The Economic Benefits of Snowmobiling in Wyoming: A Travel Cost Approach with Market Segmentation

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Abstract:

Little research has been done on the economic benefits of snowmobiling. This study used a cluster analysis and the travel cost method to identify different snowmobiler segments and estimate their respective consumer surplus values. Consumer surplus estimates ranged from $12 to $49 per day for the different segments.

INTRODUCTION

Snowmobiling as a form of recreation is an increasingly important activity for residents and visitors to the west. Participation in outdoor recreation has increased substantially in recent decades. It has been estimated that the activity brings in $3.7 million dollars a year from non-residents alone (Taylor, Fletcher, and Skidgel, 1995). This growth is expected to continue through the end of the century (Buchanan and Kamby, 1990). Understanding the motivation and behavior of participants of various winter activities will help managers and policy-makers design appropriate policies for managing winter recreational areas. This study reports the results of an extensive survey and modeling effort to investigate the economics of snowmobiling in Wyoming. The overall research objective of this study is to explore the benefits associated with snowmobiling in the State of Wyoming. Specifically, this study is designed to estimate the net benefit to Wyoming snowmobilers from snowmobiling trips in the State of Wyoming. Specific objectives of the study are:

- Determine Wyoming snowmobiler's characteristics, preferences and motivations for snowmobiling.
- Identify unique groups of snowmobilers based upon their reasons for snowmobiling.
- Estimate the individual economic benefits associated with snowmobiling in Wyoming using the Travel Cost Method.

METHODOLOGY

The Department of Commerce, Division of State Parks and Historic Sites which administers the Wyoming State Trails Program provided a list of 1,544 registered Wyoming snowmobile owners. A sample was composed of the households on this list and were sent a mail questionnaire in April of 1996. Questions in the survey were designed to elicit information on trip cost, trip behavior, reasons for snowmobiling, substitute sites, and general demographic information. The questionnaire was designed to provide information for a travel cost model of snowmobiling in Wyoming using individual data. Of the

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1,544 surveys mailed, 818 were returned and 112 were returned as undeliverable resulting in a 57 percent response rate. The sample was then grouped into five different clusters based upon individual characteristics, site attributes, and reported reasons for participating in the activity. The procedure evaluates and groups individual responses to generate a sub-sample cluster that are more similar to each other than they are to other clusters, creating a situation of homogeneity within clusters and heterogeneity between clusters (Hair et al., 1992; Aldenderfer and Blashfield, 1984).

THEORETICAL FRAMEWORK

The demand for non-market goods in a travel cost method (TCM) typically assume a utility maximization framework with income, a vector of commodities, and a vector of environmental or resource related indexes q_{ij}. This leads to a set of consumer demand functions for both market and non-market goods:

$$r_{ij} = f(p_x, p_r, Y, Q) \tag{1}$$

The number of recreational trips r_{ij}, is used as a proxy for demand for the non-market good and the cost per trip used as a proxy for price p_r. Estimates result in an ordinary demand function for a non-market good where cost per trip is inversely proportional to r_{ij}.

The estimation procedure used in this analysis incorporates a count-data process which imposes a Poisson or Negative Binomial distribution for the error term, (Creel and Loomis, 1990). The Poisson distribution assumes that the conditional mean of the dependent variable is equal to its conditional variance Greene (1990). A particular type of heterscedasticity, called over-dispersion, occurs when the conditional mean is signficantly different from its conditional variance. Estimates from a Poisson model with over-dispersion are consistent but biased downward.

This analysis uses an individual travel cost method (TCM) to estimate the economic benefits of snowmobiling to Wyoming. The model uses actual expenditures by respondents to estimate an average respondent's willingness-to-pay to participate over and above the actual travel expenditures. TCM approaches have been used to measure a variety of non-market activities, including mountain biking (Fix and Loomis, 1997), and hunting (Creel and Loomis, 1990; Offenbach and Goodwin, 1994).

Economic models were developed for the entire sample and for each of the market segment groups. The functional form for these economic models varied across the different groups, but the general demand function for snowmobiling is as follows:

QUANTITY OF TRIPS = (TRAVEL COST PER TRIP PER PERSON, INCOME, DAYS SNOWMOBILING ON TRIP, FAVORED SNOWMOBILING SITE, EXPERIENCE LEVEL, AGE, NUMBER OF WINTER ACTIVITIES PARTICIPATING IN, INDEX OF SITE QUALITY ALTERNATIVE SITE TRAVEL COST, QUALITY OF ALTERNATIVE SITE).

Total trips is a function of the cost of traveling to the site (both in terms of time and distance), income, and a vector of independent variables that relate to quality and reasons for participating. The vector of independent variables consist of the number of days spent snowmobiling on the trip, the extent to which the site was a favorite site to snowmobile, a measure of how often and how many years the individual has been snowmobiling, the snowmobiler's age, a measure of how many different winter activities the snowmobiler participates in, the quality of the site visited, the cost of traveling to a substitute site, and a measure of the quality of the substitute site.

ANALYSIS AND RESULTS

Cluster Analysis

Respondents were given 26 reasons why snowmobiling is an important recreational activity for them and asked to rate each in the survey from extremely unimportant (coded as one) to extremely

important (coded as seven) . Based upon the results the first step involved in clustering the sample began with variable clustering to identify collinear relationships among reasons. Five variable clusters were found that best summarized the psychological reasons for snowmobiling without significantly reducing the amount of information given by the original variables. These five clusters were Achievement/Stimulation dimension, Escape Personal/Social Pressure dimension, Enjoy Nature dimension and the Geography of Area, Being with Family and Friends, and Escape Physical Pressure.

The first cluster is best described by the Achievement/Stimulation dimension. There are nine member variables in this cluster, four of which fall under the Achievement/Stimulation dimension. Other dimensions which are included in this cluster are Risk Taking, Equipment, Introspection, and Autonomy/Leadership. The reasons that are included in this cluster are:

- To take risks (Risk Taking)
- To become better at it (Achievement/Stimulation)
- To have thrills (Achievement/Stimulation)
- To use my equipment (Equipment)
- To test my abilities (Achievement/Stimulation)
- To gain a sense of self-confidence (Achievement/Stimulation)
- To think about who I am (Introspection)
- To be in control of things that happen (Autonomy/Leadership)
- To talk to others about my equipment (Equipment)

The second variable cluster is best described by the Escape Personal/Social Pressure dimension. This cluster contains seven member variables, four of which fall under the Escape Personal/Social Pressure dimension. The other dimensions included in this cluster are the Autonomy/Leadership, and Introspection dimensions. Variables that are included in this cluster are:

- To do things my own way (Autonomy/Leadership)
- To get away from the usual demands of life (Escape Personal/Social Pressure)
- To have a change from my daily routine (Escape Personal/Social Pressure)
- To avoid everyday responsibility for a while (Escape Personal/Social Pressure)

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- To be on my own (Autonomy/Leadership)
- To think about my personal values (Introspection)
- To help release or reduce some built up tension (Escape Personal/Social Pressure)

The third variable cluster is best described as a combination of the Enjoy Nature dimension and the Geography of Area subset of the Learning dimension. This cluster contains four member variables, two of which fall under the Enjoy Nature dimension and two of which fall under the Learning dimension. The variables included in this cluster are:

- To be close to nature (Enjoy Nature)
- To learn about the topography of the land (Learning)
- To get to know the lay of the land (Learning)
- To view the scenery (Enjoy Nature)

The fourth variable cluster is a combination of multiple dimensions and can best be described as Being with Family and Friends. This cluster had three member variables whose dimensions are Teaching-Leading Others, Family Togetherness, and Similar People. The variables included in this cluster are:

- To share what I have learned with others (Teaching-Leading Others)
- To do something with my family (Family Togetherness)
- To be with friends (Similar People)

The fifth variable cluster can best be described as Escape Physical Pressure as all three member variables fall under this dimension. The variables included in this cluster are:

- To experience more elbow room (Escape Physical Pressure)
- To experience solitude (Escape Physical Pressure)
- To be away from crowds of people (Escape Physical Pressure)

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Based upon this variable clustering, five new variables: reason1 through reason5, were defined by summing all of the variables in each cluster and then dividing by the number of variables that were in each cluster.

Based upon the new reason variables described above, observations are then clustered. First an exploratory hierarchical clustering procedure was used to initially divide the sample into case clusters based upon the new variables. Ward's minimum variance method was used. Sample means for the five composite reasons variables were examined in order to determine the appropriate number of clusters. Given the lack of previous work in this area, there were no clear a priori expectations on the composition for each cluster. Clusters were chosen based upon minimizing the merging of non-homogenous clusters, providing clusters that were meaningful and interpretable, and the feasibility of the clusters for agency management purposes and additional economic analysis. A five cluster solution was chosen as having the most distinct groups which best met the criteria specified.

Drawing on the results of exploratory clustering procedure, a nonhierarchical clustering procedure is used for the final division of the cluster sub-sample into five distinct clusters. The first cluster contains 141 members, the second contains 116 members, the third contains 39 members, the fourth contains 33 members, and the fifth contains 98 members. A high score for the mean indicates that the reasons to snowmobile that were incorporated into the composite reasons variable were important considerations in the respondent's decision to take their most recent snowmobiling trip. The means of the reasons variables for these clusters are reported in Table 1.

The five clusters represent groups with substantially different reasons for snowmobiling and different social/demographic characteristics. A comparison is presented in Table 2. The first cluster can best be described as, "The Nature Lovers Who Need To Be Alone" cluster. These individuals scored

high on the composite reason variables that encompass the Enjoy Nature dimension and the Escape Physical Pressure dimension. This group also scored high on the composite reasons variables for Escaping Personal/Social Pressure and Being with Family and Friends, however, these scores were noticeably lower and thus are not used as a primary descriptor.

Table 1. Cluster Means

CLUSTER	REASON1	REASON2	REASON3	REASON4	REASON5
1	4.90701	5.52989	5.90071	5.67139	5.97163
2	5.85057	6.20443	6.41595	6.34483	6.43678
3	3.15670	4.64103	5.46154	5.29915	5.76068
4	3.23599	3.97403	4.87121	4.46465	3.94949
5	4.58957	4.68659	5.62245	5.59864	4.75170

The second cluster can best be described as, "Those Who Want To Experience It All." These individuals scored very high on all the composite reason variables. Of somewhat less importance to this group is Achievement/Stimulation, although they still viewed it as important when they were considering their most frequent trip.

The third cluster is best described as, "Those Who Want To Be Alone But Not Get Too Excited." These individuals scored high on the composite reason variable for Escaping Physical Pressure and scored low on the composite reason variable for Achievement/Stimulation. Also of importance to this group is Enjoying Nature and Being with Family and Friends.

Cluster 4 is best described as, "Nature Lovers Who Don't Want To Get Too Excited." This group scored relatively high on the composite reason variable for Enjoy Nature and low on the Achievement/Stimulation composite reason variable. Being with Family and Friends is also somewhat important to this group. Escaping Personal/Social Pressure or Physical Pressure are not important considerations to this group. Cluster 5 is best described as, "Nature Lovers Who Want To Be With Family and Friends." This group scored high on the composite reasons variables for Enjoy Nature and

Being with Family and Friends. Of somewhat importance to this group is Achievement/Stimulation,

Escape Personal/Social Pressure, and Escape Physical Pressure.

Table 2. Characteristic Comparison Across Clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Age	42	41	47	46	46
% Receiving at Least Some College Training	72.4%	56.9%	79.5%	60.6%	66.3%
% Employed Full Time	83.7%	86.2%	89.7%	75.8%	74.5%
% Retired	6.4%	6.0%	7.7%	21.2%	19.4%
% With Income < 19,999	6.3%	7.8%	7.7%	6.0%	5.0%
% With Income 20,000 - 39,999	27.6%	32.7%	28.3%	21.2%	32.5%
% With Income 40,000 - 74,999	48.2%	48.2%	43.6%	57.6%	41.8%
% With Income >75,000	17.7%	11.2%	20.5%	15.1%	20.4%
% Whose Enjoyment of the Trip was Reduced by the Number of People They Saw	15.8%	20.8%	7.7%	9.1%	5.1%
# of Days Snowmobiling Per Year	23	31	21	19	24
# of Trips Snowmobiling Per Year	10.67	16.59	9.36	8.35	10.83
# of Miles to Snowmobiling Site	89.95	76.31	94.85	70.61	90.80
$ Amount Spent on Trip	$124.80	$100.96	$282.82	$84.67	$98.98

Cluster 3 and 5 contain a higher percentage of individuals who earn more than $75,000 per

year (20.5 percent and 20.4 percent respectively) compared to Clusters 1, 4, and 2 (17.7 percent, 15.1

percent, and 11.2 percent, respectively), Table 2. Cluster 4 contains a higher percentage of individuals

earning between $40,000 and $74,999 per year (57.6 percent), followed by Clusters 1 and 2 (48.2

percent each), Cluster 3 (42.6 percent), and Cluster 5 (41.8 percent). Cluster 2 contains the greatest

percentage of individuals earning between $20,000 and $39,999 per year (32.7 percent), followed by

Cluster 5 (32.5 percent), Cluster 3 (28.3 percent), Cluster 1 (27.6 percent), and Cluster 4 (21.2 percent).

Cluster 2 contains the greatest number of individuals earning less than $19,999 per year (7.8 percent),

followed by Cluster 3 (7.7 percent), Cluster 1 (6.3 percent), Cluster 4 (6.0 percent), and finally Cluster 5

(5.0 percent).

The majority of the respondents for all of the clusters were male. Cluster 1 was 90.8 percent male, Cluster 2 was 90.5 percent male, Cluster 3 was 92.3 percent male, Cluster 4 was 97.0 percent male, and Cluster 5 was 93.9 percent male. Age varied somewhat between clusters, but the mean age in all clusters was between 41 and 47. The majority of the individuals for all of the clusters had completed at least a high school education. More of Cluster 3 individuals had received at least some college training (79.5 percent) in comparison to the members of the other clusters. Cluster 1 members followed Cluster 3 members in education with 72.4 percent receiving at least some college training. Following Cluster 1 were Cluster 5 with 66.3 percent, Cluster 4 with 60.6 percent and Cluster 2 with 56.9 percent receiving at least some college training.

The majority of the respondents for all of the clusters are employed full time. Cluster 3 contains the greatest number of full time employees (89.7 percent) followed by Cluster 2 (86.2 percent), Cluster 1 (83.7 percent), Cluster 4 (75.8 percent), and finally Cluster 5 (74.5 percent). Cluster 4 contains the greatest number of retired individuals (21.2 percent) followed by Cluster 5 (19.4 percent), Cluster 3 (7.7 percent), Cluster 1 (6.4 percent), and Cluster 2 (6.0 percent).

Model Estimation

The results above suggest a substantial difference in the reasons why people snowmobile, and thus points to why managers may want to pay attention to market segmentation. Results of Poisson regressions on the pooled sample and segments and imposing a negative binomial distribution, show a substantial variation in a snowmobiler's marginal willingness to pay and consumer surplus, depending upon their motivation, Table 3. The consumer surplus per trip for the pooled model estimated that across the entire sample, the average snowmobiler generated $68 per trip in consumer surplus and $817 per year. Individuals in Cluster 5 (Nature Lovers Who Want to Be With Family and Friends) valued

snowmobiling more than individuals in any other cluster while individuals in Cluster 1 (The Nature Lovers Who Need to Be Alone) valued the experience the least. Cluster 5 individuals valued the experience over Cluster 3 (Those Who Want to Be Alone But Not Get Too Excited) by a factor of 1.6 and over Cluster 4 (Nature Lovers Who Don't Want to Get Too Excited) by a factor of two. The other clusters fell between two extremes of Cluster 5 and Cluster 1. Cluster 2 (Those Who Want to Experience It All) ranked second highest, Cluster 4 ranked third, and Cluster 3 ranked fourth.

Table 3. Model Estimation and Comparison, Parameter Estimates and T-Statistics

	Pooled Sample	Cluster1	Cluster2	Cluster3	Cluster4	Cluster5
	Linear	Log-log	Linear	log-log	Linear	Linear
CHI-SQUARE	1586.75	698.4627	1373.152	161.666	112.3276	137.4403
N	427	141	116	39	33	98
			Parameter Estimates and T– Statistics			
COSTPPER	-0.0120	-0.4326	-0.0181	-0.4924	-0.0215	-0.0108
	(-8.0830)	(-3.9990)	(-2.753)	(-1.6990)	(-3.0310)	(-3.1490)
INCOME	0.0000	0.3709	1.18E-05	-0.1486	0.00002	0.0000
	(2.9870)	(3.8040)	(2.026)	(-1.1400)	(2.2720)	(2.0020)
DAYSTRIP	-0.0002	-0.0163	-0.0163			-0.1156
	(-0.007)	(-0.1870)	(-0.187)			(-1.5240)
WINTERAC	-0.0356	-0.1158	0.2639			-4.39E-02
	(-0.79)	(-0.632)	(3.214)			(-0.354)
QUALITY	0.0174					0.0104
	(5.1360)					(1.6430)
AGE	-0.0098	-0.2474	0.0282			-0.0055
	(-2.6980)	(-1.0220)	(3.7220)			(-1.0470)
ALTCOST	0.0020	-0.4326	0.0043	0.4613		-0.0004
	(1.9880)	(-3.9990)	(1.1200)	(1.9150)		(-0.2650)
ALTQUAL	0.1150					0.0477
	(2.3510)					(0.5230)
ACTEXPER	0.0010			0.4876		0.0012
	(8.6280)			(2.2130)		(5.9540)
COMPARE	0.3414			0.9891	0.5953	0.4989
	(8.6060)			(1.6510)	(4.2550)	(5.9390)
EDUCAT		0.1860	0.1860			
		(2.5150)	(2.5150)			
Predicted # of Trips	9	9	12	7	7	9
Mean Days per trip	1.57	1.57	1.66	1.56	1.42	1.55
Mean # of Trips	12	11	17	9	9	11
			Consumer Surplus Estimates			
Consume Sur. / Trip	68	20	46	32	36	76
Consume Sur/ Day	43	12	28	21	25	49

Consumer surplus on a per day – per visit basis shows similar rankings. Cluster 5 is the highest ranked group while cluster 1 is the lowest ranked. Cluster 5 individuals generated $49 per day while Cluster 1 generated $12 per day.

SUMMARY AND CONCLUSIONS

The objectives of this study were to examine the characteristics, preferences and motivations for snowmobiling of Wyoming snowmobilers, to identify groups of snowmobilers based upon their reasons for snowmobiling, and to estimate economic benefits associated with resident snowmobiling. In order to determine economic benefits, the travel cost method was used to estimate consumer surplus values. Multiple clustering methods were used to segment the market and canonical discriminant analysis was used to describe the differences among the market segments.

Five distinct groups of snowmobilers were found using both agglomerative and iterative clustering techniques. Condensed reason variables that best describe the motivations of snowmobilers were achievement/stimulation dimension, escaping personal/social pressure dimension, enjoying nature and learning the geography of the area dimensions, being with family and friends dimensions, and escaping physical pressure dimension. An agglomerative hierarchical clustering procedure is used with the new variables from the variable cluster technique to separate the respondent's into natural groups based upon their reasons for snowmobiling.

The travel cost method was used to calculate consumer surplus values on a statewide basis, for each of the market groups. Unique travel cost models were estimated for each of the market groups. The models for the market groups differed from each other both in their functional form and model specification. Consumer surplus for Wyoming snowmobilers in the statewide model was estimated to be

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$68 per trip. Consumer surplus values for the market segments varied with a high of $76 per trip (Nature Lovers Who Want To Be With Family and Friends) to a low of $20 per trip, (The Nature Lovers Who Need to Be Alone). "Those Who Want To Experience It All" had the second highest consumer surplus of $46 per trip. "Nature Lovers Who Don't Want To Get Too Excited" cluster had the third highest consumer surplus estimate of $36 per trip. "Nature Lovers Who Need To Be Alone" had the next highest consumer surplus estimates of $36 per trip followed by "Those Who Want To Be Alone But Not Get Too Excited" with $32 per trip.

Potential weaknesses of this study include the limited number of observations for Cluster 3 and Cluster 4. The limited number of observations made it difficult to fit a model to the data for Cluster 3 and Cluster 4. Additionally, the limited number of observations makes the models particularly sensitive to outliers and influential observations. However, there was quite a bit of variation in the total number of trips. Responses varied from 1 to 117 total trips to the area of the respondent's last trip.

Strengths of this study include the breadth of information that was gathered on Wyoming snowmobilers and the applicability of that information to the management of the Wyoming Snowmobile Trails Program. Knowledge of the different market segments allows State policy makers and winter recreation site managers the option of managing areas for specific user groups. It also provides the necessary benefit estimates to conduct cost-benefit analysis for projects that will only impact specific locations or groups of snowmobilers. Understanding the reasons that the snowmobilers participate in the sport allows for better management of the resource to meet those expectations. Moreover, given the paucity of research on snowmobiling this study should also provide information regarding the possible economic benefits associated with, and motivations for, snowmobiling to winter recreation managers.

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