.13	0.335	0	1
$150,000 to $199,999	0.05	0.21	0	1
$200,000 or more	0.09	0.291	0	1
n=	4315			

Table 2: Least Squared Regression To Estimate WTP

Equation	**(i)**	**(ii)**	**(iii)**
Intercept	43.568	40.287	35.169
	(1.093)	(1.674)	(3.973)
# 'Big 5' Animals Seen (W_1)	0.936	0.921	1.344
	(0.086)	(0.085)	(0.310)
\$25,000 to \$34,999 (I_1)	NA	1.619	10.670
	( )	(1.726)	(5.321)
\$35,000 to \$49,999 (I_2)	NA	2.001	6.552
	( )	(1.586)	(4.766)
\$50,000 to \$74,999 (I_3)	NA	2.741	10.111
	( )	(1.509)	(4.539)
\$75,000 to \$99,999 (I_4)	NA	4.513	6.136
	( )	(1.599)	(4.893)
\$100,000 to \$149,999 (I_5)	NA	4.364	8.838
	( )	(1.644)	(4.974)
\$150,000 to \$199,999 (I_6)	NA	4.901	8.591
	( )	(2.106)	(6.577)
\$200,000 or more (I_7)	NA	8.649	16.254
	( )	(1.749)	(5.388)
Interactions	No	No	Yes
R-square statistic	0.174	0.198	0.203
Adjusted R-square	0.03	0.039	0.041

Graph 1: Household Income's Effect on Willingness-To-Pay for Wildlife Viewing