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The Economic Value of Off-Highway Vehicle Recreation

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Off-highway vehicle (OHV) recreation is a popular form of recreation in the western U.S. Little attention has been given to developing an understanding of the nature of OHV recreationists. The purpose of this paper is to advance research on OHV recreation, specifically focused on the economic value of this recreation activity. A statewide telephone survey followed by a self-administered mail survey was conducted in Arizona. The contingent valuation method was used to calculate the value of OHV recreation. OHV recreation by Arizona residents produces a high value of consumer surplus to the users, ranging from $54 to $96 per trip; the extent of consumer surplus depending on the specific type of vehicle used.

KEYWORDS: *Off-highway vehicle recreation, contingent valuation, economic value, consumer surplus.*

Introduction and Related Literature

Off-highway vehicle (OHV) recreation is an important and popular form of recreation, especially in the western United States. Participation in OHV recreation has been growing rapidly in recent years. Hammit and Cole (1998) noted that in 1960 OHV use was not even included on a nation-wide recreation study because use levels were so low. By 1982, however, 11% of people 12 years old or older used wheeled OHVs, with another 3% using snowmobiles. Additionally, on U.S.D.A. Forest Service land, OHV use doubled during the 1970s to 5.3 million user days for wheeled OHVs and 3.3 million user days for snowmobiles (Feuchter, 1980). More recent data reported by Cordell (1999) indicated 14% of Americans 16 years old or older, not including snowmobilers, engaged in off-road driving in 1994-95, representing 27.9 million users. OHVers averaged 685.5 million total user days per year in the U.S. OHV recreation participation increased 44% from 1982-83 to 1994-95. It is notable that proportionally the Rocky Mountain/Great Plains

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region, of which Arizona is a member, has higher OHV recreation participation than any other region with over 20% of the population participating, a number consistent with Arizona specific studies (Freye, Andereck, Vogt, & Valentine, 1998). Cordell (1999) also suggests the number of people participating in OHV recreation will continue to grow. Projections for participation in OHV recreation to 2050 suggest participation will grow in all regions, especially the Rocky Mountain/Great Plains region, which will see a projected 37% increase. Days of off-road driving are also projected to increase in the U.S., including a 54% increase in the Rocky Mountain region.

OHV recreation activities tend to be controversial uses of land resources largely due to the associated environmental and social impacts (Hammit & Cole, 1998). These environmental and social costs are becoming more important due to the increasing participation rates and projections of increasing OHV recreation activity. From the perspective of the physical environment, OHV activity has been associated with a wide range of negative impacts (Cole, 1993; Liddle, 1997). Such impacts include pollution from emission, fuel leakage and noise; the spread of invasive weeds; vegetation crushing and reduction of species diversity; and destabilization and erosion of soils and dunes (Hosier & Eaton, 1980; Kuss, 1986; Lonsdale & Lane, 1994; Majer, 1980; Priskin, 2003a; 2003b; Rickard, McLachlan, & Kerley, 1994). It has also been found to disturb wildlife and prevent recovery of natural environments from impacts (Godfrey & Godfrey, 1980; Priskin, 2003b). Priskin (2003a; 2003b) concludes that OHV use is extremely harmful from a physical environment perspective.

Off-highway vehicle recreation has also been associated with social costs on recreationists. Most research investigating motorized recreation has focused on comparing motorized with non-motorized recreationists, especially with respect to perceptions of conflict or negative reactions experienced by non-motorized recreationists (Andereck, Vogt, Larkin, & Freye, 2001; Behan, Richards, & Lee, 2001; Ivy, Stewart, & Lui, 1992; Jackson & Wong, 1982). Priskin (2003b) found that, on average, visitors to coastal areas perceived four-wheel driving to be harmful to the environment. As well, studies investigating the nature of conflict in recreation settings have discovered asymmetric antipathy with respect to conflict perceptions where some user groups express more negative evaluations than other groups. Frequently, recreationists report little conflict with others who are participating in the same or similar activities, but do perceive conflict with those engaged in faster, more mechanized, or more technologically oriented activities (Andereck et al., 2001). Asymmetrical conflict has most often been discovered between motorized and non-motorized user groups (Vittersø, Chipeniuk, Skår, & Vistad, 2004) with non-motorized users perceiving conflict with motorized users.

The costs of OHV recreation should be compared to the economic value or consumer surplus derived from OHV use for making policy decisions. Consumer surplus is the value of a recreation activity beyond what must be paid to enjoy it. It is an economic measure of an individual's satisfaction after all costs of participation have been paid. The consumer surplus, also

called net willingness-to-pay, is the theoretically preferred measure of net benefits or net economic value (Bergstrom et al., 1990b). Summing individuals' net willingness-to-pay provides a measure of aggregate net benefits to society. Cost-benefit information can help policy makers and managers in making difficult decisions. For example, when contemplating decisions regarding OHV activities on public land resources, does the economic value offset the environmental impact and conflict issues that accompany OHV use?

Rosenberger and Loomis (2001), in their comprehensive annotated bibliography and meta analysis on outdoor recreation use valuation, identified only three studies that estimate the economic value of OHV activities. Using a national zonal travel cost model Bergstrom and Cordell (1991) reported a consumer surplus of $15.06 per person per activity day in 1987, while Bergstrom et al. (1996) reported a consumer surplus in 1992 of $3.97 and $30.58 per activity day for two different U.S.D.A. Forest Service Regions using an individual travel cost model. A third study by Walsh and Olienyk (1981) reported consumer a surplus of $6.45 per activity day in 1980 for a Forest Service Region using contingent valuation methods. More recently, Coupal, Bastian, May, and Taylor (2001) used a travel cost model to determine economic benefits of motive-based snowmobiler segments. They found an average consumer surplus of $68.00 per trip, but also found that consumer surplus values differed by market segment. As a result, they suggested researchers, when possible, segment recreationists based on behavioral or other characteristics to more accurately reflect economic benefits.

In summary, very little attention has been given to developing a more thorough understanding of the nature of OHV recreation. Given the prevalence and projection for growth of OHV recreation and its associated environmental, economic and social impacts, research to gain a better grasp of this recreation activity segment is warranted. The purpose of this paper is to advance research with respect to OHV recreation, specifically focused on the economic value of this form of recreation activity.

Methodology for Estimating Economic Value

Two methods are commonly used to determine the economic value or consumer's surplus of recreation: The contingent valuation method (CVM) (Fix & Loomis, 1998; Lee & Chun, 1999), and the travel-cost method (TCM) (Fix & Loomis, 1998; Zawacki et al., 2000). Both methods have been applied to OHV recreation, as noted previously. The data available for this paper lends itself to only using the CVM to estimate economic value.

The CVM has been used to value a range of goods. It has been used to measure the value of recreation activities (Bergstrom, Stoll, Titre, & Wright, 1990b; Fix & Loomis, 1998); endangered species (Boyle & Bishop, 1987; Loomis & White, 1996); specific environmental attributes such as urban forest amenities (Tyrväinen & Väänänen, 1998); and improved water quality, or improved wildlife habitat (Whitehead, Blomquist, Hoban, & Clifford, 1995;

Lee & Chun, 1999). The CVM is a stated preference technique or direct method to estimate consumer surplus via constructed hypothetical markets through which people express their willingness to pay for a recreation opportunity. A primary advantage of using CVM is its ability to measure use and/or nonuse value.

Although the hypothetical nature of willingness-to-pay questions and contingent valuation is not without critics there are several factors that lead to valid and reliable economic value estimates using CVM. Whitehead et al. (1995) found that when implemented with actual users of a resource, the willingness-to-pay estimates varied in theoretically predictable ways. They concluded, as have others (Berstrom, Stoll, & Randall, 1990a; Whitehead & Blomquist, 1991; Boyle, Welsh, & Bishop, 1993), that the validity and reliability of WTP estimates increase with respondent familiarity and information about a resource.

Methods

Survey and Questionnaire Design

This study uses data collected as part of an economic impact study of off-highway vehicle recreation in Arizona (Silberman, 2003). The objectives of the Arizona study were to estimate the number of OHV recreation days and expenditure economic impacts in each Arizona County. Since no record exists of those engaged in OHV recreation in Arizona, a random telephone survey of Arizona households was used to identify respondents for a detailed mail questionnaire.

The random telephone survey of households in each Arizona County used affirmative responses to each of three questions to qualify a household for the self-administered mail questionnaire, and as OHV recreation households. The telephone survey was conducted over a one-year period to get a random sample of the type of OHV activity across a year and different types of weather conditions. The three questions are presented below and were asked as the initial questions in the telephone survey:

1. Does anyone in your household own a motorized vehicle designed to travel off-highway such as an ATV, 4-wheel drive vehicle, SUV, motorcycle, dirt bike, mini-bike, dune buggy or snowmobile?
2. Does anyone in your household drive any of these vehicles in places such as: backcountry roads, unimproved roads, trails that are roughly graded or non-maintained, or anywhere you would not ordinarily drive a regular passenger vehicle?
3. We are interested in off-highway recreational driving. By recreational driving, I mean driving off-highway just for fun or as a means to do outdoor recreation activities such as hunting, fishing, and wildlife watching, camping, hiking or exploring the outdoors. Is this the kind of off-highway recreational driving that you or other household's members do?

The number of telephone numbers called was 63,855. The number of households reached was 15,024. The number driving an OHV for recreation was 4,328. The percentage of households driving an OHV for recreation ranged from a high of 53% in Greenlee County to a low of 19% in Pima County (Tucson). Once respondents answered affirmatively to all three questions and agreed to complete a mail questionnaire, they were sent the self-administered mail questionnaire. The percent of households driving an OHV for recreation agreeing to the self-administered mail questionnaire was 77%. Mail questionnaires were sent to 3,118 households. The mail questionnaire returns rate was 41%, or 1,269 useable respondents. The returned questionnaires may be subject to a response bias because those who are more avid participants in OHV recreation might be more likely to agree to the self-administered questionnaire and send it back. Respondents to the telephone survey that agreed to return the self-administered mail questionnaire reported an average of 15.85 OHV recreation trips per year while those not agreeing to participate reported 15.95 OHV trips per year (no statistical difference measured by a means difference t-test). Respondents that completed the self-administered mail questionnaire reported an average of 15.93 OHV trips per year. Avidity response bias is not present based on the average number of OHV trips per year. The 41% response rate was likely influenced by the timing of the survey that started in October 2001 immediately after September 11, 2001, and by the complexity and length of the questionnaire. Efforts were made to increase the response rate using a follow-up telephone call, but resource constraints limited use of this technique or others, such as a reminder postcard to improve the response rate.

The question soliciting information on trip expenditures asked about the most recent recreation trip during which an OHV was used. Data were collected on lodging, restaurant dining, groceries, other food and drinks, fuel, supplies and services such as replacement parts and repairs, shopping for souvenirs and other trip expenses such as user fees and equipment rental. Respondents were asked to identify those trip expenditures at home before the trip and those at the destination. The contingent valuation question was asked immediately after the respondent reported trip expenditures for the most recent recreation trip taken during which an OHV was used. The wording of the contingent valuation question was,

> This is a hypothetical question. Assume that recreation using an OHV became more expensive due to an increase in gas prices or something else. The total estimated trip expenses for your travel party are listed in the previous question. Now think about your portion of the trip expenditures. What is the maximum amount you would be willing to pay to experience your last recreation trip using an OHV in addition to your portion of the trip expenditures listed above? For example, if the trip expenditures above were $500, there were 5 people in your travel party, and your portion of the expenditures was $100, how much money above $100 would you be willing to pay to experience the recreation trip?

Other information collected about the most recent recreation trip during which an OHV was used included the month and year of the trip, the

Arizona County or location for an out-of-Arizona trip, the number of people in the travel party, the length in hours or number of days of the trip, the type of OHV used (multiple response question) and the recreation activities participated in on the trip (multiple response question). The type of OHV used had the following categories: ATV (all terrain vehicles), 4-wheel drive truck, 2-wheel drive truck, SUV (sport utility vehicle), Dirt bike/motorcycle/mini-bike, Dune buggy/sand rail, and snowmobile.

Activities associated directly with driving an OHV for recreation were driving back roads, dirt biking, hill climbing, trail riding, snowmobiling, open-area driving, rock-crawling and competitive OHV events. Non-OHV recreation activities on the questionnaire are hiking/walking, sightseeing, picnicking, mountain bike riding, bicycling, wildlife/bird watching, camping, boating, fishing, hunting, target shooting, horseback riding, personal watercraft riding, swimming, visiting historical/archeological sites, backpacking, cross-county skiing, photography, river running, and rock climbing. Eighty nine percent of the respondents participated in at least one of the non-OHV recreation activities. This suggests that a joint benefits issue is present where respondents gain consumer surplus from multiple (OHV and non-OHV) recreation activities on their last OHV recreation trip.

Another section of the self-administered mail questionnaire asked respondents to evaluate their most recent recreation trip that included OHV activities. Respondents were asked to rate the importance and level of satisfaction for each of 36 evaluation items. Among the items were: developing my skills and abilities, enjoying the natural beauty and scenery, safety of OHV areas, and a number of other benefit-related items. A summary item, "overall OHV recreation experience," was also included. Respondent demographic characteristics were captured on the questionnaire.

Sources of Potential Bias in CVM

Mitchell and Carson (1989, chapter 11) provided a detailed classification of ways in which questionnaire design can affect respondents so as to introduce bias into the WTP values derived from a CVM study. Biases that may be present in this CVM study are from: the elicitation question, implied value cues, not confronting respondents with a real situation, and the incentive for respondents to not reveal their true preferences.

The elicitation of willingness to pay is an open-ended question in which no value is specified and individuals are asked a question on their maximum WTP for OHV recreation. Where respondents have experience in purchasing the recreation good (which is the case in this instance since all respondents are answering relative to their most recent OHV recreation trip), then open-ended questions offer a relatively easy method of eliciting bids (Garrod & Willis, 1999). Where respondents have no prior experience in purchasing the good (environmental issues such as clean water, clean air, and protection of a particular species) then respondents may experience considerable difficulty with the open-ended format. For this reason the NOAA report by

Arrow et al. (1993) advocates that open-ended formats should not be used to elicit non-use or passive use values for environmental goods. We are estimating use-values for recreation that respondents are quite familiar with and as such the open-ended elicitation question as a source of potential bias will be minimized.

An implied value cue bias may occur because the WTP elicitation question uses the respondent's expenditures on the last OHV recreation trip as a reference point. It is possible that the WTP valuations will cluster around the respondent's expenditures, referred to as starting point bias (Boyle et al., 1985; Cummings, Brookshire, & Schulze, 1986). Silberman and Klock (1989) found even respondent familiarity with the commodity being valued did not overcome starting point bias. To control for starting point bias we included as an independent variable the per-capita expenditures on the last OHV recreation trip the respondent participated in. Another implied value cue bias may occur by using the example of $500 for total party trip expenditures and 5 people in the party for a per-capita expenditure of $100. An analysis of the bids does not suggest that the example influenced final bids. Bids are not clustered around $100 and range from zero to $2,000. Fifty-six percent of the bids are less than $100 and the largest percentage of bids were $50 and $100, both representing 13% of respondent bids. Eight percent of the respondents had a valid zero bid.

Hypothetical bias is a potential error caused by not confronting a subject with a real situation. Mitchell and Carson (1989) suggest that a CV question in which there is a high degree of market realism will minimize hypothetical bias. Our subjects are familiar with the commodity and have prior valuation experience. We expect hypothetical bias to be minimized.

Strategic bias is an attempt to influence the outcome of the survey by not revealing a true valuation. One form of strategic bias arises from the efforts of respondents to reduce their obligation by stating a low value, the "free rider problem." This form of strategic bias has been diminished by excluding protest bids from the analysis. Immediately after the WTP elicitation question there was a space for respondent comment. Comments from 16 respondents clearly protested the elicitation question and were dropped from the analyses. Protest comments included statements that the government should be paying for OHV recreation and comments that they did not want to place a dollar value on their OHV recreation experience. The small number of protest bids indicates that the question was understood and not offensive thus not resulting in free-rider strategic bias. Another form of strategic bias arises when respondents bid high to ensure provision of the good when they believe that actual payments are not expected. An analysis of the bid distribution does not indicate this form of strategic bias is present. The payment vehicle and elicitation question, moreover, did not refer to any potential increase in the availability of OHV recreation. We expect strategic bias to be minimized in this study.

CVM Bid Function

Dollar amounts from the WTP open-ended elicitation question are used as the dependent variable in a CVM bid function. Independent variables are: (1) Annual household income that was reported in nine categories from $15,000 or less to more than $100,000. The mid-point of each category was used to convert the category to a dollar figure. Incomes more than $100,000 were set at $125,000; (2) Length of last OHV recreation trip in days where part of a day is measured; (3) Satisfaction with the last OHV recreation trip measured by a dummy variable taking on the value 1 if a respondent ranked satisfaction with the last OHV recreation trip as 4 or 5 on a 5-point scale with "5" as "extremely satisfied" and "1" as "not at all satisfied"; and (4) Spending per-person on last OHV recreation trip (control for starting point bias). The sign of all the independent variables in the bid function are expected to be positive. Higher incomes, greater length of stay, satisfaction with the last OHV recreation trip, and larger spending per-person will result in an increase in WTP.

Dummy variables for recreation activities the respondent participated in during the last OHV recreation trip are also included as independent variables in the bid function. The questionnaire item was a multiple response question, and respondents checked all their activities. Respondents participated in an array of activities from those specific to using an OHV such as dirt biking, hill climbing and open-area driving, to hunting and fishing, and general recreation activities such as camping and sightseeing (see Table 1 for a complete list of activities). The recreation activity dummy variables are used to isolate the impact of OHV recreation and non-OHV recreation activity like hunting and fishing on the respondent's WTP bid. This approach will control for the joint benefits problem where respondents gain consumer surplus from multiple (non-OHV) recreation activities on their last OHV recreation trip. Only those recreation activity dummy variables statistically significant at the 10% level are retained in the final model (Kennedy, 2003; Maddala, 1977).

The CVM bid function is estimated using ordinary least squares for all respondents (pooled) and separately for the following types of OHVs: ATV (all terrain vehicle), 4-wheel Truck, SUV (sport utility vehicle) and Dirt Bike/Motorcycle/Mini Bike/Dune Buggy. The last category grouped together a number of similar off-highway vehicles due to small sample sizes for each of the OHV included in the grouping. The hypothesis is that the type of activities respondents participate in will vary by type of OHV used and demographic and trip characteristics will also vary by OHV used. This follows the suggestion made by Coupal et al. (2001) that researchers, when possible, segment recreationists' based on behavioral or other characteristics to more accurately reflect economic benefits. Thus, WTP was estimated by type of OHV used.

TABLE 1
Variables and Mean Values Used in CVM Bid Function

	Pooled	ATV	Truck	SUV	Motorcycle or Dune Buggy
Dependent Variable—Amount willing to pay	$101.41	$119.94	$107.45	$92.74	$145.03
Socioeconomic & OHV Characteristics in Bid Function					
Annual household income(000's)	$62.67	$66.33	$59.63	$66.23	$63.57
Satisfied with last OHV Experience	0.73	0.81	0.70	0.71	0.76
Last OHV trip Spending Per Capita	$72.49	$82.02	$74.28	$68.97	$114.65
Length of last OHV trip in days	1.3541	1.7488	1.5466	1.2040	1.8823
OHV Recreation Dummy Variables					
Back road driving	0.77	0.76	0.80	0.81	0.69
Dirt bike riding	0.11	0.21	0.11	0.08	0.57
Hill climbing	0.25	0.36	0.25	0.23	0.43
Trail riding	0.30	0.61	0.24	0.20	0.62
Snowmobile riding	0.01	0.00	0.00	0.01	0.01
Open area driving	0.23	0.31	0.26	0.19	0.36
Rock crawling	0.11	0.08	0.11	0.11	0.07
Entered competitive events	0.02	0.03	0.02	0.02	0.06
Non-OHV Recreation Dummy Variables					
Hiking or walking	0.40	0.26	0.41	0.54	0.32
Sightseeing	0.52	0.47	0.50	0.58	0.40
A picnic	0.38	0.33	0.37	0.44	0.31
Mountain bike riding	0.03	0.04	0.04	0.03	0.05
Bicycling	0.01	0.01	0.01	0.01	0.03
Wildlife/bird watching	0.22	0.17	0.21	0.26	0.17
Camping	0.31	0.37	0.37	0.28	0.50
Boating	0.05	0.05	0.06	0.04	0.08
Fishing	0.16	0.12	0.22	0.15	0.17
Hunting	0.12	0.12	0.18	0.09	0.05
Shooting	0.11	0.10	0.16	0.08	0.11
Horseback riding	0.03	0.04	0.04	0.02	0.03
Jet skiing	0.02	0.03	0.03	0.03	0.04
Swimming	0.07	0.07	0.09	0.08	0.12
Historical/archaeological sites	0.17	0.14	0.16	0.19	0.15
Backpacking	0.03	0.01	0.03	0.04	0.04
Cross-country skiing/snowboarding	0.00	0.00	0.00	0.00	0.00
Photography	0.24	0.18	0.22	0.31	0.24
River running	0.03	0.03	0.04	0.02	0.05
Rock climbing	0.04	0.03	0.06	0.06	0.05
Sample Size	919	319	438	288	149

Results

The means for the variables used in CVM bid function are reported in Table 1. The mean values for the variables show differences across the types of off-highway vehicles. A paired sample t-test of the differences in means across the six combinations of pairs based on OHV type (ATV-Truck; ATV-SUV; ATV-Motorcycle; Truck-SUV, Truck-Motorcycle; & SUV-Motorcycle) was performed to test for statistical significance of the reported differences in means. Most noticeable is the range in the dependent variable, willingness-to-pay. The average WTP ranges from $145.03 for those using a motorcycle or dune buggy to $92.74 for those using a SUV (average WTP is statistically different at the 10% level or better for all six pairs). There is also variation across the type of off-highway vehicle in the independent variables. The mean difference t-test shows that at least three pairs are statistically different for each of the independent variables. Length of last OHV trip ranges from a high of 1.8823 for those using a motorcycle or dune buggy to a low of 1.2040 for respondents using a SUV (statistically different for three pairs). Differences are also present across OHV type with respect to participation in recreation activities. Respondents using a 4-Wheel Truck went hunting and fishing (18% and 22%) at a higher rate than respondents using another OHV (the hunting & fishing percentages are statistically different for 4 pairs). Respondents using an ATV or a Motorcycle/Dune Buggy went hill climbing and trail riding at a substantially higher percentage than those using a 4-Wheel Truck or SUV (these variable means are statistically different for 4 pairs).

CVM Bid Function Results

A Chow-test of the differences to determine whether the coefficients in a regression model are the same in separate sub-samples showed that all the sub-samples based on OHV type are statistically different from each other (Kennedy, 2003) and supports estimating the bid function separately for each OHV vehicle used by respondents. The results of estimating the pooled and separate CVM bid functions are reported in Table 2. The explanatory power of the CVM bid functions, measured by R-square, are reasonably good given the individual cross-section data and the regression coefficients are consistent with the expected direction of influence. Annual household income, number of hours on last OHV recreation trip, spending per person on last OHV recreation trip is statistically significant and positive in all the equations. Satisfaction is statistical significant in four out of the five equations and positive in all five models. Carson (2000) noted that equations with reasonable explanatory power and coefficients with the expected signs provide evidence in support of the proposition that the survey has measured the intended construct.

The results in Table 2 show the recreation activity dummy variables that are statistically different from zero at the 10% level or better. In the pooled bid function, for example, open-area driving, which is an OHV recreation

TABLE 2
CV Bid Functions
(Standard Errors in Parenthesis Below Estimated Regression Coefficients)

	Pooled Sample	ATV	4-Wheel Truck	SUV	Motorcycle or Dune Buggy
CVM Model					
Income	0.374*	0.847*	0.449**	0.505*	0.972*
	(0.126)	(0.248)	(0.202)	(0.19)	(0.411)
Satisfied with last OHV trip	28.441*	38.204**	24.685***	14.12	54.670***
	(8.937)	(19.695)	(12.946)	(14.043)	(29.861)
# of days on last OHV trip	11.041*	15.410*	7.057***	8.057***	15.413**
	(2.7)	(4.779)	(3.983)	(4.599)	(7.866)
Control Variable for Starting Point Bias					
Spending per person on last trip	0.357*	0.337*	0.653*	0.239*	0.299*
	(0.034)	(0.061)	(0.062)	(0.048)	(0.08)
OHV Recreation Activity Dummy Variables					
Open Area Driving	22.121**			63.443*	
	(9.471)			(16.372)	
Dirt Bike Driving				44.937***	
				(24.633)	
Non-OHV Recreation Activity Dummy Variables					
Hunting	26.061**			37.598***	
	(12.606)			(22.019)	
Jet Skiing	45.126***	109.273*	82.347**		
	(27.122)	(44.413)	(38.047)		
Photography	15.181***	38.691**			
	(9.253)	(19.915)			
River Running			54.646***	84.484**	
			(29.391)	(42.718)	
Boating				54.768***	
				(34.328)	
Mountain Bike Riding				63.348***	159.095*
				(39.762)	(59.972)
Backpacking					168.967*
					(64.969)
Constant	3.545	−32.195	−0.393	−1.9	−35.805
R-Square	0.211	0.253	0.302	0.267	0.273
Sample Size	919	319	438	288	149

*Statistically different from zero at 1% level or better
**Statistically different from zero at 5% level or better
***Statistically different from zero at 10% level or better

activity increases, the respondent's WTP bid by $22.12. Respondents doing open-area driving had a higher WTP bid than respondents that did not do open-area driving. Also in the pooled bid function the non-OHV activities that had a positive and statistically significant impact on the respondents WTP bid are hunting (adding $26. 06), jet skiing (adding $45.13), and doing photography (adding $15.18).

CVM Estimated WTP

The estimated WTP or net economic value for OHV recreation from Arizona residents for each vehicle type is reported in Table 3. The calculations use the mean values from Table 1 multiplied by the regression coefficients from Table 2. [The pooled equation estimated WTP = −22.044 + .398*62.73 + 2.7*17.14 + 11.198*1.36 + .352*72.74 + 20.852*.23 + 26.857*.12 +14.839*.25, or $101.55.] The first part of Table 3 displays the estimated WTP using all the coefficients in the bid function. The coefficients are grouped into categories: the CVM model includes annual household income, number of days and satisfaction; OHV recreation and non-OHV recreation includes statistically significant dummy variables reported in Table 2. Notice that the estimated WTP derived from the CV model is substantially larger for ATV and Motorcycle or Dune Buggy. The estimated WTP ranges from a high of $145.55 for motorcycle or dune buggy to a low of $92.59 for a SUV.

The adjusted WTP subtracts from the estimated WTP the impact of starting point bias and non-OHV recreation. This is equivalent to setting the regression coefficients on starting point bias and non-OHV recreation

TABLE 3
Estimated WTP for OHV Recreation

	Pooled Sample	ATV	4-Wheel Truck	SUV	Motorcycle or Dune Buggy
Constant Term	$3.55	−$32.20	−$.39	−$1.90	−$35.81
CVM Model	$59.14	$113.91	$54.88	$53.20	$132.26
OHV Recreation Activity	$5.09			$15.65	
Starting Point Bias	$25.88	$27.64	$48.56	$16.48	$34.38
Non-OHV Recreation Activity	$7.67	$10.64	$4.69	$9.16	$14.71
Estimated WTP	$101.32	$120.00	$107.73	$92.59	$145.55
Subtract					
Starting Point Bias	($25.88)	($27.64)	($48.56)	($16.48)	($34.38)
Non-OHV Recreation	($7.61)	($10.64)	($4.69)	($9.16)	($14.71)
Adjusted WTP	**$67.83**	**$81.72**	**$54.48**	**$66.95**	**$96.46**
95% Confidence Interval	[$5, $130]	[−$47, $210]	[−$32, $141]	[−$34, $168]	[−$105, $301]
Average # of days on Last OHV Trip	1.7869	2.0773	1.9211	1.6736	2.1324
Adjusted WTP/day	**$37.96**	**$39.34**	**$28.36**	**$40.00**	**$45.24**

dummy variables equal to zero. This approach removes from the CVM bid function the influence of starting point bias and non-OHV recreation. In the instance of non-OHV recreation we have controlled for the joint benefits problem. The adjusted WTP estimates range from a high of $96.46 for motorcycle or dune buggy to a low of $54.48 for a 4-Wheel truck. A 95% confidence interval is reported for the adjusted WTP estimates (calculated by using the 95% confidence interval for each estimated regression coefficient). For the pooled sample we are 95% confident that the adjusted WTP fall in the range of $5.18 to $130.44. The adjusted WTP per day is calculated by dividing the adjusted WTP by the mean length of the trip in days where any part of a day is counted as one day. The adjusted WTP per day ranges from a low of $28.36 for 4-Wheel Truck to a high of $45.24 for a Motorcycle or Dune Buggy. Both ATV and Motorcycle or Dune Buggy have a mean number of days on the last OHV trip greater than two, and the larger number of days for these vehicles compared with the others reduces some of the differences in adjusted WTP estimates across vehicles.

Conclusion

The purpose of this study is to estimate the economic value of OHV recreation. The CVM economic value estimate uses detailed information about the last OHV trip taken by respondents (reducing recall bias) and segments OHV participants on the basis of the types of vehicles used. Economic value from the CVM shows that OHV recreation by Arizona residents produces consumer surplus to the users, ranging from $54 to $96 per trip depending on the type of vehicle used. Respondents that use vehicles that are more focused on OHV recreation (ATV and Motorcycle/Dune Buggy/Dirt Bike) have higher consumer surplus values per trip, $96 and $82, than respondents that use vehicles that have multiple purposes (4-Wheel Truck at $54 and SUV at $67). Differences remain across vehicles after accounting for the length of the last recreation trip using an OHV. Length of the trip is somewhat longer for ATV and Motorcycle/Dune Buggy. This study supports the contention of Coupal et al. (2001) that important differences exist in recreation users engaged in a specific activity. Differences between the pooled model and segments highlight the importance of differentiating recreation users for economic benefit measurements. In the Coupal et al. (2001) study, segments were based on motives for why people snowmobile. Pooling of respondents can result in WTP estimates subject to aggregation bias. Our findings show that significant differences are present in WTP for OHV recreation across segments of respondents based on the type of vehicle used.

Strengths of this study include the breadth of information that was gathered on Arizona residents using an OHV for recreation, the detailed information on the last OHV trip taken, the random telephone survey to identify households using OHV for recreation, and the large number of respondents

that completed the self-administered mail questionnaire. The explanatory power of the estimated CV bid functions and statistically significant coefficients with the expected signs provide evidence that the questionnaire and survey has measured the intended WTP construct. It seems likely the CVM results reported here can be generalized to OHV recreation in other states. Future research on OHV recreation should be sensitive to the importance of having a clear, precise definition of this activity, and the prevalence of those participating in OHV recreation to also engage in other recreation activities during their OHV recreation trip (joint benefits issue).

The net economic benefits reported here should be considered in the controversy over use of public recreation lands by off-highway vehicles; the estimates can help guide land management policies. Off-highway vehicle recreation may be an economically competitive use for public recreation lands when the consumer surplus or economic value is evaluated against the environmental and social costs. Providing estimates of the net economic value of OHV recreation that can be generalized is of importance given the growth of this form of recreation, the environmental issues surrounding its use, the competition for recreation use of public lands, and budget cuts that have limited public funding for outdoor recreation. Another possible use of these results is informing the setting of user fees for OHV recreation (www.orbanet.org). The net economic value represents the consumer surplus or maximum user fee.

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