# Visitor Valuation of Riparian Habitat in the Upper Santa Cruz Basin

by

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**Abstract**

This study uses contingent valuation survey data to estimate the factors that affect willingness to pay to maintain instream flow and riparian habitat in the Upper Santa Cruz River basin in Santa Cruz County, Arizona. Data come from a survey of 371 visitors to Tumacacori National Historical Park and Tubac Presidio State Park. This research estimates various important factors influencing people's willingness to pay to preserve the riparian area. Double-Hurdle model have been utilized to estimate the WTP. The results identify several variables as substantive determinants of people's willingness to pay to riparian habitat preservation. From the results, the significant factors include membership in local environmental organizations residence, income, decreasing times for habitat degradation. They all have big positive impact on willingness to pay. The factor indicating if visitors are seasonal residence positively affects willingness to pay.

# CHAPTER ONE

## Introduction

The objective of this study is to estimate non-market values for upper Santa Cruz River. The non-market value of this river is based on visitors' willingness to pay for preserving the riparian habitat and instream flows.

Why maintaining riparian habitats and instream flow is a substantial issue? Riparian habitats have main ecological functions such as reduction of floodwater runoff, filtration and retention of terrestrial upland sediment, reduction of chemical inputs from uplands by immobilizing, storing, and transforming them, stabilization of stream banks and build up of new stream banks and increased water storage and recharge for subsurface aquifers. The instream flow system provides many beneficial services and values, which include groundwater recharge, flood mitigation, water supplies, pollution attenuation, navigation, nutrient transport and recycling, biological productivity, aesthetic values, and recreational opportunities such as fishing, boating, swimming, and wildlife viewing. They play an important role in soil conservation, biodiversity, and aquatic ecosystems, which are crucial in ecology, environmental management, and civil engineering.

Besides, instream flow and riparian area are also very important habitat to land birds. Bird species depend on riparian habitat for nesting, stop-over sites during migration and places to live during the winter. Habitat loss and degradation are probably the most essential factors causing the decline of riparian bird populations. Riparian habitat not only supports healthy bird populations but also other wildlife including fish.

Especially, riparian area is even more important in Arizona, which are estimated only 0.4% of the total land area in Arizona. In our study, we focus on the riparian area in Santa Cruz Basin, which is a green bridge connecting U. S. (Arizona) and Mexico (Sonoran). It begins in Arizona and flows south into Mexico, where it makes a u-turn, and flows north back across the international boundary into Arizona and through Santa Cruz County, Pima County and the City of Tucson. The Santa Cruz River provides the riparian habitat to a large number of resident and migratory species. The riparian habitat in the Santa Cruz River belongs to one of the country's largest cottonwood-willow riparian corridor, which is critical to the ecological integrity of southeastern Arizona and northwestern Sonora. It supports the highest density and abundance of plants and animals in the region by constituting less than two percent of the land area in the Southwest. Moreover, the Upper Santa Cruz River is the primary water resource in Santa Cruz County, providing water to communities, farmers and ranchers in other parts of the county. It not only increases municipal water supplies, but also contributes to local community economies by feeding agricultural and ecological process. It has played a central role to the culture of the region.

As the population increasing in Arizona, numerous new residents have been drawn by the Santa Cruz River every year. Increased population increases municipal water use which makes the riparian area more vulnerable. Since the vegetation in riparian area is completely depending on surface flow and shallow groundwater resources, reduction of natural groundwater recharge and storage and deterioration of water quality has been resulted from the fast-paced development, groundwater depletion and a prolonged

drought. For an arid region where water is scarce, conserving the vital water resource seems to be more critical in maintaining riparian ecosystem.

Furthermore, measuring the economic effects of riparian habitat and instream flow in Santa Cruz River may provide useful information for policy makers. Policy decisions can be made on the basis of the non-market good value analysis. Government policy makers can gauge the efficiency of public investments. Therefore, measuring the economic value of riparian habitat and instream flow preservation is critical.

Now raises the question what are the non-market good, in our study, the habitat and instream flow in Santa Cruz River worth? There is no price for the riparian habitat and instream flow, but they do contribute utility to the site visitors for Santa Cruz River. Thus, the value of riparian habitat and instream flow in Santa Cruz River is monetized by the direct benefit to the site visitors.

Visitors to Santa Cruz River have a key influence. They get benefit from the recreation activity in this area, so if they have self-consciousness and be willing to contribute in promoting regional water conservation, it will be helpful to reduce the cost of maintaining the riparian ecosystem. The direct benefit to visitors is measured by their willingness to pay. Here we used contingent valuation method in two parks along Santa Cruz River to measure this value. This contingent valuation on visitor's willingness to pay will offer important information to policy makers or other organization to aid preservation.

# CHAPTER TWO

## Literature Review

Colby and Orr (2005) conducted a survey in Upper San Pedro River Basin in southern Arizona in 2001, they used the method of contingent valuation to evaluate people's willingness to pay (WTP) for preservation of the riparian habitat in San Pedro River. By using the heteroskedastic Tobit model, they found among the significant variables, income, expenditure and visited that area previously had positive influence on WTP, but age had negative influence.

In Colby and Smith-Incer's (2005) research in Kern River Preserve, they evaluate visitor's WTP for habitat restoration and examine an annual WTP of $77 per visitor to preserve the habitat. For the effect of independent variables on WTP, income, repeated visits, education and membership of an environmental organization had positive influence. The square of age, gender, bird watcher had negative effect. Besides, they did an expenditure analysis, which indicates overnight stay for communities to experience significant economic benefits from visitors is important.

Ojeda, Mayer and Solomon surveyed on the residents in Ciudad Obregon in Mexico about their WTP for restoring instream flows in Yaqui River Delta in Mexico. A single-bound dichotomous choice bid followed by an open-ended question eliciting maximum WTP has been used in their research. They found key variables related to WTP are income, education level, number of children in household and initial bid amount.

Loomis, Kent, Strange, Fausch, Covich (2000) conducted a contingent valuation survey for the ecosystem services in five areas along the Platte River. Households have been asked a dichotomous choice WTP question regarding purchasing the increase in ecosystem services through a higher water bill. They used Logit model and the independent variables included: bid amount, unlimited water, government purchase, environmentalist, average water bill and urban. Then they compared the benefits and costs of restoring ecosystem services. Their conclusion is mean WTP for increase five ecosystem services of Platte River is $21 per month in a higher water bill, which is sufficient to pay for the conservation easements on agricultural land along the river and leasing of water for instream flow.

Holmes, Bergstrom, Huszar, Kask and Orr III (2004) estimated the benefits and costs of riparian restoration projects along the Little Tennessee River in western North Carolina. To assess household WTP to pay increased county sales taxes for differing amounts of riparian restoration, dichotomous choice WTP question has also been presented to local residents. Their results showed that the benefits of ecosystem restoration were a non-linear function of restoration scale. Standard probit and random effects Probit model have been utilized in this study, and a likelihood ratio test showed that the random effects model was statistically superior to the standard probit model. There are two variables: sales tax and whether or not respondents owned property along the river have negative sign and significant in both models. If the respondent had a college degree parameter, age and income were positive and significant. But the significance of these variables decreased in the random effects model. The scale of

restoration, as measured by linear and quadratic terms describing miles of restoration was significant in both models.

Sanders, Walsh and Loomis (1990) estimated a statistical demand function for the protection of rivers in the Rocky Mountains of Colorado. WTP from a sample of the general population of Colorado was investigated. The predictors include preservation value, option value, existence value, bequest value and recreation use of value. Education and probability of future recreation use of the river, and importance of knowledge on river protection are strongly positive and significant. They suggested that the total value of river should include not only the consumption of onsite recreation, but also include the offsite consumption on habitat preservation.

Some researchers have estimated non-market values of not only in instream flows but also the agricultural land. Rosenberger and Walsh (1997) used contingent valuation method to estimate the nonmarket value of a ranchland protection program in the Yampa River Valley in Routt County, Colorado. They included a dummy variable indicating the respondent's attitude about the resource relative to other environmental issues in the county which is positive and statistically significant. Also household size is significant too but with negative sign. Other variables such as household income, age, acreage, if purchased by government are not significant. Their conclusion is local residents' willingness to pay is substantial, but insufficient to justify protecting the existing quantity of valley ranchland.

Lindsay, Halstead, Tupper and Vaske (1992) investigated coastal beach visitors' willingness to pay for a beach erosion control program. They developed the Tobit model to utilize survey data obtained from recreational beach users at Maine and New Hampshire beaches. The independent variables which are statistically significant in influencing a beach users' WTP for coastal beach protection included the number of years visiting a particular beach, income level, familiarity with beach protective laws, respondents' state of residence, and the presence of sand dunes.

Chambers C.M, Chambers P.E. and Whitehead (1998) employed a contingent valuation method to measure the non-market value of quasi-public goods such as historical site in Missouri. They utilized the grouped data, Tobit and Cragg regression techniques to analyze WTP. All models reveals income has a positive effect on WTP. Moreover, as family size increase, budgets tighten, result in the decrease of WTP. WTP is higher for females and increase with education.

Halstead, Lindsay, and Brown (1991) compared ordinary least squares estimation and Tobit analysis used in contingent valuation method. They used the data obtained from a 1989 survey of users of the Pemigewasset Wilderness Area in New Hampshire, and compared the differences in the parameter estimates' sign, size and significance. An examination of zero bids was also conducted, and then they reach the conclusion: Tobit analysis appreared to be the more theoretically correct method for WTP data sets with large numbers of zero bids.

# CHAPTER THREE

## 3.1 Survey Methodology: Contingent Valuation Method

The survey methodology utilized in this study is contingent valuation. It is frequently used for placing monetary values on environmental goods and services not bought and sold in the marketplace. This method tries to elicit people in the survey to say how they would perform if they were placed in certain contingent circumstances. Contingent Valuation Method was first applied in academia research is by Robert Davis in 1963 to estimate the benefits of outdoor recreation opportunities in the Maine backwoods.

Not only contingent valuation is flexible and applicable with the marketable good, it also with flexibility and applicability of a wide range of environmental amenities. Another advantage is this is usually the only feasible method with the consideration of passive-use value. Passive-value has also been called as bequest value, intrinsic value, inherent value, stewardship value, look-existence value and nonuse value. Kruitilla in 1967 first mentioned this concept, and he found that many people value natural wonders simply for their existence. The reason these people have positive willingness to pay because they obtain utility through vicarious enjoyment of these areas. In 1989, this concept passive-use value was popularized, which mandated that such values be included in a natural resource damage assessment to the extent that they can reliably measured.

### 3.2 Data Collection

Data collection was based on a contingent valuation of visitors' willingness to pay for the riparian habitat and instream flow in upper Santa Cruz River. All the factors influence visitors' willingness to pay are estimated from a questionnaire-based survey at two key visitor locations. The questionnaire included questions concerning visitors' general demographic information and visiting patterns (Appendix D). There were 371 surveys have been collected finally, and 287 surveys qualified as usable for the econometric model.

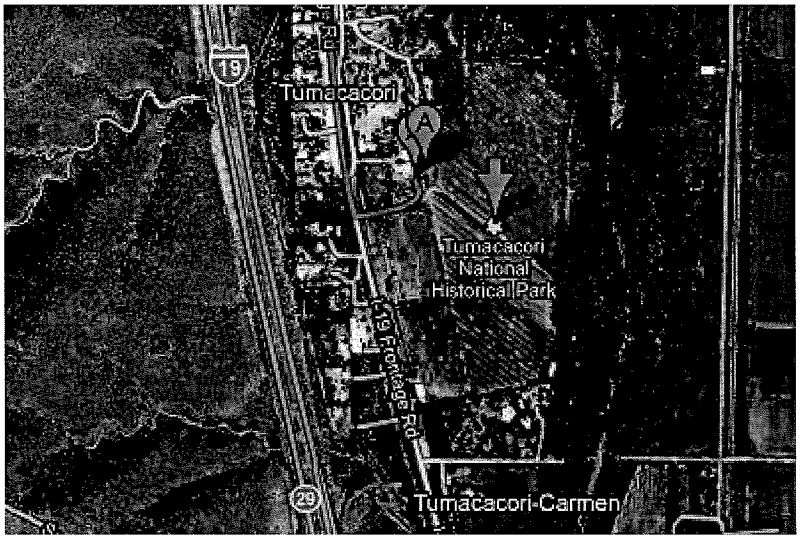
There is a trail named Anza Trail lies along the Santa Cruz River between Tubac Presidio State Historic Park and Tumacacori National Historical Park. Since our interest is people's willingness to pay for preserving Santa Cruz River, these two parks became the crucial location to conduct the survey. Among the usable surveys, 83 were from Tubac Presidio State Historic Park, and 124 were from Tumacacori National Historical Park, and 2 surveys are no information about the location.

Tubac Presidio State Historic Park is located in Tubac, Arizona. It's in the heart of the Sonoran Desert about 50 miles due south of Tucson 20 miles north of Nogales, Arizona.

**Figure 3-1 Satellite Map of Tubac Presidio State Historic Park**


Tumacácori National Historical Park is located in the upper regions of the Sonoran Desert and the upper Santa Cruz River Valley of southern Arizona. The park consists of 360 acres in three communities.

**Figure 3-2 Satellite Map of Tumacacori National Historical Park**



The survey was mainly conducted in the December in 2006, Octorber, November and Decmeber in 2007. There were 6 interviewers who participated in the survey. The interviewers included professor and students from the University of Arizona. Among the qualified suveys, 57 were collected in 2006, 149 were collected in 2007 and 3 surveys were no date information. The reason to choose fall and winter to conduct the survey is due to the weather condition in Arizona. October, November and December is the peak time of outdoor activity in Arizona. Another reason is there are also some special events in these two parks in October and December every year. Tubac Presidio State Historic Park has a cultural event called Anza Days in conjunction with Tumacácori National Historical Park's Historic Reenactment High Mass is held in October yearly. Another event called La Fiesta de Tumacácori was held each year on the first full weekend in December in Tumacácori National Historical Park. So the date of survey was selected carefully to catch the visitors for these two events.

Tubac Presidio attracted 14,439 visitors in 2007. The visitation for Tubac Presidio in 2001 was 18,770. Visitation at the parks declined 23.1% during this period. Following is a table about the visitation to Tumacacori National Historical Park from 2006 to 2009.

**Table 3-1 Visitation to Tumacacori National Historical Park from 2006 to 2009**

| Tumacacori NHP Rec Visits | | | | |
|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 |
| January | 3,548 | 3,843 | 3,481 | 3,489 |
| February | 5,559 | 5,295 | 5,815 | 5,646 |
| March | 7,037 | 6,353 | 6,692 | 5,600 |
| April | 4,497 | 5,290 | 4,037 | 3,699 |
| May | 3,112 | 3,203 | 2,146 | 2,055 |
| June | 1,436 | 1,202 | 1,160 | 1,418 |
| July | 1,455 | 1,328 | 1,299 | 1,420 |
| August | 1,240 | 1,239 | 1,261 | 1,198 |

| | | | | |
|---|---|---|---|---|
| September | 1,594 | 1,537 | 1,868 | 1,445 |
| October | 2,453 | 2,260 | 2,205 | 2,146 |
| November | 2,751 | 2,922 | 3,114 | 4,789 |
| December | 10,333 | 11,012 | 12,001 | 7,732 |
| 2007 Total | 45,015 | 45,484 | 45,079 | 40,637 |

From the table, the visitation from 2006 to 2008 was increasing. But in 2009, this visitation dropped. Due to the climate in this area, visitors in summer time drop precipitately starting from June. The winter in Tumacácori is mild and summer is too hot. November through February has daily temperatures typically ranging between 35 and 70°F. The hot, dry summer months of May and June bring highs typically between 95 and105°F. From late fall through early spring highs average between 65 and 80°F. Visitation reached the peak in December. Hence, from the visitation summary concluded from recent years, we believe that the respondents in our survey are representative for all the visitors in these two parks.

**3.3 Survey Instrument Design**

Since contingent valuation is based on surveys, the questionnaire should be designed carefully to get people to think about and reveal their maximum willingness to pay for some specific aspects of the environment.

There are some useful techniques can be used in the questionnaire to elicit from respondents their estimate of what the environmental feature or amenity is worth to them. The first technique is to ask people straightforward how much they are willing to pay without prompting or probing on the part of the interviewer. Bidding game is the second method. In this method, respondent starts with a bid at a low level and increases progressively the value until the interviewer indicates his limit amount has been reached

or he can starts with a high number and lower it gradually until the threshold value. Another approach is providing interviewers some response cards with a range of values there. Then the respondents will be asked to check off their maximum willingness to pay on the cards. All these three approaches are very common techniques for contingent valuation, but there are still some problems existing in these methods.

Because it is a hypothetical situation people face in contingent valuation, then interviewers may give hypothetical responses not governed by the discipline of real marketplace. Whether people know enough about their real preferences to be able to give valid responses and even if they know their true preferences, whether they would have incentives to misrepresent them are questionable. When the interviewers are asked to put a real value on something which is currently beyond the market, the responses may reflect not just the value of a particular item, but it also depends on the economic system they want to live in, which results in respondents' misstatement of their real willingness to pay. People can be expected to overstate their preferences when they have this kind of hope, other people will do the same thing, so their share of the cost of making the item available will be very small. But if people face the situation that their answers might be used to establish payment schedules for the goods, they are prone to give a deflated estimate of their willingness to pay. Hence, to differentiate whether the willingness to pay reported by respondents are real or not, is the first essential step.

Therefore, the design of dependent variable becomes the most key issue in WTP survey analysis. The design of dependent of variable should be truly elicit respondents' willingness to pay. Dichotomous choice bid has been used frequently in recent years. In

this type of question, respondents will be provided with only one bid amount, and they will be asked to "take it or leave it" (Hanemann, 1984; Loomis, 1987). This approach has the advantage of minimizing potential biases by not asking respondents to directly state their WTP, and it matches the way of decision making for consumers in the market place closely. It is consistent with the utility theory (Loomis 1987).

Another approach becomes popular which use iterative bidding or open-ended bid formats to elicit willingness to pay. There are some advantages of this format. First of all, the data sets in open ended survey analysis can be smaller than the dichotomous choice, which can reduce the time and expense of the survey process. Moreover, iterative bidding can reduce the effect when the bid ranges fall into a narrow range and the values are low, the final bid solicited may influenced by the amount of starting-point chosen to begin the bidding game. In addition, iterative bidding can help the respondents avoid less maximizing the utilities derived from non-market goods, or help them see far enough that discretionary income will be a realistic constraint.

The goal of the questionnaire is to provide the interviewers with a scenario which they can evaluate the how much the non-market goods worth. Hence, the respondents will be shown a hypothetical scenario as the "constructed market", involving defining the scenario used and showing photographs. Moreover, respondents were asked to state their maximum annual WTP based on the modified payment card intervals with an option to write in an alternative amount.

The questionnaire started with a brief introduction and the definition of riparian which ensured the uniform understanding of the term of riparian by all interviewers. Then

respondents were presented with the preserved status and degraded status of the Upper Santa Cruz River by using the photographs of healthy and degraded riparian landscape. The purpose of the introduction was to inform the respondents of the constructed market and the preservation initiative being hypothesized.

The questionnaire included 20 questions. The first question concerned on whether the interviewers have previously visited the Santa Cruz River / Anza Trail or not. The next question elicited people's willingness to pay immediately. The interviewers were asked about how much they would be willing to contribute to this non-profit foundation, in the form of a one-time contribution, in order to permanently preserve the Santa Cruz River habitat as it is today. The interviewers were shown photograph 1 at the same time. Respondents can choose thirteen bid categories in a payment card-type format: $0, $10, $20, $30, $50, $75, $100, $150, $200, $300, $500, $750, $1000, and a category "other amount". The WTP point valuation used in this survey followed a standard practice. There are several reasons for that. The amount of bid chosen by the respondent is not an exact statement of WTP but an indication that the WTP lies in the interval between the chosen amount and the next highest option.

Then there were follow-up questions regarding how often would the respondents visit Santa Cruz River / Anza Trail over the next two years under the condition that riparian habitat has been preserved or not preserved. Next came the questions to determine reasons for positive or zero bids to the preservation initiative. There are two categories for the zero bids, one is genuine zero bids and the other is protest zero bids. If the motive of respondents to choose zero is they don't agree the constructed market or

hypothetical scenario, these responses would be indentified as the protest bids. In opposite, if the respondents accept the constructed market, but they are not willing to pay for preservation, then they can be regarded as valid zero bids. In the question to distinguish valid zero bid and the protest zero bids, the respondents need to check one reason that best explains why they would not be willing to contribute to the non-profit foundation.

The next question is for positive bidders, they were queried on where they would obtain the money to preserve the riparian habitat. The objective of this question is to confirm the respondents had fully thought through their bids.

Moreover, sociodemographic characteristics such as age, gender, residence status, education, employment status, and membership of environmental organizations were also collected. Some other questions concerning the frequency of bird watching and hiking were included in the questionnaire. Those are all crucial factors which may affect people's willingness to pay.

# CHAPTER FOUR

## Description of Variables and Summary Statistics

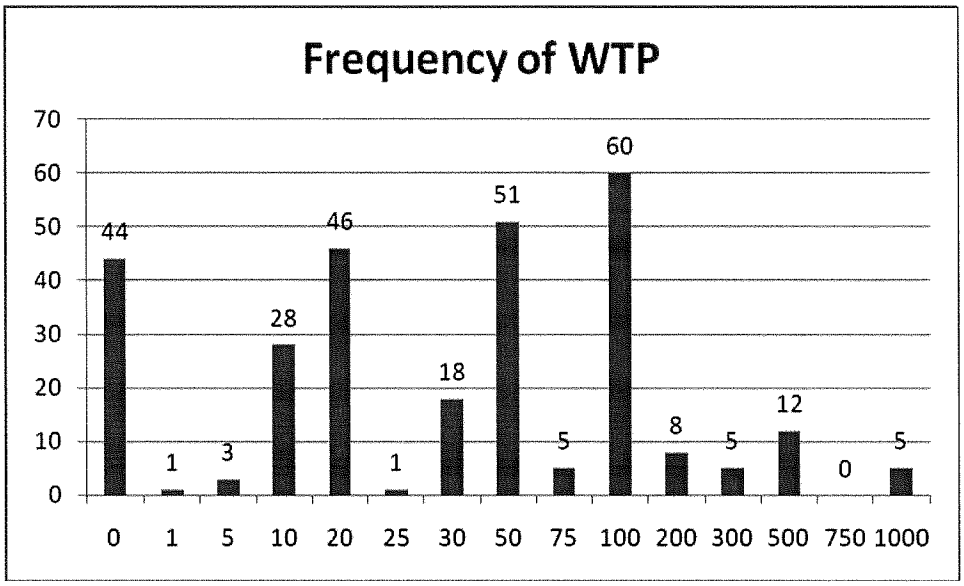
### 4.1 Dependent Variable

**Ln(WTP)**

The purpose of this study is to find the factors that influence people's willingness to pay for the riparian habitat and instream flow in upper Santa Cruz River. Here in this study, we used the natural logarithm transformation of WTP. The reason is in contingent valuation survey, most of the observations are clustered around small values. We encountered a converge problem in our regression model. Making the values range smaller by taking the natural logarithm is helpful in solving the convergence problem. Moreover, since the zero bidder will be discarded at the first place in the truncated regression, we don't have to worry about the there is no meaning for Ln(0) when we transform WTP to the natural logarithm form.

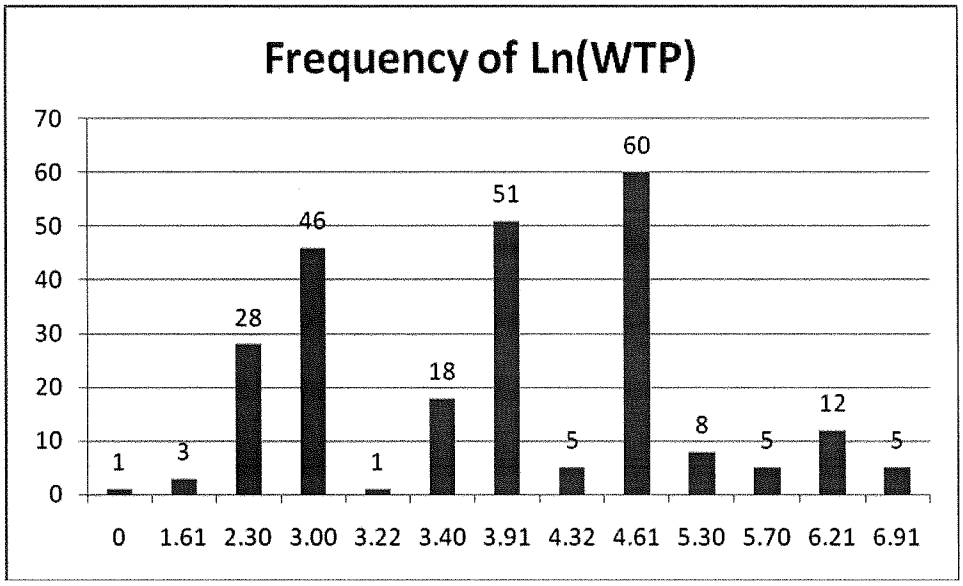
The original WTP distribution is shown in the following graph. Despite the zero bids, the WTP bids are principally clustered in $10, $20, $50 and $100. Each of these bids exceeds 10% of total bids. Not many people choose to pay a big amount of money. Only 30 respondents, which is 10.5% of the total would be willing to pay more than $200.

**Figure 4-1 Distribution of WTP**




After the natural logarithm transformation of the dependent variable, wtp still clusters chiefly in 2.30, 3.00, 3.91 and 4.61, which are the natural logarithm of $10, $20, $50, and $100. Hence, this is consistent with the distribution before the transformation. We believe that the transformation of dependent variable is reliable in our model. In the following graph, we didn't include the zero bidders, which is because in the truncated regression, all the zero bidders will be discarded first.

**Figure 4-2 Distribution of Ln(WTP)**




**WTPpos**

Another dependent variable in this study is WTPpos which is a binary outcome. It has the value of 1 when people gave a positive willingness to pay, and 0 when people state they are not willing to pay any money for preserving the riparian habitat in this area. This dichotomous outcome variable will be used in the Probit model which will be explained in a later chapter.

## 4. 2 Explanatory Variables and Descriptive Statistics

**Tuma**

Tuma is a dummy variable. It was given the value of 1 if the respondent was interviewed at the Tumacacori National Historical Park, and 0 if he was interviewed at

the Tubac Presidio State Historic Park. From this variable, we wanted to know if the location the visitors have been interviewed has an effect on the willingness to pay.

There were 164 visitors have been interviewed at the Tumacacori National Historical Park, which is 57.14% of the total amount of 287 qualified surveys, and 123 visitors have been interviewed at Tubac Presidio State Historic Park, which is 42.86% of the total.

**Fiesta**

Fiesta is a dummy variable which gives the value of 1 if the respondent was interviewed during the season that the Fiesta festival was held. This festival is called La Fiesta de Tumacacori which is always held each year on the first full weekend in December. We wanted to investigate if people who are more interested in this festival will have a higher willingness to pay by including this variable.

There were 136 visitors interviewed when the fiesta was held, which was 47.39% of the total amount of 287 qualified surveys. There were 151 visitors which was 52.61% of the total who didn't visit the area when the fiesta was held.

**Year06**

Year06 is a dummy variable with the value equaling to 1 if the visitor was interviewed in 2006, and 0 if he was interviewed in 2007. Given the information from this variable, we wanted to know whether the visiting time for the respondents is a factor that influences willingness to pay.

There were only 74 respondents which was 25.78% of the total amount of 287 qualified surveys that were interviewed in the year 2006, and 213 visitors that were interviewed in 2007, which was 74.22% of the total.

**Interviewer**

Interviewer variables are dummy variables indicating different interviewers who participated in this survey. In the contingent valuation, the interviewer might have an influence on respondents' answers. Hence, by including these interviewer dummy variables, we can find out effect of interviewer variables on people's willingness to pay. For all the interviewer dummies, IntTS is the default.

**Table 4-1 Classification of Interviewer**

| Category | Frequency | Percentage |
|---|---|---|
| IntKB | 34 | 11.85% |
| IntGF | 13 | 4.53% |
| IntRK | 63 | 21.95% |
| IntRKCT | 48 | 16.72% |
| IntCT | 90 | 31.36% |
| IntCTJel | 2 | 0.70% |
| intCH | 19 | 6.62% |
| IntJel | 1 | 0.35% |
| IntTS | 17 | 5.92% |

**VISITED**

VISITED is a dummy variable. It was given the value of 1 if the respondents visited the Santa Cruz River before, and 0 if they never visited this area. We expected this variable to be positive. A previous trip to the Santa Cruz river will yield a higher willingness to pay.

There were 192 visitors who have visited Santa Cruz River before, which is 67.94% of the total amount of 287 qualified surveys, and 92 visitors stated that they have never been to Santa Cruz River, which is 32.06% of the total.

**DeclineV**

The variable DeclineV indicates that given the condition that water flows have not been preserved and the riparian area has declined, how many planned visits do respondents have. We expected this variable to have a negative sign, because under the assumption of a declined environment, if the respondents still plan to visit, it means they don't really care what the riparian habitat looks like, so they might state a lower WTP.

**Table 4-2 Classification of DeclineV**

| Category | Frequency | Percentage |
|---|---|---|
| **0** | 88 | 30.66% |
| **1-2** | 103 | 35.89% |
| **3-4** | 49 | 17.07% |
| **5-6** | 23 | 8.01% |
| **7-8** | 6 | 2.09% |
| **9-10** | 18 | 6.27% |

**PlanV**

PlanV indicates how often visitors plan to visit given the current riparian habitat at the Santa Cruz River / Anza Trail over the next two years. The sign of this variable is expected to be positive. Since visitors plan to visit the area more often, they will be more concerned about the riparian habitat here; therefore they will have a higher willingness to pay.

**Table 4-3 Classification of PlanV**

| Category | Frequency | Percentage |
|---|---|---|
| **0** | 22 | 7.67% |
| **1-2** | 73 | 25.44% |
| **3-4** | 84 | 29.27% |
| **5-6** | 46 | 16.03% |
| **7-8** | 14 | 4.88% |

| | | |
|---|---|---|
| **9-10** | 48 | 16.72% |

**DeclinePos**

The variable DeclinePos is a dummy variable. It was given the value of 1 if planned visits under the condition of declined environment are greater than the planned visits in current state, 0 otherwise. We expected this variable to be negative. People who are willing to pay more must be the people who care about riparian habitat more. They might not plan to visit more if the instream flows and riparian habitat declines.

There were only 13 respondents, which were 4.53% of the total, that stated they will visit again even the riparian habitat degrades. The rest of 274 respondents which were 95.47% will reduce their planned visits if the riparian ecosystem degrades.

**DeclSame**

The variable DeclSame is a dummy variable. It was given the value of 1 if planned visits under the condition of a declined environment are greater than or equal to the planned visits in the current state, 0 otherwise. We expected this variable to be negative. People who are willing to pay more must be the people who care about riparian habitat. In a logical sense, they will decrease their visits to the area instead of visiting more.

There were 116 visitors who will continue visiting or even visit more under the conditions of a declined riparian habitat, which is 40.42% of the total amount of 287 qualified surveys. 171 visitors stated that they will reduce their planned visits, which is 59.58% of the total.

**Plan0**

The variable Plan0 is a dummy variable. It was given the value of 1 if current planned visits equal 0. We expected this variable to be negative. If people have no plans to visit upper Santa Cruz river again, they might not be willing to pay money to preserve the instream flows and riparian habitat of theSanta Cruz River.

There were only 22 respondents who had no plan to visit the Santa Cruz River again, which was 7.67% of the total respondents. There were 265 respondents which were 92.33% of the total amount of those who planned to visit the area again.

**Season**

The variable "Season" is a dummy variable and equals to 1 if they said they were seasonal resident of Arizona or seasonal resident of Santa Cruz County, otherwise equals to 0. This variable can have positive or negative effect on willingness to pay. Not like year-round residence, they only spent time in this area in some specific season, so they probably don't care the habitat preservation as much as the local residence. However, they visited this area occasionally. It's possible for some of them who have housing or relatives here. Also seasonal residence might suggest they will visit this area again, so they want to stay in a better environment or at least as the same environment as now, in this sense, this factor will have a positive influence on WTP.

There are 52 respondents who are seasonal resident of Santa Cruz County or Arizona, which is 18.12% of the total. Among the rest of 235 respondents, there are 201 respondents are year-round resident of Santa Cruz County or Arizona, and 34 interviewee didn't respond to this question.

**NotRes**

The variable "NotRes" is a dummy variable. It indicates if the interviewees answered the question about their residence. It equals to 1 if they gave no responses regarding their residence question, 0 otherwise.

There are 11.85% of the total which are 34 respondents gave no answer to the residence question. 253 respondents which are 88.15% reported their residence status.

**ReasonPos**

The variable ReasonPos stands for the reasons why respondents gave positive WTP responses.

**Table 4-4 Reason for Positive WTP bids**

| Reason for Positive WTP bids | Frequency | Percent |
|---|---|---|
| a. I am a regular visitor to the Santa Cruz River / Anza Trail. | 52 | 18.12 % |
| b. I plan to be a regular visitor to the Santa Cruz River / Anza Trail. | 16 | 5.17% |
| c. I want this riparian area to be maintained so that others can enjoy it. | 105 | 36.59 % |
| d. I receive satisfaction from knowing that the riparian habitat will be maintained. | 98 | 34.15 % |
| e. Other reasons | 14 | 4.88% |

**Age**

Age variable is categorical and is recoded as the following table. The sign of this variable can be positive or negative since different categories of age may have different preferences. There are also some other factors related to age. Older people might participate more in outdoor activities, so they want to pay more. Middle-aged people may have higher income, so they are able to pay more.

**Table 4-5 Classification of Age**

| Variable | Category | Frequency | % |
|---|---|---|---|
| Age_a | 18-25 | 15 | 5.23% |
| Age_b | 26-35 | 20 | 6.97% |
| Age_c | 36-45 | 36 | 12.54% |
| Age_d | 46-55 | 43 | 14.98% |
| Age_e | 56-65 | 99 | 34.49% |
| Age_f | 66-75 | 61 | 21.25% |
| Age_g | 76-85 | 13 | 4.53% |

From the table above, it is shown that there is a large proportion of visitors that fall into the group who are older than 46. The mean age is 52, since older people will have more time for outdoor activity.

**Gender**

The variable "Gender" is a dummy variable representing a visitor's gender. It takes the value of 1 if the visitor is female, and 0 if male. This variable's sign can be positive or negative, because which gender will have more propensities to pay money for riparian habitat is unknown. There are 52.61% of the respondents who were female and 47.39% were male.

**Education**

The variable Education is an ordered category variable. The sign is expected to be positive. The intuition is that educated people have more concern for environmental issues, so they will have a higher willingness to pay.

**Table 4-6 Classification of Education**

| Variable | Category | Frequency | % |
|---|---|---|---|
| Education_a | High School | 22 | 7.67% |
| Education_b | Some College / Technical School | 59 | 20.56% |
| Education_c | Completed College / Technical School | 64 | 22.30% |

| | | | |
|---|---|---|---|
| Education_d | Some Graduate or Professional School | 35 | 12.20% |
| Education_e | Completed Graduate or Professional School | 107 | 37.28% |

**Employ**

The Employment variable was categorized as the following table. Most of the visitors are employed full-time, which is 42.86% of the total number of the 287 useful surveys. The second largest category is retired people, which is 41.81% of the total.

**Table 4-7 Classification of Employment Status**

| Variable | Category | Frequency | % |
|---|---|---|---|
| Employ_a | Employed full-time | 123 | 42.86% |
| Employ_b | Employed part-time | 26 | 9.06% |
| Employ_c | Retired | 120 | 41.81% |
| Employ_d | Homemaker | 7 | 2.44% |
| Employ_e | Unemployed | 6 | 2.09% |
| Employ_f | Student | 5 | 1.74% |

**EMPFAM**

The variable "EMPFAM" indicates the number of full-time employed people in the household. It is expected to have a positive effect on WTP. The more people in a household who are employed full-time, the more income a household will have.

**Table 4-8 Classification of Number of Full-time Employed**

| Category | Recoding | Frequency | % |
|---|---|---|---|
| zero | EMPFAM = 0 | 108 | 37.63% |
| 1 | EMPFAM = 1 | 75 | 26.13% |
| 2 | EMPFAM = 2 | 85 | 26.92% |
| more than 2 | EMPFAM = 3 | 19 | 6.62% |

Since there are a large number of older visitors, 61.27% are above the age 55, they might have retired already. Hence, there is a big amount of zero for number of full-time employed in the household, which is 37.63%. And in a regular family, the couples are both working, so another big category is 2 number of family member full-time employed in a household. It is 26.92%. In some family, only one of the couple go to work, so the category only 1 people is full-time employed in the household is also big, which is 26.13%.

**Income_self_**

There is a question in the questionnaire asking the respondents to report household income (before taxes) last year. We call this variable "income_self_", which indicates the self-reported income from the respondents. The average self_reported income is $70251.46. We expected this variable to have a positive sign, since when people have higher income, they are more capable to make a contribution to preserve the riparian habitat.

**FOSCR**

FOSCR is a dummy variable which reveals if the respondent is a member of the conservation group Friends of the Santa Cruz River. It was given the value of 1 if the respondents are members of Friends of the Santa Cruz River, and 0 if they are not. We expected this variable to be positive. Visitors who belong to this conservation group would be more concerned about the Santa Cruz River, so it is more possible that they are willing to pay more.

Among all the visitors, 12 of them are the members of Friends of the Santa Cruz River. The other 275 visitors are not members.

**Anza**

The variable Anza is a dummy variable indicating whether a respondent is a member of any local conservation group besides Friends of the Santa Cruz River. It was given the value of 1 if they have a membership, and 0 otherwise. We expected this variable to be positive. Visitors who belong to any conservation group care about environmental issues, so it is possible that they are willing to pay more.

Among all the visitors, only 8 of them are the members of a local conservation organization except FOSCR, which is only 2.79% of the total. The other 279 visitors are not members of any local conservation group except for FOSCR.

**LocalCon**

LocalCon is a dummy variable suggesting whether a respondent is a member of any local conservation group. It has the value of 1 if the respondents belong to some local conservation organization, and 0 if they don't. We expected this variable to be positive. Visitors who belong to a local conservation group would be more concerned about the local environment, including the riparian habitat of the Santa Cruz River.

Among all the visitors, 18 of them are members of some local environment group. The other 269 visitors are not members of any local environment group.

**OthCon**

OthCon is a dummy variable indicating whether a respondent is a member of any conservation group. It was given the value of 1 if they have the membership, and 0

otherwise. We expected this variable to be positive. Visitors who belong to any conservation group care about environmental issues, so it is possible that they are willing to pay more.

Among all the visitors, 99 of them are members of some environment group. The other 188 visitors are not members of any conservation group.

**FREQBIRD**

The variable "FREQBIRD" specifies how often visitors go bird watching.

**Table 4-9 Classification of Frequency of Bird Watching**

| Variable | Category | Frequency | % |
|---|---|---|---|
| FREQBIRD_a | zero times per year | 132 | 45.99% |
| FREQBIRD_b | at least once a year | 36 | 12.54% |
| FREQBIRD_c | at least twice a year | 30 | 10.45% |
| FREQBIRD_d | at least six times per year | 18 | 6.27% |
| FREQBIRD_e | at least once a month | 18 | 6.27% |
| FREQBIRD_f | at least twice a month | 8 | 2.79% |
| FREQBIRD_g | at least once per week | 12 | 4.18% |
| FREQBIRD_h | more than once per week | 33 | 11.50% |

There are 132 respondents who don't go bird watching every year, which is 45.99% of the total. However, there also exist people who go bird watching more than once per week, which is 11.5% of the total useable survey. Thus, among all the respondents, there are big fans of bird watching as well as people who don't do birding. We expect FREQBIRD_a to be negative sign because for the people who never go birding, they will not be willing to pay to preserve the bird watching area. But another condition can happen, even if people don't go bird watching at all, they still may enjoy outdoor activity,

so they might still have a positive WTP. Other FREQBIRD variables are expected to be positive because people who like to go birding frequently care about the habitat for birds more than other people. As a result, they will have a higher WTP.

**FREQHIKE**

The variable "FREQHIKE" measures approximately how often respondents go hiking or walking in natural areas.

**Table 4-10 Classification of Frequency of Hiking**

| Variable | Category | Frequency | % |
|---|---|---|---|
| FREQHIKE_a | zero times per year | 9 | 3.14% |
| FREQHIKE_b | at least once a year | 16 | 5.57% |
| FREQHIKE_c | at least twice a year | 36 | 12.54% |
| FREQHIKE_d | at least six times per year | 71 | 24.74% |
| FREQHIKE_e | at least once a month | 48 | 16.72% |
| FREQHIKE_f | at least twice a month | 23 | 8.01% |
| FREQHIKE_g | at least once per week | 35 | 12.20% |
| FREQHIKE_h | at least twice per week | 13 | 4.53% |
| FREQHIKE_i | more than twice per week | 36 | 12.54% |

It seems people go hiking more frequently than bird watching. For the people who never go hiking, the proportion of the total is only 3.14%. Except for FREQHIKE_a, other frequency of hiking variables are expected to have positive effect on WTP. For the people who never go hiking, they probably are not as concerned about environmental issues as people who go hiking often. For the people who go hiking more often, they want to have a better environment for hiking. Therefore, they would like to pay more money for environmental preservation.

## CHAPTER FIVE

### Data clean-up

Several surveys were incomplete. The method used to deal with missing data in this study is listwise deletion. If one or more variables are left blank, then the entire observation is dropped. There is an advantage of this listwise deletion. If the data are missing completely at random, then this method has been proven to be valid. (Little, 1992).

First of all, we want to see if the dependent variable WTP is suitable for the listwise deletion. If there is a significant difference in the dependent variable, it would be revealed in the accumulative WTP distribution between the original sample and new cleaned sample. The frequency of the accumulative of WTP amount from the original data set is shown in the following table. For instance, the first row includes everyone who bids $1000. The second category includes $750 WTP bidders and $1000 WTP bidders. The third category includes the sum of $500 bidders, $750 bidders and $1000 bidders, and so on.

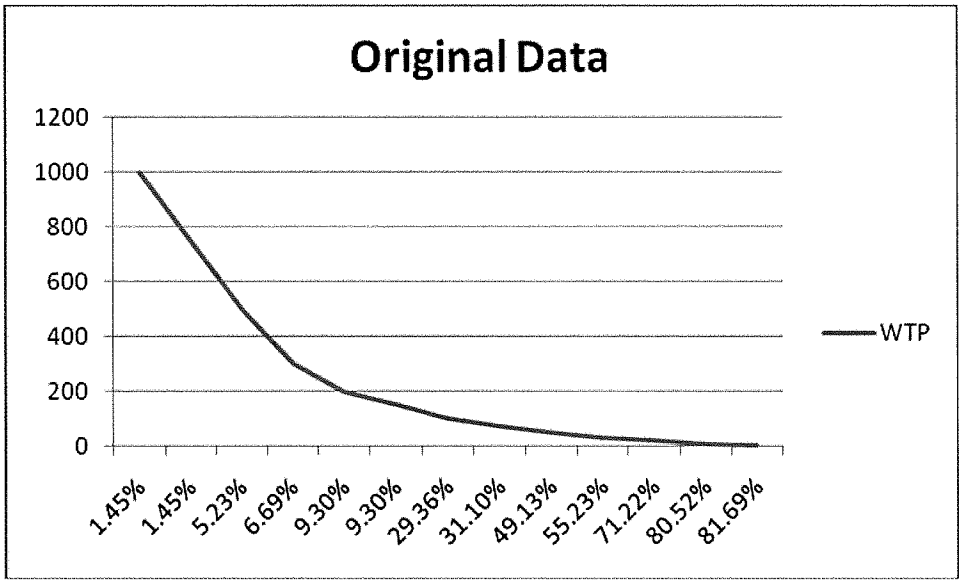
**Table 5-1 Cumulative WTP Amount distribution for the original sample**

| WTP amount | Frequency | Percentage |
|---|---|---|
| $1000 or more | 5 | 1.45% |
| $750 or more | 5 | 1.45% |
| $500 or more | 18 | 5.23% |
| $300 or more | 23 | 6.69% |
| $200 or more | 32 | 9.30% |
| $150 or more | 32 | 9.30% |
| $100 or more | 101 | 29.36% |
| $75 or more | 107 | 31.10% |
| $50 or more | 169 | 49.13% |
| $30 or more | 190 | 55.23% |

| | | |
|---|---|---|
| $20 or more | 245 | 71.22% |
| $10 or more | 277 | 80.52% |
| $1 or more | 281 | 81.69% |

With these data, we put a cumulative percentage on the horizontal axis and the cumulative WTP amount on the vertical axis then plot on a graph. The graph looks like the demand curve which illustrates the frequency of a respondent willingness to pay such amount or more.

**Figure 5-1 Frequency of WTP respondents will to pay or more for the original data**



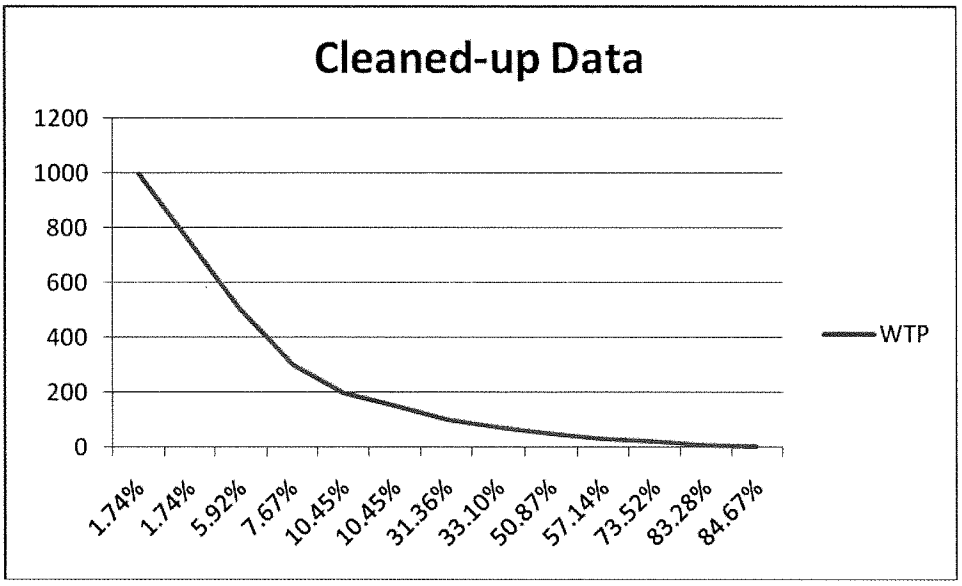

And the frequency of the accumulative WTP amount from the cleaned-up data set is shown in Table 2 and Figure 2.

**Table 5-2 Cumulative WTP Amount distribution for the cleaned-up sample**

| WTP amount | Frequency | Percentage |
|---|---|---|
| $1000 or more | 5 | 1.74% |
| $750 or more | 5 | 1.74% |
| $500 or more | 17 | 5.92% |
| $300 or more | 22 | 7.67% |

| | | |
|---|---|---|
| $200 or more | 30 | 10.45% |
| $150 or more | 30 | 10.45% |
| $100 or more | 90 | 31.36% |
| $75 or more | 95 | 33.10% |
| $50 or more | 146 | 50.87% |
| $30 or more | 164 | 57.14% |
| $20 or more | 211 | 73.52% |
| $10 or more | 239 | 83.28% |
| $1 or more | 243 | 84.67% |

**Figure 5-2 Frequency of WTP respondents will to pay or more for cleaned-up data**




Hence, from the two figures above, there is no significant difference of accumulative WTP distribution between the two data sets. Moreover, we conducted several tests in the meantime to see if the means of all the variables from the original data set are significantly different from the means of the cleaned-up data set.

For the variables which are continuous, t-tests were used to test differences in means. In this process, an F test was used to detect if these variables' variances after deletion are statistically different from the original sample's variances. Depending on the

result of the F test, we conducted the t-test by using the equal variance or unequal variance t-test. We treated WTP and EMPFAM as continuous variables. For the variable of WTP, the p-value for the F test is 0.1244, hence we failed to reject the null hypothesis that the variance from two samples are equal. Secondly, we conducted the equal variance t-test to analyze the difference of means. The results suggest that there is no statistical difference from the original sample and cleaned sample. For the variable of EMPFAM, the p-value of the F test for testing the difference of variance is 0.4893, which means we can use the equal variance t-test for testing means. The result of the t-test reveals that there is no significant difference of the means from these two samples. The following is a table of the result of the test of means of the continuous variables.

**Table 5-3 Percent change in mean and t-stat and corresponding p-value**

| Variable | Original Mean | After Mean | % change in mean | t-stat | p-value |
|---|---|---|---|---|---|
| **WTP** | 79.4361 | 86.4321 | 8.81% | -0.5623 | 0.5741 |
| **EMPFAM** | 1.0557 | 1.0523 | -0.32% | 0.0450 | 0.7924 |

However, to test the difference of categorical variables from the original sample and new sample, we did some other tests in our study. For the variables with dichotomous outcome, a binomial test of significance can be used. The binomial test can test whether the proportion of zero responses for the dichotomous variable significantly differs from a hypothesized proportion of zero responses. In our study, for the variables which have two-level categories, we can test in the new cleaned-up data set, whether the proportion of zero responses is significantly different from the proportion from original

data set. If they are not statistically different, we will assume that the listwise deletion method for cleaning the data won't affect our outcome. Table 2 summarizes the binomial test results. From the binomial Z-stats and the p-values, the results suggest that for the two-level categorical variables, there is no significant difference between the sample before and after deletion.

**Table 5-4 Percent change in mean and Binomial Z-stat and corresponding p-value**

| Variable | Original Mean | After Mean | % change in mean | Binomial Test Z | Exact P value |
|---|---|---|---|---|---|
| SC_year | 0.2466 | 0.2404 | -2.51% | 0.2430 | 0.8704 |
| SC_season | 0.0740 | 0.0662 | -10.54% | 0.5047 | 0.7157 |
| AZ_year | 0.4767 | 0.4599 | -3.52% | 0.5688 | 0.6108 |
| AZ_season | 0.1014 | 0.1156 | 14.00% | -0.7623 | 0.4971 |
| VISITED | 0.6844 | 0.6794 | -0.73% | 0.1807 | 0.9659 |
| ReasonPos_a | 0.1885 | 0.1812 | -3.88% | 0.3169 | 0.8208 |
| ReasonPos_b | 0.0546 | 0.0557 | 2.10% | -0.0857 | 1.0000 |
| ReasonPos_c | 0.3470 | 0.3659 | 5.43% | -0.6710 | 0.5400 |
| ReasonPos_d | 0.3224 | 0.3415 | 5.91% | -0.6910 | 0.5272 |
| ReasonPos_e | 0.0628 | 0.0488 | -22.32% | 0.9790 | 0.3961 |
| GENDER | 0.5291 | 0.5261 | -0.57% | 0.1007 | 0.9659 |
| FOSCR | 0.0377 | 0.0418 | 10.91% | -0.3657 | 0.7976 |
| Anza | 0.0216 | 0.0279 | 29.05% | -0.7312 | 0.5652 |
| EMPLOY_a | 0.3978 | 0.4286 | 7.74% | -1.0651 | 0.3150 |
| EMPLOY_b | 0.0926 | 0.0906 | -2.17% | 0.1173 | 1.0000 |
| EMPLOY_c | 0.4414 | 0.4181 | -5.27% | 0.7943 | 0.4631 |
| EMPLOY_d | 0.0245 | 0.0244 | -0.45% | 0.0120 | 1.0000 |
| EMPLOY_e | 0.0245 | 0.0209 | -14.67% | 0.3939 | 0.8863 |
| EMPLOY_f | 0.0218 | 0.0174 | -20.08% | 0.5079 | 0.8065 |

A chi-square goodness of fit test has been used for the variables which are divided into intervals. The chi-square goodness of fit test can test if the observed proportions for categorical variables are statistically different from hypothesized proportions. Hence in

our study, the null hypothesis is: the proportions of categorical variables from the data set before listwise deletion are the same as the proportions from after deletion.

For the age variable, the percentage change of the proportion of each category is no more than 16%. And the result of Chi-square goodness of fit test shows that there is no significant difference between the original sample and cleaned sample.

**Table 5-5 Percent change of proportion for age variable and chi-square test**

| Variable | Original Percent | Test Percent | % change in percent |
|---|---|---|---|
| AGE_a | 5.23 | 4.44 | -15.11% |
| AGE_b | 6.97 | 6.11 | -12.34% |
| AGE_c | 12.54 | 11.39 | -9.17% |
| AGE_d | 14.98 | 14.72 | -1.74% |
| AGE_e | 34.49 | 33.89 | -1.74% |
| AGE_f | 21.25 | 24.44 | 15.01% |
| AGE_g | 4.53 | 5.00 | 10.38% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **2.44** | **0.87** | | |

**Table 5-6 Percent change of proportion for education level and chi-square test**

| Variable | Original Percent | Test Percent | % change in percent |
|---|---|---|---|
| EDUCATION_a | 7.67 | 8.61 | 12.26% |
| EDUCATION_b | 20.56 | 21.39 | 4.04% |
| EDUCATION_c | 22.30 | 22.22 | -0.36% |
| EDUCATION_d | 12.20 | 11.67 | -4.34% |
| EDUCATION_e | 37.28 | 36.11 | -3.14% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **0.57** | **0.97** | | |

For the education level variable, the percentage changes of the proportions of each category are all less than 13%. And the chi-square goodness of fit test fails to reject the null hypothesis that the original sample is significantly differ from the cleaned one.

**Table 5-7 Percent change of proportion for frequency of birding and chi-square test**

| Variable | Original Percent | Test Percent | % change in percent |
|---|---|---|---|
| FREQBIRD_a | 45.99 | 47.03 | 2.26% |
| FREQBIRD_b | 12.54 | 11.61 | -7.42% |
| FREQBIRD_c | 10.45 | 10.48 | 0.29% |
| FREQBIRD_d | 6.27 | 6.80 | 8.45% |
| FREQBIRD_e | 6.27 | 5.95 | -5.10% |
| FREQBIRD_f | 2.79 | 2.83 | 1.43% |
| FREQBIRD_g | 4.18 | 3.97 | -5.02% |
| FREQBIRD_h | 11.5 | 11.33 | -1.48% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **0.4902** | **0.9995** | | |

For the variable frequency of birding, the percentage change of the proportions of each category are all less than 8%. The chi-square goodness of fit test fails to reject the null hypothesis. Therefore the original sample does not significantly differ from the cleaned one.

**Table 5-8 Percent change of proportion for frequency of go hiking and chi-square test**

| Variable | Original Percent | Test Percent | % change in percent |
|---|---|---|---|
| FREQHIKE_a | 3.14 | 3.62 | 15.29% |
| FREQHIKE_b | 5.57 | 6.13 | 10.05% |
| FREQHIKE_c | 12.54 | 13.09 | 4.39% |
| FREQHIKE_d | 24.74 | 23.4 | -5.42% |
| FREQHIKE_e | 16.72 | 16.43 | -1.73% |
| FREQHIKE_f | 8.01 | 8.64 | 7.87% |

| | | | |
|---|---|---|---|
| FREQHIKE_g | 12.2 | 11.98 | -1.80% |
| FREQHIKE_h | 4.53 | 4.46 | -1.55% |
| FREQHIKE_i | 12.54 | 12.53 | -0.08% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **0.775** | **0.9993** | | |

For the variable frequency of hiking, the percentage change of the proportions of each category are no more than 16%. The result of the chi-square goodness of fit test shows that the original sample is not significantly different from the cleaned sample.

From all the tests above, it reveals that after 84 observations have been discarded, the change of descriptive statistics is minimal.

# CHAPTER SIX

## Measures of Association for Contingency Tables

A chi-square test has been used to measure the relationship between two categorical variables. In our study, we want to analyze the effect of all the independent variables on whether a visitor chooses to pay or not. Hence, the dependent variable here is binary outcome. We call this variable WTPpos. It gives the value of 1 if respondents have positive bids and gives the value of 0 if respondents were not willing to pay any money. Furthermore, the independent variables such as age, education, employment status, frequency of birding, frequency of hiking etc from the questionnaire are all recoded as categorical. That's the reason we want to conduct the chi-square test to measure the relationship between WTPpos and the categorical explanatory variables. The null hypothesis here is there is no association between the row variable and the column variable.

However, when the sample size is not large enough, the test statistics will not have an asymptotic chi-square distribution when the null hypothesis is true. The assumption of chi-square test is one or more cells of the contingency table have an expected frequency of five or more. If there is a cell with a frequency of five or less, the Fisher's exact test should be used.

The Fisher's exact test has no such assumption and can be used regardless of how small the expected frequency is. It assumes that the rows and columns in the contingency table are fixed. The Fisher's exact test uses the hypergeometric distribution to compute probabilities of possible tables conditional on the observed row and column totals.

Therefore, we reported the two-sided p-value of the fisher's exact test here. The two-sided p-value is the sum of all possible tables with hypergeometric probabilities that are less than or equal to the probability of the observed table. From the two-sided p-value, we can tell if there are significant associations between the independent variables and positive bidders. If the p-value is smaller than the significance level, it will support that there is a significant relationship.

The Goodman-Kruskal gamma coefficient statistic is an alternative measure of association of two categorical variables. Gamma coefficient is also very useful to measure both variables lying on an ordinal scale. Pairs of observations were classified as concordant or discordant. Therefore, gamma is based on the number of concordant and discordant pairs of observations, ignoring tied pairs. Gamma coefficient has the range from -1 to 1, suggesting the negative association to positive association. And a zero value suggests the row and column variables are independent. We reported the gamma coefficient, asymptotic standard error (ASE) of gamma and gamma coefficient divided by ASE suggesting the Z statistics for gamma test. From this division, we can tell if the gamma coefficient is significant.

Cochran-Armitage test is a test for trend in binomial proportions across levels. In our study, the dependent variable has two levels, 0 and 1, and when the independent variable is ordinal, then the Cochran-Armitage test is appropriate.This test is appropriate for a two-way table where one variable has two levels and the other variable is ordinal. The two-level variable represents the response, and the other variable represents an explanatory variable with ordered levels. The Cochran-Armitage test is on a basis of the

regression coefficient for the weighted linear regression of the binomial proportions on the scores of the independent variable levels. In Cochran-Armitage test, the null hypothesis is that the binomial proportions are the same for all levels of the explanatory variable, in other words, there is no trend. The trend statistic has an asymptotic standard normal distribution under the null hypothesis. We reported the p-value of the Cochran-Armitage test to show the significance of this test.

**Table 6-1 Results of Gamma and Gamma ASE**

| Variable | Gamma | Gamma ASE | Gamma/Gamma ASE |
|---|---|---|---|
| Age | 0.0902 | 0.1127 | 0.800355 |
| Education | 0.1596 | 0.1131 | 1.411141 |
| Birding | 0.3048 | 0.1586 | 1.921816 |
| Hiking | 0.0414 | 0.1317 | 0.314351 |

**Table 6-2 Results of Fisher's exact test and Cochran Armitage test**

| Test Name | Fisher Test p-value | Cochrane Armitage p-value |
|---|---|---|
| Effect of Tuma | 0.0029 | 0.0025 |
| Effect of Fiesta | 0.0049 | 0.0037 |
| Effect of Year06 | 0.71 | 0.6145 |
| Effect of Interviewer | 4.14E-04 | 0.0115 |
| Effect of visited | 0.0218 | 0.0155 |
| Effect of DeclineV | 0.0175 | 0.1555 |
| Effect of PlanV | 0.0000641 | 0.0268 |
| Effect of DeclinePos | 0.4287 | 0.4276 |
| Effect of DeclSame | 0.0453 | 0.038 |
| Effect of Plan0 | 8.603E-07 | <.0001 |
| Effect of Age | 0.8469 | 0.49 |
| Effect of Gender | 0.7446 | 0.706 |
| Effect of Residence | 0.0015 | 0.0008 |
| Effect of Education | 0.3713 | 0.2131 |
| Effect of Employment | 0.1459 | 0.1861 |
| Effect of EMPFAM | 0.8397 | 0.5306 |
| Effect of FOSCR | 0.6996 | 0.4919 |

| | | |
|---|---|---|
| Effect of Anza | 0.6131 | 0.2222 |
| Effect of LocalCon | 0.3261 | 0.2344 |
| Effect of OthCon | 0.0002565 | 0.0005 |
| Effect of Birding | 0.0398 | 0.1449 |
| Effect of Nobirding | 0.0017 | 0.0013 |
| Effect of Hiking | 0.105 | 0.8528 |
| Effect of Nohiking | 0.034 | 0.0138 |

Unfortunately, all the gamma coefficients are not significant for those ordinal variables as shown in the Table 6-1.

In Table 6-2, variables of Tuma, Fiesta, Interviewers, Visited, PlanV, DeclSame, Plan0, Residence, OthCon, No birding and No hiking are significant in both fisher's exact test and Cochrane Armitage test.

For the variable Tuma, the Fisher's exact test p-value reveals that if the visitors were interviewed from Tumacacori Park, it will have some relationship with whether the visitors would like to contribute money. The Cochrane Armitage test is significant also, showing that from visitors of Tubac to visitors of Tumacacori, there exists a trend of WTP from zero to positive.

The results of variable the Fiesta, suggesting this variable has a positive association with a visitor's positive WTP. Moreover, there is a trend between people who didn't attend the Fiesta, to people who did, to have positive contribution.

Whether a respondent visited these two parks before or not has a positive relationship with positive contribution. Also the trend test shows that people who visited before will pay more than those who never visited.

PlanV indicates respondent's current planned visits. It has been classified into the following categories: 0 time, 1-2times, 3-4times, 5-6times, 7-8times and 9-10times. Fisher's exact test shows there is relationship between current planned visits and WTP. The relationship is positive. The trend test reveals people are willing to pay more if they planned to visit more times.

DeclSame is a variable having a value of 1 when people planned to decrease their visits to this area and also the declined visits is greater than or equals to their current planned visits. This variable is related to the positive WTP and they have a negative relationship. Also, the trend test is significant.

The Plan0 variable has a value of 1 when respondents do not plan to visit again. It also has a negative association with positive WTP. It means that compared to people who do not plan to visit again, people who have planned visits are more willing to contribute money.

The Residence variable is categorized as the following: A. a year-round resident of Santa Cruz County, Arizona; B. a seasonal resident of Santa Cruz County, Arizona; C. a year-round resident of Arizona; D.a seasonal resident of Arizona, E. no response to this question. There is a trend for this variable of closer to Santa Cruz County to farther away from Santa Cruz County. The tests results show there is a negative relationship between the residence status and WTP. If a respondent lives closer to the Santa Cruz County area, he will be more likely to have positive willingness to pay.

The variable of OthCon is significant in these three tests. It suggests the respondent belongs to some other conservation organization has some relationship with WTP and the relationship is positive.

If the visitors don't go bird watching, there is a negative relationship with WTP. From no bird watching to frequent bird watching, people are willing to pay zero to positive. The same is true for hiking.

## CHAPTER SEVEN

### 7.1 Econometric Method: Double-Hurdle Model

In contingent valuation, respondents frequently state a zero WTP. There will occur problems if these zero bids are not taken care of carefully. Estimates of parameters would be biased and inconsistent due to a failure to recognize the censored or truncated distribution of WTP. Tobit model can address this problem properly. However, an alternative way which is called Double-Hurdle model is less restrictive than Tobit model in contingent valuation study. The method separates the two decisions that the individual may take, in our study, which are, willingness to pay to preserve the riparian habitat or not willing to pay. Basically, Double-Hurdle model assumes two things which are different from Tobit.

1. The probability of a limit observation ( zero) is given by a probit model with parameter vector $\beta_p$. That is,

$$p(y_i = 0) = \Phi(-x_i\beta_p)$$

2. The density of $y_i$, under the condition being a non-limit (positive), is that of $N(x_i\beta, \sigma^2)$, truncated at zero. Thus,

$$f(y_i \mid y_i > 0) = \frac{1}{\Phi(x_i\beta_{tr}/\sigma)} \frac{1}{\sqrt{2\pi\sigma^2}} \times \exp[\frac{-1}{2\sigma^2}(y_i - x_i\beta_{tr})^2]$$

Tobit model is a special case if $\beta_p = \beta_{tr}/\sigma$ which was included in the Double-Hurdle Model. There are some advantages of Double-Hurdle Model. First of all, Double-Hurdle Model allows for these two decisions whether to participate or not affected by

different sets of variables. Secondly, Double-Hurdle Model has separate coefficients for $E(y_i \mid y_i > 0)$ and $P(y_i = 0)$. Unlike tobit model, positive coefficient means the corresponding explanatory variable has a positive effect on both parts. Thirdly, Double-Hurdle Model provides the non-zero observations a separate distribution. However, in Tobit model, it links the shape of distribution of the positive observations and probability of zero observations.

In our Double-Hurdle Model, we used two different sets of variables. First, we try to get the estimation of the Probit model to evaluate factors for visitors stated a zero WTP or not. Second, we get the estimation of the truncated regression for the subsample of positive bidders.

In the Probit model, the dependent variable is WTPpos, given the value of 0 if people are not willing to pay for the riparian habitat of upper Santa Cruz River, and 1 if they have a positive willingness to pay. The independent variables include if the respondents are interviewed at Tumacacori National Historical Park, if the respondents are interviewed at 2006, if the respondents have visited this area before, if the respondents planned to visit this area again, whether they are seasonal resident or not, indicating if they choose to answer their residence status question, their education level, employment status, number of full-time employed people in the household, if they belong to any conservation organizations, the dummy variable indicating if they have don't go birding at all per year, and the dummy variable indicating if they don't go hiking per year. The variables regarding to the education level and employment status are represented in category. The default education level is Education_d, which stands for

some graduate or professional school, while the default employment status is Employ_a, indicating full-time employed. The default education level and default employment status were dropped in the Probit model.

In the truncated regression, the dependent variable is the natural logarithm transformation of WTP, which is calculated as ln(WTP). Another reason to use ln(WTP) as the dependent variable in the truncated regression is because we found the natural logarithm form can reduce the heteroskedasticity in this model. After discarding the zero bidders, why they will have a positive willingness to pay is explained by the same set of variables as in the Probit model but only five more variables were included. These five variables are from the questionnaire, in which the respondents stated the reason why their wiliness to pay is greater than zero.

**Table 7-1 Double-Hurdle Estimates and Marginal Effect (P-value in Parentheses)**

| | Double-Hurdle | | | | |
|---|---|---|---|---|---|
| | Probit Coefficients | | Marginal Effect | Truncated Coefficient | |
| **Tuma** | 0.7415 | (0.0142)** | 0.1067 | 0.1659 | (0.3307) |
| **Year06** | -0.6385 | (0.0613)** | -0.0919 | -0.0735 | (0.6900) |
| **Visited** | -0.3212 | (0.2407) | -0.0462 | -0.1686 | (0.3558) |
| **Plan0** | -1.1493 | (0.0032)** | -0.1654 | -1.1523 | (0.0037)** |
| **season** | -0.4571 | (0.1664) | -0.0658 | -0.3606 | (0.0783)* |
| **NotRes** | -1.3246 | (0.0004)** | -0.1906 | 0.1618 | (0.5684) |
| **EDUCATION_a** | 1.0385 | (0.0513)* | 0.1494 | -0.2093 | (0.5447) |
| **EDUCATION_b** | 0.6563 | (0.0818)* | 0.0944 | 0.0055 | (0.9840) |
| **EDUCATION_c** | 1.2810 | (0.0027)** | 0.1843 | -0.3601 | (0.1769) |
| **EDUCATION_e** | 1.0242 | (0.0056)** | 0.1474 | -0.0460 | (0.8477) |
| **EMPLOY_b** | 0.2415 | (0.6401) | 0.0347 | -0.1164 | (0.6759) |
| **EMPLOY_c** | -0.3499 | (0.3002) | -0.0503 | -0.0519 | (0.8090) |
| **EMPLOY_d** | -0.9314 | (0.1507) | -0.1340 | 0.3431 | (0.4966) |
| **EMPLOY_e** | -1.4165 | (0.0370)** | -0.2038 | 0.4134 | (0.5313) |
| **EMPLOY_f** | -1.2552 | (0.0793)* | -0.1806 | -0.2572 | (0.6466) |

| | | | | | |
|---|---|---|---|---|---|
| **EMPFAM** | -0.3053 | (0.0468)** | -0.0439 | -0.0590 | (0.5630) |
| **conserv** | 1.0501 | (0.0008)** | 0.1511 | 0.3495 | (0.0246)** |
| **FreqBird_a** | -0.3118 | (0.2104) | -0.0449 | -0.0581 | (0.7037) |
| **FreqHike_a** | -0.6064 | (0.2735) | -0.0873 | -0.7658 | (0.1359) |
| **ReasonPos_a** | | | | 0.3461 | (0.0955)* |
| **ReasonPos_b** | | | | 0.4520 | (0.1401) |
| **ReasonPos_c** | | | | 0.1498 | (0.3993) |
| **ReasonPos_d** | | | | 0.2426 | (0.1610) |
| **ReasonPos_e** | | | | 0.8843 | (0.0189)** |
| **Constant** | 1.0874 | (0.0441) | | 3.8238 | (<.0001) |
| **Log Likelihood** | | -83.8810 | | -357.93829 | |
| **R-squre** | | 0.2500 | | 0.1455 | |

Note: *Significantly different from zero at the 10% significance level. **Significantly different from zero 5% significance level.

In the Double-Hurdle model, the variable Tuma is significant at 5% level when people make the decision to pay for preserving the Santa Cruz River or not. The marginal effect result indicates that the probability of choosing to pay rises by 10.67% for the individual who is interviewed at Tumacacori to the one who is interviewed at Tubac. But the Tumacacori variable is not significant in the truncated model. It suggests once people decide to pay, whether they are interviewed at Tumacacori National Historical Park or not won't be a factor to influence how much they will pay.

The Probit model suggests respondent's decision to pay or not is negatively influenced by the variable "Year06", which is statistically significant. From the visitors who were interviewed at 2006 to 2007, the probability of choosing to pay falls by 9.19%.

The variable "Visited" are not significant in both Probit model and truncated regression. These results suggest that whether respondents have visited this area before won't have effect on people's willingness to pay.

The dummy variable indicating if people plan to visit again has a negative sign and is highly significant in the Probit model. This means visitors who have no plan to visit the Santa Cruz River again will choose to not to pay instead of giving positive willingness to pay. The marginal effect indicates from no plan to visit again to have plans to visit again, increase the probability of positive willingness to pay by 16.54%. This variable is also significant and has a negative sign in the truncated regression. Therefore, for the positive bidders, if they switch no plan to plan to visit the Santa Cruz River again, their willingness to pay will be increased. In particular, the marginal effect shows their wiliness to pay will be increase by $1.14.

The variable "Season", which verifies if the visitor is a seasonal residence of Santa Cruz County or Arizona, is significant at 10% level and has a negative influence on WTP for positive bidders, i.e. is significant only in the truncated regression but not Probit model. The explanation is for the seasonal residences, in one aspect they are not like year-round residence; they probably don't care the habitat preservation as much as the local residence. However, they will visit this area occasionally. It's possible for some of them who have housing or relatives here, so in this aspect, they might not want to the riparian habitat be degraded. Hence, the seasonal residence won't be a factor to decide if they are willing to pay or not. But for the positive bidder, since the seasonal visitors will not stay in this area as long as the local visitors, so they won't contribute more money than the local visitors. The marginal effect also reveals that willingness to pay increase $ 0.3592 for people who is a seasonal resident of Santa Cruz County or Arizona than the visitors who are not seasonal resident.

The variable "NotRes" is only significant in the Probit model, but not significant in the truncated part. This result suggest visitor's might choose to give positive WTP to zero WTP from the one who chose to reply the question of their residence status to the one who didn't reply this question, and the probability is 19.06% which is suggested by the Probit marginal effect. Whether visitors responded the question of the residence status won't have effect on WTP for positive bidders.

The Probit model indicates that respondent's decision to pay for the riparian habitat or not is positively influenced by all the education variables. These education variables are significant at least at 10% significance level. The coefficients of Probit and marginal effect show that how big the effect on people's decision to pay or not depend on different education level. If they the visitors complete college has the biggest influence. Then next bigger influence is from if they finish some graduate school. If they have high school degree and if they complete graduate school almost have the same influence. The smallest influence is from the education level of if they finish some college. From lower than high school degree to high school, the probability of becoming positive bidders is 14.94%. From high school to some college, the probability of becoming positive bidders is 9.44%. From some college to complete college, the probability of becoming positive bidders is 18.43%. From some graduate school to complete graduate school, the probability of becoming positive bidders is 14.74%.

For all the employment status variables, only people who are unemployed and people who are student are significant in the Probit model. These two factors will negative influence on people's decision whether to pay or not. Visitors, who switch from

unemployed to employed, increase the probability of positive WTP by 20.38%. Respondents, who switch from student to nonstudent, increase the probability of positive WTP by 18.06%. The reason for this result might be for people who are unemployed or student, they won't have much money as people who are employed or who have already graduated from school. None of the employment status variables are significant in the truncated regression, which suggest that once people decided to contribute money, their employment status would not affect how much money they will contribute.

The variable "EMPFAM" indicating how many people employed full-time in the household is significant and has negative influence on willingness to pay. This result shows more people employed full-time in a household will result to a lower WTP. A possible reason might be for the household who have more people employed full-time, they have less leisure time. They have less outdoor activity; therefore they don't want to contribute too much money on preserving the riparian habitat of the Santa Cruz River. The marginal effect of Probit model indicates the probability of choosing to pay rises by 4.39% for each additional increase in number of people who are employed full-time in a household. However, this variable is not significant for the positive bidders.

The variable "conserve" is highly significant in both Probit and truncated regression. And the sign is positive, which is expected. The results suggest people who belong to any conservation organization will choose to pay rather than not paying. Switching from visitors who are not member of conservation organization to member, the probability of WTP>0 increases by 15.11%. Once they choose to pay, they will have higher wiliness to pay if they are a member of some conservation group. If the respondent

is a member of some conservation organization, he must be concerned about the riparian habitat and willing to denote some money. This result is consistent with Colby and Smith-Incer's study in Kern River preserve, 2005.

The two dummy variables indicating whether people never go hiking per year and never go bird watching per year are not significant.

In truncated part, we included more variables which gave the reason why people's willingness to pay are greater than zero. Among these reasons, the reason showing if they are a regular visitor to the Santa Cruz River/ Anza Trail is significant at 10% level. And other reason visitors explained is significant at 5% level. Positive willingness to pay is significant and positively influenced by these two reasons, as was expected. The partial derivative for the reason of a regular visitor indicates that WTP rises by $0.34 for the individual not a regular visitor to a regular visitor to the Santa Cruz River/ Anza Trail. Likewise, WTP rises by $0.88 if they have some other reason for the positive WTP.

### 7.2 Squared Multiple Correlation and Adjusted Count R-square

We calculated the adjusted Count R-square to measure the fitness of the Probit model and squared multiple correlation for the truncated regression.

The adjusted Count R-square calculates the proportion of correct predictions beyond the null model. The idea here is for an effective model, it should improve on this null model, for which the Count R-Square is adjusted.

$$R^2 = \frac{Correct - n}{Total - n}$$

$n$= Count of most frequent outcome

The adjusted count R-square for Probit model is 0.250, which suggests 25% of the change from zero WTP to positive WTP can be explained by these explanatory variables.

The squared multiple correlation can be calculated by taking square of pearson correlation between predicted WTP and real WTP. The squared multiple correlation for the truncated regression is 0.1455, showing that for only positive bidders, the proportion of variation in WTP explained by variation of the explanatory variables is 14.55%.

## CHAPTER EIGHT

### The Analysis of Self-reported Income

In the previous regression model, we didn't include income as an explanatory variable. However, income is always an important factor to influence people's willingness to pay. Income implies ability to pay. The respondent cannot express their willingness to pay if he doesn't have sufficient income or wealth. In this chapter, we want to analyze the effect from income on WTP. First of all, there are still some missing observations in our previous cleaned-up data set. By taking out of all the missing self-reported income observations, there were 243 observations left in the reduced sample. Before we utilize the econometric model in the reduced sample, we still want to see if there is a statistical difference between the new reduced data and the original data.

**Table 8-1 Percent change in mean and t-stat for continuous variables**

| Variable | Original Mean | After Mean | % change in mean | t-stat | p-value |
|---|---|---|---|---|---|
| **WTP** | 79.44 | 86.29 | 8.62% | -0.52 | 0.6019 |
| **income_self_** | 70842.30 | 70256.41 | -0.83% | 0.10 | 0.9209 |
| **EMPFAM** | 0.97 | 1.00 | 3.00% | -0.38 | 0.7017 |

The results suggest for the continuous variables, there is no statistical difference from the original sample and cleaned sample after the missing income data was deleted. Income_self_ is newly included continuous variable in both of the data sets. The t-test fail to reject that the mean of new data set is statistically different from the original one. All the percentage changes in means are no more than 9%. Results of t-test for the other two variables show that there are no significant differences.

**Table 8-2 Percent change in mean and Binomial Z-stat and corresponding p-value**

| Variable | Original Mean | After Mean | % change in mean | Binomial Test Z | Exact P value |
|---|---|---|---|---|---|
| **SC_year** | 0.2466 | 0.2393 | -2.96% | 0.2585 | 0.8649 |
| **SC_season** | 0.0740 | 0.0598 | -19.19% | 0.8281 | 0.4933 |
| **AZ_year** | 0.4767 | 0.4829 | 1.30% | -0.1901 | 0.9001 |
| **AZ_season** | 0.1014 | 0.1154 | 13.81% | -0.7087 | 0.5361 |
| **VISITED** | 0.6844 | 0.6838 | -0.09% | 0.0210 | 1.0000 |
| **Q8a** | 0.1885 | 0.1624 | -13.85% | 1.0211 | 0.3494 |
| **Q8b** | 0.0546 | 0.0470 | -13.92% | 0.5111 | 0.7420 |
| **Q8c** | 0.3470 | 0.3718 | 7.15% | -0.7968 | 0.4646 |
| **Q8d** | 0.3224 | 0.3462 | 7.38% | -0.7774 | 0.4768 |
| **Q8e** | 0.0628 | 0.0513 | -18.31% | 0.7263 | 0.5718 |
| **GENDER** | 0.5291 | 0.5128 | -3.08% | 0.4989 | 0.6641 |
| **FOSCR** | 0.0377 | 0.0470 | 24.67% | -0.7476 | 0.5409 |
| **Anza** | 0.0216 | 0.0214 | -0.93% | 0.0245 | 1.0000 |
| **EMPLOY_a** | 0.3978 | 0.4615 | 16.01% | -1.9921 | 0.0555 |
| **EMPLOY_b** | 0.0926 | 0.0940 | 1.51% | -0.0748 | 1.0000 |
| **EMPLOY_c** | 0.4414 | 0.4060 | -8.02% | 1.0911 | 0.3052 |
| **EMPLOY_d** | 0.0245 | 0.0171 | -30.20% | 0.7328 | 0.6385 |
| **EMPLOY_e** | 0.0245 | 0.0214 | -12.65% | 0.3100 | 0.9759 |
| **EMPLOY_f** | 0.0218 | 0.0128 | -41.28% | 0.9406 | 0.4960 |

For the 0-1 value dummy variables, the results of binomial test were shown in the table above. Although for some variable like EMPLOY_f, the percentage change of means was reduced 41.28%, the p-value of binomial test revealed that there is no statistical difference between the mean of original data and new reduced data. However, there is only one variable has a significant change of mean, which is EMPLOY_a, the mean from original data and reduced data are statistically different at 10% significance level. EMPLOY_a indicates full-time employed. Income will be influenced by the factor of full-time employment, which might be the reason why this variable has a significant

change when the missing income was deleted. Among the missing income observations, it must contain some observations with full-time employment status.

Next following tables will show the results of the chi-square goodness of fit.

**Table 8-3 Percent change of proportion for age variable and chi-square test**

| Variable | New Percent | Original Percent | % change in percent |
|---|---|---|---|
| AGE_a | 2.56 | 4.44 | -42.34% |
| AGE_b | 7.69 | 6.11 | 25.86% |
| AGE_c | 14.10 | 11.39 | 23.79% |
| AGE_d | 17.09 | 14.72 | 16.10% |
| AGE_e | 34.19 | 33.89 | 0.89% |
| AGE_f | 20.09 | 24.44 | -17.80% |
| AGE_g | 4.27 | 5.00 | -14.60% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **7.2897** | **0.2949** | | |

**Table 8-4 Percent change of proportion for education level and chi-square test**

| Variable | New Percent | Original Percent | % change in percent |
|---|---|---|---|
| EDUCATION_a | 6.84 | 8.61 | -20.56% |
| EDUCATION_b | 19.23 | 21.39 | -10.10% |
| EDUCATION_c | 23.08 | 22.22 | 3.87% |
| EDUCATION_d | 12.82 | 11.67 | 9.85% |
| EDUCATION_e | 38.03 | 36.11 | 5.32% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **1.9465** | **0.7456** | | |

**Table 8-5 Percent change of proportion for frequency of birding and chi-square test**

| Variable | New Percent | Original Percent | % change in percent |
|---|---|---|---|
| **FREQBIRD_a** | 45.3 | 47.03 | -3.68% |
| **FREQBIRD_b** | 13.25 | 11.61 | 14.13% |
| **FREQBIRD_c** | 9.83 | 10.48 | -6.20% |

| | | | |
|---|---|---|---|
| **FREQBIRD_d** | 5.56 | 6.8 | -18.24% |
| **FREQBIRD_e** | 6.84 | 5.95 | 14.96% |
| **FREQBIRD_f** | 3.42 | 2.83 | 20.85% |
| **FREQBIRD_g** | 4.27 | 3.97 | 7.56% |
| **FREQBIRD_h** | 11.54 | 11.33 | 1.85% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **1.977** | **0.9611** | | |

**Table 8-6 Percent change of proportion for frequency of hiking and chi-square test**

| Variable | New Percent | Original Percent | % change in percent |
|---|---|---|---|
| **FREQHIKE_a** | 3.42 | 3.62 | -5.52% |
| **FREQHIKE_b** | 5.98 | 6.13 | -2.45% |
| **FREQHIKE_c** | 11.97 | 13.09 | -8.56% |
| **FREQHIKE_d** | 25.64 | 23.4 | 9.57% |
| **FREQHIKE_e** | 18.38 | 16.43 | 11.87% |
| **FREQHIKE_f** | 5.98 | 8.64 | -30.79% |
| **FREQHIKE_g** | 10.68 | 11.98 | -10.85% |
| **FREQHIKE_h** | 4.7 | 4.46 | 5.38% |
| **FREQHIKE_i** | 13.25 | 12.53 | 5.75% |
| **Chi-Square** | **Pr > ChiSq** | | |
| **3.6689** | **0.8857** | | |

Hence, for these categorical variables, each variable has several categories. The chi-square goodness of fit test shows that for age, education level, frequency of hiking, frequency of birding, we fail to reject that the original sample is statistically different from the reduced sample.

In conclusion, after all the missing self-reported income values have been discarded, there were 234 observations remaining. From the t-tests, binomial test, chi-square goodness of fit tests, it reveals the change of descriptive statistics is minimal.

After getting the results above, now we can utilize the Double-Hurdle model in our new reduced sample when the self-reported income was included. We have to treat the income variable very carefully. First of all, to make coefficient of income variable comparative to other coefficients, we scaled the self-reported income variable. We divided income_self_ by 100,000 in the Double-Hurdle model. Moreover, in the Probit model part, we encounter the converge problem when the income variable was included. Since income will highly influenced by the employment status, we dropped all the employment status variable in the Probit model. The result is shown in the following table.

**Table 8-7 Probit part of Double-Hurdle model when including income**

| Parameter | Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|
| **Intercept** | 1.5496** | 0.5874 | 2.64 | 0.0083 |
| **Income_self_** | 0.0926 | 0.1920 | 0.48 | 0.6295 |
| **Tuma** | 0.8554** | 0.3670 | 2.33 | 0.0198 |
| **Year06** | -0.8656** | 0.4164 | -2.08 | 0.0376 |
| **Visited** | -0.3777 | 0.3132 | -1.21 | 0.2279 |
| **Plan0** | -1.1934** | 0.4283 | -2.79 | 0.0053 |
| **season** | -0.5328 | 0.3784 | -1.41 | 0.1591 |
| **NotRes** | -1.2744** | 0.4131 | -3.09 | 0.002 |
| **EDUCATION_a** | 0.3398 | 0.5347 | 0.64 | 0.5251 |
| **EDUCATION_b** | 0.2118 | 0.4302 | 0.49 | 0.6225 |
| **EDUCATION_c** | 0.3412 | 0.4387 | 0.78 | 0.4367 |
| **EDUCATION_e** | 0.3928 | 0.4188 | 0.94 | 0.3483 |
| **EMPFAM** | -0.1176 | 0.1646 | -0.71 | 0.4749 |
| **conserv** | 0.8914** | 0.3577 | 2.49 | 0.0127 |
| **FreqBird_a** | -0.5368* | 0.3039 | -1.77 | 0.0773 |
| **FreqHike_a** | -1.0870* | 0.5719 | -1.90 | 0.0574 |

Note: *Significantly different from zero at the 10% significance level.
**Significantly different from zero 5% significance level.

In the Probit model, we focus on predicting whether people will have a positive wiliness to pay or no willingness to pay. However, self-reported income here is not significant. Other factors which would have positive effect on people's decision to pay or not are: if the respondent was interviewed at Tumacacori National Historical Park and if he is a member of any conservation organizations. The negative effects include: if he was interviewed at 2006, if he has 0 planned visit, if he didn't respond to the question about their residence status. These factors are consistent with the results when self-reported income was not included. Besides, if respondents don't go hiking or birding at all every year, the effect is negative which are expected. However, the variables indicating the education level become not significant when including income variable.

**Table 8-8 Truncated regression of Double-Hurdle model when including income**

| Parameter | Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|
| **Intercept** | 3.3065** | 0.4346 | 7.61 | <.0001 |
| **Income_self_** | 0.6146** | 0.1620 | 3.79 | 0.0001 |
| **Tuma** | 0.2729 | 0.1823 | 1.5 | 0.1345 |
| **Year06** | -0.1693 | 0.1910 | -0.89 | 0.3755 |
| **Visited** | -0.1937 | 0.1972 | -0.98 | 0.3258 |
| **Plan0** | -1.2462** | 0.4025 | -3.1 | 0.0020 |
| **season** | -0.5518** | 0.2308 | -2.39 | 0.0168 |
| **NotRes** | 0.2138 | 0.3050 | 0.7 | 0.4832 |
| **EDUCATION_a** | 0.0257 | 0.3654 | 0.07 | 0.9440 |
| **EDUCATION_b** | -0.2665 | 0.2709 | -0.98 | 0.3252 |
| **EDUCATION_c** | -0.5843** | 0.2644 | -2.21 | 0.0271 |
| **EDUCATION_e** | -0.1392 | 0.2417 | -0.58 | 0.5646 |
| **EMPLOY_b** | -0.0566 | 0.2882 | -0.2 | 0.8442 |
| **Employ_c** | 0.2903 | 0.2219 | 1.31 | 0.1907 |
| **EMPLOY_d** | 0.3254 | 0.5702 | 0.57 | 0.5682 |
| **EMPLOY_e** | 0.9111 | 0.6418 | 1.42 | 0.1558 |
| **EMPLOY_f** | 0.3868 | 0.6398 | 0.6 | 0.5455 |

| | | | | |
|---|---|---|---|---|
| **EMPFAM** | -0.0288 | 0.1067 | -0.27 | 0.7875 |
| **conserv** | 0.3012* | 0.1636 | 1.84 | 0.0657 |
| **FreqBird_a** | -0.1227 | 0.1651 | -0.74 | 0.4574 |
| **FreqHike_a** | -0.8429 | 0.5440 | -1.55 | 0.1212 |
| **ReasonPos_a** | 0.0896 | 0.2286 | 0.39 | 0.6952 |
| **ReasonPos_b** | 0.2943 | 0.3487 | 0.84 | 0.3987 |
| **ReasonPos_c** | 0.2598 | 0.1880 | 1.38 | 0.1670 |
| **ReasonPos_d** | 0.3959** | 0.1850 | 2.14 | 0.0324 |
| **ReasonPos_e** | 0.9022** | 0.3820 | 2.36 | 0.0182 |
| **_Sigma** | 1.0113 | 0.0506 | 20 | <.0001 |

Note: *Significantly different from zero at the 10% significance level.
**Significantly different from zero 5% significance level.

In the truncated regression, where we only concentrate on the positive bidders, we found self-reported income will positively and significantly influence how much people will contribute to preserve the riparian habitat of the Upper Santa Cruz River. Since income will reflect people's ability to pay, this result is as expected. Visitor's membership of any conservation organization is positively related to willingness to pay. Furthermore, there are two reasons why people have positive WTP are significant in the truncated regression. These two reasons are if they receive satisfaction from knowing that the riparian habitat will be maintained and other reasons the respondents stated. These two factors have positive influence on WTP, which is as expected. The variables having negative effect on willingness to pay are zero planned visits, seasonal residence of Santa Cruz County or Arizona, and education level indicating people finish college or technical school.

In conclusion, only Plan0 and conserve are significant in both of the models. This results suggest if respondents have 0 planned visits, it is likely they will choose not to pay instead of paying, even they have positive WTP, respondents will pay less amount of

money than the people who planned to visit again. For the people who are a member of any conservation group, they are more likely to choose to have positive WTP instead of zero WTP. When they decided to pay, their WTP will be higher than people who are not member of conservation group. However, respondent who stated higher income will have higher WTP only when they have made the decision to make a contribution, but their decision to pay or not is not affected by the self-reported income.

## CHAPTER NINE

### Comparison with Other CV Studies

In our study, we found visitors' one-time contribution to preserve the riparian habitat of Upper Santa Cruz River is $86.43. Comparing to previous study that used contingent valuation method as well, we can find a variety of both higher and lower estimates. Since these contingent valuation surveys were conducted on different years, we converted all the WTP in 2007 dollars by using Price Indexes for Gross Domestic Product. Colby and Smith Incer found a regular annual donation of $91.81(in 2007 dollars) for protecting the Kern River. Colby and Orr (2001) found people are willing to pay $93(in 2007 dollars) as a onetime contribution to for preservation of the Upper San Pedro River Basin in southern Arizona. Ojeda, Mayer and Solomon (2006) found that people were willing to have a contribution of $6.61 per month to be paid in water bill, so the annual contribution is $81.61 in 2007 dollars to preserve Yaqui River, Sonora, Mexico. In Crandall, Colby and Rait's research in 1990, the annual payment is $95.68 using contingent valuation method and $142.79 both in 2007 dollars using travel cost method for Arizona's Hassayampa River Preserve. Loomis, Kent, Strange, Fausch, and Covich (1999) found there is a WTP of $308.74 (in 2007 dollars)for the preservation of 45 mile section of Platte River. Lindseyand Knapp (1999) reported an estimate of $13.18 (in 2007 dollars) as the most people would be willingness to pay during 1997 and 1998 for Crooked Creek Greenway. Farber and Griner (1996) cited $58.04 (in 2007 dollars) per household per year for 5 years when they conducted the contingent valuation at two sub-basins of the Lower Allegheny Watershed in Western Pennsylvania. Collins,

Rosenberger and Fletcher found people are willing to pay $178.78 (in 2007 dollars) per year to preserve the Decker Crook watershed in Monogalia and Pretson Counties of West Virgina. Finally, in Berrens, Ganderton and Silva's research, they reported people were willing to contribute $116.92 (in 2007 dollars) annually for each of five years for the instream flows on all major New Mexico Rivers. Following is a table of the summary of the comparison.

**Table 9-1 Comparison of CV Studies**

| Authors | Year | Resource | WTP | WTP in 2007 |
|---|---|---|---|---|
| Colby&Orr | 2001 | Upper San Pedro River Basin Southern AZ | $79.31 one time contribution for preservation of the SPRNCA | $93.00 |
| Colby&Smith Incer | 2000 | Kern River Preserve, South Fork Kern River Valley, California | $76.56( regular annual donation) | $91.81 |
| Monica Ilija Ojeda, Alex S. Mayer a and Barry D. Solomon | 2006 | Yaqui River, Sonora, Mexico | $6.61 per month, to be paid in water bill, or $79.28 per year | $81.61 |
| Crandall, Colby& Rait | 1990 | Arizona's Hassayampa River Preserve | $97 per visitor (travel cost method) $65 annually (contingent valuation method) | $95.68 |
| Loomis, Kent, Strange, Fausch, and Covich | 1999 | 45 mile section of Platte River | $21 per month or $252 annually | $308.74 |
| Lindsey, Knapp | 1999 | Crooked Creek Greenway | $10.76 (the most they would be willingness to pay during 1997 and 1998) | $13.18 |
| Farber &Griner | 1996 | Two sub-basins of the Lower Allegheny Watershed in Western Pennsylvania: Loyalhnna Creek's sub-basin and Conemaugh River's sub basin | $45.36 per household per year for 5 years | $58.04 |
| Collins, Rosenberger & Fletcher | 2002-2003 | Decker Crook watershed in Monogalia and Pretson Counties of | $12.91 per respondent per month or $154.92 per year | $178.78 |

| | | | | |
|---|---|---|---|---|
| Berrens, Ganderton& Silva | 1995 | West Virgina Instream flows on all major NM Rivers | $89.68 annually for each of five years | $116.92 |

# CHAPTER TEN

## Summary and Conclusions

This study explores the influential factors on visitors' willingness to pay for riparian habitat and instream flow of Santa Cruz River. A survey-based contingent valuation method was utilized to estimate these factors' effect on willingness to pay. These factors included visitors' demographic characteristic, household information, visitation pattern, and outdoor activity preference. From the Double-Hurdle model, the factors which can influence people's decision on whether to pay and how much they will pay once they decide to pay can be estimated separately. Hence, we separate the significant factors for both part.

Chapter 1 is a brief introduction about the study objective, study area, the importance of this study and the methodology of this study. In Chapter 2, past studies relative to this topic has been investigated. Most of them used contingent valuation which proved to be widely used to examine the non-market goods. But different models had been utilized to measure willingness to pay. The most popular model for WTP contingent valuation is Tobit model, although other researchers have tried Logit, standard probit and random effects probit model for binary outcome dependent variable. In these previous studies, income, membership of conservation group, and education are significant in most cases, but other factors vary depending on different area and different conditions.

In Chapter 3, we explained what contingent valuation method is and why it was used in this study at first. Then we described when, where and how the data has been collected. The survey-based data has been collected in Tumacacori National Historical

Park and Tubac Presidio State Historic Park in winter 2006 and fall, winter 2007. In the last part of this chapter, the techniques about survey instrument design were introduced, and also our questionnaire pattern was presented concisely. The dependent variable should be designed with caution. Our survey used the 13 WTP categorical bids to elicit visitors' willingness to pay. Then there were follow-up questions to verify the true willingness to pay and screen out the protest zero bids.

Chapter 4 gives the description of dependent variable and all explanatory variables. We used two different sets of variables for the Probit model and truncated regression. For Probit model, the dependent variable only has 0-1 value. Then we used the natural logarithm transformation of WTP for dependent variable in truncated regression. The explanatory variables are basically the same in Probit and truncated part. But there are five more variables in the truncated part. These five more variables are the reasons respondents checked in the questionnaire why they have positive WTP. The factors we considered includes educational level, employment status, if the respondent is a seasonal residence of Arizona or Santa Cruz County, if the respondent was interviewed at Tumacacori park, if he is interviewed at 2006, if they respond to the question regarding to their residence status, how many people full-time employed in the household, if the visitor go bird watching per year and if he goes hiking per year, if he visited that area before, if he plans to visit this area again, and if he is a member of any conservation organizations. From the result of descriptive statistics, we found the characteristic of visitors to these two parks are mainly with age above 55, most of them have college

degree. 67.94% have visited Santa Cruz before, 18.12% are seasonal residence to Arizona or Santa Cruz County.

In Chapter 5, we illustrate the method we deal with missing value. The listwise deletion was used here. We also conducted some tests to see if the means of these variables still stay the same after deleting the missing data. These tests include T-test for continuous variables, binomial tests for the binary outcome variable and chi-square goodness of fit tests for the variable which have more than two categories. All the tests indicated that after listwise deletion, the cleaned-up data didn't change too much comparing to the original data.

Non-parametric tests of association were used to test the relationship between the categorical independent variable and WTP with 0-1 value. Fisher's exact test and Cochran-Armitage test were conducted. The Goodman-Kruskal gamma coefficient statistic was also calculated. Variables of Tuma, Fiesta, Interviewers, Visited, PlanV, DeclSame, Plan0, Residence, OthCon, No birding and No hiking are significant in these test. This result verifies these variables have some relationship with visitor's decision on whether to pay or not.

Based on the characteristic of our variables, we develop the econometric model in Chapter 7. Double-Hurdle model was chosen due to we want to separate the factors influence visitor's decision on pay or not and the factors on how much people are willing to pay once they have decide to pay. The marginal effects were also included in our results.

From the Double-Hurdle model, the significant factors for visitor's decision on whether to contribute money on preserving the Santa Cruz River or not are if the visitor was interviewed at Tumacacori National Park, if he was interviewed at 2006, if he plans to visit this area again, if he responded to the residence status question, if he is unemployed or if he is a student, if he is a member of any conservation organization, how many people full-time employed in the household, and the education level. Once the visitors have made their decision to pay for the riparian habitat and instream flow of this area, the factors affect how much they will pay include if the respondent plans to visit again, if he is a seasonal resident of Santa Cruz County or Arizona, if he is a member of any conservation group, if he is a regular visitor of the Santa Cruz River/ Anza Trail, and other reasons respondents state for their positive bids. The signs of these factors are all as expected.

There are some possible future work can be considered. First of all, we can aggregate up the WTP based on visitors' surveys to check if the surveys are representative to all visitors. Moreover, we can transfer people's one-time payment in this survey to the annual payment, and we can convert this willingness to pay to the form of per acre foot per year. By this, we will see if the total WTP is reasonable for representing the non-market value of for Santa Cruz River.

In addition, based on the distribution of dependent variable, an ordered Probit model can be utilized to see if this model is plausible to this study. Furthermore, since the survey was conducted in two locations, Tumacacori National Historical Park and Tubac

Presidio State Historic Park. We can test if visitors to Tubac Park have different WTP than visitors to Tumacacori.

# Appendix A: Basic Definitions

**Instream Flow:**

The term "instream flow" is defined by the amount of water flowing in a natural stream or river that is needed to sustain aquatic species and habitats.

**Riparian Habitat:**

Riparian habitat refers to the interface between land and a stream, which is characterized by vegetated areas along bodies of freshwater including streams, lakes and rivers. Riparian habitat exists in many forms including grassland, woodland, wetland or even non-vegetative.

## Appendix B: Summary of Descriptive Statistics for Explanatory Variables

| Variable | Mean | Std Dev | Minimum | Median | Maximum |
|---|---|---|---|---|---|
| **WTP** | 102.0823 | 170.4572 | 1 | 50 | 1000 |
| **WTPpos** | 1.0000 | 0.0000 | 1 | 1 | 1 |
| **lnwtp** | 3.9052 | 1.1447 | 0 | 3.9120 | 6.9078 |
| **Tuma** | 0.6091 | 0.4890 | 0 | 1 | 1 |
| **Fiesta** | 0.5103 | 0.5009 | 0 | 1 | 1 |
| **Year06** | 0.2634 | 0.4414 | 0 | 0 | 1 |
| **IntKB** | 0.1029 | 0.3044 | 0 | 0 | 1 |
| **IntGF** | 0.0494 | 0.2171 | 0 | 0 | 1 |
| **IntRK** | 0.2140 | 0.4110 | 0 | 0 | 1 |
| **IntRKCT** | 0.1358 | 0.3433 | 0 | 0 | 1 |
| **IntCT** | 0.3498 | 0.4779 | 0 | 0 | 1 |
| **IntCTJel** | 0.0041 | 0.0642 | 0 | 0 | 1 |
| **intCH** | 0.0782 | 0.2690 | 0 | 0 | 1 |
| **IntJel** | 0.0041 | 0.0642 | 0 | 0 | 1 |
| **Visited** | 0.7078 | 0.4557 | 0 | 1 | 1 |
| **DeclineV** | 2.4074 | 2.6850 | 0 | 2 | 10 |
| **PlanV** | 4.5473 | 3.0466 | 0 | 4 | 10 |
| **DeclinePos** | 0.0412 | 0.1991 | 0 | 0 | 1 |
| **DeclSame** | 0.3786 | 0.4860 | 0 | 0 | 1 |
| **DecScale** | 0.4198 | 0.5720 | 0 | 0 | 2 |
| **Plan0** | 0.0370 | 0.1892 | 0 | 0 | 1 |
| **ReasonPos_a** | 0.1975 | 0.3990 | 0 | 0 | 1 |
| **ReasonPos _b** | 0.0617 | 0.2412 | 0 | 0 | 1 |
| **ReasonPos _c** | 0.4115 | 0.4931 | 0 | 0 | 1 |
| **ReasonPos _d** | 0.4033 | 0.4916 | 0 | 0 | 1 |
| **ReasonPos _e** | 0.0453 | 0.2083 | 0 | 0 | 1 |
| **GENDER** | 0.5309 | 0.5001 | 0 | 1 | 1 |
| **SC_year** | 0.2593 | 0.4391 | 0 | 0 | 1 |
| **SC_season** | 0.0658 | 0.2485 | 0 | 0 | 1 |
| **AZ_year** | 0.4733 | 0.5003 | 0 | 0 | 1 |
| **AZ_season** | 0.1193 | 0.3249 | 0 | 0 | 1 |
| **season** | 0.1852 | 0.3892 | 0 | 0 | 1 |
| **NoRes** | 0.0823 | 0.2754 | 0 | 0 | 1 |
| **EDUCATION_a** | 0.0782 | 0.2690 | 0 | 0 | 1 |
| **EDUCATION_b** | 0.1893 | 0.3926 | 0 | 0 | 1 |
| **EDUCATION_c** | 0.2263 | 0.4193 | 0 | 0 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **EDUCATION_d** | 0.1152 | 0.3200 | 0 | 0 | 1 |
| **EDUCATION_e** | 0.3909 | 0.4890 | 0 | 0 | 1 |
| **EMPLOY_a** | 0.4321 | 0.4964 | 0 | 0 | 1 |
| **EMPLOY_b** | 0.0988 | 0.2990 | 0 | 0 | 1 |
| **EMPLOY_c** | 0.4198 | 0.4945 | 0 | 0 | 1 |
| **EMPLOY_d** | 0.0206 | 0.1423 | 0 | 0 | 1 |
| **EMPLOY_e** | 0.0123 | 0.1107 | 0 | 0 | 1 |
| **EMPLOY_f** | 0.0165 | 0.1275 | 0 | 0 | 1 |
| **EMPFAM** | 1.0370 | 0.9635 | 0 | 1 | 3 |
| **FOSCR** | 0.0453 | 0.2083 | 0 | 0 | 1 |
| **Anza** | 0.0329 | 0.1788 | 0 | 0 | 1 |
| **LocalCon** | 0.0700 | 0.2556 | 0 | 0 | 1 |
| **OthCon** | 0.3868 | 0.4880 | 0 | 0 | 1 |
| **conserv** | 0.4568 | 0.4992 | 0 | 0 | 1 |
| **FREQBIRD_a** | 0.4198 | 0.4945 | 0 | 0 | 1 |
| **FREQBIRD_b** | 0.1358 | 0.3433 | 0 | 0 | 1 |
| **FREQBIRD_c** | 0.1193 | 0.3249 | 0 | 0 | 1 |
| **FREQBIRD_d** | 0.0658 | 0.2485 | 0 | 0 | 1 |
| **FREQBIRD_e** | 0.0700 | 0.2556 | 0 | 0 | 1 |
| **FREQBIRD_f** | 0.0329 | 0.1788 | 0 | 0 | 1 |
| **FREQBIRD_g** | 0.0412 | 0.1991 | 0 | 0 | 1 |
| **FREQBIRD_h** | 0.1152 | 0.3200 | 0 | 0 | 1 |
| **FREQHIKE_a** | 0.0206 | 0.1423 | 0 | 0 | 1 |
| **FREQHIKE_b** | 0.0494 | 0.2171 | 0 | 0 | 1 |
| **FREQHIKE_c** | 0.1358 | 0.3433 | 0 | 0 | 1 |
| **FREQHIKE_d** | 0.2510 | 0.4345 | 0 | 0 | 1 |
| **FREQHIKE_e** | 0.1770 | 0.3824 | 0 | 0 | 1 |
| **FREQHIKE_f** | 0.0782 | 0.2690 | 0 | 0 | 1 |
| **FREQHIKE_g** | 0.1276 | 0.3343 | 0 | 0 | 1 |
| **FREQHIKE_h** | 0.0453 | 0.2083 | 0 | 0 | 1 |

## Appendix C: Questionnaire for Contingent Valuation Method

Date: __/__/__ Location: _____
Interviewer:_____

Thank you for participating in a **University of Arizona** study to help understand how visitors and local residents value natural resources in riparian areas. The survey has 20 questions and will take about 10-15 minutes to complete.

**Disclaimer:** This survey is not funded or sponsored by Arizona State Parks, Tubac Presidio State Park, the National Park Service, or the Tumacacori National Historical Park

**Please turn the page to begin the survey.**

The word *riparian* refers to an area where plants and animals thrive because of water availability at, or just below, the land surface. Water is the critical element. Without adequate water, the riparian ecosystem will gradually degrade – represented in Photograph 2 (the Santa Cruz River a few miles north of the study area).

Wildlife on the Upper Santa Cruz River is comprised of approximately 100 species of birds, and several species of reptiles and small mammals. The diversity of birds and other wildlife found in the Upper Santa Cruz riparian corridor is largely due to trees and other vegetation along the river's bank, which depends on adequate water (Photograph 1).
Year-round flows in the Santa Cruz River depend mostly upon treated wastewater flows downstream of the Nogales International Wastewater Treatment Plant (NIWTP), located nine miles north of the border in Arizona.

Suppose that these water flows were threatened and a non-profit foundation has been formed to acquire water and to promote regional water conservation in order to maintain the Santa Cruz riparian corridor as it is today. If the foundation does not receive enough contributions from individuals like you, adequate water flows will not be available. Trees and other plants would begin to die, degrading the riparian habitat and reducing the abundance and diversity of birds and other wildlife (Photograph 2)

1. Have you previously visited the Santa Cruz River / Anza Trail?

☐ Yes ☐ No

The following questions are included to help us learn more about your values for riparian areas. **We are not soliciting contributions** and **your answers are confidential**.

2. Please check the most, you as an individual, would be willing to contribute to this non-profit foundation, in the form of a one-time contribution, in order to permanently preserve the Santa Cruz River habitat as it is today (show Photograph 1):

☐ $0 ☐ $10 ☐ $20 ☐ $30 ☐ $50 ☐ $75 ☐ $100

☐ $150 ☐ $200 ☐ $300 ☐ $500 ☐ $750 ☐ $1,000

☐ *other amount* : _____

3. Suppose that water flows have not been preserved and the riparian area has declined (show Photograph 2). Under these conditions, how often would you visit the Santa Cruz River / Anza Trail over the next two years?

   0 times ☐ 1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐ 9☐ 10 or more ☐

4. How often do you plan to visit given the current riparian habitat at the Santa Cruz River / Anza Trail over the next two years

   0 times ☐ 1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐ 9☐ 10 or more ☐

5. If your answer to question 2 was zero, or if you left this space blank, please check the

   **one** reason below that best explains why you answered this way:

   ☐ I would not benefit from the preservation of the Santa Cruz River riparian habitat.

   ☐ Preservation of this habitat should be undertaken at no cost to me.

   ☐ I can go to other locations to enjoy riparian habitat and diverse bird and wildlife species. ☐ I need to spend the money on other priorities.

   ☐ I did not fully understand what I was being asked to do.

   ☐ I found the question offensive or implausible.

   ☐ I'd rather make an annual contribution of $ ____ (please fill in)

   ☐ Other, please explain: _____

6. If your answer to 2 was **greater than zero**, please answer the following question:

   In order to actually make the contribution you checked for question 2, you would need to reduce spending on other items. Please indicate which **one** of the following categories you would spend less on:

   ☐ Groceries ☐ Contributions to environmental causes

   ☐ Savings ☐ Charitable contributions (not environmental causes)

   ☐ Entertainment ☐ Vacations ☐ Other

7. Now that you have thought about how you would rearrange spending to make the contribution that you answered for 2, do you want to change the amount that you indicated?

   ☐ Yes ☐ No

   If yes, please go back to 2, cross out your first answer and circle the revised amount.

8. If your answer to question 2 was **greater than zero**, please check the **one** reason below that best explains why you answered this way:

   ☐ I am a regular visitor to the Santa Cruz River / Anza Trail.

   ☐ I plan to be a regular visitor to the Santa Cruz River / Anza Trail.

   ☐ I want this riparian area to be maintained so that others can enjoy it.

   ☐ I receive satisfaction from knowing that the riparian habitat will be maintained.

   ☐ Other, please explain: _____

The last few questions ask about you and your household.
They are essential to help us understand visitor characteristics.

9. What is your age (in years):

☐ 18-25 ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐ 56-65 ☐ 66-75 ☐ 76-85 ☐ +85

10. Female ☐ Male ☐

11. Your home zip code: _____

12. Are you : ☐ A year-round resident of Santa Cruz County, Arizona
☐ A seasonal resident of Santa Cruz County, Arizona
☐ A year-round resident of Arizona
☐ A seasonal resident of Arizona

13. If you are a year-round or seasonal resident of Santa Cruz County, how many years have you lived in the county? _____ (number of years)

14. Please indicate level of education:

☐ High School ☐ Some College / Technical School
☐ Completed College / Technical School
☐ Some Graduate or Professional School
☐ Completed Graduate or Professional School

15. What is your employment status?

☐ Employed full-time ☐ Employed part-time ☐ Retired
☐ Homemaker ☐ Unemployed ☐ Student

16. How many people in <u>your household</u> are employed full-time?

☐ zero ☐ 1 ☐ 2 ☐ more than 2

17. Please indicate your household income (before taxes) last year?

| | | |
|---|---|---|
| ☐ Less than $10,000 | ☐ $40,000–$44,999 | ☐ $90,000–$99,999 |
| ☐ $10,000–$14,999 | ☐ $45,000–$49,999 | ☐ $100,000–$149,999 |
| ☐ $15,000–$19,999 | ☐ $50,000–$54,999 | ☐ $150,000–$199,999 |
| ☐ $20,000–$24,999 | ☐ $55,000–$59,999 | ☐ $200,000 –$249,999 |
| ☐ $25,000–$29,999 | ☐ $60,000–$69,999 | ☐ $250,000 or 499,999 |
| ☐ $30,000–$34,999 | ☐ $70,000–$79,999 | ☐ $500,000 or greater |
| ☐ $35,000–$39,999 | ☐ $80,000–$89,999 | ☐ decline to answer |

18. Are you a member of any organization that supports conservation, environmental or wildlife concerns?

☐ Yes ☐ No

If yes, please specify: _____ _____

_____ _____ _____

19. Approximately how often do you go bird watching?

☐ zero times per year ☐ at least once a year ☐ at least twice a year

☐ at least six times per year ☐ at least once a month ☐ at least twice a month

☐ at least once per week ☐ more than once per week

20. Approximately how often do you go hiking or walking in natural areas?

☐ zero times per year ☐ at least once a year ☐ at least twice a year

☐ at least six times per year ☐ at least once a month ☐ at least twice a month

☐ at least once per week ☐ at least twice per week

☐ more than twice per week

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