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Temporal reliability test of nonconsumptive wildlife recreation benefits constructed from choke price data

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Abstract

Choke price data from the 2001 and 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (FHWAR) is used to construct welfare measures for wildlife-watching trips. Findings from an Oaxaca-Blinder decomposition analysis showed them to be temporally reliable which favors transferability across time.

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1. Introduction

Benefit measures such as willingness to pay (WTP) are said to be temporally reliable if it is stable across time. Given theoretical validity, temporally reliable estimates from one period can be used to inform policies in another. Thus, the reliability of benefit measures has strong implications for reducing the overall cost of policy studies especially when the scale of contingent valuation (CV) surveys are at the national level. The purpose of this paper is to conduct a temporal reliability test using CV data from the 2001 and 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (FHWAR). In particular, the investigation focuses on nonconsumptive wildlife recreation, which has increased in popularity over the past several decades.

Many authors have found evidence in favor of temporal reliability in CV studies as shown in a review by McConnell, Strand and Valdes (1998). For example, Loomis (1989) used the test-retest method on a sample of Californian households who were asked about higher water fees for Lake restoration. This technique essentially re-surveys the same participants after a certain amount of time has passed, then compares the new responses to those of the first survey. After the course of a nine month period, Loomis (1989) found no significant difference between the first and second WTP responses. Carson, et al. (1997) employed the same procedure but across a two year span. Additionally, the authors tested three separate features of respondent choices for inconsistencies but similar to Loomis (1989), were unable to detect any significant changes in responses. Whitehead and Hoban (1999) used an alternative approach in that they compared two different samples from a local population, and taken across a five year span. The authors applied the Oaxaca–Blinder decomposition method to isolate any structural differences that may have arisen between the time period. In spite of the change in WTP values that occurred during the five years, the authors were still able to conclude that benefits were temporally reliable. They explained that the differences were actually caused by the changes in factors that directly affect WTP and was not due to changes in the underlying structure. More recently, Whitehead and Aiken (2007) tested for temporal reliability using CV data from the 1991 and 1996 FHWAR surveys. In contrast to the studies mentioned above, the authors were unable to verify temporal reliability even after accounting for the usual WTP determinants. Upon closer examination however, the authors discovered subtle discrepancies in the elicitation questions that may have led to the deviations in values.

This paper provides a follow-up to Whitehead and Aiken (2007) by testing the temporal reliability of CV data from the 2001 and 2006 FHWAR surveys. The elicitation format in FHWAR has since changed from dichotomous-choice (1991–96) to open-ended questions (2001–06). Moreover, the new questions elicit something distinctly different from that of other open-ended questions in CV. Unlike traditional open-ended questions that directly ask respondents to state their WTP (Loomis 1989), the questions in the 2001–06 surveys asked respondents to state the cost at which it becomes too expensive to continue their activities; in essence, their ‘choke’ price. Nevertheless, theoretically valid measures of welfare are obtained using the choke price and shown to be temporally reliable.

The two main objectives in this paper are: 1) construct welfare values for wildlife-watching trips using data on the respondent’s choke price; and 2) test for temporal reliability using the Oaxaca–Blinder decomposition method (Oaxaca 1973; Blinder 1973).

2. FHWAR Survey background

Since 1955, the US Fish and Wildlife Service's (USFWS) National Survey of Fishing, Hunting and Wildlife-Associated Recreation (FHWAR) has been conducted every 5 years to collect information on the number of anglers, hunters, and wildlife-watching participants, and their activity expenditures in the United States. Primary data collection for the 2001 and 2006 surveys were carried out by the US Census Bureau in two phases. The initial screening phase consisted of interviews from a sample of 85,000 households nationwide to identify individuals who have fished, hunted, or engaged in wildlife-watching activities in the previous year, and also those who had engaged or planned to engage in those activities in the current year. The second phase consisted of detailed interviews from a sub-sample of likely anglers, hunters and wildlife watchers who were identified during the initial screening phase. Participants in the second phase were interviewed for information pertaining only to his or her activities and expenditures.

Since 1980, a contingent valuation method section has been included in the detailed interviews, where the elicitation format has undergone several changes over the years. For instance, the 1980–85 surveys employed iterative bidding, the 1991–96 surveys employed a dichotomous choice, and the 2001–06 employed a open-ended format[1]. As mentioned by Whitehead and Aiken (2007), differences in the formats confound temporal reliability tests when conducted across surveys. Moreover, the authors showed that even subtle discrepancies in the elicitation questions may affect test results. Incidentally, similar discrepancies were not detected in any of the 2001–06 questions used in the current study.

Only the wildlife-watching sample were considered in this study to focus on testing the benefits from nonconsumptive wildlife recreation[2]. The US Fish and Wildlife Service reported that wildlife-watching activities has continually increased since 1991 in terms of the number of participants, days spent in activity, and total expenditures (USFWS 2007)[3]. Economic impact analyses showed substantial contributions from wildlife-watching activities. For example, wildlife-watching in 2006 generated $122.6 billion in economic output, 1.1 million jobs, and $18.2 billion in local, state, and federal tax revenues (Leonard 2008).

3. Welfare Variables in the 2001–06 FHWAR

The open-ended questions in the 2001–06 FHWAR elicited the respondent's choke price instead of their WTP. For wildlife-watching activities, the question was:

> How much would have been too much to pay to take even 1 trip to feed, photograph,or observe wildlife…?

[1] Many researchers prefer the dichotomous choice format and its variants (double-bounded, multiple-bounded, spike model). However, this format may not be as practical as open-ended questions for national level surveys. Dichotomous choice requires much larger sample sizes, a bid distribution, and some variants can be very difficult to implement at the national level. For comparative studies on CV elicitation formats, see Cummings et al. (1986), Desvousges et al. (1993), and Venkatachalam (2004).

[2] Previous studies on the value of nonconsumptive wildlife recreation using FHWAR data can be found by referring to Hay and McConnell (1979); Hay and McConnell (1984); Rockel and Kealy (1991); and Zawacki, Marsinko, and Bowker (2000).

[3] In contrast, hunting and fishing statistics for the same set of categories has fallen during the same period.

Whitehead and Aiken (2007) modeled WTP as the difference in expenditure functions when the respondent faces the choke price *P**. Here, the sum of the (Marshallian) consumer surplus and total cost modeled WTP and are constructed using the choke price.

$$\text{WTP} = \text{CS} + \text{Exp} \quad (1)$$

, CS is consumer surplus, Exp = *PT* is total trip cost, *P* is average trip cost, and *T* is the number of trips taken by the respondent. The data on total trip cost was provided by the survey and applied directly to Equation 1. The value of CS was obtained by first assuming a linear reservation price curve (RP) for wildlife-watching trips with y-intercept *P** and slope = – (*P**–*P*)/*T*. Then the triangular area CS shown in Figure 1 was calculated. Together with area, Exp, gives the respondent's WTP for wildlife-watching trips. Equation 1 is not theoretically equivalent to the expenditure difference equation in Whitehead and Aiken (2007). In fact, WTP here is *total* willingness to pay, and CS may better approximate the Whitehead and Aiken (2007) formulation (Willig 1979). Temporal reliability however, is tested for both measures of welfare because CS may behave differently from WTP. For instance, one-time purchases of equipment (camera, books, or binoculars) and club membership fees might lead to significant structural differences in expenditures between two adjacent periods. This could affect the reliability of WTP, but not CS. In this case, only surplus benefits are transferrable while total benefits remain period specific.

4. Data

As in Whitehead and Aiken (2007), the models included information on whether the respondent visited public or private land and photographed wildlife (Table 1). Also, a comparable set of demographic variables: age, gender, education, marital status, and income level were included, where the variable for income was coded similar to the authors' for comparison. The variables indicating special interest in wildlife around the home, out-of-state visitations, and the welfare variables were unique to the present study. Most of the summary statistics between the two samples were very similar (Table 2). Private land use however was 5 percent higher in 2001, but income was 5 percent lower. Compared to the Whitehead and Aiken (2007) sample, there were about 25 percent more private land visitations and respondents were on average 7 years older. In addition, about 20 percent more reported that they photographed wildlife in the study sample. Extreme values caused the distributions of CS and WTP to be heavily skewed as indicated by the large differences between the mean and median values. Therefore, a log transformation of the welfare variables were used in the models.

5. Oaxaca–Blinder Decomposition

The decomposition equation, following Oaxaca (1973) and Blinder (1973), are obtained by first estimating separate regression functions for the comparison groups (2001 and 2006 sample in our case), then deconstructing the difference in the predicted values into its constituent parts.

$$\Delta Y = \Delta X\beta_{01} + X_{01}\Delta\beta + \Delta X\Delta\beta \quad (2)$$

,where $\Delta Y = Y_{06} - Y_{01}$ is the difference in the predicted values, $\Delta X = X_{06} - X_{01}$ is the difference in the mean covariates, and $\Delta\beta = \beta_{06} - \beta_{01}$ is the difference in the estimated coefficients of the two samples. The first term in the right-hand side of Equation 2 captures the difference in Y attributed by differences in observable factors. These may be demographic variables, but also certain attitudinal characteristics as demonstrated by Whitehead and Hoban (1999). The second term captures the difference arising from unobservable factors. These are structural differences in Y, which mark fundamental shifts in how the value is derived. Therefore, temporal reliability is rejected if $X_{01}\Delta\beta \neq 0$. Finally, the last term captures the difference arising from the simultaneous interaction of the observable and unobservable components.

6. Results

The coefficient estimates for YR_2001 variables were insignificant for both models (Table 3), which imply that the 2001 sample was not statistically different from the 2006 sample. This was further corroborated by the differential coefficients for ΔWTP and ΔCS in the Oaxaca-Blinder results. With the exception of the schooling variable and the constant, all estimates were statistically significant at the 5% level. Similar to Whitehead and Aiken (2007), public land visits had a stronger correlation with benefits than private land visits. Amongst the WTP and CS models, special interest in around-the-home wildlife was relatively stronger in WTP, but income was stronger in CS. Contrary to Whitehead and Aiken (2007), both models showed a negative correlation with marital status. Coefficient estimates for the Oaxaca-Blinder decomposition terms were all insignificant, implying no structural changes in WTP or CS were detected, and both benefit measures were temporally reliable.

7. Concluding Remarks

This paper provided a follow-up to Whitehead and Aiken (2007) by testing the temporal reliability of benefit estimates from the 2001 and 2006 FHWAR surveys. In particular, total willingness to pay (WTP) and the consumer's surplus (CS) from nonconsumptive wildlife recreation was the focus of this study. There were three significant departures from Whitehead and Aiken (2007). First was the use of the respondent's choke price for constructing WTP and CS values. The coefficient estimates from these models were in general agreement with those of the WTP model of the authors. Incidentally, this is the first study to test benefits constructed from choke price data. Second was the application of the Oaxaca-Blinder decomposition method to test for temporal reliability. The technique proved useful for this task as Whitehead and Hoban (1999) had found in their study. Finally, the results of both benefit measures were strongly in favor of temporal reliability. If the 2011 FHWAR employs the same elicitation format, prospects for benefit transfers are encouraging.

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Table I. Variable lables and descriptions

Variable	Descritption
Public	= 1 if respondent visited ares on public land, 0 otherwise
Private	= 1 if respondent visited ares on private land, 0 otherwise
Photo	= 1 if respondent photographed wildlife away from home, 0 otherwise
Wildlife	= 1 if respondent has special interest in wildlife around home, 0 otherwise
OutState	= 1 if respondent traveled out of state for wildlife watching, 0 otherwise
Age	Age of respondent
Education	Years of schooling
Gender	= 1 if respondent is male, 0 otherwise
Income	= 1 if respondent's household income ≥ $40,000, 0 otherwise
Married	= 1 if respondent is married, 0 otherwise
Exp	Total costs of wildlife-watching trips (in-state and out-of-state)
CS	Consumer surplus from wildlife-watching trips (in-state and out-of-state)
WTP	Willingness to pay for wildlife-watching trips (in-state and out-of-state)

Notes : Exp, CS, and WTP values were obtained by summing the separate in-state and out-of-state calculations. For example WTP = WTP(IS) + WTP(OS), where WTP(IS) = CS(IS) + Exp(IS), WTP(OS) = CS(OS) +Exp(OS), and IS = in-state and OS = out-of-state.

Table II. Summary Statistics

	Pooled (n = 3,865)			2001 (n = 1,722)			2006 (n = 2,093)		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
Public		0.85	0.36		0.84	0.37		0.85	0.35
Private		0.41	0.49		0.44	0.50		0.39	0.49
Photo		0.51	0.50		0.48	0.50		0.54	0.50
Wildlife		0.76	0.43		0.77	0.42		0.75	0.43
OutState		0.33	0.47		0.32	0.47		0.33	0.47
Age		45.57	14.29		43.92	14.01		46.98	14.38
Education		14.40	2.51		14.32	2.49		14.46	2.52
Gender		0.50	0.50		0.51	0.50		0.49	0.50
Income		0.72	0.45		0.69	0.46		0.74	0.44
Married		0.70	0.46		0.70	0.46		0.70	0.46
CS	123	1614.00	35203.50	123	623.85	2260.89	125	2452.29	47782.27
WTP	310	2052.45	35334.60	306	1062.05	2833.72	312	2890.96	47934.90

Notes : Exp, WTP, and Income in 2006 constant dollars. The Income variable was adjusted to include respondents with household income ≥ $35,000 in the 2001 sample to approximate the CPI inflation factor (1.14) used for adjusting other variables.

The statistics presented in this table are unweighted values. Weighted summary statistics can be obtained from the official report released by the U.S. Fish & Wildlife Service

Table III. Results for WTP and CS regressions and Oaxaca-Blinder decomposition

	Dep var = log(willingness to pay)		Dep var = log(consumer surplus)	
	Pooled (*n* = 3,865)		Pooled (*n* = 3,865)	
	Coeff.	*t*-stat	Coeff.	*t*-stat
Public	1.325	6.16	1.187	4.92
Private	0.665	5.54	0.499	3.49
Photo	0.893	8.08	0.825	6.29
Wildlife	1.466	3.05	0.578	3.48
OutState	1.198	11.25	1.053	7.98
Male	0.267	2.67	0.305	2.33
Income	0.299	2.22	0.442	2.76
Age	0.069	2.80	0.066	2.30
Age^2	-0.001	-2.99	-0.001	-2.56
Married	-0.328	-2.77	-0.440	-3.11
Education	0.016	0.59	0.024	0.80
YR_2001	-0.032	-0.39	-0.057	-0.43
Constant	-0.179	1.60	0.053	0.08
R^2	0.109		0.070	

Oaxaca-Blinder Decomposition Results

	Coeff.	*t*-stat		Mean	SD
ΔWTP	0.085	0.75	WTP_{01}	5.195	1.323
$\Delta X\beta_{01}$	0.006	0.13	WTP_{06}	5.280	1.072
$X_{01}\Delta\beta$	0.013	0.11	WTP_{Pooled}	5.241	1.163
$\Delta X\Delta\beta$	0.066	1.69			
ΔCS	0.094	0.70	CS_{01}	4.105	
$\Delta X\beta_{01}$	-0.006	-0.12	CS_{06}	4.199	
$X_{01}\Delta\beta$	0.020	0.15	CS_{Pooled}	4.156	1.093
$\Delta X\Delta\beta$	0.080	1.78			

Note : Decomposition estimates was obtained using the OAXACA command in STATA Ver. 11. For a comprehensive overview of this command, see Jan (2008). WTP and CS are predicted values following the model estimates. Model estimates for the individual samples are available upon request.

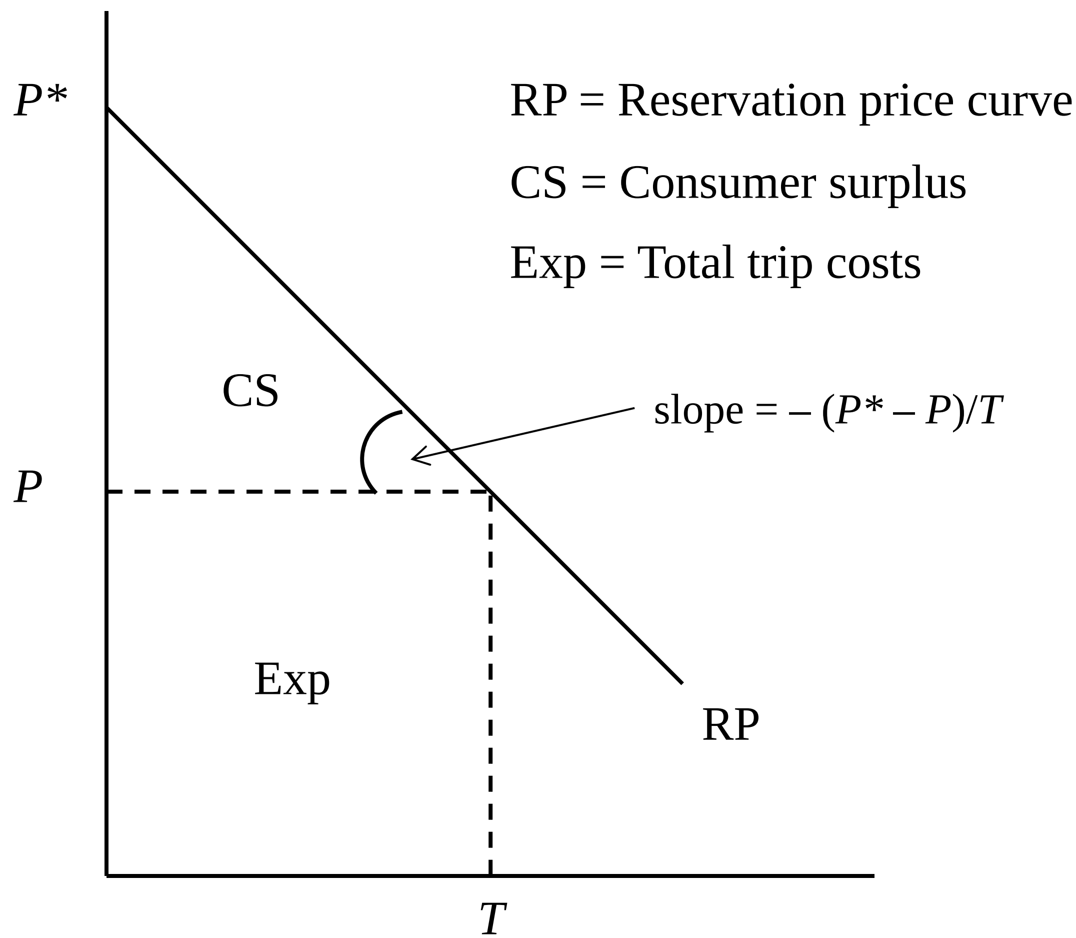

Fig. 1. Welfare measures for wildlife-watching trips