Using Multiple-Scenario Contingent Valuation Data to Estimate Willingness to Pay for Restoration of Mississippi's Barrier Islands

By

GwanSeon Kim
(gk84@msstate.edu)
Mississippi State University
Phone: 662-617-5501

Daniel R. Petrolia
(Petrolia@agecon.msstate.edu)
Mississippi State University
Phone: 662-325-2888

Matthew Interis
(Interis@agecon.msstate.edu)
Mississippi State University
Phone: 662-325-4787

Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Corpus Christi, TX, February 5-8, 2011

1. Introduction

1.1 General Problem

The contingent valuation method is one of the standard approaches to measure the value of environmental goods or quality, and it is based on stated preference. Petrolia and Kim (2009) measured Mississippi coastal residents' Willingness to Pay (WTP) for restoration of the Mississippi's barrier islands at three different scales: their current condition (Status-Quo), their condition before Hurricane Camille (Pre-Camille), and their condition before 1900 (Pre-1900). To obtain the data, they used the single-bounded dichotomous choice contingent valuation (SBDC) method, and they used a follow-up question for level of uncertainty, which indicates how sure respondents are about their response. They used random-effects probit models to analyze data, and estimated WTP by using non-parametric and parametric methods. They found that Turnbull lower-bound mean WTP for the Pre-Camille was $152.

Petrolia and Kim (2009) estimated the WTP for the three different scenarios separately. This research applies a novel method of nonmarket valuation to the case of barrier-island restoration in Mississippi, and proposes a different approach which is similar to the double-bounded, which is developed by Hannemann, and it was derived by Loomis and Kanninen (Habb and McConnell 2002), method to estimate WTP for the Pre-Camille option by using additional data from the other two scenarios. For convenience, we call this novel variant of the double-bounded dichotomous choice method the 'quasi-double bounded' method. In the scenario, implementing the Pre-Camille option means getting more land than there is now (Status-Quo option), and implementing the Pre-1900 option means getting more land than implementing the Pre-Camille option. To apply the quasi-double bounded method, we assume that if a respondent reports he is not WTP the proposed bid for the largest-scale Pre-1900 option, he is also not WTP that same amount for the smaller Pre-Camille option.

Similarly, if he is WTP the proposed bid to maintain the current levels, he should be willing to pay at least that amount for the larger option. In this way, responses to the Pre-1900 and Status-quo options could, in certain cases, be used as bounds on WTP for the Pre-Camille option.

The single bounded and double bounded dichotomous choice question are well known approaches to elicit the value of WTP. In the single bounded dichotomous choice question, respondents theoretically answer “yes” if the value from the proposed program or policy for environmental quality is higher than the offered bid; otherwise they answer “no”. In double bounded dichotomous choice questions, the respondents are offered a higher bid if they said “yes” to the initial bid amount, and they are offered a lower bid money if they said “no” to the initial bid.

Some researchers argue that double bounded dichotomous choice question is not appropriate model to estimate WTP. Clarke (2000) found that double-bounded method is biased because the response to initial and follow-up WTP questions were inconsistency due to the higher probability of nature that respondents answer “no” to the follow-up WTP question if the offered bid is higher than initial bid. Cooper, Hanemann, and Signorello (2002) also mentioned that the double-bounded format has been criticized because of evidence of response bias that response to the second bid with the initial bid is inconsistence. Habb and McConnell (2002) say that after the first question respondent’s behaviors are altered in double-bounded model. “If the respondent’s distribution of willingness to pay shifts between the offered bids, then estimates of WTP using current DB-DC practice may be incorrectly modeled (McLeo and Bergland, 1999). Flachaire and Hollard (2006) stated one major problem, which is starting point bias, to use the double bounded model due to the fact that first bid can affect to response of the second bid.

Even though there are some problems for using the double bounded, many researchers prefer to use the double-bounded method rather than the single-bounded because the latter often suffers from poor statistical efficiency. Hanemann, Loomis, and Kanninen (1991) estimate WTP for wetlands in the San Joaquin Valley using survey data. They estimate the WTP value using single and double bounded method for comparison. They show that the double bounded method is more statistically efficient than the single bounded approach. Using the double-bounded model, efficiency will increase with more observations as number of responses increase. Kanninen (1993) states that many researchers accept that use of the double-bounded procedure improve reliability of responses. In addition, the double bounded dichotomous contingent valuation formation can bring more accurate welfare estimates (McLeod and Bergland, 1999).

1.2 Objectives

Estimate respondent's WTP to restore the barrier islands to their Pre-Camille status, using additional information gained from their responses to the WTP questions for restoring the islands to their Pre-1900 status and maintaining their current levels.

2. Conceptual framework

2.1 Quasi-Double bounded Model

Figure 1 show how quasi-double bounded model is created between lower and upper bound based upon responses to the Pre-Camille option in quasi-double bounded model. The respondent is asked weather he is willing to pay a certain amount to restore the barrier island to Pre-Camille option. If he responds "yes", we have a lower bound on his WTP. The respondent is also asked if he is willing to pay higher amount for the Pre-1900 option. Since the Pre-1900 option involves restoring more land, we can assume that he is not willing to pay this higher amount for the Pre-Camille option, which involves restoring relatively less land, if the respondent answers "no" to the Pre-1900 option. Therefore, the bid asked for the Pre-1900 option can be interpreted as an upper bound on the respondent's WTP for the Pre-

Camille option. On the other hand, if the respondent answers “yes” to the Pre-1900 option, it gives no new information because it provides positive infinity bound. Using the same concept, if the respondent answers “no” to certain amount to restore the barrier island to the Pre-Camille option, we have an upper bound on his WTP. The respondent is also asked if he is willing to pay some lower amount for the Status-Quo option. In this case, we can assume that if the respondent answers “yes” to this option, he is also willing to pay this lower amount for the Pre-Camille option because the Pre-Camille option involves restoring relatively more land. Thus, the bid asked for the Status-Quo option can be interpreted as a lower bound on the respondent’s WTP for the Pre-Camille option. If the respondent, however, answers “no” to the Status-Quo option, it provides no new information in the quasi-double bounded model.

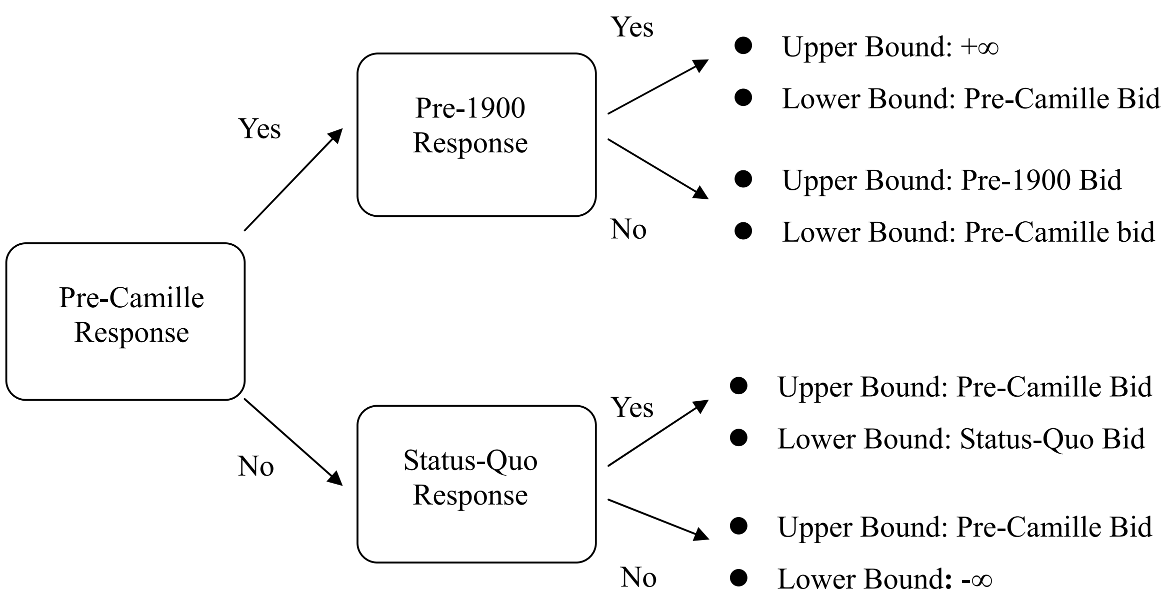

Figure 1. Interval based on responses for each restoration option

2.2 Random WTP model

This thesis follows the Random WTP model proposed by Cameron and James (1987).

In closed-ended CV survey data which is dichotomous referendum choice, each respondent is offered bid, t_i, and his true WTP is either greater than or less than t_i based upon his response. Then, we assume that

$$Y_i = x'_i\beta + u_i.$$

where Y_i is unobserved continuous valuation (WTP), x_i is a vector of explanatory variables, and it has some known distribution with a mean of $x'_i\beta$. u_i is error term. By employing the offered bid as

$$I_i = 1 \text{ if } Y_i > t_i$$

$$= 0 \text{ if } Y_i < t_i$$

where I_i is discrete indicator variable. So probability of "yes" can be written as

$$\Pr(I_i = 1) = \Pr(Y_i > t_i) = \Pr(u_i > t_i - x'_i\beta)$$

$$= \Pr[u_i/\sigma > (t_i - x'_i\beta)/\sigma]$$

$$= 1 - \Phi[(t_i - x'_i\beta)/\sigma]$$

where, Φ is the standard normal cumulative density function, and σ is standard deviation, and assume that the error term is normally distributed.

The log-likelihood function becomes

$$\log L = \sum \{I_i \log[1 - \Phi(t_i - x'_i\beta)/\sigma)] + (1 - I_i) \log[\Phi(t_i - x'_i\beta)/\sigma)]\}$$

The presence of t_i allows σ to be identified, which is possible to separate β in order to determine the underlying valuation function.

3. Experimental Design

This section includes explanations of the variables which are used for constructing model of willingness to pay to restore Mississippi's barrier islands. Additionally, this section explains a description of survey and questions with related the variables.

For the market scenario, the respondents were given introduction of restoration program for barrier islands in Mississippi. The introduction mentioned “The Mississippi barrier islands are continuously changing shape, size, and location. Overall, though, total land area has decreased by 36 percent since the 1850s, falling from a combined 10,290 acres to 6,545 acres. Although no exact predictions can be made, it is expected that they will continue to lose more land in the future”. Four different maps (1850, 1966, 2002, and 2006) were also provided to the respondents in order to show how the barrier islands have changed in shape, size, and location from 1850 to 2006.

A dichotomous referendum-style question was used for the elicitation method, so each respondents was ask to decide “yes” for the restoration or “no” for no action. The respondents asked to evaluate three different types of restoration options: Status-Quo Option, Pre-Camille Option, and Pre-1900 Option. A map and brief introduction for each option were provided to the respondents. Each restoration option stated that the program would entail restoration and periodic maintenance for the next 30 years period, and it would cost each Mississippi taxpaying household a one-time payment of $X. One of the five bids were recoding assigned to each survey for each scenario: $7, $13, $20, $26, and $33 for the Status-Quo option, $77, $153, $230, $306, and $383 for the Pre-Camille Option, and $195, $391, $586, $782, and $977 for the Pre-1900 option.

A total five-hundred and ninety four surveys were returned. The overall response rate was 20%. Table 2 describes comparison of the sample and the population demographics. The data used for the population was obtained from the 2005-2009 American Survey Community 5-Year estimates (USCB 2010). Comparing with the population, the sample is more male, whiter, older, more educated, more republic, and wealthier than the population. For residency, 62.16% of the sample which is three hundred seventy four respondents is coastal residents, and the coastal residents in the population is 12.03% which was calculated that total residents from three coastal counties (Hancock, Harrison, and Jackson) in the

Mississippi is 355,075 out of 2,951,996 total Mississippi residents.

Kruskal-Wallis equality-of-population rank test and T-test were used for treatment bias among demographic indicators. All demographic variables were not significant at 5% level. It means the hypothesis that the populations are the identical cannot be rejected under the three survey treatments: ordering of restoration option, different name of restoration option, and inclusion or exclusion of the uncertainty question. In other words, the treatment samples are not biased.

Table 1

Comparison of Sample and Population Demographics Proportions (N = 444)

		Sample	Population*
Gender	Male	61.26%	48.50%
Race	White	86.94%	60.00%
Age	65 years and over	28.15%	12.50%
Number of Household** (median)		2.4	2.6
Education**	Some school	2.05%	21.20%
	High school	50.00%	31.20%
	Bachelor's Degree	30.45%	12.40%
	Master's, Professional or Doctoral Degree	17.50%	6.70%
Political party**	Republican	53.20%	N/A
Income (median)		$45,625	$36,796
Residency	Coastal	62.16%	12.03%

*Population data from ACS 05-09 estimates

** Number of observation is 436, 440, and 438 respectively

Table 2 shows frequency and percentage of "yes" and "no" responses for each restoration scenario based on offered bid:

"*Suppose a State referendum were held today on the restoration option. A majority vote would be necessary to implement the project and, if passed, the payment would be collected on your 2008 state income tax return. Would you support the restoration option and* *therefore be willing to make a* <u>*one-time*</u> *payment of $X to implement it?"*

Table 2

WTP for each restoration option with bid

Status Quo Option					
WTP	No	Percentage of No	Yes	Percentage of Yes	Total
$7	18	14.88%	69	21.90%	87
$13	27	22.31%	69	21.90%	96
$20	27	22.31%	62	19.68%	89
$26	20	16.53%	56	17.78%	76
$33	29	23.97%	59	18.73%	88
Total	121		315		436

Pre-Camille Option					
WTP	No	Percentage of No	Yes	Percentage of Yes	Total
$77	35	14.00%	53	27.32%	88
$153	47	18.80%	51	26.29%	98
$230	59	23.60%	33	17.01%	92
$306	46	18.40%	31	15.98%	77
$383	63	25.20%	26	13.40%	89
Total	250		194		444

Pre-1900 Option					
WTP	No	Percentage of No	Yes	Percentage of Yes	Total
$195	47	15.36%	40	31.25%	87
$391	63	20.59%	31	24.22%	94
$586	66	21.57%	23	17.97%	89
$782	59	19.28%	18	14.06%	77
$977	71	23.20%	16	12.50%	87
Total	306		128		434

Table 3 shows result from the question to determine most important issues in terms of improving quality of life in the Mississippi Gulf Coast.

"*Suppose you could decide how $100 of tax revenue could be divided among the following programs. How would you allocate it?"*

The respondents are asked two different questions of government programs. The first question of the government programs is general questions that involve number of jobs and economic activity, quality and affordability of healthcare, protection of the Mississippi coast and its residents from hurricanes and other hazards, improving the education system, and other. The second question of the government programs is more specific questions regarding the hurricanes and other hazards that include restoration of coastal wetlands, beaches, and other natural habitat, restoration of barrier islands, improvement of hurricane forecast, warning systems and evacuation procedures, improvement of hurricane-protection structure, like seawalls and levies, and other. According to the result from the Table 3, the respondents allocated their money almost equivalent to various programs except other choice, and it indicates that the respondents think all the government programs are equally important issue in terms of improving quality of the life in the Mississippi Gulf Coast.

Table 3

Most important issue on different government programs

General Government Programs (N=444)	Mean	Std. Dev.
Increasing the number of jobs and economic activity	$25.27	20.29
Improving the quality, availability, and affordability of healthcare	$22.61	18.68
Protecting of the Mississippi coast and its residents from hurricanes and other hazards	$22.38	20.01
Improving the education system	$23.07	18.89
Other	$6.67	17.50

Specific Government Programs (N=444)	Mean	Std. Dev.
Restoration of coastal wetlands, beaches, and other natural habitat	$26.76	16.96
Restoration of barrier islands	$24.98	16.31
Improvement of hurricane forecasts, warning systems and evacuation procedures	$19.07	17.23
Improvement of hurricane protection structures, like seawalls and levies	$24.57	17.60
Other	$4.62	16.60

4. Econometric Estimation and Model Specification

This study uses interval censored model to estimate what factors affect to the respondent’s decision on Pre-Camille option by incorporating other two restoration options.

This section also explains what variables are used in interval censored model.

Interval censored model

The interval censored model is one approach to model the WTP of the Pre-Camille including data from the Status-quo and Pre-1900. It can be used in referendum survey when the researcher does not know about the respondent's exact magnitude of valuation because referendum data only represent intervals between WTP and given amount money.

Stata Manual (2009) provides the method to analyze the interval censored data, and following discussion is based on Stata Manual (2009). If researcher know the value for the *jth* individual is somewhere in interval [y_{1i}, y_{2j}], then the likelihood contribution from the individual is represented as Pr ($y_{1i} \leq Y_j \leq y_{2j}$). For censored data, individuals' likelihoods contain a term of the form Pr ($Y_j \leq y_j$) for left-censored data and Pr ($Y_j \geq y_j$) for right-censored data, where y_j is the observed censoring value and Y_j denotes the random variable the dependent variable in the model. In this case, if the data is left-censored, it will be represented by -∞ as lower endpoint, and right-censored is ∞ as upper endpoint.

The likelihood for interval regression begins with y = X β + ε, where y represents continuous outcome which is either observed or unobserved. This model assumes $\varepsilon \sim N(0, \sigma^2 I)$. Observations $j \in L$ are left-censored, and unobserved t_j (i.e., point data) is less than or equal to t_{Lj}. Observations $j \in R$ are right-censored, and the unobserved t_j is greater than or equal to t_{Rj}. Observations $j \in I$ are intervals, and the unobserved t_j is in interval [t_{1j}, t_{1j}], then the log likelihood is

$$\ln L = \sum_{j \in L} w_j \log \Phi\left(\frac{t_{Lj} - X\beta}{\sigma}\right) + \sum_{j \in R} w_j \log\left\{1 - \Phi\left(\frac{t_{Rj} - X\beta}{\sigma}\right)\right\}$$

$$+ \sum_{j \in I} w_j \log\left\{\Phi\left(\frac{t_{2j} - X\beta}{\sigma}\right) - \Phi\left(\frac{t_{1j} - X\beta}{\sigma}\right)\right\}$$

Where Φ() is the standard cumulative normal and w_j is the weight for the *j*th observation.

Application of this method Cameron (1988) uses the maximum likelihood estimation by censored logistic regression to estimate the value from referendum survey data. The author uses a subset of the data which was conducted in an in-person survey of recreational salmon fishermen in order to estimate the fishermen's WTP via increased fishing cost.

Application of this method includes that Carson *et al*. (1994) estimate the value for the preservation of Australia's Kakadu conservation zone. They use the double-bounded discrete-choice CV survey to obtain information. The authors define an interval estimate of the WTP by ask questions with two discrete choices, and they analyze the data using survival analysis techniques because of interval-censored data. Then, they estimate the mean WTP using the Turnbull nonparametric approach and parametric approach under Weibull distribution.

Model Specification

Table 4 shows summary statistics of each independent variable used in the interval censored model. It also shows expected signs for all the variables because it represents a relationship between the variables and WTP. The gender, race, age, residency, and incomes are used as demographic variables. For demographic variables except income, the expected sign can be a positive or negative because it is unknown. However, expected sign of the income variable is positive due to the fact that if people have higher income, they are more willing to pay for the restoration than people who have lower income.

The protection and improvement were used as one of key factors in the model, and expected sign for those variables are positive because if respondents think protection of the Mississippi coast and it residents from hurricanes and other hazards, they are more willing to pay for the restoration. In addition, if they want to improve hurricane protection structures, they would be more willing to pay for the restoration.

Government variable was used to measure how WTP will be influenced by if respondents have confidence in the ability of government agencies to carry out hurricane protection efforts in timely manner. The expected sign of the government variable is negative because if respondents have no confidence on government, they would not be willing to pay for proposed program.

Reducing damage is another factor because it is important to determine respondent's decision if they think reducing damage is important characteristic of Mississippi's barrier islands. If the respondents think Mississippi's barrier islands are important on reduction damages, they are more willing to pay for the restoration. Thus, expected sign is positive.

Comfort variable is included in model if the respondents are comfortable with all questions contained in survey, they would more willing to pay to the proposed program, so relationship between the comfort variable and WTP is expected as positive.

Three different survey treatments, which are question order, label with historical reference, and cheaptalk, are used in the model in order to determine how the respondent's decision is influenced by three different survey treatments. The relationship between each different survey treatment and WTP is a positive or negative.

5. Results

This section discusses results from the interval regression estimation. Marginal WTP and mean WTP are presented in this section. Additionally, this section provides a comparison of results between the single-bounded model and quasi-double bounded model. Table 5 and 6 show results from the single-bounded and the quasi-double bounded model. In both tables, a marginal WTP, standard error, significance levels, and confidence are presented.
According to the results, all coefficient signs in both single and quasi-double bounded model show same as expected signs in Table 4. This study found that variables of residency, government, male, age, comfort, label, and cheaptalk are not significant at 5% level in both models; in other words, those variables have no impact on WTP.

However, Petrolia and Kim (2009) found that the residency is significant. To explain the residency variable in this study, a correlation test was used, but there was no correlation with other variables. Another possible way to explain why the residency is not significant in this study is due to the fact that the damage variable has high impact on WTP, and the damage variable represents the residency variable that if the respondents live in coast, they have benefits from the islands. One of the most benefits from the island is reducing damage from storms and hurricanes on the coast.

The variables of protection, improvement, damage, white, and income significantly affect on WTP for the Pre-Camille option at 5% level of significant in both single and quasi-double bounded model. Only question order variable is found as significant in the single-bounded model, and it presents that if payment questions are ordered by descending in the survey, their WTP is $127.34 more than the questions ordered by ascending in the survey. For the protection variable, if respondent indicates a relatively higher priority for protecting the Mississippi coast from the hurricanes relative to other pressing issues such as jobs, healthcare, and education, then they are more WTP $3.45 in the single bounded model and $1.32 in the quasi-double bounded model. The respondents stated that if they think improvement of hurricane protection and forecast or evacuation procedure is more interested than restoration of coastal wetlands, barrier-island, and other natural habitats, then they are less WTP $2.33 in the single bounded model and also less WTP $0.72 in the quasi-double bounded model. The respondents contribute average WTP $628.88 in the single bounded model and $227.53 in the quasi-double bounded model if they think the MS barrier islands are important for reducing storm surge, wave energy from storms. White respondents are $219.42 more WTP than non-white respondents in the single bounded model and $49.30 more in the quasi-double bounded model.

Table 4

Interval-Censored Model Variables and Descriptions (N=444)

Variable	Type	Description	Mean	Std. Dev	Min	Max	Exp.Sign
Residency	Binary	1 if resident of the Mississippi Gulf Coast; 0 if otherwise	0.62	0.49	0	1	+
Protection	Continuous	Dollar allocation for Protection of the Mississippi coast from hurricanes and other hazards	$22.38	20.01	0	100	+
Improvement	Continuous	Dollar allocation for Improvement of hurricane protection structures	$43.64	25.68	0	100	-
Government	Binary	1 if No confidence; 0 otherwise	0.54	0.50	0	1	-
Reducing Damage	Ordered Categorical	4 if importance of MS Barrier Islands to reduce damages from storms and hurricanes is extremely important; 3 if somewhat important; 2 if no opinion; 1 if not important	3.52	0.77	1	4	+
Male	Binary	1 if male; 0 if female	0.61	0.49	0	1	+/-
White	Binary	1 if white; 0 if otherwise	0.87	0.34	0	1	+/-
Age	Binary	Continuous between 18 - 94	56.45	14.19	18	90	+/-
Income	Ordered Categorical	1 if < $20K; 2 if $20K -$40K; 3 if $40K-$60K; 4 if $60K-$80K; 5 if $80K-$100K; 6 if $100K or more	3.45	1.64	1	6	+
Comfort	Binary	1 if comfortable with survey questions; 0 otherwise	0.96	0.19	0	1	+
Question Order	Binary	1 if order of restoration question is descending; 0 otherwise	0.45	0.50	0	1	+/-
Label	Binary	1 if survey version came with historical reference; 0 otherwise	0.52	0.50	0	1	+/-
Cheaptalk	Binary	1 if survey version include uncertainty question; 0 otherwise	0.52	0.50	0	1	+/-

Table 5

Interval censored regression estimation for Single-Bounded model

Variables	Coef. / Marginal WTP	S.E.	P>z	[95% Conf.Interval]		Mean WTP
Residency	69.40	51.50	0.18	-31.55	170.35	$43.03
Protection	3.45	1.32	0.01*	0.87	6.03	$77.21
Improvement	-2.33	1.10	0.03*	-4.48	-0.17	-$101.68
Government	-23.83	45.90	0.60	-113.8	66.13	-$12.87
Damage	178.66	50.35	0.00*	79.97	277.35	$628.88
Male	-32.91	47.16	0.49	-125.34	59.52	-$20.08
White	219.42	94.03	0.02*	35.13	403.72	$190.90
Age	-1.41	1.76	0.42	-4.85	2.04	-$79.59
Income	56.24	17.54	0.00*	21.86	90.62	$194.03
Comfort	225.35	162.02	0.16	-92.22	542.91	$216.34
Question Order	127.34	54.38	0.02*	20.75	233.92	$57.30
Label	-13.83	44.48	0.76	-101.01	73.34	-$7.19
Cheaptalk	64.74	46.41	0.16	-26.21	155.69	$33.66
Constant	-1074.20	359.91	0.00	-1779.62	-368.78	-$1,074.20
					Total WTP:	$145.74

Observations = 444

Log likelihood = -240.53

LR chi2(13) = 107.19

Prob > chi2 = 0.00

*Significant at 5% Level

Table 6

Interval censored regression estimation for Quasi-Double Bounded model

Variables	Coef. / Marginal WTP	S.E.	P>z	[95% Conf.Interval]		Mean WTP
Residency	6.67	16.17	0.68	-25.02	38.36	$4.14
Protection	1.32	0.40	0.00*	0.54	2.10	$29.54
Improvement	-0.72	0.33	0.03*	-1.36	-0.07	-$31.42
Government	-23.99	15.71	0.13	-54.77	6.80	-$12.95
Damage	64.64	11.92	0.00*	41.29	88.00	$227.53
Male	-17.94	15.99	0.26	-49.27	13.40	-$10.94
White	49.30	25.12	0.05*	0.08	98.53	$42.89
Age	-0.01	0.58	0.98	-1.16	1.13	-$0.56
Income	22.60	4.97	0.00*	12.85	32.35	$77.97
Comfort	73.28	43.49	0.09	-11.95	158.51	$70.35
Question Order	20.53	15.25	0.18	-9.36	50.43	$9.24
Label	-9.36	15.17	0.54	-39.09	20.36	-$4.87
Cheaptalk	17.77	15.13	0.24	-11.88	47.42	$9.24
Constant	-205.89	80.09	0.01	-362.85	-48.93	-$205.89
					Total WTP:	$204.26
Observations = 444						
Log likelihood = -328.56						
LR chi2(13) = 103.35						
Prob > chi2 = 0.00						

*Significant at 5% Level

For income variable, the income is measured in category unit between 1 and 4, thus one unit change represents a change in income of $20,000. In single bounded, a one-unit increase in income category adds $56.24 to WTP, and $22.60 adds in the quasi-double bounded model. Overall, the total average WTP for the single bounded model is $145.74 and $ 204.26 in quasi-double bounded model. The difference between the two models is $58.52.

6. Conclusion

This study uses a quasi-double bound approach to estimate willingness to pay (WTP) for the restoration of Mississippi's Barrier islands to Pre-Camille option. The main objective of this study is to improve WTP estimates compared to the single bound approach by incorporating more observations from other scenarios. An interval censored model was used in both cases to estimate WTP, analyze the variables used in model, and compare WTP.

Magnitudes of coefficients were similar under both models and were found to have the expected signs. The only difference between the two models was the question order variable that was significant only in the single-bounded model. Especially, the damage variable was found as primary factor on WTP in both models. For total WTP in the single bounded model is $145.74 and total WTP of $204.26 in the quasi-double bounded model. Using the quasi-double bounded model by incorporating more data from other scenarios, WTP was $58.52 higher than the single-bound model.

Future steps include a formal comparison of model efficiency and a comparison of the efficiency of WTP estimates. This study provides estimate of the value that individuals' willingness to pay for restoring the Mississippi barrier islands in Gulf coast. Furthermore, this study supports information to policy makers when they make restoration projects for funding related to Mississippi Barrier islands, and they can decide whether the funding from taxes by households will be acceptable or not.

References

Cameron, T.A. and M.D James. 1987. "Estimating Willingness to Pay from Survey Data: An Alternative Pre-Test-Market Evaluation Procedure." *Journal of Marketing Research* 14 (Nov.):389-95

Cameron, T.A. 1988, "A New Paradigm for Valuing Non-Market Goods Using Referendum Data: Maximum Likelihood Estimation by Censored Logistic Regression." *Journal of Environmental Economics and Management* 15:355-379.

Carson, R.T., L. Wilks, D. Imber. 1994. "Valuing the Preservation of Autralia's Kakadu Conservation Zone." *Oxford Economic Papers* 46:727-49.

Clarke, P.M. 2000, "Valuing the benefits of mobile mammo-graphic screening units using the Contingent valuation method." *Applied Economics* 32: 1647-1655

Copper, J.C., M. Hanemann, G. Signorello. 2002 "ONE-AND-ONE-HALF-BOUND DICHOTOMOUS CHOICE CONTINGENT VALUATION." *The Review of Economics and Statistics* 84(4): 742-750

Flachaire, E. and H. Guillaume. 2006 ."Controlling Starting-Point Bias in Double-Bounded Contingent Valuation Survey." *Land Economic* 82 (Feb): 103-111.

Haab, T.C. and K.E. McConnell. 2002. *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation.* Northampton, MA:Edward Elgar.

Hanemann, W., J. Loomis, and B. Kanninen. 1991 "Statistical Efficiency of Double-bounded Dichotomous Choice Contingent Valuation." *American Journal of Agricultural Economics* 73 (Nov.):1255-36.

Kanninen, B.J. 1993. "Optimal Experimental Design for Double-bounded dichotomous choice contingent valuation" *Land Economics* 69:138-146.

McLeod, D.M. and O. Bergland 1999. "Willingness-to-Pay Estimates Using the Double-Bounded dichotomous-Choice Contingent Valuation Format: A Test for Validity and Precision in Bayesian Framework" *Land Economics* 75:115-125

Petrolia, D. and T. Kim. 2009. "What are Barrier Islands Worth? Estimates of Willingness to Pay for Restoration." *Marine Resource Economics* 24:131-146.

StataCorp. 2007. *Stata Release 10.0 Statistical Software*. College Station, TX: StataCorpLP.

StataCorp. 2009. *Stata Manual Version 11*. Stata Press. College Station, TX.

United States Census Bureau (USCB). 2010. *2006-2008 American Community Survey*. Internet URL: http://factfinder.census.gov/servlet/ACSSAFFFacts?_event=Search&geo_id=04000US22&_geoContext=01000US%7C04000US22&_street=&_county=&_cityTown=&_state=04000US28&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=040&_submenuId=factsheet_1&ds_name=ACS_2009_5YR_

SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=.
and Managements 36:170-185.