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Willingness to Pay for Submerged Maritime Cultural Resources

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ABSTRACT

Many consider salvage value and tourism expenditures as the only economic values of a historic shipwreck. This paper looks at one alternative, the non-market value generated by management of shipwrecks as submerged maritime cultural resources. We consider the question: How much are people willing to pay to maintain shipwrecks in their pristine state? The contingent valuation method was implemented during summer 2001 as part of a telephone survey to households in eastern North Carolina. We find that households are willing to pay about $35 in a one-time increase in state taxes. Willingness to pay is internally validated by expected relationships with prices and income but fails to pass the scope test. We speculate that we inadvertently succumbed to the well-known "birds" problem. The double-bounded willingness to pay questions are not incentive compatible and are subject to starting point bias, despite efforts to minimize these effects.

1. INTRODUCTION

Submerged maritime cultural resources (i.e., historic shipwrecks) can be valuable archaeological sites with information that helps to understand past societies and the development of maritime activities throughout the world. In contrast, the market value of a historic shipwreck is the price of the artifacts salvaged from a shipwreck as determined through auction or direct sale. Contemporary salvors (i.e., treasure hunters) find profit by salvaging abandoned ships or ships in distress, a practice rooted in ancient law.

Another market value related to historic shipwrecks is the expenditures made by visitors to maritime museums, historic ship replicas, and decommissioned ships. The creation of museums and exhibits protects historic shipwrecks but they still entail the removal of the wreck and its contents from underwater. Such a venture is not economically viable for all wrecks. The cost of excavation and conservation of shipwrecks is high. Most archaeologists, historians, and even the general public would not want all shipwrecks disturbed in this manner. Ships considered tombs to those who died there, ships with historical significance, and ships too fragile to safely excavate could be maintained as underwater preserves.

In contrast to salvage value and tourism expenditures, the non-market value of shipwrecks includes the use and non-use value of historic shipwrecks. Use value includes the benefits to recreational divers who enjoy historic shipwrecks as destinations. Non-use value includes the benefits to people who enjoy knowing about historic shipwrecks without on-site use. Non-users of shipwrecks might include tourists who gain knowledge by visiting coastal areas, waterfronts, maritime museums and ship memorials. Such knowledge can also be obtained through reading and watching television programs.

Nevertheless, salvage is the only economic value typically considered when investigating the value of shipwrecks. In this context, Kaoru and Hoagland (1994) suggest that application of the contingent valuation method is the preferred methodology to obtain estimates of the value of shipwreck protection in order to balance the competing demands of shipwrecks. In one related application, Vrana and Halsey (1992) estimate use value by asking respondents about willingness to pay for permits to dive in a hypothetical Great Lakes park that includes historic shipwrecks.

The purpose of this paper is to determine whether there are potentially significant non-market values for managing historic shipwrecks as submerged maritime cultural resources rather than as salvageable market commodities. We use the contingent valuation method to estimate this value and consider the methodological issues of scope and incentive incompatibility with double-bounded valuation questions.

Scope insensitivity exists if willingness to pay estimates for a public good and a public good of greater quality or quantity are not significantly different. Critics of the contingent valuation method argue that scope insensitivity renders the contingent valuation method invalid for policy analysis (e.g., Diamond and Hausman, 1994). Others argue that findings of sensitivity to scope are common (e.g., Hanemann, 1994) and that the scope test is not a critical test of the validity

of the contingent valuation method (Randall, 1998). Navrud and Ready (2002) find that no contingent valuation of culture study to date has tested for scope effects. In this paper we provide the first application that considers whether willingness to pay for cultural resources is sensitive to scope.

Double-bounded willingness to pay questions are prone to incentive incompatibility (Alberini et al., 1997). For example, respondents who vote for a proposal at a fixed tax amount may perceive that government is wasting money when they are confronted with the same proposal priced at a higher tax amount. Respondents who vote against the project may perceive that the project will be of lower quality when confronted with a lower tax amount. In both cases there are incentives to vote against the project in the second question, regardless of true willingness to pay, and the second willingness to pay amount may shift downward. We adopt a suggestion made by Alberini et al. (1997) in an attempt to minimize incentive incompatibility.

In the next section we provide a description of the survey and the responses. Next we describe the willingness to pay models. Then we present the empirical results. Finally, we offer some conclusions.

2. THE SURVEY

In order to measure the non-market value of historic shipwrecks we designed contingent valuation questions as part of an omnibus telephone survey of eastern North Carolina residents conducted during the summer of 2001. The response rate of 46% is measured as the number of completed surveys divided by the sum of completions and refusals. The number of completed surveys is 913. Eight hundred eighty-four cases are useable for the analysis. This sample includes two-hundred forty cases with household income values imputed from a regression model. 1 The sample average household income is $37,210. Sixty-nine percent of the sample is white and 37% is male. Sixty-one percent of the sample is married. The average household size is 2.44. Average education is 13.39 years and the average age is almost 50 years.2

Several questions specific to historic shipwrecks were presented to survey respondents.3 The purpose of these questions is to estimate the willingness to pay for a historic shipwreck state park with protection from treasure hunters in North Carolina. The first two questions are about knowledge of shipwrecks and begin with some background information. Respondents are given a definition of historic shipwrecks and told that "over 5,000 ships have been lost off the North Carolina coast earning the state the nickname: the graveyard of the Atlantic". We then ask respondents how much they know about historic shipwrecks.

Respondents are told that the state Historic Preservation Office monitors over 5,000 shipwrecks and the state underwater archaeology unit has studied about 900 of these wrecks. The policy problem is then described. Respondents are told that the state cannot adequately protect a shipwreck from treasure hunters. Respondents are asked to suppose that North Carolina was considering a historic shipwreck state park that would protect the most important shipwrecks from treasure hunters. Access to the park would be monitored and controlled and information about the park would be distributed to the public.

Then the willingness to pay questions are presented. Respondents are told that creation of the park would require additional state money to protect the most important shipwrecks. Respondents are given "one estimate" of the cost as a onetime increase in state taxes and then asked to suppose that the creation of the park was put to a vote in the next statewide election. The willingness to pay questions are presented as a state-wide referendum (i.e., "would you vote for or against the park?").

There are eight versions of the willingness to pay questions. The first, singlebound question has two versions for the park size (50 or 100 protected shipwrecks) and four price versions ($10, $30, $60, $90).4 Double-bounded questions present a follow-up. If the referendum vote is "for" on the first willingness to pay question, the next presents a variation in the proposal in which the size of the park is increased by 2.5 and the price is doubled. If the referendum vote is "against" or "don't know" on the first question the size of the park is divided by 1.25 and the price of the park is halved in the follow-up question.

For those respondents who received the 50 shipwreck park version, 67%,51 %, 34%, and 40% voted for the park at taxes of $10, $30, $60, and $90. The differences are statistically significant at the $p = 0.01$ level $(X\ 2 = 27.29$ [3 dfj). For those respondents who received the 100 shipwreck park version, 58%, 49%, 36%, and 43% voted for the park at taxes of $10, $30, $60, and $90. The differences are statistically significant at the $p = 0.01$ level $(X\ 2 = 12.34$ [3 dfj). Overall, 47% and 46% voted for the 50 and 100 shipwreck parks. The differences across the size of the park are not statistically significant.

The double-bounded responses indicate that most were reluctant to change their answers when the park size and tax amount changed (Table I). Twenty-nine percent and 46% of respondents in each park size version voted for and against on each question, respectively. Less than 20% voted for on the first question and against on the second. Less than 10% voted against on the first question and for on the second.

3. WILLINGNESS TO PAY MODELS

Both single-bound and double-bounded willingness to pay models are estimated. With the single-bound data the probit model is used to empirically determine the factors that affect the for and against votes in the first referendum. With the doublebounded data the random effects probit model for panel data is used (Alberini et al., 1997; Greene, 2000). The willingness to pay models are derived from the probit coefficients using the procedures described in Cameron and James (1987). The standard errors for the coefficients and the willingness to pay estimates are constructed using the Delta Method (Cameron, 1991; Greene, 2000, p. 278). The LIMDEP econometric software is used (Greene, 1997).

Two models for the single-bound and double-bounded data are estimated. The first model includes only economic variables that might affect willingness to pay including the one-time tax amount, the size of the park *(Quantity),* on-site use prices *(Travel Cost* 1 and *Travel Cost* 2), and income. The second model includes demographic variables.

Table I. Responses in the double-bounded referendum

Tax amount	For/for	For/against	Against/for	Against/against
50 Shipwrecks				
$10	55	13	3	31
$30	32	24	3	50
$60	20	22	10	72
$90	19	23	13	50
Total	126	82	29	203
Percent	28.64%	18.64%	6.59%	46.14%
100 Shipwrecks				
$10	45	16	3	41
$30	27	22	6	46
$60	34	14	16	70
$90	23	22	10	49
Total	129	74	35	206
Percent	29.05%	16.67%	7.88%	46.40%

By incorporating different sizes of the park into the experimental design we conduct the scope test. Since willingness to pay should be non-decreasing in scope the expected sign of the *Quantity* variable is positive or zero (Whitehead et al., 1998). In response to a suggestion made by Alberini et al. (1997) we vary the quantity of the good (i.e., size of the park) between the first and second referendum in an attempt to minimize incentive incompatibility. The goal is to (l) convince those that are being asked to pay more that they will receive a larger good in return and (2) convince those that are being asked to pay less that they are receiving a good of equal quality.

The on-site use price variables measure the potential own-price and cross-price effects of the park as a travel destination (Whitehead et al., 1994).5 The *Travel Cost* 1 variable measures the travel and time costs of a trip from the population center of the respondent's county to the Outer Banks of North Carolina (i.e., "the graveyard of the Atlantic"). The town of Manteo is considered as the gateway to the Outer Banks for most visitors and is used in the distance calculation. The *Travel Cost* 2 variable measures the travel and time costs of a trip to Morehead City, near the location of the remains of the pirate Blackbeard's flagship, the *Queen Anne's Revenge.* The mean travel costs to Manteo and Morehead City are $130 and $103. We control for both incentive compatibility and starting point bias with two additional independent variables in both double-bounded models (Whitehead, 2002).

In the random effects probit we include a dummy variable equal to one for the second willingness to pay question and zero otherwise *(Shift)* and the *Shift* variable interacted with the tax amount from the first question *(Anchor).* When the probit

results are converted to the willingness to pay model the *Shift* effect measures the difference in willingness to pay between the first and second questions. The *Anchar* effect measures the weight attached to the tax amount in the first referendum question. In other words, it is a test for starting point bias (Herriges and Shogren, 1996).

Table II. Willingness to pay models

Variable	Single-bound				Double-bounded			
	Coeff.	*t*-ratio	Coeff.	*t*-ratio	Coeff.	*t*-ratio	Coeff.	*t*-ratio
Constant	1.85	0.07	−146.71	−2.40	−13.44	−0.70	−145.22	−2.78
Quantity	−0.12	−0.47	−0.12	−0.52	−0.01	−0.10	0.07	0.65
Travel Cost 1	−0.20	−1.81	−0.19	−1.88	−0.19	−1.95	−0.16	−1.74
Travel Cost 2	0.21	1.34	0.18	1.21	0.34	2.35	0.30	2.03
Income	1.24	2.88	0.53	1.34	1.01	3.04	0.38	1.00
White			14.05	1.05			16.21	1.25
Male			19.56	1.57			15.69	1.32
Married			−25.90	−1.74			−29.14	−2.04
Household size			12.19	2.03			13.69	2.49
Education			12.12	3.67			11.11	3.80
Age			−0.30	−0.78			−0.62	−1.56
σ	142.40	4.82	129.51	5.20	42.00	5.41	51.06	4.56
Willingness to pay	38.20	4.30	38.99	4.78	34.15	5.21	32.82	4.80
Shift					−47.12	−4.50	−54.67	−4.26
Anchor					0.52	3.59	0.54	3.38
ρ					0.92	40.65	0.88	21.13
Beginning LL	−610.57		−610.57		−1198.52		−1198.52	
Ending LL	−587.11		−568.51		−1034.47		−1015.80	
Cases	884		884		884		884	
Responses	1		1		2		2	

4. EMPIRICAL RESULTS

The results of the willingness to pay models are presented in Table II. The vector of coefficients in each model is statistically different from zero according to the likelihood ratio test (i.e., X^2 = -2[Beginning LL - Ending LL]). In the double-bounded models the *p* parameter is the contribution of the total variance in the error term due to the error term common to the respondent (i.e., the random effects). The *p* parameter indicates that almost all of the variation is at the individual level and not random error. This result indicates that the random effects specification is appropriate.

The scale parameter, (), is the negative inverse of the probit coefficient of the

tax amount. In each model the scale parameter is positive and statistically different from zero indicating that as the tax amount increases respondents are less likely to vote for the project. Respondents are behaving rationally in the referendum. Another consistent result in across the models is the lack of a scope effect. Respondents do not perceive the park with 100 shipwrecks to be more valuable than the park with 50 shipwrecks.

In each model, the coefficient of *Travel Cost I* is negative and statistically significant. In the double-bounded models the coefficient of *Travel Cost* 2 is positive and statistically significant. These results suggest that respondents perceive the coastal area near the Outer Banks to be the location of the proposed park and the coastal area near Morehead City to be a substitute location for on-site activities related to the park. The absolute value of the own-price coefficient can be interpreted as the increased number of recreation trips that would be taken with establishment of the park (Huang et al., 1997). Across the models, the range of increased trips is 0.16 to 0.20 for each respondent. In other words, between 16% and 20% of the respondents would take one additional trip to the Outer Banks with establishment of the park. A significant portion of willingness to pay is use value.

In the models without demographic variables the coefficient of *Income* is positive and statistically significant. This result reveals that the shipwreck park is a normal good. The income elasticity of willingness to pay is 1.21 in the single-bound model and 1.10 in the double-bounded model. The income elasticity is high relative to most contingent valuation applications. This indicates that willingness to pay is very sensitive to income. When demographic variables are added to the models the income coefficients are no longer significantly different from zero. This is not surprising since income is correlated with each of the demographic variables.

In the single-bound model willingness to pay is $26 lower for married respondents, $12 higher for each additional household member, and $12 higher for each additional year of education. In the double-bounded model, willingness to pay is $29 lower for married respondents, $14 higher for each additional household member, and $11 higher for each additional year of education. Race, gender, and age do not have statistically significant effects on willingness to pay. The vector of demographic coefficients is statistically significant according to the likelihood ratio statistic for the single-bound *(X 2* = 37.22 [6 df]) and double-bounded models *(X 2* = 37.34 [6 df]).

The willingness to pay estimates from the first referendum question are between $38 and $39 in the single-bound models and between $33 and $34 in the double-bounded models. The differences in the single-bound and double-bounded willingness to pay estimates are not statistically different. In the double-bounded models the shift effect is statistically significant and greater in absolute value than the willingness to pay estimates. This indicates that the incentive incompatibility is so extreme that the willingness to pay estimates implied from the second referendum are negative (in the linear model). The anchoring effect indicates that the willingness to pay implied from the second referendum question is a function of the starting tax amount.

5. CONCLUSIONS

The primary purpose of this paper is to provide an estimate of the willingness to pay for management of submerged maritime cultural resources. The empirical results indicate that respondents are willing to pay money for protection of shipwrecks from treasure hunters and preserving the public good aspects of these cultural resources. The willingness to pay models are sensible and conform to economic theory. This indicates that the willingness to pay estimates have some degree of validity and are useful for policy analysis.

We find that willingness to pay is insensitive to the scope of the policy. This result, by itself, does not invalidate the willingness to pay estimates since willingness to pay should be nondecreasing in scope. However, it is troubling since an increase in willingness to pay after a doubling of the size of the park is intuitively appealing. On closer inspection of the contingent valuation scenario we may have unwittingly succumbed to the "birds" problem. Boyle et al. (1994) find that willingness to pay does not vary for a program to avoid the deaths of "much less than 1 %", "less than 1 %", and "about 2%" of the migratory waterfowl population in the central flyway. Hanemann (1994) argues that it is not surprising that willingness to pay does not differ across these programs because respondents may not perceive any difference in the number of birds when placed in percentage terms. In our survey, the park size varies from 50 to 100 of the 5,000 shipwrecks that the state of North Carolina monitors. It should not be surprising that willingness to pay does not vary when shipwreck protection varies from 1 % to 2% of the total.

Our experimental design also includes a previously untested attempt to solve the incentive incompatibility problem of double-bounded willingness to pay questions. Nevertheless, we find that the follow-up responses suffer from incentive incompatibility as measured by a large shift in willingness to pay from the first to the second question. In addition, the follow-up willingness to pay responses suffer from starting point bias. These results may be due to the "birds" problem described above. If respondents did not consider the change in the scope of the park to be significant, then an insignificant change in scope should not affect the incentive incompatibility of the follow-up willingness to pay question.

An understanding of the economic value of historic shipwreck management is useful in helping to determine how many resources should be devoted toward protecting historic shipwrecks from treasure hunters and other consumptive users. According to the 2000 Census there are about 850,000 households in the sample region. Using the most conservative willingness to pay estimate from Table II the aggregate willingness to pay is $27.90 million (2001 U.S. dollars). A 30-year annuity yielding 5% would generate $1.73 million in annual revenue for managing the park. If the annual cost of managing the park is less than $1.73 million, establishment of the park represents an improvement in economic efficiency. Aggregate benefit estimates are biased downward by the extent to which residents of the rest of North Carolina and other states value historic shipwreck protection in North Carolina.

Our results suggest a number of topics for future cultural valuation research. Inclusion of contingent behavior questions would be one way of validating the willingness to pay estimates for cultural resources. Joint estimation of trip data

and willingness to pay data could be used to calibrate the willingness to pay data and differentiate between use and non-use values (Huang et al., 1997). Second, future contingent valuation of culture research should investigate scope effects. Researchers should vary the quantity or quality of the cultural resource by more than 1 % or 2% of the total. Finally, researchers should continue to investigate the incentive compatibility of follow-up questions in order to exploit the potential gains in efficiency from bounded willingness to pay without biasing willingness to pay estimates. Any variations in the wording or context of the follow-up questions that avoids misperceptions about the intentions of the questions would be an improvement.

NOTES

1. See Appendix A at the primary author's website for a discussion of the data imputation procedure.
2. See Appendix B at the primary author's website for a comparison of sample demographics to the population demographics.
3. See Appendix C at the primary author's website for the survey questions and raw data frequencies.
4. A pretest of these tax amounts was not feasible due to a limited research budget.
5. See Appendix D at the primary author's website for details about the travel cost variables.

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