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Value of open space in Missoula County, Montana| An economic study using contingent valuation

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THE VALUE OF OPEN SPACE IN MISSOULA COUNTY MONTANA:
AN ECONOMIC STUDY USING CONTINGENT VALUATION

By
Mike Kadas

Presented in partial fulfillment of the requirements
for the degree of
Master of Arts
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Approved by
Richard W. Barrett
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Date January 24, 1995
Population growth and development in this large Northern Rockies valley has brought increasing attention to the loss of nearby viewsheds, recreation opportunities and wildlife habitat. This pressure has focused public interest on the value of open space and methods for preserving it.

This study uses a dichotomous choice contingent valuation methodology to develop estimates of the economic value of open space for Missoula County and a specific site in Missoula County, the North Hills. The full model also incorporates significant demographic and attitudinal variables and shows their effect on individual willingness-to-pay for preserving open space.

The study incorporates a recent public referendum for a county-wide open space bond as an independent validation procedure of the methodology. Other methodological issues addressed are the effects of question order in the survey instrument and the similarities between responses to the survey and an exit poll conducted at the time of the referendum.

Missoula County residents are willing to pay $1.7 million year for the next ten years to preserve open space county-wide and $840,000 a year for the next ten years to preserve the North Hills site. Being female, well educated and a member of an environmental organization all tend to correspond to a higher willingness-to-pay for open space. Level of income was not found to be a significant variable.
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Finally, even with all this help there are certain to be errors in the final product. They are the sole responsibility and property of the author.

Mike Kadas
Chapter 1

Statement of the Problem

1.1 Introduction

Recent population growth and development have focused the attention of residents of Missoula County on a favorite amenity of living in or near the Missoula valley--open space. Uncluttered hillsides and riparian areas rank high among the reasons many Missoulians have for living in the area. As these attributes are threatened, demand for knowledge about open space and ways of preserving it has grown.

This thesis analyzes two of the important economic questions that help to define the open space issue. What is the value Missoulians ascribe to open space? And what kinds of characteristics distinguish those who place higher or lower values on this important public resource?

1.2 Economic Basis of the Problem

People are willing to earn less income in order to enjoy some more valuable amenity. The Missoula area is a good example of this. High environmental quality, low crime rates, good schools, diverse recreational opportunities, a state university and numerous other amenities draw people to the area. Many could move to some other place and gain higher paying employment, but they choose to stay in
Missoula and enjoy the various amenities that the area offers. In staying, they are making an economic decision and revealing something about how they value these amenities. However, because the amenities come with the place as a bundle, it is difficult to sort them out and calculate a value for an individual amenity, such as open space or the low crime rate.

A way of getting around this problem of bundled amenities is to determine the value of a single amenity by asking or observing what individuals or households would pay to continue receiving that particular amenity. When open space is lost due to development, individuals lose the benefits they derive from various uses of that open space, such as view sheds, wildlife habitat, recreation potential and so on. Anticipating this loss of utility, an individual is willing to reallocate her resources and pay some amount to preserve all or part of the existing open space. The value of the amenity or resource is then the sum of the amounts that the population is willing-to-pay to preserve the resource.

One problem in determining an individual's willingness-to-pay (WTP) to preserve open space is the fact that it is not a regularly purchased market good. This is partially because open space is a relatively expensive commodity, along the lines of real estate, and few people have the individual resources with which to purchase it.
When there are mechanisms for people to pool their resources, they can be in the position to acquire open space collectively. This is what is done in the case of trust funds, such as the Nature Conservancy and the Rocky Mountain Elk Foundation, established for the preservation of open space and other environmental resources. These organizations take individual contributions, pool them, and use the resulting funds to purchase property or the rights to certain property uses, such as open space or wildlife habitat. In this way, a market for the public good does emerge, but to participate in this market one must have either relatively large resources, or be willing and able to pool resources with others.

However, even when a limited market of this type exists, and individual willingness-to-pay can be determined, it does not lead to the correct measure of value of the resource. This is because of the relatively small size of the market and important incentives which encourage people not to pay at the level they truly value the resource.

If open space is present, one cannot be excluded from enjoying it. This non-excludability is a defining characteristic of a public good. The other defining characteristic is non-rivalry. In the case of open space both are present, but non-excludability is the most
obvious. There are many who enjoy and derive benefits from the open vistas and riparian areas of the Missoula valley, yet they pay nothing to preserve and maintain these places. Individuals who enjoy the benefits of a public good, yet make no contribution towards its maintenance, are taking advantage of this non-excludability feature. They can be described as 'free riders'.

This 'free rider' problem is indicative of an economic inefficiency. People have no incentive to reveal through market purchases the true value they place on a public good like open space because they can receive the good for free. This market inefficiency makes it difficult for markets to determine an accurate value for the good in question and leads to inadequate provision of the good by the market.

Unfortunately, trust funds do not resolve the free rider problem. Even when trust funds are present there are still many people who receive benefits, but avoid paying for them. A consequence of a market which encourages free riders is an inefficient allocation of resources. Unless a way can be found to bring free riders into the market, there will be the provision of much less of the public good than the community would efficiently benefit from. This is not an uncommon situation. Getting free riders to participate

---

1 Non-rivalry refers to the situation where one person's consumption of a good does not diminish another person's ability to consume the same good. As in the case of open space, one person's viewing of a vista does not affect another person's ability to view the same vista.
in paying for an amenity often requires the participation of the government. One of the main reasons governments form is to insure that particular public goods, such as police and fire protection are provided in an economically efficient manner.

1.3 Local Efforts to Preserve Open Space

Development pressures in the Missoula valley have forced people concerned about open space to find ways to maintain the existing inventory of open spaces. This is done most directly by acquiring either the land in question or a conservation easement to the land. Other, less direct and more temporary measures involve zoning regulations and negotiations with developers.

Acquiring land or conservation easements comes about in three general ways. The first is a donation by the current owner of the land. This happens often and is generally motivated by the owners' desire to maintain the land in its current state. Such a gift can be carried out as an outright transfer of the land or as the assignment of a conservation easement to some trustee. The other two ways involve a purchase. Either a governmental entity, or a non-profit conservation organization, purchases the rights to the land. In the case of the government, the funds used are generally supplied by taxpayers; with conservation organizations the funds are raised through donations.
In the Missoula valley there are currently three organizations operating trust funds for preserving open space in some way. The largest is the Rocky Mountain Elk Foundation. While its focus is considerably broader than the Missoula valley, it has participated in some transactions in Missoula County where elk habitat was an issue. The second group is the Five Valleys Land Trust, which has participated in several transactions in Missoula County. Its focus is on preserving a mix of wildlife habitat and open areas for viewsheds and recreation. Save Open Space is the third group, which was formed most recently and has focused on lands which are adjacent to the Missoula urban area. Two other groups, the Montana Land Reliance and The Nature Conservancy, have much broader constituencies, but also provide the same general service of purchasing local land and conservation easements for environmental reasons.

In addition to the private organizations, in 1980 the city of Missoula, with voter approval, created a Conservation Bond for the purpose of purchasing park lands and open space. This was a $500,000 bond which passed after several attempts and was used to purchase both a conservation easement for the face of Mount Sentinel and land downtown along the riverfront, in the Hellgate Canyon and a small parcel on Mount Jumbo.

In the spring of 1994 the Missoula County Commission
voted to place on the June primary election ballot a new conservation bond. This measure would allow the commissioners to create $8 million of general obligation county debt to be repaid over ten years. If approved by the electorate, the bond revenue would be used to purchase property and easements for parks and open space.

In the June election the measure gained a majority of the vote (11,324 yes to 9,105 no, or 55.4 percent), but failed to pass since state law requires that for a simple majority to approve a general obligation bond at least 40 percent of the registered voters must participate in the vote. In the case that less than 40 percent of the registered voters participate, the bond must be approved by 60 percent of those voting. While over 40 percent of the registered voters turned out for the election, only 38 percent cast votes on the open space question.

Over the summer the County Commission was persuaded to again place the issue before the people, this time in the November 1994 general election. The general election results in November were 13,309, yes, to 20,179, no, or only 39.74% in support.

1.4 Proposed Research

The goals of this thesis are twofold. The first is to estimate true economic values for open space in the Missoula Valley and the North Hills of the Missoula Valley. Included
in this task is the development of a broader understanding of the demographic and attitudinal factors involved in valuing open space.

Since the contingent valuation (CV) method will be used to estimate those values, this study also provides the opportunity to examine an important issue regarding the CV method. A panel in a report to The National Oceanic and Atmospheric Administration (NOAA) recently recommended guidelines for CV studies and areas for additional research (Arrow, et.al. 1993). Among the areas for additional research is the situation where a real voter referendum can be used for comparison and validation of a CV study. The Missoula County Commission provided such an opportunity by placing the ten year, $8 million, open space bond on the June 1994 primary election ballot.

By conducting a CV study prior to the primary election the results of the CV can readily be compared with the results of the election. This comparison can help to determine if CV studies tend to estimate accurately the percentile levels of support. To help in using the June election as a validation procedure, an exit poll was conducted during the election regarding voters' views about open space.

1.5 Thesis Organization

This thesis is organized in four chapters, with eight
appendices. The second chapter provides a brief historical overview of the development of valuing public goods and in particular the contingent valuation methodology and its theoretical basis. This is followed by a more rigorous detailing of the dichotomous choice model and methods for calculating various values derived from the model.

Because the survey instrument is so central to a contingent valuation, the development and implementation of the survey used in this study is described in detail.

Chapter three focuses on the analytical results of the contingent valuation and exit poll and some of the nuances of the contingent valuation method.

Chapter four summarizes the results of this valuation of open space in the Missoula valley and draws conclusions about the strengths and weaknesses of this study and the contingent valuation method as it has been used in this study.
Chapter 2
Methodology

2.1 Introduction

This chapter will proceed with a brief history of the evolution of the CV method, a description of the methodologies used for calculating welfare measures, explanatory variables and a section on survey design and implementation.

The foundations for valuing public goods were laid by Alfred Marshall (1890) with his development of the welfare measure consumer surplus, and by John Hicks (1943) with the introduction of compensated demand and four more welfare measures, compensating and equivalent variations and surpluses. These theoretical measures of the value of public goods are widely accepted. The problem is in finding good empirical procedures to estimate these theoretical measures. One such method is CV.

Mitchell and Carson (1989) outline the early development of the CV method, beginning with the suggestion by Ciriacy-Wantrup (1947 and 1952), of direct interviews to determine natural resource values. In the early 1960’s Ph.D. candidate Robert K. Davis (1963), using interviews of Maine hunters and recreationists, actually estimated values for recreation. An assessment of the state of the art by Cummings, et al. (1986) summarizes the developments of the previous two decades and makes recommendations for the
future. The most recent comprehensive work regarding the CV method is the above mentioned synopsis by Mitchell and Carson (1989).

While CV studies have gained wide acceptance, particularly in the valuation of environmental public goods, there continues to be debate as to the validity of the technique. A recent articulation of the various points of view was published by American Economic Association with articles by Portney (1994), Hanemann (1994) and Diamond and Hausman (1994). One can reasonably anticipate that this discussion will continue for some time, particularly considering the magnitude of the values derived by CV studies with respect to environmental damage litigation.


Regarding the more specific issue of using an actual voter referendum as a validation for a CV, Carson, Hanemann and Mitchell (1987) provide the most direct example of this type of validation. An earlier work by Deacon and Shapiro (1975) using two California referenda lays some groundwork. Other work in the area is focused primarily on school levy

A CV study relies on data collected through a carefully formulated survey. The valuation questions in the survey are the key element in that they elicit the respondent's hypothetical willingness to pay for the particular attribute being valued. In this study the valuation questions are framed in a dichotomous choice, or referendum format. The responses are a simple yes or no to a particular bid level. This format closely resembles actual market transactions and is nearly identical to the question faced by a voter. As will be explained below, the yes or no responses can be used to calculate various welfare measures.

2.2 Estimation of Welfare Measures

The basic framework for valuing open space can be described using an expenditure function (Mitchell and Carson, 1989), such as equation 2-1,

$$ e(P,q,U) = Y, \quad (2-1) $$

where $P$ is a vector of prices, $q$ is a vector of fixed public goods, $U$ is a level of utility, and $Y$ is the minimum amount of income needed to maintain the utility level. Equivalent surplus (Hicks, 1943) is then the difference in the minimum amount of income required to maintain the utility level when the quantity of public goods is changed, as shown in equation 2-2.
\[ ES = [e(P_0, q_0, U_1) = Y_0] - [e(P_0, q_1, U_1) = Y_1] \quad (2-2) \]

\[ ES = Y_0 - Y_1 \]

The answers from a valuation question allow for the description of individual willingness-to-pay (WTP) or change in income required to maintain the current level of utility.

These answers, when using a dichotomous choice format, form a vector of "yes", "no" observations, which are a function of a vector of bid levels and a vector of other demographic or explanatory characteristics of the respondents. This relationship can be formulated as the probability \( \pi \) of a respondent accepting an offer \( t \) given the respondent's true willingness-to-pay \( W \) (Hanemann 1984 and Cameron 1988)

\[ \pi(t) = Pr(W > t) = 1 - F(t), \quad (2-3) \]

where \( F(\cdot) \) is a cumulative distribution function of the WTP values in the population.

If it is assumed that the WTP values have a logistic distribution (as is done in this study), then \( \pi \) can be reformulated as

\[ \pi(t; \mathbf{x}) = [1 + \exp(-\alpha t - \gamma' \mathbf{x})]^{-1}, \quad (2-4) \]

where \( \pi \) is the probability that an individual with the covariate vector \( \mathbf{x} \) (demographic variables, income and so on) is willing to pay the bid level \( t \), and the estimated parameters are \( \alpha \) and \( \gamma \).

From this, the logit equation (L), can be derived. \( L \) is the log of the odds of a "yes" to the valuation question
and p are the observed response proportions or percentiles (Duffield, et al. 1994),
\[ L = \ln[p/(1-p)] = \alpha t + \gamma'x \] (2-5)

Such a distribution might look like that in Graph 2-1.

Graph 2-1

2.2.1 Calculation of Household Mean Willingness-to-Pay

The estimated coefficients can be used to determine mean and median WTP of the sample. The logit reported below for the purpose of computing WTP is limited to a simple bivariate form, utilizing only bid level t and the respondent’s willingness to accept that bid level. The household mean willingness-to-pay is

\[ M = \int_0^\infty \left[ 1 + \exp(-\gamma_c (-\alpha_t \ln t)) \right]^{-1} dt \] (2-6)

where \( \alpha_t \) is the bid coefficient and \( \gamma_c \) is the constant coefficient (Hanemann, 1984). When \( \alpha_t \) is less than 0 (as in this study) the mean is infinite. Because of this, and the large effect a very limited number of high bids can have on the right hand tail of the logistic distribution and therefore the mean calculation, it is necessary to truncate the calculation at some point (Duffield and Patterson, 1991). Including the truncation simply changes equation (2-6) to
$$M = \int_0^Z [1 + \exp(-\gamma_c (-\alpha_t \ln t))]^{-1} dt \quad (2-7)$$

where $z$ is the point of truncation. Duffield and Patterson and others (Boyle, Welsh, and Bishop 1988 and Bowker and Stoll 1988) suggest using the highest bid amount or some percentile of the willingness-to-pay distribution as the truncation point. However in the case of this study, because of the large changes in the mean when truncated at different amounts, a more conservative truncation rule is utilized. To insure confidence in the truncation point the largest bid value with at least five "yes" observations was used.

2.2.2 Calculation of Percentile Measures

From the estimated distribution of the respondents' WTP, the equation for the amount, $\beta$, a particular percentile, $1-p$, would be willing to pay can be calculated as

$$\beta_p = \exp(\gamma_c/\alpha_t) [p/(1-p)]^{-1/\alpha_t}, \quad (2-8)$$

where $p$ is the percentile not willing to pay $\beta$. When $p$ equals 0.5, $\beta_p$ is the median WTP. In this case the term in brackets from equation (2-8) equals 1.

From equation (2-8) it is possible to predict the percentile support for a bond issue to provide the public good. If it is assumed that those households whose WTP is greater than the average tax increase will vote yes, then
the percent supporting a bond measure will be 1-p, where p
is the value which satisfies

\[ \Delta T = \exp \left( \frac{\gamma_c}{-\alpha_t} \right) \left[ \frac{p}{(1-p)} \right]^{-1/\alpha_t}, \tag{2-9} \]

and \( \Delta T \) is the average tax increase.

This is the basic procedure followed by Carson, Hanemann and Mitchell in their study using polling information to estimate a referendum result (1987). Their study focused on California Proposition 25 ("Clean Water Bond Law of 1984"), which if passed by the California electorate would have authorized a 20 year bond issue of $325 million, largely for the purpose of constructing sewage treatment plants. The debt service for the bond would have come from the state general fund. The cost (\( \Delta T \)) would have been approximately $4 per household for the next 20 years. Their estimate of voter support for the referendum, given their assumptions about the behavior of undecided voters, was quite accurate.

The approach followed by Carson, et al. requires an implicit assumption that all households pay the average tax increase of $4. If this is not true, there can be households whose WTP is greater than the average tax increase (and who should vote yes), but whose individual tax increase is greater than both the average tax increase and their WTP. Hence they will vote no. Similarly there may be households whose WTP is less than the average tax increase, but nevertheless vote yes if their individual tax increase
is small enough.

Thus the percentage support for any measure is not just a function of the joint distribution of WTP and mean tax increase, but of the distribution of WTP and the distribution of tax increases.

In this study payment of debt service is through a county-wide increase in property taxes. Because payment is though the property tax base, the distribution of tax increase depends on the distribution of house values. Therefore the distribution of willingness-to-vote yes is a function of the distribution of WTP and the distribution of house values. This is most directly calculated by using bond amount \( b \) in place of tax increase \( t \) in the logit equation, 2-5, as bond amount, being a function of tax amount and house value, incorporates both the distribution of WTP and the distribution of house values.

2.2.3 Explanatory Variables

The demographic and qualitative data from the survey can be utilized in a multivariate model. The elements of the covariate vector \( x \) in (2-5) are the values of the demographic and qualitative variables such as age, education, gender, income and so on. The estimated coefficients can be used to calculate the effect of the particular characteristic on WTP. This allows for the identification and quantification of characteristics of
those who are more or less likely to support the public good in question.

Estimated coefficients can be interpreted by transforming the coefficient, such that it provides an estimate of $\lambda_j$, the change in the odds of willingness to vote yes due to a one unit change in the variable $x_j$. Specifically,

$$\lambda_j = \exp(\gamma_j)$$

(2-10)

where $\gamma_j$ is the coefficient of the variable $x_j$ being interpreted. Values of less than one, one, or more than one indicate respectively that a factor reduces, does not change or increases the likelihood of a yes vote.

Another method for interpreting explanatory variables has been offered by Cameron (1988), who has shown that the estimated coefficients from the maximum likelihood estimates of the "logit" equation (2-5) can be reparameterized by dividing the coefficients by the estimated bid coefficient. This reparameterization allows for a simpler interpretation of the effect of the coefficients. The log-log coefficients can be used as elasticity point estimates of willingness-to-pay. A one percent change in the variable would result in a $\gamma_j/a_t$ percent change in willingness-to-pay. A reparameterized log-lin coefficient would indicate the percent change in willingness-to-pay due to a one unit change in the variable. The reparameterized bid variable $(k)$ is simply $1/a_t$. 
This study will use both methods.

2.2.4 Confidence Intervals

The confidence intervals for truncated mean and percentile measures are calculated using a bootstrap process (Krinsky and Robb 1986 and Duffield and Patterson 1991). A large number (2000) of random draws from a multivariate distribution defined by the estimated bivariate coefficients and the associated variance/covariance matrix are generated. For the mean each draw pair of coefficients is then used to calculate a mean using equation (2-4). The standard errors (SE) of the 2000 truncated means are then calculated and entered into the equation

\[ CI_M = \pm SE_M \times t_{0.05/2, n-k}, \]  

(2-11)

where \( t \) is the t-statistic at the 95 percent confidence level, unless otherwise noted.

The confidence interval for the median is calculated similarly. By equation (2-8), the median WTP is

\[ \beta_{0.5} = \exp(\gamma_c/-\alpha_t), \]  

(2-12).

Standard errors are then calculated from the iterations of \( \beta_{0.5} \) which are derived from the iterations of \( \gamma_c \) and \( \alpha_t \) entered into equation (2-12). The standard errors of \( \beta_{0.5} \) are entered into the equation

\[ CI_\beta = \pm SE_\beta \times t_{0.05/2, n-k}, \]  

(2-13).
The confidence interval for the percentile measure is arrived at using a similar methodology. The random draw iteration process is the same. Then each draw pair of coefficients is entered in the equation

\[ \beta_{bid} = \frac{100}{1 + \exp(\gamma_c + (\alpha_t \times \ln \text{bid}))} \]  

(2-14)

where bid is the particular point for which the evaluation is desired (generally the amount required for a particular electoral measure) and corresponds to a particular percentile level of no votes. Standard errors are calculated for the iterations of \( \beta_{bid} \), and then entered into equation (2-13).

The confidence interval for the change in the odds of the explanatory variables is calculated with equation (2-15) (Hosmer and Lemeshow 1989):

\[ \text{CI}_{\lambda_j} = \exp(\lambda_j \pm z_{1-.05/2} \times SE(\lambda_j)) \]  

(2-15).

While the reparameterization for elasticity estimates is fairly straightforward, calculating standard errors is somewhat more complicated. Krinsky and Robb (1986) have shown how this can be done using the estimated asymptotic covariance matrix from the original parameterization. This involves calculating the variance of the reparameterized coefficient by

\[ \text{Var}(k) = (1/\alpha^4) \text{var}(\alpha) \]

\[ \text{Var}(\gamma_j/\alpha_t) = (\gamma_j^2/\alpha^4) \text{var}(\alpha) - 2(\gamma_j/\alpha^3) \text{cov}(\alpha, \gamma_j) + (1/\alpha^2) \text{var}(\gamma_j) \]  

(2-16)
From this standard errors are readily calculated by

\[ SE_{\gamma_j/a} = \sqrt{\text{var}(\gamma_j/a)} \]  

and the confidence interval follows from equation (2-13).

2.3 Survey Design

The survey instrument developed for this study has four elements: the introduction, non-controversial demographic and familiarity questions, valuation scenarios and potentially controversial demographic questions. Each of these elements is discussed below.

2.3.1 Survey Introduction

Prior to the implementation of the survey, letters of introduction were sent to all respondents in the sample for whom addresses could be acquired\(^2\). This was done both to increase participation in the survey (Dillman 1978) and to encourage respondents to begin thinking about open space and how they would value it. The letter briefly described the survey and included an aerial photograph of the Missoula Valley. The photograph highlighted specific threatened open spaces areas to help with orientation and identification.

The survey\(^3\) began by making sure the interviewer had

\[^2\] The timing and content of the letter is discussed below in section 2.4 Survey Implementation. For a copy of the letter see Appendix 1.

\[^3\] See appendices 2.1 and 2.2 for copies of the survey.
contacted the right household\textsuperscript{4}. If not, the phone number and name of the desired respondent were confirmed and the interviewer apologized for any inconvenience. In the case of wrong or changed numbers, efforts were made to find the correct phone number.

Respondents were then asked if they had received the introductory letter. If not the interviewer explained that it was a simple introduction and not necessary for the interview. In order to maintain gender balance in the survey, the interviewer asked to speak with the person in the household who had had the most recent birthday. If this was a different person than the person who initially answered the phone the new person was asked if she or he had read the introductory letter. The interviewer also asked if it was a convenient time to do an interview, and if not, when would be a better time. This was followed by a brief introduction stating that the interview would take about ten minutes\textsuperscript{5}, that all information was voluntary, confidential and would only be used for this study, and asked if the respondent had any questions.

\textsuperscript{4} While the sample selection must necessarily focus on individuals, the analysis uses households. Once the right household has been contacted using the individual in the initial sample, the interviewer identified the appropriate individual within the household.

\textsuperscript{5} As experience was gained with interviews it was found that they generally took about fifteen minutes, so interviewers were asked to change the ten to fifteen in the introduction.
2.3.2 Non Controversial Demographic Questions

To begin the survey several easy and non-threatening questions were asked, such as the number of years lived in Missoula, years lived at current residence, number of children living at home, and whether the respondent lived in the city, was registered to vote and intended to vote in the primary election.

These were followed by three familiarity questions. Respondents were asked if they were "Very Familiar", "Somewhat Familiar", "Not Very Familiar" or "Not At All Familiar" with a particular aspect of open space. The first of these inquired about familiarity with recent open space developments, the second about conservation easements and the third about the 1980 City of Missoula Conservation Bond.

These questions served two purposes. The first of these was to educate respondents with regard to terms which would be used later in the survey. The second was to measure characteristics of respondents that might affect the evaluation of open space.

2.3.3 Valuation Scenarios

One of the keys to a successful CV survey are the valuation scenarios. These are the series of statements and questions in which respondents are asked whether they would be willing to pay a tax or make a contribution of some amount in order to assure the provision of a public good. A
valuation scenario must provide the respondent with a clear description of the good being valued, the payment mechanism and how much it will cost. In this study two different methods of payment, or payment vehicles, were used: a tax increase and a contribution to a trust fund.

Because of the potential for respondent fatigue, a questionnaire is limited in the number of valuation scenarios which can be presented. The survey implemented for this study has three valuation scenarios, two using a tax increase as the payment vehicle, and one using a trust fund contribution as the payment vehicle.

2.3.3.1 Embedding

A potential problem with the CV method is the so called "embedding" effect, which is the tendency on the part of respondents to answer valuation questions without placing the question in the context of their own limited budget, and to not distinguish between different quantities of the good being valued (Kahneman and Knetsch 1992 and Loomis, Lockwood and DeLacy 1993). An important part of any CV survey instrument is to remind the respondents of the real life budget constraints they face and the other types of goods they may wish to purchase with their limited budget. One method of doing this is to precede the actual valuation

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6 This point is emphasized repeatedly in the literature, particularly note Arrow, et al. (1992) and Mitchell and Carson (1989).
question with one or two questions which remind respondents of trade-offs they must make in order to devote additional resources to the good being valued in the survey.

The survey instrument accomplished this by first asking respondents to assign a level of importance to a series of common governmental expenditures, including open space. This question was followed by a similar level of importance question regarding five distinct unprotected open space areas in the county.

2.3.3.2 Bid Levels and Distribution

One important aspect of a dichotomous choice CV is varying the bid level across the sample. In the case of a property tax payment vehicle this creates a complication in that different bond amounts imply different millage increases, and for each level of millage increase the actual tax increase varies, based on house value. Therefore, in order to provide respondents with an accurate estimate of the tax increase they would face due to a particular bond level for open space preservation, it was necessary to determine the value of each respondent’s home. This was done by asking how much the respondent thought their house would sell for if they were to sell it in the next month. The interviewer read from a table a list of house value ranges, and circled the value the respondent chose. In the case of renters the ranges were in monthly rent.
In an open ended pretest\(^7\), a class of economics students was asked how much they would be willing to contribute in terms of a tax increase and in terms of a contribution to a trust fund to preserve the North Hills. The mean for the tax increase was $59 and for the trust fund question was $52. Based on an average home value in Missoula of $61,300, the $59 for a tax increase would equate to a 25 mill increase\(^8\). Intuitively this value seemed quite high for an acceptable tax increase for the county population at large.

Other research into recent electoral history indicated that mill levy increases for economic development, local government buildings and school facilities of much smaller millages had had difficulty in gaining voter approval. Based on this and the fact that open space advocates were discussing bond amounts from $5 to $25 million, five bond levels were chosen for each of the property tax payment vehicle questions, $1 million, $4 million, $8 million, $15 million and $25 million.

Because actual tax increase is a function of bond level or mills levied, and house value, the survey required a

\(^7\) See appendix 3 for a copy of the pretest questionnaire.

\(^8\) The mean value of $61,300 was provided by the Missoula County Assessors office. This value is then multiplied by the tax rate for residences (3.86 percent), which results in the taxable value, which is then multiplied by a mill (1/1000th). The result is the tax increase required for a one mill increase in taxes on the average Missoula home, $2.37. This number was then divided into the average willingness to pay to arrive at the 25 mill figure.
mechanism for the interviewer to calculate the tax increase for an individual respondent after the respondent had provided the interviewer with his or her house value (or monthly rent). This was done using Table 2-1, below.

TABLE 2-1: House Value, Bond Amount and Tax Increase for a County-wide Bond

<table>
<thead>
<tr>
<th>BOND AMOUNT (in millions)</th>
<th>1</th>
<th>4</th>
<th>8</th>
<th>15</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAX INCREASE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. $0-$40,000</td>
<td>$2</td>
<td>$7</td>
<td>$14</td>
<td>$26</td>
<td>$43</td>
</tr>
<tr>
<td>2. $40,000-$60,000</td>
<td>$3</td>
<td>$10</td>
<td>$21</td>
<td>$39</td>
<td>$65</td>
</tr>
<tr>
<td>3. $60,000-$80,000</td>
<td>$3</td>
<td>$14</td>
<td>$28</td>
<td>$52</td>
<td>$86</td>
</tr>
<tr>
<td>4. $80,000-$100,000</td>
<td>$4</td>
<td>$17</td>
<td>$35</td>
<td>$66</td>
<td>$108</td>
</tr>
<tr>
<td>5. $100,000-$125,000</td>
<td>$5</td>
<td>$22</td>
<td>$43</td>
<td>$82</td>
<td>$135</td>
</tr>
<tr>
<td>6. $125,000-$150,000</td>
<td>$6</td>
<td>$26</td>
<td>$52</td>
<td>$98</td>
<td>$162</td>
</tr>
<tr>
<td>7. $150,000-$200,000</td>
<td>$8</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$216</td>
</tr>
<tr>
<td>8. $200,000-$500,000</td>
<td>$21</td>
<td>$87</td>
<td>$174</td>
<td>$328</td>
<td>$540</td>
</tr>
<tr>
<td>9. $500,000-$1,000,000</td>
<td>$42</td>
<td>$174</td>
<td>$347</td>
<td>$656</td>
<td>$1081</td>
</tr>
<tr>
<td>10. Greater than 1 mil</td>
<td>&gt;$42</td>
<td>&gt;$174</td>
<td>&gt;$347</td>
<td>&gt;$656</td>
<td>&gt;$1081</td>
</tr>
</tbody>
</table>

The values in the table were arrived at by taking the mills required for the particular bond amount and multiplying that number by the higher value in each range, the residential tax rate (3.86 percent) and dividing by 1000. The tax increase amounts were then rounded to the nearest dollar.

Since there are five bond amounts for each of the two tax increase questions, there are a total of twenty five potential combinations for the two questions. Using the initial sample of 541, this yields 21 or 22 copies of each combination.

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9 These millage amounts were provided by Missoula County budget staff.
To identify the bond amount to be used in a particular interview the bond amount and column of tax values below it were systematically highlighted in different colors to indicate the tax increase to be used in each question.

Using the answer to the house value question the interviewer circled the reported house value. The value in this row of the highlighted column is the respondent’s tax increase, which is also circled by the interviewer and used in the next question, the valuation question.

A similar table was established for renters, the only difference being the left hand column, which was calibrated in monthly rent as opposed to house value. An assumption was required to correlate monthly rent and house value. This was the property management rule of thumb that monthly rent ought to be one percent of house value. To check this rule we also calculated what rents would be, assuming interest payments, insurance costs and profits. The results were roughly the same amounts as the rule of thumb.

2.3.3.3 Valuation Questions

The heart of any valuation scenario is the valuation question. The survey contained three valuation questions. Each question utilized a different payment vehicle or resource to be valued.

The survey was conducted in March 1994. Because of the impending primary election and county-wide vote, in June, on
the $8 million bond for open space, it was appropriate to ask a valuation question which replicated the actual voter referendum. This would allow the use of the referendum results as a validation procedure for the survey results.

This question was asked in exactly the same form that it was to appear on the ballot.

Earlier this month the Missoula County Commissioners placed on the June 1994 ballot a new conservation bond proposal with the following ballot language, "for the purpose of, establishing and funding the Missoula County Open Space Acquisition Fund, which shall be used to acquire interests in or rights in property including land and water, that will provide a means for the preservation of significant open space land or the preservation of native plants or animals, or park or recreational purposes, or geological or geographical formations of scientific, historic, aesthetic or educational interest in Missoula County and to pay the costs associated with the issuance of the bonds."

22. Keeping in mind your household budget. Suppose that this new conservation bond were for $____ million, and knowing that approval of the bond would increase your property taxes by $____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
   1. FOR
   2. AGAINST
   3. NOT VOTE AT ALL

In a further effort to address the embedding issue the question also reminds the respondent "Keeping in mind your household budget".

The difficulty with a county-wide referendum question is that the quantity of open space which would be acquired or preserved is ill-defined. It is not clear how much of what kind of open space can or will be purchased for $8
million. However, since the actual vote was to be used as a validation procedure it was necessary to follow the precise wording on the primary election ballot.

A second referendum type question was also asked. However, it was limited to a specific area, the North Hills, so as to fix, or hold constant, the quantity being examined. Immediately preceding the North Hills question the respondent was asked if they understood where the North Hills were located. This was done to insure that respondents clearly understood the area they were being asked to value.

Another potential issue regarding CV is question order (Boyle, Reiling and Phillips 1990 and Boyle, Welsh and Bishop 1993). To detect any question order bias the survey was divided into two versions. Version one asked the Missoula County bond referendum question first and the North Hills bond referendum question second; version two reversed this order.

Following each of the two tax increase questions respondents were asked what was their main reason for voting the way they did. The responses to this question can be used to examine protest votes and general voting motivations.

The third valuation scenario kept the North Hills as the fixed quantity and used a different type of payment vehicle: a voluntary contribution to a trust fund for
acquiring property and conservation easements to the North Hills. This question was preceded by two questions. First in order was a familiarity question designed to make sure that respondents understood what a trust fund was. Second, respondents were asked how much if anything they contributed to environmental or conservation organizations or causes in 1993. This question was asked to address the embedding issue and remind respondents of others types of contributions they made with their conservation dollar.

2.3.4 Potentially Controversial Demographic Questions

A number of questions were saved for the end of the questionnaire because respondents sometimes object to them and cut off the interview. These questions regarded occupation, age, membership in environmental organizations, education, and income.

Finally respondents were asked if they had anything else they would like to add concerning either open space or the survey.

2.4 Survey Implementation

In order to be representative, a random sample of the population, in this case voting age adults living in Missoula County, was taken. This was done by systematically drawing names from the Missoula and Western Montana phone book (U.S. West 1994). The procedure used was to take the
name at the bottom of each column in areas included in the county. If the name at the bottom of the column belonged to a business, the fifth name above would be taken. If that name was also a business, then the fifth name above was used, and so on. If no residential number was arrived at in the column using this procedure the column was skipped. If a name was drawn that did not lie within the county (various sections of the phone book include areas both in and out of the county) the column was also skipped. The initial sample contained 541 names and phone numbers.

As noted above, a letter briefly explaining the survey was sent on March 17 to every member of the sample for whom there was an address. Beginning on March 21 and continuing through April 2, interviews were conducted by phone, generally from 6 to 9 p.m. Interviews were conducted primarily from the offices in the Economics Department at the University of Montana. A small number of interviews were conducted from the home of the interviewer to accommodate a limited number of interviewers and respondents. Interviews generally took about 15 minutes. Phone numbers from the sample were called repeatedly until a contact was made. Several times respondents asked to be called back at a specific time. This request was accommodated as often as possible. On March 29th messages were left for those potential respondents who had an

10 See appendix 1.
answering machine, but had not been contacted\textsuperscript{11}. This resulted in three respondents returning the call and agreeing to be interviewed. Table 2-2 summarizes the disposition of the original 541 surveys.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|}
\hline
\textbf{Category} & \textbf{Value} \\
\hline
Completed Interviews & 343 \\
\hline
Refusals & \\
No Reason Given & 68 \\
Sick or Aged & 12 \\
Unable to Reach & \\
No Answer & 27 \\
Answering Machine & 20 \\
Language Difficulty & 3 \\
\hline
Sub-total of Potential Respondents & 473 \\
\hline
Excluded from Sample & \\
Business & 3 \\
Moved from County & 11 \\
Disconnected Number & 42 \\
Lost Surveys & 12 \\
Sub-Total & 68 \\
\hline
Total Original Sample & 541 \\
\hline
Cooperation Rate & 81.1\% \\
Completion Rate & 72.5\% \\
\hline
\end{tabular}
\caption{Completion and Response Rate Statistics}
\end{table}

Removing those who did not live in Missoula County, the businesses, the disconnects and the lost surveys from the original sample left a working sample of 473. The completion rate (completions divided by sample) was 72.5\%.

\textsuperscript{11} See appendix 4 for the text of the answering machine message.
percent and the cooperation rate (completions divided by completions and refusals) was 81.1 percent. 17.5 percent of the sample refused to participate and 9.9 percent were not contacted. The two week time span for interviews and the persistent number of call backs explain the relatively good cooperation and completion rates. By standard practice, these completion rates are acceptable and should provide valid estimates.

A comparison with U.S Census data for Missoula County shows that the sample of respondents was also reasonably representative of the gender and place of residence of the population in the county. According to the U.S. Census (1990), 81.2 percent of the people living in Missoula County live within the urban area. Of the respondents to the survey, 82.6 percent lived in the urban area. Also, based on the 1990 Census, the gender mix in Missoula County is 50.8 percent female. 47.5 percent of the respondents to the survey were female.

Forty-three individuals participated as interviewers; they all took part in a 30 to 45 minute training session prior to conducting any interviews. The training session included a brief discussion of the objectives of the survey; cautions about introducing bias and leading respondents; cautions about respondent confidentiality; a review of
questions the respondent may have about the survey\(^{12}\); and a practice run through the survey with another interviewer. Interviewers were volunteers from either the Economics department or the group Save Open Space.

Because of the large number of interviewers a test was run to detect any interviewer bias. A dummy variable for each interviewer was run with the bivariate model. A significant \( t \) statistic for the dummy variable coefficient would indicate interviewer bias. None of these \( t \) statistics was significant even at the 80 percent confidence level.

### 2.5 Exit Poll

Because of a concern that voters might tend to overestimate their respective tax increase attributable to passage of the open space bond, an exit poll was conducted on the day of the primary election\(^{13}\). The poll was designed following the recommendations of Levy (1983) and Nadler (1981). Four polling places (Lolo, Meadow Hill, Paxson and Hellgate Elementary), representing a cross section of Missoula County, were used. Interviews were done from 8 to 10 a.m., noon to 2 p.m. and 5 to 7 p.m. to avoid creating bias by over sampling particular demographic

\(^{12}\) See appendix 5 for a copy of "WHAT THE RESPONDENT MAY WANT TO KNOW ABOUT THIS SURVEY", a list of questions and answers about the survey. Each interviewer was given a copy of this sheet for quick reference if asked any questions.

\(^{13}\) See appendix 6 for a copy of the exit poll survey instrument.
groups, such as people who work or senior citizens (Busch and Lieske 1985). Respondents were asked how they voted on the open space bond, their house value and what they believed would be the increase in their taxes if the open space bond were to pass. A limited number of demographic questions were also asked.
Chapter 3

Analysis of Results

3.1 Median and Mean Willingness-to-Pay

Table 3-1 reports household median and mean WTP, the resulting county-wide WTP\textsuperscript{14} and the range of the confidence interval for the county-wide willingness-to-pay, for each of the three valuation questions asked.

The estimate for the ten year annual value of open space in Missoula County is $1,706,385 plus or minus $175,832. This can be compared to the maximum annual contribution for the $8 million open space bond levy, which is $1.2 million for each of ten years (9 mills\textsuperscript{15} x $136,000,000 county-wide taxable value). This indicates that Missoula County residents place considerably higher value on open space than what is required for the $8 million open space bond.

\textsuperscript{14} County-wide willingness-to-pay is generated by multiplying the number of households in the county (28,722) as determined by the U.S. Census (1990) by the mean household willingness-to-pay for the valuation being used.

\textsuperscript{15} It should be noted that in this analysis and in the survey 9 mills was used as the millage required for an $8 million bond. This amount was arrived at after conversations with Missoula County budget personnel. In the course of the Primary election the county and open space advocates used approximately 7.5 mills for tax increase calculations, based on the assumption that the entire $8 million bond authority would not be used immediately.
TABLE 3-1: Bivariate Logit Model: Coefficients, Medians and Means

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Asymptotic t-statistic</th>
<th>Median</th>
<th>Truncated Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>County-wide Valuation (county-wide tax increase)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMTX*</td>
<td>-0.31683</td>
<td>0.09209</td>
<td>-3.4404</td>
<td>$77.60</td>
<td>$59.48</td>
</tr>
<tr>
<td>Constant</td>
<td>1.3787</td>
<td>0.32102</td>
<td>4.2946</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County-wide Total=$1,708,385 with a CI of ±$175,832</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio Test</td>
<td>12.528</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Hills Valuation (county-wide tax increase)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LNTX*</td>
<td>-0.43203</td>
<td>0.090165</td>
<td>-4.7915</td>
<td>$15.23</td>
<td>$29.31</td>
</tr>
<tr>
<td>Constant</td>
<td>1.1766</td>
<td>0.30139</td>
<td>3.9038</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County-wide Total=$841,842 with a CI of ± $96,501</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio Test</td>
<td>25.0927</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Hills Valuation (trust fund contribution)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTAMT*</td>
<td>-0.81276</td>
<td>0.10218</td>
<td>-7.9543</td>
<td>$16.14</td>
<td>$34.61</td>
</tr>
<tr>
<td>Constant</td>
<td>2.2604</td>
<td>0.37526</td>
<td>6.0235</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County-wide Total=$994,068 with a CI of ± $146,254</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio Test</td>
<td>84.3153</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N=343

LMTX, LNTX and LTAMT are respectively the log of the dollar bid amounts (tax increase or contribution) for Missoula County open space, North Hills open space and North Hills open space paid for with a trust fund contribution.

As previously noted, the county-wide tax increase question suffers from the fact that the quantity of open space to be acquired is not clearly defined. This implies that county residents are willing to pay $1.7 million a year

16 Using the rule noted above, the amounts for truncating the mean for the county-wide open space referendum, the North Hills referendum and the North Hills contribution are respectively $108, $65 and $100. In the case of the North Hills referendum there were only three yes votes at $65. However, there were also bids at $66 and $69. Collectively the three bid levels had eight yes votes. Because these bids are grouped so closely together they were treated as one bid for the truncation decision.
for the next ten years for open space without knowing with any specificity what that amount will purchase. The lack of a fixed amount of open space to be preserved did not deter a significant number of respondents from voting for the program. This indicates a strong desire for even an open ended program and a high level of confidence in the ability of the county commissioners to adequately manage the program.\textsuperscript{17}

Table 3-1 also lists the mean and median values for the two North Hills valuations. While the values appear to be relatively close to one another it is important to emphasize the different time frames of the two questions. The referendum question is an \textit{annual} tax increase for ten years, the trust fund question is for a \textit{one time} contribution. This indicates that the referendum payment vehicle yields a much higher total value (over time) than the trust fund contribution payment vehicle.

Based on the discussion in Chapter 1 about "free riders" and efficient markets, this result is not surprising. A valuation which includes the values of all individuals who benefit from open space is bound to be higher than one that includes just those who are willing to make a voluntary contribution.

\textsuperscript{17} In TABLE 11: Reason for Vote Choice, the differences between the county-wide open space bond and the North Hills bond in the categories "Indefiniteness of the Proposal" and "Mistrust of Government" indicate that even fewer people had what could be summarized as "trust" problems in the well defined North Hills valuation.
3.2 Predicting Election Results

From the distribution of WTP, the percentage of the population which would support an open space bond can be calculated as a function of the bond amount.

The curve labeled **Tax Increase** in Graph 3-1, shows for a county-wide open space bond this relationship between bond amount and willingness to vote yes, on the assumption that all households pay the average increase implied by the bond. This is the procedure followed by Carson, et al (1987). On the right axis are the average dollar amounts households would be required to pay for the corresponding bond amount on the left axis. The curve labeled **Bond Increase**, depicts the same relationship when bond amount \( b \) is used as the independent variable in the equation for estimating willingness-to-vote yes. As discussed in section 2.2.2 Calculation of Percentile Measures, it reflects both the distributions of WTP and house values.

This graph was developed from those respondents who were both registered to vote and planned to vote in the primary. Of this sub-sample, respondents who chose "NOT TO VOTE" on the referendum question were assumed to have voted "NO". The model with these assumptions predicts a 62.3 percent majority in favor of an $8 million open space bond when tax increase is used as the bid variable. When bond amount is used as the bid variable, rather than tax increase, the model predicts a 58.5 percent majority. The
confidence intervals for both of these estimates is plus or minus 6 percent. The actual ballot measure received 55.4 percent support. So the vote using b was inside the confidence interval generated by a 95 percent confidence standard, and using t, was just outside the confidence interval. In this case, using bond amount as the independent variable provides a closer estimate of actual voting behavior. As discussed above, in section 2.2.2 Calculation of Percentile Measures, bond amount is the theoretically correct variable for making the calculation. This conclusion is supported by results of two estimates.

The Bond Increase curve also indicates that even as
much as a $19 million dollar bond would receive a majority vote. However this prediction must be tempered by the size of the confidence interval (plus or minus 6 percent). There is a high level of confidence that up to a $10 million bond would pass. However, to go much higher would push the 50th percentile into the lower end of the confidence interval.

The model, using bond amount, predicted fairly accurately the result of the June vote. This is encouraging news for proponents of the CV method. However, interest in the CV method is primarily focused on estimating valuations, not voting behavior. What do these results tell us about the accuracy of the valuation done in section 3.1 Median and Mean Willingness-to-pay?

The vote prediction analysis indicates that for voting behavior the design and implementation of the survey\textsuperscript{18}, and the censored logistic regression used to analyze the data generated accurate results. While it is not possible to make a statistical extrapolation from the accuracy of the voter prediction to the accuracy of the valuation based on tax increase, the results at least buttress the case for the CV method. Theoretically respondents reveal their WTP through their acceptance or disapproval of a particular tax increase. It is that amount which is the key to their decision, and that amount which is the basis for estimating

\textsuperscript{18} Also see section 3.8 Exit Poll regarding similarities in responses from the CV sample and the exit poll respondents.
a valuation. In the case of voter prediction, it is bond increase which is correctly analyzed, but again the basis for respondents' decisions are principally tax increase, which is functionally related to bond increase through house value. It is necessary to modify tax increase to millage or bond amount for the voter analysis, but tax increase is driving the voter decision.

Related to the question of accuracy is the variation of the confidence interval over the range of the vote

![Graph 3-2](image-url)
prediction. As can be seen in Graph 3-2, the confidence interval is relatively consistent in the area of greatest interest, an $8 million bond. This is a function the $8 million bond amount being at the center of five bid levels asked in the survey. The confidence interval becomes wider at bid levels where fewer respondents were sampled.

As noted above, another open space bond proposal was placed on the November ballot following its technical failure on the June ballot. In the November election the issue failed by a wide margin (40 percent to 60 percent). This apparent reversal of voter support raises the question of which, if either election should be used as a validation measure for the open space CV.

It is possible that the presence of, and debate about, five other tax related referendum measures on the November ballot heightened voters' sensitivity to tax issues, focusing more interest the cost side of the open space issue. It should not be surprising that the value of a public good would change over time, though a shift of the magnitude indicated by the two votes, only five months apart, seems to be particularly large.

An examination of demographic differences between primary election voters and general election voters\(^\text{19}\) offers relatively little in the way of an explanation for

\(^{19}\) The Primary vs. General demographic data that is used in this section was generously provided by the Montana State Democratic Party.
this large change in voter preferences. Women tend to have a higher voter participation in primary elections than men by 55 to 45 percent. In general elections this imbalance is reduced to 52 to 48 percent. Since women are more likely to vote for open space (see section 3.3 Explanatory Variables), this will make a general election bond slightly more difficult to pass. However, it would be very unlikely that this change in voter demographics could explain a 15 percent change in voter preferences. Other demographic variables for which there were differences between primary and general populations were not shown to be significant as explanatory variables.

Another possibility is that only people with strongly held opinions voted in the primary, and those voting only in the general election, while not feeling strongly about it, tended to oppose the open space bond. On the other hand the CV survey was conducted much closer in time to the primary election, which therefore is a better reference point.

The results of the elections indicate the volatility of electoral actions, and particularly the effects of other issues on the ballot, possibly creating information and question order biases. These issues suggest some drawbacks to using elections as validation measures for CV studies.

Graph 3-3, depicts the relationship between bond amount and willingness to vote yes on a strictly North Hills bond. The median value for a North Hills bond is $3.45 million.
Calculated at the $2 million bond level, the bond would receive 55.3 percent of the vote plus or minus 8.9 percent.

![Graph 3-3](image)

Using the lower limit of the confidence interval, one would conclude that up to a $1.2 million bond to preserve open space on the North Hills would receive a majority vote.\(^{20}\)

3.3 **Explanatory Variables**

The survey included the collection of data on several demographic and qualitative household variables that can be

\(^{20}\) This conclusion should be tempered by the fact that such a small bond might encounter opposition simply because of its small size and proportionately high implementation costs.
used to build a statistical model to explain WTP.

Table 3-2 lists the variables and their definition.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMTX</td>
<td>the log of the bid (tax increase) for the county-wide open space bond</td>
</tr>
<tr>
<td>LNTX</td>
<td>the log of the bid (tax increase) for the North Hills only bond</td>
</tr>
<tr>
<td>LTAMT</td>
<td>the log of the bid (contribution) for the North Hills only trust fund</td>
</tr>
<tr>
<td>DLTR</td>
<td>dummy variable with 1, received introductory letter; 0, did not receive letter</td>
</tr>
<tr>
<td>LYMS</td>
<td>the log of the number of years lived in Missoula</td>
</tr>
<tr>
<td>LNUP</td>
<td>the log of the number of people living in the household</td>
</tr>
<tr>
<td>DZIP</td>
<td>dummy variable with 1, lives in urban area (zip=59801, 59802 or 59803); 0 lives in rural part of county</td>
</tr>
<tr>
<td>DCHI</td>
<td>dummy variable with 1, has children; 0 does not</td>
</tr>
<tr>
<td>DOSI</td>
<td>dummy variable with 1, very or somewhat familiar with open space issues; 0, not very or not at all familiar with open space issues</td>
</tr>
<tr>
<td>DCBND</td>
<td>dummy variable with 1, very or somewhat familiar with the 1980 city of Missoula Conservation Bond; 0, not very or not at all familiar with the 1980 bond</td>
</tr>
<tr>
<td>DRENT</td>
<td>dummy variable with 1, renter; 0, homeowner</td>
</tr>
<tr>
<td>LVAL</td>
<td>the log of the value of the home</td>
</tr>
<tr>
<td>DENVEM</td>
<td>dummy variable with 1, belongs to an environmental organization; 0, does not</td>
</tr>
<tr>
<td>DEDU</td>
<td>dummy variable with 1, finished college; 0, did not finish college</td>
</tr>
<tr>
<td>DSEX</td>
<td>dummy variable with 1, female; 0, male</td>
</tr>
<tr>
<td>LAGE</td>
<td>the log of the age of the respondent</td>
</tr>
<tr>
<td>DOCC</td>
<td>dummy variable with 1, employed in development industry (construction or real estate); 0, not employed in development industry</td>
</tr>
<tr>
<td>LIN</td>
<td>the log of the annual household income</td>
</tr>
<tr>
<td>DSNH</td>
<td>dummy variable with 1, can see the North Hills from current residence; 0 cannot see North Hills</td>
</tr>
</tbody>
</table>

The effect of the variable on the change in the odds of willingness-to-vote-yes and the confidence interval at the 95 percent level of the change in the odds is reported in Table 3-3.

The interpretation of the change in the odds is described in section 2.3.3 Explanatory Variables. As an example, the model predicts that for a person who has
finished college (DEDU), the odds that that person will vote yes to a given tax increase are 2.32 times that of someone who has not finished college. In the case of having children (DCHI), one is only 0.5 times as likely to vote yes as someone who has no children.

Because the values reported estimate a specific change in the odds, the confidence interval is helpful in indicating the degree of confidence the model has in that estimate. The confidence interval indicates the range, with 95 percent confidence, within which the true value will lie. The larger the confidence interval around the true value, the less the confidence in the point estimate.
### TABLE 3-3: Full Model for County-wide Open Space Based on a County-wide Bond Change in the Odds of Willingness-to-Pay

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Asymptotic t-Statistic</th>
<th>Change in Odds</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMTX</td>
<td>-0.3717</td>
<td>0.12052</td>
<td>-3.0840(^1)</td>
<td>0.68956</td>
<td>0.544, 0.873</td>
</tr>
<tr>
<td>DLTR</td>
<td>0.53937</td>
<td>0.28082</td>
<td>1.9207(^3)</td>
<td>1.71493</td>
<td>0.989, 2.974</td>
</tr>
<tr>
<td>LYMNS</td>
<td>-0.059278</td>
<td>0.13310</td>
<td>-0.44537</td>
<td>0.94245</td>
<td>-0.320, 0.202</td>
</tr>
<tr>
<td>LNUPS</td>
<td>0.46782</td>
<td>0.32744</td>
<td>1.4287</td>
<td>1.59651</td>
<td>-0.174, 1.110</td>
</tr>
<tr>
<td>DZIPS</td>
<td>-0.31041</td>
<td>0.37119</td>
<td>-0.83627</td>
<td>0.73314</td>
<td>0.354, 1.518</td>
</tr>
<tr>
<td>DCHI</td>
<td>-0.68801</td>
<td>0.35412</td>
<td>-1.9429(^3)</td>
<td>0.50257</td>
<td>0.251, 1.006</td>
</tr>
<tr>
<td>DOSI</td>
<td>0.69637</td>
<td>0.31603</td>
<td>2.0352(^2)</td>
<td>2.00646</td>
<td>1.080, 3.728</td>
</tr>
<tr>
<td>DCBND</td>
<td>0.57230</td>
<td>0.28994</td>
<td>1.9739(^2)</td>
<td>1.77234</td>
<td>1.004, 16.758</td>
</tr>
<tr>
<td>DRENT</td>
<td>0.54019</td>
<td>0.37536</td>
<td>1.4391</td>
<td>1.71634</td>
<td>0.822, 3.582</td>
</tr>
<tr>
<td>LVAL</td>
<td>0.037947</td>
<td>0.28993</td>
<td>0.13088</td>
<td>1.03868</td>
<td>-0.530, 0.606</td>
</tr>
<tr>
<td>DENVEM</td>
<td>0.58802</td>
<td>0.33620</td>
<td>1.7490(^3)</td>
<td>1.80042</td>
<td>0.931, 3.480</td>
</tr>
<tr>
<td>DEDU</td>
<td>0.84232</td>
<td>0.30197</td>
<td>2.7894(^1)</td>
<td>2.32175</td>
<td>1.285, 4.196</td>
</tr>
<tr>
<td>DSEX</td>
<td>0.90815</td>
<td>0.27196</td>
<td>3.3392(^1)</td>
<td>2.47973</td>
<td>1.455, 4.226</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.31245</td>
<td>0.40488</td>
<td>-0.77171</td>
<td>0.73165</td>
<td>-1.106, 0.481</td>
</tr>
<tr>
<td>DOCC</td>
<td>0.67553</td>
<td>0.52444</td>
<td>1.2881</td>
<td>1.96508</td>
<td>0.703, 5.493</td>
</tr>
<tr>
<td>LIN</td>
<td>0.042537</td>
<td>0.23299</td>
<td>0.18257</td>
<td>1.04346</td>
<td>-0.414, 0.499</td>
</tr>
<tr>
<td>Constant</td>
<td>0.80280</td>
<td>1.7483</td>
<td>0.45919</td>
<td>2.23177</td>
<td>0.072, 68.67</td>
</tr>
</tbody>
</table>

\(^{1}\) Values are significant at 99% level  
\(^{2}\) Values are significant at 95% level  
\(^{3}\) Values are significant at 90% level  

Likelihood Ratio Test 65.3174

Table 3-4 presents the same valuation scenario as Table 3-3, however with the coefficients and standard errors reparameterized to allow an interpretation of the coefficients as a percent change in WTP. As can be seen, the reparameterization, while easier to interpret, has higher standard errors and therefore fewer significant variables.
TABLE 3-4: Full Model for County-wide Open Space
Based on a County-wide Bond
Reparameterized to Reflect Percentage Change in WTP

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Asymptotic t-Statistic</th>
<th>Percent Change</th>
<th>Confidence Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>k(1/LMTX)</td>
<td>-2.69032</td>
<td>0.87234</td>
<td>-3.08405^</td>
<td>-269.0%</td>
<td>±171.0%</td>
</tr>
<tr>
<td>DLTR</td>
<td>1.45109</td>
<td>0.90008</td>
<td>1.61218</td>
<td>326.8%</td>
<td>±176.4%</td>
</tr>
<tr>
<td>LYM5</td>
<td>-0.15948</td>
<td>0.36507</td>
<td>-0.43684</td>
<td>-15.9%</td>
<td>±71.6%</td>
</tr>
<tr>
<td>LNUP</td>
<td>1.25859</td>
<td>0.9704</td>
<td>1.29699</td>
<td>125.9%</td>
<td>±190.2%</td>
</tr>
<tr>
<td>DZIP</td>
<td>-0.83512</td>
<td>1.02222</td>
<td>-0.81697</td>
<td>-56.6%</td>
<td>±200.4%</td>
</tr>
<tr>
<td>DCHI</td>
<td>-1.85098</td>
<td>1.16531</td>
<td>-1.58840</td>
<td>-84.3%</td>
<td>±228.4%</td>
</tr>
<tr>
<td>DOSI</td>
<td>1.87346</td>
<td>1.02881</td>
<td>1.82100^</td>
<td>551.1%</td>
<td>±201.6%</td>
</tr>
<tr>
<td>DCBND</td>
<td>1.53967</td>
<td>0.93031</td>
<td>1.65502^</td>
<td>366.3%</td>
<td>±182.3%</td>
</tr>
<tr>
<td>DRENT</td>
<td>1.4533</td>
<td>1.12417</td>
<td>1.29277</td>
<td>327.7%</td>
<td>±220.3%</td>
</tr>
<tr>
<td>LVAL</td>
<td>0.10209</td>
<td>0.79169</td>
<td>0.12895</td>
<td>10.2%</td>
<td>±155.2%</td>
</tr>
<tr>
<td>DENVER</td>
<td>1.58197</td>
<td>1.04471</td>
<td>1.51427</td>
<td>386.5%</td>
<td>±204.8%</td>
</tr>
<tr>
<td>DEDU</td>
<td>2.26611</td>
<td>1.11088</td>
<td>2.03993^</td>
<td>864.2%</td>
<td>±217.7%</td>
</tr>
<tr>
<td>DSEX</td>
<td>2.44322</td>
<td>1.09169</td>
<td>2.23803^</td>
<td>1051.0%</td>
<td>±214.0%</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.84060</td>
<td>1.1212</td>
<td>-0.74974</td>
<td>-84.1%</td>
<td>±219.8%</td>
</tr>
<tr>
<td>DOCC</td>
<td>1.81740</td>
<td>1.58276</td>
<td>1.14825</td>
<td>515.6%</td>
<td>±310.2%</td>
</tr>
<tr>
<td>LIN</td>
<td>0.11444</td>
<td>0.63118</td>
<td>0.18131</td>
<td>11.4%</td>
<td>±123.7%</td>
</tr>
<tr>
<td>Constant</td>
<td>2.15978</td>
<td>4.72176</td>
<td>0.45741</td>
<td>216.0%</td>
<td>±925.5%</td>
</tr>
</tbody>
</table>

Likelihood Ratio Test 65.3174
^ Values are significant at 99% level
^ Values are significant at 95% level
^ Values are significant at 90% level
^ For dummy variables percent change in WTP is exp(γj)-1

(Halvorsen and Palmquist)
N=324

Tables 3-5 and 3-6 present the reparameterized models for the North Hills referendum valuation and the North Hills trust fund valuation.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Asymptotic t-Statistic</th>
<th>Percent Change*</th>
<th>Confidence Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>K(1/LNTX)</td>
<td>-2.31836</td>
<td>0.62874</td>
<td>-3.68733</td>
<td>-231.8%</td>
<td>±123.2%</td>
</tr>
<tr>
<td>DLTR</td>
<td>-0.35102</td>
<td>0.65116</td>
<td>-0.53906</td>
<td>42.1%</td>
<td>±127.6%</td>
</tr>
<tr>
<td>LYMS</td>
<td>-0.25174</td>
<td>0.29756</td>
<td>-0.84601</td>
<td>25.2%</td>
<td>±58.3%</td>
</tr>
<tr>
<td>LNUP</td>
<td>-0.99020</td>
<td>0.75718</td>
<td>-1.30774</td>
<td>-99.0%</td>
<td>±148.4%</td>
</tr>
<tr>
<td>DZIP</td>
<td>-0.35412</td>
<td>0.89142</td>
<td>-0.39725</td>
<td>-29.8%</td>
<td>±174.7%</td>
</tr>
<tr>
<td>DCHI</td>
<td>-0.3827</td>
<td>0.80725</td>
<td>-0.47407</td>
<td>-31.2%</td>
<td>±158.2%</td>
</tr>
<tr>
<td>DOSI</td>
<td>0.39835</td>
<td>0.73297</td>
<td>0.543496</td>
<td>48.9%</td>
<td>±143.7%</td>
</tr>
<tr>
<td>DCSND</td>
<td>0.90085</td>
<td>0.74548</td>
<td>1.20842</td>
<td>246.2%</td>
<td>±146.1%</td>
</tr>
<tr>
<td>DRENT</td>
<td>1.121</td>
<td>0.90680</td>
<td>1.23620</td>
<td>206.8%</td>
<td>±177.7%</td>
</tr>
<tr>
<td>LVAL</td>
<td>0.07488</td>
<td>0.67821</td>
<td>0.110409</td>
<td>7.5%</td>
<td>±132.9%</td>
</tr>
<tr>
<td>DENVEM</td>
<td>1.74505</td>
<td>0.88674</td>
<td>1.96794</td>
<td>472.6%</td>
<td>±173.8%</td>
</tr>
<tr>
<td>DEDU</td>
<td>1.78538</td>
<td>0.84819</td>
<td>2.10492</td>
<td>496.2%</td>
<td>±166.2%</td>
</tr>
<tr>
<td>DSEX</td>
<td>1.42587</td>
<td>0.73437</td>
<td>1.94161</td>
<td>316.1%</td>
<td>±143.9%</td>
</tr>
<tr>
<td>LAGE</td>
<td>-1.25091</td>
<td>1.02245</td>
<td>-1.22344</td>
<td>-125.1%</td>
<td>±200.4%</td>
</tr>
<tr>
<td>DOCC</td>
<td>0.92547</td>
<td>1.22175</td>
<td>0.7575</td>
<td>152.3%</td>
<td>±239.5%</td>
</tr>
<tr>
<td>LIN</td>
<td>0.09199</td>
<td>0.53074</td>
<td>0.17332</td>
<td>9.2%</td>
<td>±104.2%</td>
</tr>
<tr>
<td>DSNH</td>
<td>0.21284</td>
<td>0.63511</td>
<td>0.33513</td>
<td>123.7%</td>
<td>±124.4%</td>
</tr>
<tr>
<td>Constant</td>
<td>6.14552</td>
<td>4.26885</td>
<td>1.43962</td>
<td>614.6%</td>
<td>±836.7%</td>
</tr>
</tbody>
</table>

Likelihood Ratio Test 65.3214

1 Values are significant at 99% level
2 Values are significant at 95% level
3 Values are significant at 90% level
4 For dummy variables percent change in WTP is \(\exp(y)^i\)-1

N=324
The results in the four tables indicate that being female, well educated and a member of an environmental group are generally significant and will increase the probability that an individual will support open space, or will be willing-to-pay higher amounts for open space.

The factors affecting willingness-to-pay for the North
Hills Trust Fund valuation are fairly similar to those identified for the two referendum valuations. However, two additional variables also appear as significant. First, the value of one's home appears to be marginally important, in that as the value increases, so does WTP. And second, being involved in the development industry (realtors, builders, contractors, etc.) has a strong negative effect on willingness to contribute to a North Hills open space trust fund.

There were several other variables which were not significant in any of the valuations, even at a confidence level as low as 70 percent. They include income, location (urban vs. rural) and length of residence in Missoula County. The most disconcerting of these are income and location. Theoretically income should have a measurable positive effect on willingness to pay for open space. The fact that it does not raises some interesting questions. One possible explanation is pointed to in the exit poll results (see section 3.8 Exit Poll), where many people simply were not aware of the cost of paying for open space. For many residents the costs of maintaining open space may be perceived to be small enough that the decision to vote yes or no is made on other grounds than cost, such as attitudes about governmental involvement or concerns about development. For these individuals, level of income would have little impact on their decision to support or oppose
open space contributions.

It was expected that people living in the urban area and facing the most direct visual impacts of development would also have a higher WTP. However this hypothesis was not substantiated in the study. The urban/rural dummy variable (DZIP) was not significant in any of the regressions. And being able to see the North Hills (DSNH) was not significant in either of the North Hills Valuations. This can perhaps be explained by the fact that while many people live outside the urban area, most are in the urban area on a regular basis for business, entertainment or social reasons.

3.4 Question Order

As noted above, the issue of question order has been raised with regard to the CV methodology. Tables 3-7 and 3-8 present the differences resulting from reversing the order of the two tax increase valuation questions. Table 3-7 shows in the second and third columns the estimated coefficients and t statistics for the full model for county-wide valuation, the fourth and fifth columns depict the same valuation with additional dummy variables for version 1 for the intercept (DV), slope (DVLMTX) and all the independent variables (DDLTR for DLTR and so on). Table 3-8 presents the same information for the North Hills valuation.
### TABLE 3-7: Question Order Differences

**Full Model for County-wide Open Space**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Asymptotic t Statistic</th>
<th>Coefficient</th>
<th>Asymptotic t Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.80280</td>
<td>0.45919</td>
<td>-1.6839</td>
<td>-0.67985</td>
</tr>
<tr>
<td>LMTX</td>
<td>-0.37170</td>
<td>-3.0840</td>
<td>-0.64765</td>
<td>-3.4137</td>
</tr>
<tr>
<td>DLTR</td>
<td>0.53937</td>
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<td>0.91298</td>
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<tr>
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<td>0.0052131</td>
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<tr>
<td>LNUP</td>
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<td>1.4287</td>
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</tr>
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<td>-0.93679</td>
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<td>-1.9429</td>
<td>-1.0249</td>
<td>-1.8801</td>
</tr>
<tr>
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<td>1.7372</td>
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<tr>
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</tr>
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<tr>
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<td>-0.77171</td>
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</tr>
<tr>
<td>DCBND</td>
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<td>1.2881</td>
<td>0.42483</td>
<td>0.55461</td>
</tr>
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<td>LIN</td>
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<td>0.57027</td>
</tr>
<tr>
<td>DV</td>
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<td>DDCCHI</td>
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<td>-2.3766</td>
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</tr>
<tr>
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<td>-0.33747</td>
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</tr>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>DDSEX</td>
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<td>0.57400</td>
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</tr>
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<td>DLAGE</td>
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</tr>
<tr>
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<td>0.52378</td>
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</tr>
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<td>-0.51683</td>
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</tr>
</tbody>
</table>

**Likelihood Ratio Test** 65.3174

**Likelihood Ratio Test between models** 25.6

1. Values are significant at 99% level
2. Values are significant at 95% level
3. Values are significant at 90% level
TABLE 3-8: Question Order Differences
Full Model for North Hills Open Space

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Asymptotic t Statistic</th>
<th>Coefficient</th>
<th>Asymptotic t Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<td>1.4842</td>
<td>1.1067</td>
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<td>-0.43949</td>
<td>-3.4495</td>
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<td>DLTR</td>
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<td>-0.013906</td>
<td>-0.038142</td>
</tr>
<tr>
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<td>-0.10858</td>
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<td>-0.36620</td>
<td>-1.8661</td>
</tr>
<tr>
<td>LNUP</td>
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<td>-0.64165</td>
<td>-1.4475</td>
</tr>
<tr>
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<tr>
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<tr>
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<td>1.6562</td>
</tr>
<tr>
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<tr>
<td>DV</td>
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<td>DVLMTX</td>
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<td>DDLTR</td>
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<td>DLLYM</td>
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<tr>
<td>DDRRENT</td>
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<td>DDLVAL</td>
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<tr>
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<td></td>
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<td>DDSSEX</td>
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<td></td>
<td></td>
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<td>DLLAGE</td>
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</tr>
<tr>
<td>DDSNH</td>
<td>0.37926</td>
<td>0.63444</td>
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</tr>
</tbody>
</table>

N=324
Likelihood Ratio Test 65.3214
Likelihood Ratio Test between models 29.64
\[ \chi^2 = 7.30, 18 \approx 28.8693 \]

Values are significant at 99% level
Values are significant at 95% level
Values are significant at 90% level
One can see that in the county-wide valuation the intercept dummy variable for version 1 is not significant and the slope dummy variable is only marginally significant, registering at the 90 percent level. A likelihood ratio test between the full model and the full model with version 1 dummy variables indicates that question order is not generating significant differences in the valuation. However, in the North Hills valuation the dummy variable for slope is significant at the 99 percent level and the likelihood ratio test between the regressions is also significant. This indicates that question order is having a significant effect on the North Hills valuation.

Given that question order is having an effect on valuations, a related question is are the differences consistent? The results indicate the answer is a qualified yes. Values for the same valuation question were generally less when asked after another valuation question. This result was arrived at by separating the sample into subsamples based on the version of the survey instrument, and then running each valuation question of each version as a bivariate logit. These results are presented in Table 3-9.
The median values show a consistent trend that second questions get lower values. However, this is qualified by the fact that the bid variable in the version 1 county-wide regression is not significant. This calls into question the median value reported.

Another method for examining these differences is to calculate non-parametric means as described by Duffield and Patterson (1991). This method aggregates the differences in bid levels times the proportion of respondents supporting a
particular bid level. This aggregation generates a non-
parameterized mean. Equations (3-1) and (3-2) show this
formulation.

\[ M_{T'} = \sum_{i=1}^{k} \Delta x_i p_i \]  

(3-1)

where

\[ \Delta x_i = \frac{(x_{i+1} - x_{i-1})}{2}, \quad i=2, \ldots, k-1, \]
\[ \Delta x_1 = x_1 + \frac{(x_2 - x_1)}{2}, \quad \text{and} \]
\[ \Delta x_k = \frac{(x_k - x_{k-1})}{2} + (T - x_k). \]  

(3-2)

when \( x_i \) is the ith bid amount, \( k \) is number of distinct bid
levels, \( T \) is truncation point and \( p_i \) is the proportion of
"yes" votes at the ith bid.

A weakness of this methodology is a tendency to report
inflated values when the number of responses at high bid
levels is small. Because the method used to calculate bid
levels (millage times house value) creates a scattered
number of high bid levels, this is a clear problem with the
data. To overcome this the bid levels were aggregated in
descending order into ten fairly equal groups. A weighted
average bid level and percent voting "yes" were calculated
for each group. This is shown in Table 3-10.\textsuperscript{21}

\textsuperscript{21} This same representation of the data set without the
aggregation can be seen in appendix 7.
The results from calculating the non-parametric means are shown in Table 3-11. Because the truncation point \( T \) is the highest average bid, in the last equation in (3-2), \( \Delta x_k \), is 0. The non-parametric means reveal a consistent pattern.
of first questions receiving higher valuations.

<table>
<thead>
<tr>
<th>TABLE 3-11: Non-parametric Means of Versions 1 &amp; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regression</strong></td>
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<tr>
<td><strong>County-Wide Valuation</strong></td>
</tr>
<tr>
<td>Version 1 (county-wide question first)</td>
</tr>
<tr>
<td>Version 2 (county-wide question second)</td>
</tr>
<tr>
<td><strong>North Hills Valuation</strong></td>
</tr>
<tr>
<td>Version 1 (North Hills question second)</td>
</tr>
<tr>
<td>Version 2 (North Hills question first)</td>
</tr>
</tbody>
</table>

Graphs 3-4 through 3-7 depict this data graphically to show the relationship between bid level and percentile support.
These graphs indicate the scattered nature of responses to the two first valuation questions (County: Version 1 and North Hills: Version 2) and the more predictable responses in the second valuation questions.

These results bring into question the accuracy of the valuation. Specifically, should only those interviews where the key question was offered second be used for the valuation? This issue will be considered next by examining how the county-wide valuations compare with actual voter results.
Graph 3-8, using bond amount as the independent variable, shows the effect of question order on the level of voter support. While the median value is considerably lower in the case when the county-wide valuation is second ($19.6 million compared to $14.9 million), the effect on the area of interest (the $8 million bond) is not so clear. The percentage of support for primary voters for an $8 million bond using the whole sample is 58.5 percent, and 58.8 percent when using only those surveys in which the county-wide valuation question was the second valuation asked. The confidence intervals for these two estimates are 52.5 to 64.5 percent and 50.2 to 67.4 percent, respectively. Since
the confidence interval for the second question only sample, includes all of the confidence interval for the whole sample it appears that the results at the $8 million bond level are indistinguishable. This finding down plays the effect of question order, particularly at the amounts where the question has higher levels of support. However, this conclusion must be tempered by the fact that while the full model for county-wide open space showed no conclusive differences due to question order, the full model for the North Hills valuation did indicate a significant difference. Unfortunately no validation mechanism exists for the North Hills valuation.

3.5 Voting Reasons

Each of the bond valuation questions was followed by a question asking the main reason for the respondent’s choice in the valuation. These questions yielded a wide variety of results which were then categorized into twelve groups. These results are summarized in Graphs 3-9 and 3-10, and Table 3-12\(^2\).

This data should be viewed cautiously. Because respondents were asked a wide range of values (tax increases), an individual might very well have answered this question differently had she or he been asked to support the

\(^2\) In order to make the graphs more readable the initial 12 groups have been consolidated into 7 groups. This is shown in the distinction between sub-groups and main groups in Table 3-12.
bond at a different level. Nevertheless, the results of the questions are interesting, particularly the large number of respondents who noted "quality of life" or "too much growth" as their main reason for voting yes. Neither of these justifications implies a concern about the cost of preservation, so a strong majority of the people who voted yes did not specifically mention cost as the main reason for their vote. On the opposition side only a slight majority of the "no" voters cited "high cost" as their reason for opposition, the other reasons being, "indefiniteness of the proposal", "mistrust of government", "open space a lesser priority" and "miscellaneous". It is apparent that several concerns besides cost are driving voters decision making on the open space issue.

"Wildlife" concerns are noticeable for the relatively small number who choose it as their main reason, though several others noted "wildlife" as a secondary reason.
TABLE 3-12: Reasons for Vote Choice

<table>
<thead>
<tr>
<th>Category</th>
<th>County Bond</th>
<th>North Hills Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sub-groups</td>
<td>main groups</td>
</tr>
<tr>
<td><strong>NO'S</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>Indefiniteness of Proposal</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>Mistrust of Government</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Open Space a Lower Priority</td>
<td>4%</td>
<td>15%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Cost Too Much</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>North Hills a Low Priority</td>
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<td>NA</td>
</tr>
</tbody>
</table>

**YES'S**

<table>
<thead>
<tr>
<th>Category</th>
<th>County Bond</th>
<th>North Hills Bond</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>sub-groups</td>
<td>main groups</td>
</tr>
<tr>
<td>Good Investment</td>
<td>16%</td>
<td>10%</td>
</tr>
<tr>
<td>Affordable, Good Investment</td>
<td>13%</td>
<td>9%</td>
</tr>
<tr>
<td>Timing, needs to be done now</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>32%</td>
<td>25%</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>31%</td>
<td>24%</td>
</tr>
<tr>
<td>Heritage</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Wildlife</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Too Much Growth</td>
<td>13%</td>
<td>13%</td>
</tr>
</tbody>
</table>

* All columns do not add to 100 percent due to rounding.

3.6 Familiarity Issues

Among the questions in the survey leading up to the valuation questions were four regarding the respondent's familiarity with open space issues and concepts. The first
asked how familiar the respondent was with open space issues. Graph 3-11 shows the results of the question. Nearly three fourths of the respondents described themselves as either "very familiar" or "somewhat familiar" with recent open space issues. This high level of familiarity reflects the high level of attention that open space issues are currently receiving in the and is a positive sign of the interest the media and individuals have taken in the issue.

The second and third familiarity questions regarded conservation easements and trust funds. Both of these questions were utilized to educate respondents' as to the nature of conservation easements and trust funds. This was important because the concepts were used in valuation questions. Since conservation easements and trust funds are key tools in preserving open space, the questions also give an indication of the depth of respondents' understanding of open space issues. Graphs 3-12 and 3-13 both indicate a reasonably high familiarity with these concepts.
The fourth familiarity question involved the 1980 City of Missoula conservation bond. As Graph 14 indicates, respondents were relatively unfamiliar with this bond and the preservation of open space and of park lands which resulted from it.

3.7 Level of Importance Questions

In order to help alleviate the embedding problems mentioned earlier, two questions were used to remind respondents of other competing uses for tax dollars. Both questions avoided asking respondents to rank particular items against each other, but did ask respondents to assign
a level of importance to competing demands. The first question focused on how additional tax revenues ought to be used. Graph 3-15 shows the average value generated for each category of new tax expenditure. From this we can see that

Graph 3-15

education and pollution control are the most highly preferred new expenditures, with open space and poverty programs being in the middle, and roads and health care receiving the lowest priority for new tax revenues.

The second question asked respondents to rank five well known and threatened open areas: Mount Jumbo, the Fort Missoula area, the Clark Fork riverfront from the Russell Street bridge to the Bitterroot river, the Bitterroot
riverfront from where Highway 93 crosses the river to where it joins the Clark Fork, including McCauley Butte, and the North Hills. Graph 3-16 summarizes the results of this question.

While all areas received fairly high rankings, the North Hills comes out as a slightly lower priority than the other four areas, which are clustered closely together.
3.8 Exit Poll

Of the 287 respondents who participated in the exit poll only 150, or 52 percent, filled in both the house value and tax increase questions. This result indicates that a large number of voters who voted on the open space question either did not know or care what the tax increase was and were casting their ballot based on criteria other than cost. This finding is also corroborated by other evidence presented above (see section 4.4 Voting Reasons).

Of the 150 respondents who did fill in the house value and tax increase questions, 29 percent expected a tax increase that was within 25 percent of the actual tax increase they would have faced given the value of their house. Results also show that people who voted yes tended to underestimate the tax increase and people who voted no tended to overestimate it. These results indicate that the concern about systematic tax increase overestimation by voters was unfounded and not a significant factor in the analysis. Table 3-13 summarizes these results of the exit poll.
TABLE 3-13: Exit Poll
Estimated Tax Increase for $8 Million Bond

<table>
<thead>
<tr>
<th>Category</th>
<th>All Voters</th>
<th>Yes Voters</th>
<th>No Voters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Voters</td>
<td>287</td>
<td>184</td>
<td>96</td>
</tr>
<tr>
<td>Voters who completed the survey</td>
<td>150</td>
<td>96</td>
<td>54</td>
</tr>
<tr>
<td>Those who estimated 75% or less</td>
<td>38%</td>
<td>45%</td>
<td>26%</td>
</tr>
<tr>
<td>Those who estimated plus or minus 25%</td>
<td>29%</td>
<td>26%</td>
<td>33%</td>
</tr>
<tr>
<td>Those who estimated 125% or more</td>
<td>33%</td>
<td>29%</td>
<td>41%</td>
</tr>
</tbody>
</table>

A second issue regarding the exit poll is whether people behaved differently when responding to the CV survey than they did when responding to the exit poll. This can be examined by pooling the two samples and creating a set of variables which are the product of the independent variables and a dummy variable for whether or not the observation was collected in the exit poll. Table 3-14 below presents these results.

As can be seen, the results are mixed. On the one hand, neither the intercept or slope interaction variables for the exit poll (DEXIT and DEXITLMT) are significant. Also, a likelihood ratio test between the two regressions is not significant. These tests indicate that there is not a statistical difference between the samples. However, the interaction variable for education (DDEDU) is highly
significant and has a different sign from the education variable without the exit poll interaction (DEDU). This indicates that while having completed college increases one’s WTP in a CV, it actually decreases WTP when one is responding to an exit poll.

Overall, the similarities of the two samples are a positive indication that this CV study and exit poll generate very similar results.

### TABLE 3-14: Contingent Valuation and Exit Poll Pooled Samples

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Asymptotic t Statistic</th>
<th>Coefficient</th>
<th>Asymptotic t Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.6774</td>
<td>2.0104</td>
<td>2.6302</td>
<td>1.7453</td>
</tr>
<tr>
<td>LMTX</td>
<td>-0.41005</td>
<td>-4.1703</td>
<td>-0.36538</td>
<td>-3.1883</td>
</tr>
<tr>
<td>DENVEM</td>
<td>0.91399</td>
<td>3.6054</td>
<td>0.62007</td>
<td>2.0116</td>
</tr>
<tr>
<td>DEDU</td>
<td>0.67377</td>
<td>3.0909</td>
<td>0.99823</td>
<td>3.7642</td>
</tr>
<tr>
<td>DSEX</td>
<td>0.53858</td>
<td>2.6319</td>
<td>0.68462</td>
<td>2.7654</td>
</tr>
<tr>
<td>DOSI</td>
<td>0.50966</td>
<td>1.9783</td>
<td>0.69001</td>
<td>2.4099</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.69945</td>
<td>-2.2669</td>
<td>-0.73999</td>
<td>-2.2034</td>
</tr>
<tr>
<td>DRENT</td>
<td>0.25574</td>
<td>0.86641</td>
<td>0.38607</td>
<td>1.154</td>
</tr>
<tr>
<td>LVAL</td>
<td>0.08773</td>
<td>0.47909</td>
<td>0.10573</td>
<td>0.4236</td>
</tr>
<tr>
<td>DZIP</td>
<td>0.090724</td>
<td>0.32818</td>
<td>-0.29660</td>
<td>-0.8414</td>
</tr>
<tr>
<td>DEXIT</td>
<td>1.06969</td>
<td>0.2633</td>
<td>0.26337</td>
<td>0.2633</td>
</tr>
<tr>
<td>DEXITLMT</td>
<td>-0.30269</td>
<td>-1.1498</td>
<td>-1.1498</td>
<td>-1.1498</td>
</tr>
<tr>
<td>DDENVEM</td>
<td>1.0043</td>
<td>1.7146</td>
<td>1.7146</td>
<td>1.7146</td>
</tr>
<tr>
<td>DDEDU</td>
<td>-1.4713</td>
<td>-2.5396</td>
<td>-2.5396</td>
<td>-2.5396</td>
</tr>
<tr>
<td>DDSEX</td>
<td>-0.52330</td>
<td>-1.0955</td>
<td>-1.0955</td>
<td>-1.0955</td>
</tr>
<tr>
<td>DDOSI</td>
<td>-0.87224</td>
<td>-1.0799</td>
<td>-1.0799</td>
<td>-1.0799</td>
</tr>
<tr>
<td>DLAGE</td>
<td>0.089333</td>
<td>0.089811</td>
<td>0.089811</td>
<td>0.089811</td>
</tr>
<tr>
<td>DDRENT</td>
<td>-0.41529</td>
<td>-0.43471</td>
<td>-0.43471</td>
<td>-0.43471</td>
</tr>
<tr>
<td>DLVAL</td>
<td>0.10920</td>
<td>0.26882</td>
<td>0.26882</td>
<td>0.26882</td>
</tr>
<tr>
<td>DDZIP</td>
<td>1.2260</td>
<td>1.9971</td>
<td>1.9971</td>
<td>1.9971</td>
</tr>
</tbody>
</table>

Likelihood Ratio Test between models $15.3 \chi^2(9) = 18.3070$

1. Values are significant at 99% level
2. Values are significant at 95% level
3. Values are significant at 90% level
Chapter 4

Summary

People choose their place of residence for a myriad of reasons: economic, social, environmental, traditional, aesthetic and so on. Individuals may be willing to pay (or forego other benefits) to preserve certain aspects of their current environment. This is the case with open space in Missoula County. The recent influx of people into the Missoula area has heightened concerns about the future livability of the valley. The open vistas of surrounding hills and the diversity of riparian areas are important enough to many individuals, to pay to preserve them.

Residents of Missoula County are collectively willing to make large investments to insure visual, recreational, wildlife and other associated opportunities in the future. An average household contribution of $59 a year to maintain open views and nearby wildlife habitat needs to be considered in the context of the amounts paid for other common amenities and goods, such as $20 to attend a football game, play a round of golf, fill up the gas tank or feed the family at McDonalds. The difficulty with open space, because it is a public good, is finding adequate mechanisms for preservation. Public goods have an inherent 'free rider' problem, in that access to the benefits of the good can not be restricted to any individual or group of individuals. This makes it easy for individuals to enjoy
the benefits of the good, and not bear any of the burdens (costs) of maintaining the good. Free riders do recognize that they receive a benefit and are willing to pay for the benefit given a payment mechanism that they perceive to be fair. The most obvious solution to this problem is the use of publicly assessed revenues to provide public goods such as open space.

Residents, as of March 1994, were willing to make as much as a $1.7 million tax contribution (plus or minus $176,000), per year for the next ten years. This implies that a 10 year, county administered, $8 million bond would have passed relatively comfortably at that time.

Women, college graduates and members of environmental organizations are more likely to support open space. Finally, many voters do not seem to regard the cost of open space (at least at the general levels currently being discussed) to be the main factor when making their decision regarding open space preservation. Apparently the perceived costs are less important than some of the other issues of the open space discussion, such as quality of life, the pace of development, government intrusion, other priorities for tax revenues and the vague wording of the ballot language.

With regard to the CV method, this thesis has focused on three areas of specific interest, question order, referendum validation and the use of exit polls.

The results from the question order analysis are mixed
and deserve further study. The possibility exists that the first questions receive higher valuations than second questions. This implies that the first question sensitizes the respondent to an embedding problem that remains even after other more traditional methods, such as reminders of budget constraints and of other related goods or services competing for the same dollar, have been used. If this in fact is the case (something that has not been clearly demonstrated in this analysis), then it would be important for other CV studies to precede the key valuation question with a related valuation question.

The NOAA Panel on Contingent Valuation recommended experimentation with the use of actual voter referendum as a validation procedure for CV studies. This study provided a unique opportunity to do just that. Based on the results of the June Primary election the CV undertaken here has generated results reasonably close to those of the actual referendum.

However, the November election results highlight some of the difficulties of using elections as validation procedures. While valuations are expected to be dynamic, the significant swing in voter attitudes about paying for open space, at least raises the question of how to accurately use volatile voter information as a validation. It appears that other, only marginally related referendum and even candidates may have large effects on electoral
results.

With regard to the exit poll, it is reassuring to find that voters who had a perception of their potential tax increase due to the passage of the open space bond behaved in generally the same way as those in the CV study.

-END-
APPENDIX 1: Introductory Letter

The University of Montana

March 16, 1994

2-

Dear 3-,

Within the next week you will receive a call as part of a research study being conducted through the Economics Department at the University of Montana. The survey will be used to help us develop a better understanding of how the residents of Missoula County feel about open space lands in and around the Missoula Valley.

Your household is one of a small number of Missoula County residences randomly selected to participate in this survey. In order that our results represent all of the people of Missoula County, we will ask to interview the adult member of your household who has had the most recent birthday. Because of this, we ask that you share this letter with that person if it is not you. The interview should take no more than ten minutes. If we happen to call at an inconvenient time we will be happy to call back later. All of your answers will be confidential and will only be used for this study. Although you will be asked in the survey about the value you place on certain open spaces, the survey is not a solicitation for donations.

Open spaces, broadly defined, are park lands, riverfronts and hillside grasslands, such as the faces of Mt. Sentinel and Mt. Jumbo. In general, we are examining the areas in and around the Missoula Valley which are undeveloped. The main ways of preserving open space are purchases, either of the land itself, or of conservation easements, which are legal agreements where the owner of the land agrees not to develop the land in exchange for a payment.

In this study we are primarily considering the North Hills, which is the grassland area north of Interstate 90, south of the tree line, and between the existing development along Grant Creek and Rattlesnake Creek. To help you identify the area we have included the aerial photograph on the back of this letter. On the photograph we have identified the North Hills and several other existing open space areas in the Missoula Valley.

Given Missoula's current growth many of these areas will probably be developed over the next twenty years, unless the land, or conservation easements to the land, are purchased. The basic question we will be asking you is what would you be willing to pay to preserve these existing open space areas, particularly the North Hills.

We greatly appreciate your help on this survey. If you have any questions, please don't hesitate to ask our interviewer. Or, you may contact me by phone at 243-4406, or by mail.

Sincerely,

Prof. Douglas Dalenberg
Graduate Supervisor
MISSOULA VALLEY OPEN SPACE AREAS
APPENDIX 2.1: Survey Instrument version 1

Missoula Contingent Valuation Survey (Version 1)

1. Enter the Respondent ID# __________
2. Enter the Respondent’s address __________________ ________________
   Zip Code 598 __________
3. Enter Interviewer’s Name __________________

DIAL THE TELEPHONE NUMBER, IF A YOUNG CHILD ANSWERS THE PHONE ASK FOR AN
ADULT.

4. Hello. Is this the __________ (last name) residence?
   (IF NO. The number I was calling is __________ and it was for the __
   (first and last name) residence.)
   (IF WRONG NUMBER, TERMINATE WITH, E.G.: I am sorry to have bothered
   you.)

   This is __________ (interviewer’s name). I am calling from the Economics
   Department at the University of Montana. We are doing a research study
   on what economic values people in Missoula attribute to open space.
   Your telephone number and address were drawn in a random sample of
   Missoula. Last week you should have received a letter briefly
   explaining the study. Did you receive the letter?
   1. YES
   2. NO
   (IF NO. I’m sorry yours didn’t reach you. It was a brief letter we
   sent so people would know that we would be calling them.)

5. In order for our survey to be most representative, I need to talk to
   the person currently living in your household who is 18 years of age or
   older and who has had the MOST RECENT BIRTHDAY. Would that be you or
   someone else?
   1. Self [INTERVIEWER: GO TO QUESTION 6.]
   2. Someone Else [INTERVIEWER: ASK TO SPEAK WITH THAT PERSON. IF
   THEY ARE NOT HOME ASK FOR THEIR NAME AND WHEN IT WOULD BE CONVENIENT TO
   CALL THEM BACK. NAME_______________________ CALL BACK
   TIME___________] (Please transfer this information to the cover sheet).
   [INTERVIEWER: READ IF SOMEONE ELSE]

   Hello, my name is __________, and I’m calling from the Economics
   Department at the University of Montana. We are doing a research study
   on what economic values people in Missoula attribute to open space.
   Last week we sent out a letter briefly explaining the study. Have you
   seen the letter?
   1. YES
   2. NO
   (IF NO. I’m sorry yours didn’t reach you. It was a brief letter we
   sent so people would know that we would be calling them.)

6. The questions I would like to ask will take about ten minutes. But
   before starting I want to stress that this interview is completely
   voluntary and confidential. Your answers will only be used for this
   study. I would be happy to answer any questions you might have about
   the study either now or later. Okay?
7. Let me begin by asking... how long have you lived in Missoula County?  
   1. ___Months ___Years  
   2. NO ANSWER

8. How long have you lived at your current residence?  
   1. ___Months ___Years  
   2. NO ANSWER

9. How many people live in your household?  
   1. 
   2. NO ANSWER

10. Do you have children?  
    1. YES  
    2. NO [skip to question 12]  
    3. NO ANSWER [skip to question 12]

11. Do any of them live at home or in Missoula?  
    1. YES  
    2. NO  
    3. NO ANSWER

12. Do you live within the city limits of Missoula?  
    1. YES  
    2. NO  
    3. NO ANSWER

13. Are you registered to vote in Missoula County?  
    1. YES  
    2. NO  
    3. NO ANSWER

14. The primary election will be held on June 7th, included on the ballot will be two open space issues. Do you plan to vote in this election?  
    1. YES  
    2. NO  
    3. NO ANSWER

For the next three questions I will be asking how familiar you are with a concept or issue. For an answer please tell me whether you are very FAMILIAR, SOMEWHAT FAMILIAR, NOT VERY FAMILIAR or NOT FAMILIAR AT ALL.

15. The preservation of existing open spaces in the Missoula Valley has received considerable attention recently, both from the news media and various advocacy groups. How familiar are you with recent developments in open space issues?  
    1. VERY FAMILIAR  
    2. SOMEWHAT FAMILIAR  
    3. NOT VERY FAMILIAR  
    4. NOT AT ALL FAMILIAR  
    5. NO ANSWER

16. A conservation easement is a legal agreement in which the owner of a piece of land sells the right to develop that land to someone else, generally a non-profit organization or the government. Conservation easements have become widely used as a way to preserve open space because they are cheaper than outright purchase of the property. How familiar are you with the idea of conservation easements?  
    1. VERY FAMILIAR  
    2. SOMEWHAT FAMILIAR  
    3. NOT VERY FAMILIAR  
    4. NOT AT ALL FAMILIAR  
    5. NO ANSWER
17. In 1980 Missoula voters passed a $500,000 conservation bond. A bond is similar to taking out a loan, to be paid back over a fixed time period, in this case, the next 20 years. The proceeds of the bond were used to purchase what is now "John H. Toole Riverfront Park", downtown on the south side of the Clark Fork, a conservation easement for the open hillsides of Mt. Sentinel, the Old Milwaukee railroad lands in the Hellgate Canyon, now known as the Kim Williams trail, and a small parcel on Mt. Jumbo. How familiar are you with the 1980 city of Missoula Conservation Bond?
1. VERY FAMILIAR
2. SOMewhat FAMILIAR
3. NOT VERY FAMILIAR
4. NOT AT ALL FAMILIAR
5. NO ANSWER

18. Using tax dollars to purchase new park lands and preserve existing open spaces comes at some expense, either in increased taxes or in reduction of some other government service. With this in mind please rank how important you feel additional government expenditures are in the following categories. Rank each category from one to five, with one being NOT IMPORTANT and five being EXTREMELY IMPORTANT. The categories are:

<table>
<thead>
<tr>
<th>EXPENDITURE</th>
<th>NOT IMPORTANT</th>
<th>EXTREMELY IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improving Primary and Secondary Education</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>2. Controlling Air and Water Pollution</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>3. Improving Public Roads</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>4. Additional Aid to the Poor and Elderly</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>5. Providing New Health Care Services</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>6. Preserving Open Space and Purchasing New Park Lands</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>7. Other:</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
</tbody>
</table>

19. There are several areas in and around Missoula which are currently being considered in open space discussions. I would now like to ask how important you feel these areas as open space in the Missoula Valley. Please rank each area from one to five, with one being NOT IMPORTANT and five being EXTREMELY IMPORTANT. The areas are:

<table>
<thead>
<tr>
<th>AREA</th>
<th>NOT IMPORTANT</th>
<th>EXTREMELY IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mt. Jumbo</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>2. The Fort Missoula area</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>3. The Clark Fork riverfront from the Russell Street bridge to the Bitterroot river</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>4. The Bitterroot riverfront from where Highway 93 crosses the river to where it joins the Clark Fork, including McCauley Butte</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>5. The North Hills</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>6. Other areas</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>(please specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. NO ANSWER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. Do you own or rent your current residence?
1. OWN
2. RENT [go to question 25]
3. NO ANSWER
21. I am going to read a list of house value ranges. Please tell me the range that you believe your house would be in if you were to sell the house this month. You can just tell me the letter that corresponds to the appropriate range. The ranges are:

- Circle the appropriate value then use the corresponding tax increase in the RED highlighted column for the next question.

<table>
<thead>
<tr>
<th>BOND AMOUNT (in millions)</th>
<th>TAX INCREASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $0-$40,000</td>
<td>$2 $7 $14 $26 $43</td>
</tr>
<tr>
<td>2. $40,000-$60,000</td>
<td>$3 $10 $21 $39 $65</td>
</tr>
<tr>
<td>3. $60,000-$80,000</td>
<td>$3 $14 $28 $52 $86</td>
</tr>
<tr>
<td>4. $80,000-$100,000</td>
<td>$4 $17 $35 $66 $108</td>
</tr>
<tr>
<td>5. $100,000-$125,000</td>
<td>$5 $22 $43 $82 $135</td>
</tr>
<tr>
<td>6. $125,000-$150,000</td>
<td>$6 $26 $52 $98 $162</td>
</tr>
<tr>
<td>7. $150,000-$200,000</td>
<td>$8 $35 $69 $131 $216</td>
</tr>
<tr>
<td>8. $200,000-$500,000</td>
<td>$21 $87 $174 $328 $540</td>
</tr>
<tr>
<td>9. $500,000-$1,000,000</td>
<td>$42 $174 $347 $656 $1081</td>
</tr>
<tr>
<td>10. Greater than 1 mil</td>
<td>&gt;$42 &gt;$174 &gt;$347 &gt;$656 &gt;$1081</td>
</tr>
</tbody>
</table>

11. DON'T KNOW......
12. REFUSED TO ANSWER [read the following paragraph, then skip to question 23]

Earlier this month the Missoula County Commissioners placed on the June 1994 ballot a new conservation bond proposal with the following ballot language, "for the purpose of, establishing and funding the Missoula County Open Space Acquisition Fund, which shall be used to acquire interests in or rights in property including land and water, that will provide a means for the preservation of significant open space land or the preservation of native plants or animals, or park or recreational purposes, or geological or geographical formations of scientific, historic, aesthetic or educational interest in Missoula County and to pay the costs associated with the issuance of the bonds."

22. Keeping in mind your household budget. Suppose that this new conservation bond were for $____ million, and knowing that approval of the bond would increase your property taxes by $____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
   1. FOR
   2. AGAINST
   3. NOT VOTE AT ALL
   [skip to question 24]

23. Keeping in mind your household budget. Suppose that this new conservation bond were for $____ million, and knowing that approval of the bond would increase the property taxes on the average Missoula County home by $____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
   1. FOR
   2. AGAINST
   3. NOT VOTE AT ALL

24. What is the main reason for your (yes, no, would not) vote, on the previous question?
   1. ____________________________________
   2. NO ANSWER
   [skip to question 29]
25. What are your monthly rent payments? [If the respondent shares rent with someone else ask for their "individual" rent payment]

[Circle the appropriate value then use the corresponding rent increase in the RED highlighted column for the next question.]

<table>
<thead>
<tr>
<th>BOND AMOUNT (in millions)</th>
<th>ANNUAL RENT INCREASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  4  8  15  25 million</td>
<td></td>
</tr>
<tr>
<td></td>
<td>million million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly Rent</th>
<th>$0-$400</th>
<th>$400-$600</th>
<th>$600-$800</th>
<th>$800-$1000</th>
<th>$1000-$1250</th>
<th>$1250-$1500</th>
<th>$1500-$2000</th>
<th>$2000-$5000</th>
<th>$5000-$10,000</th>
<th>&gt;10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-$400</td>
<td>$3</td>
<td>$3</td>
<td>$3</td>
<td>$4</td>
<td>$5</td>
<td>$6</td>
<td>$7</td>
<td>$21</td>
<td>$42</td>
<td>&gt;$42</td>
</tr>
<tr>
<td>$400-$600</td>
<td>$10</td>
<td>$17</td>
<td>$22</td>
<td>$35</td>
<td>$43</td>
<td>$52</td>
<td>$52</td>
<td>$39</td>
<td>$347</td>
<td>&gt;$347</td>
</tr>
<tr>
<td>$600-$800</td>
<td>$21</td>
<td>$28</td>
<td>$35</td>
<td>$66</td>
<td>$82</td>
<td>$98</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
<td>&gt;$328</td>
</tr>
<tr>
<td>$800-$1000</td>
<td>$21</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
<td>$540</td>
<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
<tr>
<td>$1000-$1250</td>
<td>$21</td>
<td>$35</td>
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<td>$131</td>
<td>$328</td>
<td>$540</td>
<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
<tr>
<td>$1250-$1500</td>
<td>$21</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
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<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
<tr>
<td>$1500-$2000</td>
<td>$21</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
<td>$540</td>
<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
<tr>
<td>$2000-$5000</td>
<td>$21</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
<td>$540</td>
<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
<tr>
<td>$5000-$10,000</td>
<td>$21</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
<td>$540</td>
<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
<tr>
<td>&gt;10,000</td>
<td>$21</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$328</td>
<td>$540</td>
<td>$174</td>
<td>$566</td>
<td>$1081</td>
<td>&gt;$1081</td>
</tr>
</tbody>
</table>

Earlier this month the Missoula County Commissioners placed on the June 1994 ballot a new conservation bond proposal with the following ballot language, "for the purpose of, establishing and funding the Missoula County Open Space Acquisition Fund, which shall be used to acquire interests in or rights in property including land and water, that will provide a means for the preservation of significant open space land or the preservation of native plants or animals, or park or recreational purposes, or geological or geographical formations of scientific, historic, aesthetic or educational interest in Missoula County and to pay the costs associated with the issuance of the bonds."

26. Keeping in mind your household budget. Suppose that this new conservation bond were for $______ million, and knowing that the increase in property taxes from approval of the bond would increase your rent by $____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?

1. FOR
2. AGAINST
3. NOT VOTE AT ALL

[skip to question 27]

27. Keeping in mind your household budget. Suppose that this new conservation bond were for $______ million, and knowing that the increase in property taxes from approval of the bond would increase the rent on the average Missoula County home by $____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?

1. FOR
2. AGAINST
3. NOT VOTE AT ALL

28. What is the main reason for your (yes, no, would not) vote, on the previous question?

1. ___________________________________
2. NO ANSWER
29. The previous questions have been about open space in the Missoula Valley. I would now like to ask you about a very specific area.

The North Hills are the grassland area north of Interstate 90, between the existing development along Grant Creek and Rattlesnake Creek. Do you understand what area I am describing?
1. YES
2. NO [INTERVIEWER: PROVIDE MORE INFORMATION, "If you were to get on Interstate 90 at the VanBuren Street interchange, near the university and drive to the Reserve Street interchange, the North Hills would be the grassland area immediately to your right"]

30. From where you live can you see the North Hills?
1. YES
2. NO
3. NO ANSWER

[**HOME OWNERS**] [INTERVIEWER: USE THE GREEN HIGHLIGHTED VALUES FROM QUESTION 21]

31. Suppose that Missoula County voters were asked to approve a new conservation bond of $___ million for purchases of land and conservation easements to preserve the existing open space on just the North Hills. Keeping in mind your household budget, and knowing that approval of the bond would increase your property taxes by $___ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
1. FOR
2. AGAINST
3. NOT VOTE AT ALL

[skip to question 33]

[**RENTERS**] [INTERVIEWER: USE THE GREEN HIGHLIGHTED VALUES FROM QUESTION 25]

32. Suppose that Missoula County voters were asked to approve a conservation bond of $___ million for purchases of land and conservation easements to preserve the existing open space on just the North Hills. Keeping in mind your household budget, and knowing that the increase in property taxes from approval of the bond would increase your rent by $___ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
1. FOR
2. AGAINST
3. NOT VOTE AT ALL

33. What is the main reason for your (yes, no, would not) vote, on the previous question?
1. _______________________________________
2. NO ANSWER
34. Several organizations around the country, such as The Nature Conservancy, Ducks Unlimited and the Rocky Mountain Elk Foundation have established trust funds which are used to purchase land or conservation easements. These purchases insure that the land is preserved for such things as wildlife habitat, open space or agricultural uses, and are not developed for residential uses. How familiar are you with these types of trust funds?
1. VERY FAMILIAR
2. SOMEWHAT FAMILIAR
3. NOT VERY FAMILIAR
4. NOT AT ALL FAMILIAR
5. NO ANSWER

35. Approximately how much, if anything, did you contribute to environmental or conservation organizations or causes in 1993?
1. $____
2. NO ANSWER

36. Suppose that the bond issues referred to above failed pass. If a non-profit group established a trust fund for the specific purpose of preserving open space on the North Hills by making purchases of land and conservation easements and you were asked within the next two weeks would you be willing to make a one time contribution of $____ to the trust fund?

37. What is your occupation?
1. ____________
2. NO ANSWER

38. What is your age?
1. ____________
2. NO ANSWER

39. Are you a member of any environmental or conservation organizations, such as The Audubon Society, The National Wildlife Federation, The Nature Conservancy, or other similar organizations?
1. YES
2. NO (skip to question 40)
3. NO ANSWER (skip to question 40)

40. What is the name of the organization? (the name of one is enough)
1. ____________
2. NO ANSWER
41. What is the highest level of formal education that you have completed?
   1. Grade school
   2. Some high school
   3. High school
   4. Some college
   5. Finished college
   6. Some postgraduate
   7. Finished postgraduate

42. I am going to read a list of income categories. Please tell me which category best describes the total amount of income received by all of the members in your household during 1993. You can just tell me which letter applies. The categories are:
   1. A. Under $5000
   2. B. $5000 to $10,000
   3. C. $10,000 to $20,000
   4. D. $20,000 to $30,000
   5. E. $30,000 to $40,000
   6. F. $40,000 to $50,000
   7. G. $50,000 to $75,000
   8. H. $75,000 to $100,000
   9. I. $100,000 or over

43. That is the last of our questions. Is there anything else you would like to say about open space or this survey? Thank you very much for your time.

44. [INTERVIEWER: THE RESPONDENT'S SEX IS]
   1. Female
   2. Male

Other comments:
APPENDIX 2.2: Survey Instrument version 2

Missoula Open Space Contingent Valuation Survey (Version 2)

1. Enter the Respondent ID#________
2. Enter the Respondent's address ____________________
   Zip Code 598_
3. Enter Interviewer's Name _________________________

DIAL THE TELEPHONE NUMBER, IF A YOUNG CHILD ANSWERS THE PHONE ASK FOR AN ADULT.

4. Hello. Is this the ___(last name)____ residence?
   (IF NO. The number I was calling is ________ and it was for the __
   (first and last name)____ residence.)
   (IF WRONG NUMBER, TERMINATE WITH, E.G.: I am sorry to have bothered you.)

This is ___(interviewer's name)____. I am calling from the Economics Department at the University of Montana. We are doing a research study on what economic values people in Missoula attribute to open space. Your telephone number and address were drawn in a random sample of Missoula. Last week you should have received a letter briefly explaining the study. Did you receive the letter?
1. YES
2. NO

   (IF NO. I’m sorry yours didn’t reach you. It was a brief letter we sent so people would know that we would be calling them.)

5. In order for our survey to be most representative, I need to talk to the person currently living in your household who is 18 years of age or older and who has had the MOST RECENT BIRTHDAY. Would that be you or someone else?

   2. Someone Else [INTERVIEWER: ASK TO SPEAK WITH THAT PERSON. IF THEY ARE NOT HOME ASK FOR THEIR NAME AND WHEN IT WOULD BE CONVENIENT TO CALL THEM BACK. NAME_______________________ CALL BACK TIME_________] (Please transfer this information to the cover sheet).

   [INTERVIEWER: READ IF SOMEONE ELSE]

   Hello, my name is ___________, and I’m calling from the Economics Department at the University of Montana. We are doing a research study on what economic values people in Missoula attribute to open space. Last week we sent out a letter briefly explaining the study. Have you seen the letter?
   1. YES
   2. NO
   (IF NO. I’m sorry yours didn’t reach you. It was a brief letter we sent so people would know that we would be calling them.)

6. The questions I would like to ask will take about ten minutes. But before starting I want to stress that this interview is completely voluntary and confidential. Your answers will only be used for this study. I would be happy to answer any questions you might have about the study either now or later. Okay?
7. Let me begin by asking... how long have you lived in Missoula County?  
   1. ____ Months ____ Years  
   2. NO ANSWER

8. How long have you lived at your current residence?  
   1. ____ Months ____ Years  
   2. NO ANSWER

9. How many people live in your household?  
   1.  
   2. NO ANSWER

10. Do you have children?  
    1. YES  
    2. NO [skip to question 12]  
    3. NO ANSWER [skip to question 12]

11. Do any of them live at home or in Missoula?  
    1. YES  
    2. NO  
    3. NO ANSWER

12. Do you live within the city limits of Missoula?  
    1. YES  
    2. NO  
    3. NO ANSWER

13. Are you registered to vote in Missoula County?  
    1. YES  
    2. NO  
    3. NO ANSWER

14. The primary election will be held on June 7th, included on the ballot will be two open space issues. Do you plan to vote in this election?  
    1. YES  
    2. NO  
    3. NO ANSWER

For the next three questions I will be asking how familiar you are with a concept or issue. For an answer please tell me whether you are very FAMILIAR, SOMEWHAT FAMILIAR, NOT VERY FAMILIAR or NOT FAMILIAR AT ALL.

15. The preservation of existing open spaces in the Missoula Valley has received considerable attention recently, both from the news media and various advocacy groups. How familiar are you with recent developments in open space issues?  
    1. VERY FAMILIAR  
    2. SOMEWHAT FAMILIAR  
    3. NOT VERY FAMILIAR  
    4. NOT AT ALL FAMILIAR  
    5. NO ANSWER
16. A conservation easement is a legal agreement in which the owner of a piece of land sells the right to develop that land to someone else, generally a non-profit organization or the government. Conservation easements have become widely used as a way to preserve open space because they are cheaper than outright purchase of the property. How familiar are you with the idea of conservation easements?
1. VERY FAMILIAR
2. SOMEWHAT FAMILIAR
3. NOT VERY FAMILIAR
4. NOT AT ALL FAMILIAR
5. NO ANSWER

17. In 1980 Missoula voters passed a $500,000 conservation bond. A bond is similar to taking out a loan, to be paid back over fixed time period, in this case, the next 20 years. The proceeds of the bond were used to purchase what is now "John H. Toole Riverfront Park", downtown on the south side of the Clark Fork, a conservation easement for the open hillside of Mt. Sentinel, the Old Milwaukee railroad lands in the Hellgate Canyon, now known as the Kim Williams Trail, and a small parcel on Mt. Jumbo. How familiar are you with the 1980 city of Missoula Conservation Bond?
1. VERY FAMILIAR
2. SOMEWHAT FAMILIAR
3. NOT VERY FAMILIAR
4. NOT AT ALL FAMILIAR
5. NO ANSWER

18. Using tax dollars to purchase new park lands and preserve existing open spaces comes at some expense, either in increased taxes or in reduction of some other government service. With this in mind please rank how important you feel additional government expenditures are in the following categories. Rank each category from one to five, with one being NOT IMPORTANT and five being EXTREMELY IMPORTANT. The categories are:

<table>
<thead>
<tr>
<th>EXPENDITURE</th>
<th>NOT IMPORTANT</th>
<th>EXTREMELY IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improving Primary and Secondary Education.</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
<tr>
<td>2. Controlling Air and Water Pollution..........</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
<tr>
<td>3. Improving Public Roads........................</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
<tr>
<td>4. Additional Aid to the Poor and Elderly......</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
<tr>
<td>5. Providing New Health Care Services...........</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
<tr>
<td>6. Preserving Open Space and Purchasing New Park Lands</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
<tr>
<td>7. Other:........................................</td>
<td>1 2 3 4 5</td>
<td>No Opinion</td>
</tr>
</tbody>
</table>
19. There are several areas in and around Missoula which are currently being considered in open space discussions. I would now like to ask how important you feel these areas are as open space in the Missoula Valley. Please rank each area from one to five, with one being NOT IMPORTANT and five being EXTREMELY IMPORTANT. The areas are:

<table>
<thead>
<tr>
<th>AREA</th>
<th>NOT IMPORTANT</th>
<th>EXTREMELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Jumbo</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>The Fort Missoula area</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>The Clark Fork riverfront from the Russell Street bridge to the Bitterroot river</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>The Bitterroot riverfront from where Highway 93 crosses the river to where it joins the Clark Fork, including McCauley Butte</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>The North Hills</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>Other areas (please specify)</td>
<td>1 2 3 4 5 No Opinion</td>
<td></td>
</tr>
<tr>
<td>NO ANSWER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. I would now like to ask you about a very specific area. The North Hills are the grassland area north of Interstate 90, between the existing development along Grant Creek and Rattlesnake Creek. Do you understand what area I am describing?

1. YES
2. NO [INTERVIEWER: PROVIDE MORE INFORMATION, "If you were to get on Interstate 90 at the VanBuren Street interchange, near the university and drive to the Reserve Street interchange, the North Hills would be the grassland area immediately to your right"]

21. From where you live can you see the North Hills?

1. YES
2. NO
3. NO ANSWER

22. Do you own or rent your current residence?

1. OWN
2. RENT [go to question 27]
3. NO ANSWER
23. I am going to read a list of house value ranges. Please tell me the range that you believe your house would be in if you were to sell the house this month. You can just tell me the letter that corresponds to the appropriate range. The ranges are:
[Circle the appropriate value then use the corresponding tax increase in the GREEN highlighted column for the next question.]

<table>
<thead>
<tr>
<th>BOND AMOUNT (in millions)</th>
<th>1</th>
<th>4</th>
<th>8</th>
<th>15</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-$40,000</td>
<td>$2</td>
<td>$7</td>
<td>$14</td>
<td>$26</td>
<td>$43</td>
</tr>
<tr>
<td>$40,000-$60,000</td>
<td>$3</td>
<td>$10</td>
<td>$21</td>
<td>$39</td>
<td>$65</td>
</tr>
<tr>
<td>$60,000-$80,000</td>
<td>$3</td>
<td>$14</td>
<td>$28</td>
<td>$52</td>
<td>$86</td>
</tr>
<tr>
<td>$80,000-$100,000</td>
<td>$4</td>
<td>$17</td>
<td>$35</td>
<td>$66</td>
<td>$108</td>
</tr>
<tr>
<td>$100,000-$125,000</td>
<td>$5</td>
<td>$22</td>
<td>$43</td>
<td>$82</td>
<td>$135</td>
</tr>
<tr>
<td>$125,000-$150,000</td>
<td>$6</td>
<td>$26</td>
<td>$52</td>
<td>$98</td>
<td>$162</td>
</tr>
<tr>
<td>$150,000-$200,000</td>
<td>$8</td>
<td>$35</td>
<td>$69</td>
<td>$131</td>
<td>$216</td>
</tr>
<tr>
<td>$200,000-$500,000</td>
<td>$21</td>
<td>$87</td>
<td>$174</td>
<td>$328</td>
<td>$540</td>
</tr>
<tr>
<td>$500,000-$1,000,000</td>
<td>$42</td>
<td>$174</td>
<td>$347</td>
<td>$656</td>
<td>$1081</td>
</tr>
<tr>
<td>Greater than 1 mil</td>
<td>$42</td>
<td>$174</td>
<td>$347</td>
<td>$656</td>
<td>$1081</td>
</tr>
</tbody>
</table>

11. DON'T KNOW-------
12. REFUSED TO ANSWER [skip to question 24]

24. Suppose that Missoula County voters were asked to approve a new conservation bond of $___ million for purchases of land and conservation easements to preserve the existing open space on just the North Hills. Keeping in mind your household budget, and knowing that approval of the bond would increase your property taxes by $___ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
1. FOR
2. AGAINST
3. NOT VOTE AT ALL
[skip to question 26]

25. Suppose that Missoula County voters were asked to approve a new conservation bond of $___ million for purchases of land and conservation easements to preserve the existing open space on just the North Hills. Keeping in mind your household budget, and knowing that approval of the bond would increase the property taxes on the average Missoula County home by $___ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
1. FOR
2. AGAINST
3. NOT VOTE AT ALL
[skip to question 26]

26. What is the main reason for your (yes, no, would not) vote, on the previous question?
1. ______________________________
2. NO ANSWER
27. What are your monthly rent payments? [If the respondent shares rent with someone else ask for their "individual" rent payment.]

(Circle the appropriate value then use the corresponding rent increase in the GREEN highlighted column for the next question.)

<table>
<thead>
<tr>
<th>BOND AMOUNT (in millions)</th>
<th>ANNUAL RENT INCREASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-$400</td>
<td>$2</td>
</tr>
<tr>
<td>$400-$600</td>
<td>$3</td>
</tr>
<tr>
<td>$600-$800</td>
<td>$4</td>
</tr>
<tr>
<td>$800-$1000</td>
<td>$5</td>
</tr>
<tr>
<td>$1000-$1250</td>
<td>$6</td>
</tr>
<tr>
<td>$1250-$1500</td>
<td>$7</td>
</tr>
<tr>
<td>$1500-$2000</td>
<td>$8</td>
</tr>
<tr>
<td>$2000-$5000</td>
<td>$9</td>
</tr>
<tr>
<td>$5000-$10,000</td>
<td>$10</td>
</tr>
<tr>
<td>$10,000-$20,000</td>
<td>$11</td>
</tr>
<tr>
<td>$&gt;20,000</td>
<td>$12</td>
</tr>
</tbody>
</table>

28. Suppose that Missoula County voters were asked to approve a conservation bond of $ ____ million for purchases of land and conservation easements to preserve the existing open space on just the North Hills. Keeping in mind your household budget, and knowing that the increase in property taxes from approval of the bond would increase your rent by $ ____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?

1. FOR
2. AGAINST
3. NOT VOTE AT ALL

29. Suppose that Missoula County voters were asked to approve a conservation bond of $ ____ million for purchases of land and conservation easements to preserve the existing open space on just the North Hills. Keeping in mind your household budget, and knowing that the increase in property taxes from approval of the bond would increase the rent of the average Missoula County rental by $ ____ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?

1. FOR
2. AGAINST
3. NOT VOTE AT ALL

30. What is the main reason for your (yes, no, would not) vote, on the previous question?

1. _______________________________________
2. NO ANSWER

I would now like to ask you a question about open space in all of the Missoula Valley, instead of just the North Hills.

Earlier this month the Missoula County Commissioners placed on the June 1994 ballot a new conservation bond proposal with the following ballot language, "for the purpose of, establishing and funding the Missoula County Open Space Acquisition Fund, which shall be used to acquire interests in or rights in
property including land and water, that will provide a means for the preservation of significant open space land or the preservation of native plants or animals, or park or recreational purposes, or geological or geographical formations of scientific, historic, aesthetic or educational interest in Missoula County and to pay the costs associated with the issuance of the bonds.

[**HOME OWNERS**]

[INTERVIEWER: use the values in the RED highlighted column from question 23 for this question]

31. Keeping in mind your household budget. Suppose that this new conservation bond were for $___ million, and knowing that approval of the bond would increase your property taxes by $___ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
   1. FOR
   2. AGAINST
   3. NOT VOTE AT ALL

[**RENTERS**]

[INTERVIEWER: use the values in the RED highlighted column from question 27 for this question]

32. Keeping in mind your household budget. Suppose that this new conservation bond were for $___ million, and knowing that the increase in property taxes from approval of the bond would increase your rent by $___ a year for the next ten years, would you vote FOR the new conservation bond, AGAINST it, or NOT VOTE AT ALL?
   1. FOR
   2. AGAINST
   3. NOT VOTE AT ALL

33. What is the main reason for your (yes, no, would not) vote, on the previous question?
   1. ______________________________
   2. NO ANSWER

34. Several organizations around the country, such as The Nature Conservancy, Ducks Unlimited and the Rocky Mountain Elk Foundation have established trust funds which are used to purchase land or conservation easements. These purchases insure that the land is preserved for such things as wildlife habitat, open space or agricultural uses, and are not developed for residential uses. How familiar are you with these types of trust funds?
   1. VERY FAMILIAR
   2. SOMEWHAT FAMILIAR
   3. NOT VERY FAMILIAR
   4. NOT AT ALL FAMILIAR
   5. NO ANSWER
35. Approximately how much, if anything, did you contribute to environmental or conservation organizations or causes in 1993?
   1. $____
   2. NO ANSWER

36. Suppose that the bond issues referred to above failed pass. If a non-profit group established a trust fund for the specific purpose of preserving open space on the North Hills by making purchases of land and conservation easements and you were asked within the next two weeks would you be willing to make a one time contribution of $____ to the trust fund?

37. What is your occupation?
   1. 
   2. NO ANSWER

38. What is your age?
   1. _____
   2. NO ANSWER

39. Are you a member of any environmental or conservation organizations, such as The Audubon Society, The National Wildlife Federation, The Nature Conservancy, or other similar organizations?
   1. YES
   2. NO [skip to question 40]
   3. NO ANSWER [skip to question 40]

40. What is the name of one of the organizations?
   1. 
   2. NO ANSWER

41. What is the highest level of formal education that you have completed?
   1. Grade school
   2. Some high school
   3. High school
   4. Some college
   5. Finished college
   6. Some postgraduate
   7. Finished postgraduate

42. I am going to read a list of income categories. Please tell me which category best describes the total amount of income received by all of the members in your household during 1993. You can just tell me which letter applies. The categories are:
   1.... A. Under $5000
   2.... B. $5000 to $10,000
   3.... C. $10,000 to $20,000
   4.... D. $20,000 to $30,000
   5.... E. $30,000 to $40,000
   6.... F. $40,000 to $50,000
   7.... G. $50,000 to $75,000
   8.... H. $75,000 to $100,000
   9.... I. $100,000 or over

43. That is the last of our questions. Is there anything else you would like to say about open space or this survey? Thank you very much for your time.

44. [INTERVIEWER: THE RESPONDENT'S SEX IS]
   1. Female
   2. Male

Other comments:
APPENDIX 3: Pretest Questionnaire

Missoula North Hills Contingent Valuation Survey

1. Enter the Respondent ID#____

2. Enter the Respondent’s address ____________________
   Zip Code _____

3. Enter Interviewer’s Name _______________________

   DIAL THE TELEPHONE NUMBER, IF A YOUNG CHILD ANSWERS THE PHONE ASK FOR AN ADULT.

4. Hello. Is this the ___(last name)___ residence?

   (IF NO. The number I was calling is _______ and it was for the ___(first and last name)___ residence.)

   (IF WRONG NUMBER, TERMINATE WITH, E.G.: I am sorry to have bothered you.)

   This is ___(interviewer’s name)____. I am calling from the Economics Department at the University of Montana. We are doing a research study on what economic values people in Missoula attribute to open space. Your telephone number and address were drawn in a random sample of Missoula. Last week you should have received a letter briefly explaining the study. Did you receive the letter?

   1. YES
   2. NO

   (IF NO. I’m sorry yours didn’t reach you. It was a brief letter we sent so people would know that we would be calling them.)

5. In order for our survey to be most representative, I need to talk to the person currently living in your household who is 18 years of age or older and who has had the MOST RECENT BIRTHDAY. Would that be you or someone else?

   2. Someone Else [INTERVIEWER: ASK TO SPEAK WITH THAT PERSON. IF THEY ARE NOT HOME ASK FOR THEIR NAME AND WHEN IT WOULD BE CONVENIENT TO CALL THEM BACK.
      NAME_________] CALL BACK TIME [ ] (Please transfer this information to the cover sheet).

   [INTERVIEWER: READ IF SOMEONE ELSE]

   Hello, my name is ________ and I’m calling from the Economics Department at the University of Montana. We are doing a research study on what economic values people in Missoula attribute to open space. Last week we sent out a letter briefly explaining the study. Have you seen the letter?

   1. YES
   2. NO

   (IF NO. I’m sorry yours didn’t reach you. It was a brief letter we sent so people would know that we would be calling them.)
6. The questions I would like to ask will take about ten minutes. But before starting I want to stress that this interview is completely voluntary and confidential. Your answers will only be used for this study. I would be happy to answer any questions you might have about the study either now or later. Okay?

7. Let me begin by asking . . . how long have you lived in the Missoula Valley? __Months __Years

8. How many people live in your household? __

9. Do you have children?
   1. YES
   2. NO

10. Do any of them live at home or in Missoula?
    1. YES
    2. NO

11. Do you live within the city limits of Missoula?
    1. YES
    2. NO

12. Are you registered to vote in Missoula County?
    1. YES
    2. NO

13. Are you a member of any environmental organizations?
    1. YES
    2. NO

14. The preservation of existing open spaces in the Missoula Valley has received considerable attention recently, both from the news media and various advocacy groups. How familiar are you with recent developments in open space issues?
    1. VERY FAMILIAR
    2. SOMEWHAT FAMILIAR
    3. NOT VERY FAMILIAR
    4. NOT AT ALL FAMILIAR

15. A conservation easement is a legal agreement in which the owner of a piece of land sells the right to develop that land to someone else, generally a non-profit organization or the government. Conservation easements have become widely used as a way to preserve open space because they are cheaper than outright purchase of the property. How familiar are you with the idea of conservation easements?
    1. VERY FAMILIAR
    2. SOMEWHAT FAMILIAR
    3. NOT VERY FAMILIAR
    4. NOT AT ALL FAMILIAR

16. Several organizations around the country, such as The Nature Conservancy, Ducks Unlimited and the Rocky Mountain Elk Foundation have established trust funds which are used to purchase land or conservation easements. These purchases insure that the land is preserved for such things as wildlife habitat, open space or agricultural uses, and are not developed for residential uses. How familiar are you with these types of trust funds?
    1. VERY FAMILIAR
    2. SOMEWHAT FAMILIAR
    3. NOT VERY FAMILIAR
    4. NOT AT ALL FAMILIAR
17. The grassland area north of Interstate 90, and between the existing development along Grant Creek and Rattlesnake Creek is commonly known as the North Hills. Do you understand what area I am describing?
1. YES
2. NO [INTERVIEWER: PROVIDE MORE INFORMATION, "If you were to get on Interstate 90 at the VanBuren Street interchange, near the university and drive to the Reserve Street interchange, the North Hills would be the grassland area immediately to your right"]

18. From where you live can you see the North Hills?
1. YES
2. NO

19. Given the current rate of growth in the Missoula Valley it is probable that over the next twenty years these open hillsides will be developed if no action is taken to preserve their undeveloped nature. If you were asked within the next two weeks, would you be willing to make an annual contribution of $___ to a trust fund, that by making purchases of land and conservation easements would preserve the existing open space on the North Hills?
1. YES
2. NO

19b. What would be the most you would be willing to contribute annually to such a trust fund? $____

20. Do you own your house or rent?
1. OWN
2. RENT--go to question 22.

21. I am going to read a list of house value ranges. Please tell me the range that you believe your house would be in if you were to sell the house this month. You can just tell me the letter that corresponds to the appropriate range. The ranges are:

1. . . A . $0-$40,000
2. . . B . $40,000-$60,000
3. . . C . $60,000-$80,000
4. . . D . $80,000-$100,000
5. . . E . $100,000-$125,000
6. . . F . $125,000-$150,000
7. . . G . $150,000-$200,000
8. . . H . $200,000-$500,000
9. . . I . $500,000-$1 million
10. . . J . greater than $1 million [skip to question 23]

22. What are your monthly rent payments? $____

23. What is your occupation? _______________

24. For the next three questions I will read a number of options for the answer. Please stop me when I get to the option that describes you.
Your age is
1. 18 to 25
2. 26 to 35
3. 36 to 45
4. 46 to 55
5. 56 to 65
6. 66 or older
25. The highest level of formal education that you have completed is
1. Grade school
2. Some high school
3. High school
4. Some college
5. Finished college
6. Some postgraduate
7. Finished postgraduate

26. I am going to read a list of income categories. Please tell me which category best describes the total amount of income received by all of the members in your household during 1993. You can just tell me which letter applies. The categories are:
1. A. Under $5000
2. B. $5000 to $10,000
3. C. $10,000 to $20,000
4. D. $20,000 to $30,000
5. E. $30,000 to $40,000
6. F. $40,000 to $50,000
7. G. $50,000 to $75,000
8. H. $75,000 to $100,000
9. I. $100,000 or over

27. In 1980 Missoula voters approved a conservation bond by passing a property tax levy to purchase open space and park land. That revenue was used up several years ago with the purchase of park land along the Clarkfork riverfront (downtown and in the Heligate canyon), a small parcel on Mt. Jumbo and a conservation easement on Mt. Sentinel. How familiar are you with the 1980 conservation bond?
1. VERY FAMILIAR
2. SOMEWHAT FAMILIAR
3. NOT VERY FAMILIAR
4. NOT AT ALL FAMILIAR

28. Suppose that Missoula voters were asked to approve a new conservation bond for purchases of land and conservation easements to preserve the existing open space on the North Hills. Would you support the formation of this new conservation bond, knowing that it would increase your current property taxes by $____?
1. YES
2. NO

28b. What would be the most you would be willing to pay in increased property taxes for a conservation bond used to preserve open space on the North Hills? $____

29. Our questions have asked how you value Missoula's North Hills. I would now like to ask how your value for the North Hills compares to the value you place on other open spaces in the Missoula Valley. Please listen to the following list of five currently developable open spaces and rank them in value from highest to lowest. [INTERVIEWER, READ THE LIST THEN TAKE THE RANKINGS]

RANK AREA
1. Mt. Jumbo
2. The Fort Missoula area
3. The Clarkfork riverfront between downtown and the Bitterroot river
4. The lower stretch of the Bitterroot River, from Buckhouse Bridge to the Clarkfork river
5. The North Hills
6. Other areas (please specify)
APPENDIX 4: Answering Machine Message

MISSOULA OPEN SPACE SURVEY ANSWERING MACHINE MESSAGE

Hello, this is ________________ calling from the Economics Department at the University of Montana. Your household has been selected in a random sample to be part of a research study regarding attitudes in Missoula County about open space. The study involves a telephone survey, which takes about 10 minutes. Over the last week we have been unable to contact you by phone. It is important for us to complete as many of the survey’s as is possible. If you are willing to participate please call us at 243-2925 and tell us when would be a convenient time to complete the survey. Thank you very much for your time.
Appendix 5: Answers to Questions the Respondent May Have

OPEN SPACE SURVEY

WHAT THE RESPONDENT MAY WANT TO KNOW ABOUT THIS SURVEY

I. Who is sponsoring this survey?

The survey is part of graduate research project in the economics program at the University of Montana. There is also some financial support for the mailing and volunteer support from the group Save Open Space.

II. What is the purpose of the study?

The purpose of this study is to develop an independent assessment of public attitudes within the Missoula County about preserving open space areas in the Missoula Valley.

III. Who is the person responsible for the survey?

Mike Kadas is the graduate student who is project director. His phone number is 243-2925.

IV. How many people will be participating in the study?

We will be attempting to complete 540 interviews.

V. Who are you?/Who is conducting the survey?

I am a student in economics (or resident of Missoula), volunteering my time for these interviews.

VI. How did you get my name?

The names were randomly selected from the Missoula area phone book. (In some cases addresses were then found in the Missoula Polk Directory.)

VII. How can I be sure that this authentic?

I would be glad to give you our telephone number here at the Economics Department and you could talk with the project supervisor. It is 243-2925.

VIII. Is this confidential?

The survey is absolutely confidential. After the survey is completed, the answers are put on a computer without the names, and the names attached to the surveys are destroyed. All of the information that is released is presented in such a way that no individual response can ever be traced.
IX. Can I get a copy of the results?

Yes, let me check your name and mailing address to make sure they are correct and I will give them to the project director. The result will be ready in about three months.

X. What will the results be used for?

The results will be the basis for a master degree thesis and may be shared with local groups and policy makers involved in the open space decisions.

XI. Will someone call later and ask me to pay?

We’re just asking you to imagine a situation. You will not be placed on any mailing or phone lists because of your participation in this survey.

KEY DEFINITIONS

Conservation Bond—is a loan a local government takes from bond holders, to be paid back over a set term (ten years in this case), the proceeds from the loan are then used to purchase land and conservation easements to protect particular areas from being developed.

Conservation Easement—is a legal agreement where a land owner, for a payment, agrees not to develop the land in which the agreement pertains to.

Open Spaces—are lands which have not been residentially or commercially developed. They include agricultural lands, parks, riverfronts and riparian areas.

Trust Fund—is a fund established to purchase land and conservation easements in order to preserve open spaces.
APPENDIX 6: Exit Poll Survey Instrument

OPEN SPACE EXIT POLL – PRIMARY ELECTION, JUNE 7, 1994

THIS SURVEY IS PART OF A RESEARCH PROJECT BEING CONDUCTED BY THE ECONOMICS DEPARTMENT AT THE UNIVERSITY OF MONTANA. YOUR RESPONSES ARE COMPLETELY CONFIDENTIAL. PLEASE FILL OUT THE QUESTIONNAIRE, FOLD AND DROP IN THE "BALLOT BOX" THANK YOU FOR YOUR HELP.

1. How did you vote on the Open Space bond issue (please circle one answer)?
   a. YES  b. NO  c. DID NOT VOTE

2. What was the main reason for the way you chose to vote on the Open Space issue?

PART A: FOR HOMEOWNERS ONLY

3. If it passes how much do you think the Open Space bond will raise your annual property taxes?
   $__________

4. If you were to sell your house within the next month, how much do you believe it would sell for (please circle one)?
   a. $0 - $40,000  e. $100,000 - $125,000
   b. $40,000 - $60,000  f. $125,000 - $150,000
   c. $60,000 - $80,000  g. $150,000 - $500,000
   d. $80,000 - $100,000  h. more than $500,000

PART B: FOR RENTERS ONLY

5. If it passes how much do you think the Open Space bond will raise your annual rent? $__________

6. How much is your current monthly rent (if you share rent with others please include just your portion)? $__________

PART C: FOR EVERYONE

7. What is your age? ________ (in years)  8. a. Female  b. Male (circle one)

9. How familiar are you with current open space issues (circle one)?
   a. VERY FAMILIAR  c. NOT VERY FAMILIAR
   b. SOMEWHAT FAMILIAR  d. NOT AT ALL FAMILIAR

10. Do you belong to any environmental organizations (circle one)?  a. YES  b. NO

11. What is the highest level of formal education you have completed (circle one)?
   a. Some grade or high school  c. College degree
   b. High school diploma  d. Graduate degree

Thank you for your participation, please fold the ballot and place it in the red ballot box.
### APPENDIX 7: Non-parameterized Bid Levels

#### Distribution of Bids and Votes by Version for County-wide Question

<table>
<thead>
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<th>Bid Levels</th>
<th>Total Sample</th>
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## Distribution of Bids and Votes by Version for North Hills Question

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**bivariate valuation using tax increase with median**

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MTX NTX VMSLA VMSRN VNHRN VNHL LNH SNH TF ECTB TAMT TVT OCC AGE &
ENVEM ENNH EDU IN SEX &
/ SKIPLINES=7

set nowarnskip
genr lmtx=log(mtx)
if(vmsla.eq.1) vyes=l
ngen lnmt=log(ntx)
if(vnhl.eq.1) vynh=l
ngen ltamt=log(tamt)
if(tvt.eq.1) vtvt=l

logit vyes lmtx / coef=a
genr median=exp(-a:2/a : 1)
print median
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**bivariate election prediction using bond amount, primary voters only, with median**

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OSI CEAS CBND ED PO RD PR HE OS JU FTM CKF BRT MH OWN VAL MBD NHD &
MTX NTX VMSLA VMSRN VNHRN VNHL LNH SNH TF ECTB TAMT TVT OCC AGE &
ENVEM ENNH EDU IN SEX &
/ SKIPLINES=7

set nowarnskip
genr lmbd=log(mbd)
if(vmsla.eq.1) vyes=l
ngen lnhd=log(nhd)
if(vnhl.eq.1) vynh=l
skipif(vreg.ne.1)
skipif(vprim.ne.1)
logit vyes lmbd / coef=a
genr median=exp(-a:2/a : 1)
print median
stop
```

**full model using log of the odds**

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MTX NTX VMSLA VMSRN VNHRN VNHL LNH SNH TF ECTB TAMT TVT OCC AGE &
ENVEM ENNH EDU IN SEX &
/ SKIPLINES=7

set nowarnskip
genr lmtx=log(mtx)
if(vmsla.eq.1) vyes=l
ngen lnmt=log(ntx)
if(vnhl.eq.1) vynh=l
ngen ltamt=log(tamt)
if(tvt.eq.1) vtvt=l
skipif(yms.lt..1)
nkipif(nup.lt..1)
nkipif(val.lt..1)
skipif(age.lt..1)
skipif(in.lt..1)
```
if(ltr.eq.l) dltr=l
genr lyms=log(yms)
genr lnup=log(nup)
if(zip.lt.4) dzip=l
if(chi.eq.l) dchi=l
if(osi.lt.3) dosi=l
if(cbnd.lt.3) dcbnd=l
if(own.eq.2) drent=l
ngen lvall=log(val)
if(envem.eq.1) denvem=l
if(edu.gt.4) dedu=l
if(sex.eq.1) dsex=l
genr lage=log(age)
if(occ.lt.3) docc=l
ngen lin=log(in)
if(snh.eq.1) dsnh=l
logit vyes lmx dltr lyms lnup dzip dchi dosi dcbnd drent & lvall denvem dedu dsex lage docc lin / coef=a stderr=s

genl b=1.96
ngen o1=exp(a:1)
genl ci1p=exp(a:1-s:1*b)
genl ci1=exp(a:1+s:1*b)
print o1
print ci1
print ci1p
ngen o2=exp(a:2)
genl ci2p=exp(a:2-s:2*b)
genl ci2=exp(a:2+s:2*b)
print o2
print ci2
print ci2p
ngen o3=exp(a:3)
genl ci3p=(a:3-s:3*b)
genl ci3=(a:3+s:3*b)
print o3
print ci3
print ci3p
ngen o4=exp(a:4)
genl ci4p=(a:4-s:4*b)
genl ci4=(a:4+s:4*b)
print o4
print ci4
print ci4p
ngen o5=exp(a:5)
genl ci5p=exp(a:5-s:5*b)
genl ci5=exp(a:5+s:5*b)
print o5
print ci5
print ci5p
ngen o6=exp(a:6)
genl ci6p=exp(a:6-s:6*b)
genl ci6=exp(a:6+s:6*b)
print o6
print ci6
print ci6p
ngen o7=exp(a:7)
genl ci7p=exp(a:7-s:7*b)
genl ci7=exp(a:7+s:7*b)
print o7
print ci7
print ci7p
genl o8=exp(a:8)
genl ci8p=exp(a:8-s:8*b)
genl ci8=exp(a:8+s:2*8)
print o8
print ci8
print ci8p
genl o9=exp(a:9)
genl ci9p=exp(a:9-s:9*b)
genl ci9=exp(a:9+s:9*b)
print o9
print ci9
print ci9p
genl o10=exp(a:10)
genl ci10p=(a:10-s:10*b)
genl ci10=(a:10+s:10*b)
print ci10
print ci10p
genl o11=exp(a:11)
genl ci11p=exp(a:11-s:11*b)
genl ci11=exp(a:11+s:11*b)
print o11
print ci11
print ci11p
genl o12=exp(a:12)
genl ci12p=exp(a:12-s:12*b)
genl ci12=exp(a:12+s:12*b)
print o12
print ci12
print ci12p
genl o13=exp(a:13)
genl ci13p=exp(a:13-s:13*b)
genl ci13=exp(a:13+s:13*b)
print o13
print ci13
print ci13p
genl o14=exp(a:14)
genl ci14p=(a:14-s:14*b)
genl ci14=(a:14+s:14*b)
print o14
print ci14
print ci14p
genl o15=exp(a:15)
genl ci15p=exp(a:15-s:15*b)
genl ci15=exp(a:15+s:15*b)
print o15
print ci15
print ci15p
genl o16=exp(a:16)
genl ci16p=(a:16-s:16*b)
genl ci16=(a:16+s:16*b)
print o16
print ci16
print ci16p
genl o17=exp(a:17)
genl ci17p=exp(a:17-s:17*b)
genl ci17=exp(a:17+s:17*b)
print o17
print ci17
print ci17p
stop
**full model with reparameterization**

READ(OPSJDAT.DAT) ID V ZIP INV LTR YMS YRD NUP CHI HM CL VREG VPRIM &
OSI CEAS CBND ED PO RD PR HE OS JU FTB KRF BRT NH OWN VAL MBD NHD &
MTX VMSLA VMSRN VNHRN VNLN LNH SNH TF ECTB TAMT TVT OCC AGE &
ENMEM ENNM EDU IN SEX &
/SKIP_LINES=7

set nowarnskip

genr lmtx=log(mtx)
if(vmsla.eq.1) vyes=l
genr lntx=log(ntx)
if(vnhrn.eq.1) vynh=l
genr ltamt=log(tamt)
if(tvt.eq.1) vttv=l

skipif(ymx.lt..1)
skipif(nup.lt..1)
skipif(val.lt..1)
skipif(age.lt..1)
skipif(in.lt..1)
if(ltr.eq.1) dltr=l

set nowarnskip

genr lmtx=log(mtx)
if(vmsla.eq.1) vyes=l
genr lntx=log(ntx)
if(vnhrn.eq.1) vynh=l
genr ltamt=log(tamt)
if(tvt.eq.1) vttv=l

skipif(ymx.lt..1)
skipif(nup.lt..1)
skipif(val.lt..1)
skipif(age.lt..1)
skipif(in.lt..1)
if(ltr.eq.1) dltr=l

logit vyes lmtx dltr lymx lnup dzip dchi dosi dcbbnd drent &

matrix vargam=diag(c)
matrix varbid=c(0,1)

gen1 newvar1=(1/gamma:1+4)*varbid:1
gen1 sel=sqrt(newvar1)
gen1 ncoef1=1/gamma:1
gen1 ci1=sel*1.96

gen1 newvar2=(-gamma:2+2/gamma:1+4)*varbid:1-2*(-gamma:2/gamma:1+3) &
*varbid:2+(1/gamma:1+2)*vargam:2
gen1 se2=sqrt(newvar2)
gen1 t2=(-gamma:2/gamma:1)/se2
gen1 ncoef2=-gamma:2/gamma:1
gen1 ci2=se2*1.96

gen1 newvar3=(-gamma:3+2/gamma:1+4)*varbid:1-2*(-gamma:3/gamma:1+3) &
*varbid:3+(1/gamma:1+2)*vargam:3
gen1 se3=sqrt(newvar3)
gen1 t3=(-gamma:3/gamma:1)/se3
gen1 ncoef3=-gamma:3/gamma:1
gen1 ci3=se3*1.96
genl newvar4=(-\gamma_4^2/\gamma_1^4)*varbid:1-2*(-\gamma_4/\gamma_1^3) & *varbid:4+(1/\gamma_1^2)*vargam:4
genl se4=sqrt(newvar4)
genl t4=(-\gamma_4/\gamma_1)/se4
genl ncoef4=-\gamma_4/\gamma_1
genl ci4=se4*1.96

genl newvar5=(-\gamma_5^2/\gamma_1^4)*varbid:1-2*(-\gamma_5/\gamma_1^3) & *varbid:5+(1/\gamma_1^2)*vargam:5
genl se5=sqrt(newvar5)
genl t5=(-\gamma_5/\gamma_1)/se5
genl ncoef5=-\gamma_5/\gamma_1
genl ci5=se5*1.96

genl newvar6=(-\gamma_6^2/\gamma_1^4)*varbid:1-2*(-\gamma_6/\gamma_1^3) & *varbid:6+(1/\gamma_1^2)*vargam:6
genl se6=sqrt(newvar6)
genl t6=(-\gamma_6/\gamma_1)/se6
genl ncoef6=-\gamma_6/\gamma_1
genl ci6=se6*1.96

genl newvar7=(-\gamma_7^2/\gamma_1^4)*varbid:1-2*(-\gamma_7/\gamma_1^3) & *varbid:7+(1/\gamma_1^2)*vargam:7
genl se7=sqrt(newvar7)
genl t7=(-\gamma_7/\gamma_1)/se7
genl ncoef7=-\gamma_7/\gamma_1
genl ci7=se7*1.96

genl newvar8=(-\gamma_8^2/\gamma_1^4)*varbid:1-2*(-\gamma_8/\gamma_1^3) & *varbid:8+(1/\gamma_1^2)*vargam:8
genl se8=sqrt(newvar8)
genl t8=(-\gamma_8/\gamma_1)/se8
genl ncoef8=-\gamma_8/\gamma_1
genl ci8=se8*1.96

genl newvar9=(-\gamma_9^2/\gamma_1^4)*varbid:1-2*(-\gamma_9/\gamma_1^3) & *varbid:9+(1/\gamma_1^2)*vargam:9
genl se9=sqrt(newvar9)
genl t9=(-\gamma_9/\gamma_1)/se9
genl ncoef9=-\gamma_9/\gamma_1
genl ci9=se9*1.96

genl newvar10=(-\gamma_{10}^2/\gamma_1^4)*varbid:1-2*(-\gamma_{10}/\gamma_1^3) & *varbid:10+(1/\gamma_1^2)*vargam:10
genl se10=sqrt(newvar10)
genl t10=(-\gamma_{10}/\gamma_1)/se10
genl ncoef10=-\gamma_{10}/\gamma_1
genl ci10=se10*1.96

genl newvar11=(-\gamma_{11}^2/\gamma_1^4)*varbid:1-2*(-\gamma_{11}/\gamma_1^3) & *varbid:11+(1/\gamma_1^2)*vargam:11
genl se11=sqrt(newvar11)
genl t11=(-\gamma_{11}/\gamma_1)/se11
genl ncoef11=-\gamma_{11}/\gamma_1
genl ci11=se11*1.96

genl newvar12=(-\gamma_{12}^2/\gamma_1^4)*varbid:1-2*(-\gamma_{12}/\gamma_1^3) & *varbid:12+(1/\gamma_1^2)*vargam:12
genl se12=sqrt(newvar12)
\begin{verbatim}

\texttt{genl \texttt{ti2}=(-gamma:12/gamma:1)/sel2}
\texttt{genl \texttt{ncoef12}=-gamma:12/gamma:1}
\texttt{genl \texttt{cil2}=sel2*l.96}

\texttt{genl \texttt{newvar13}=(-gamma:13**2/gamma:1**4)*varbid:1-2*(-gamma:13/gamma:1**3) & *varbid:13+(1/gamma:1**2)*vargam:13}
\texttt{genl \texttt{sel3}=sqrt(newvar13)}
\texttt{genl \texttt{ti3}=(-gamma:13/gamma:1)/sel3}
\texttt{genl \texttt{ncoef13}=-gamma:13/gamma:1}
\texttt{genl \texttt{cil3}=sel3*l.96}

\texttt{genl \texttt{newvar14}=(-gamma:14**2/gamma:1**4)*varbid:1-2*(-gamma:14/gamma:1**3) & *varbid:14+(1/gamma:1**2)*vargam:14}
\texttt{genl \texttt{sel4}=sqrt(newvar14)}
\texttt{genl \texttt{ti4}=(-gamma:14/gamma:1)/sel4}
\texttt{genl \texttt{ncoef14}=-gamma:14/gamma:1}
\texttt{genl \texttt{cil4}=sel4*l.96}

\texttt{genl \texttt{newvar15}=(-gamma:15**2/gamma:1**4)*varbid:1-2*(-gamma:15/gamma:1**3) & *varbid:15+(1/gamma:1**2)*vargam:15}
\texttt{genl \texttt{sel5}=sqrt(newvar15)}
\texttt{genl \texttt{ti5}=(-gamma:15/gamma:1)/sel5}
\texttt{genl \texttt{ncoef15}=-gamma:15/gamma:1}
\texttt{genl \texttt{cil5}=sel5*l.96}

\texttt{genl \texttt{newvar16}=(-gamma:16**2/gamma:1**4)*varbid:1-2*(-gamma:16/gamma:1**3) & *varbid:16+(1/gamma:1**2)*vargam:16}
\texttt{genl \texttt{sel6}=sqrt(newvar16)}
\texttt{genl \texttt{ti6}=(-gamma:16/gamma:1)/sel6}
\texttt{genl \texttt{ncoef16}=-gamma:16/gamma:1}
\texttt{genl \texttt{cil6}=sel6*l.96}

\texttt{genl \texttt{newvar17}=(-gamma:17**2/gamma:1**4)*varbid:1-2*(-gamma:17/gamma:1**3) & *varbid:17+(1/gamma:1**2)*vargam:17}
\texttt{genl \texttt{sel7}=sqrt(newvar17)}
\texttt{genl \texttt{ti7}=(-gamma:17/gamma:1)/sel7}
\texttt{genl \texttt{ncoef17}=-gamma:17/gamma:1}
\texttt{genl \texttt{cil7}=sel7*l.96}

\texttt{print ncoef1}
\texttt{print sel1}
\texttt{print ti1}
\texttt{print cil1}

\texttt{print ncoef2}
\texttt{print sel2}
\texttt{print ti2}
\texttt{print cil2}

\texttt{print ncoef3}
\texttt{print sel3}
\texttt{print ti3}
\texttt{print cil3}

\texttt{print ncoef4}
\texttt{print sel4}
\end{verbatim}
print t4
print ci4

print ncoef5
print se5
print t5
print ci5

print ncoef6
print se6
print t6
print ci6

print ncoef7
print se7
print t7
print ci7

print ncoef8
print se8
print t8
print ci8

print ncoef9
print se9
print t9
print ci9

print ncoef10
print se10
print t10
print ci10

print ncoef11
print se11
print t11
print ci11

print ncoef12
print se12
print t12
print ci12

print ncoef13
print se13
print t13
print ci13

print ncoef14
print se14
print t14
print ci14

print ncoef15
print se15
print t15
print ci15

print ncoef16
print se16
print t16
print ci16
print ncoef17
print sel17
print t17
print cil17
print c
stop

**full model for question order differences
READ(OPSPda.DAT) ID V ZIP INV LTR YMS YRD NUP CHI HM CL VREG VPRIM &
OSI CEAS CBND ED PO RD PR HE OS JU FTM CKP BRT NH OWN VAL MBD NHD &
MTX NTX VMSLA VMSRN VNHRN VNHL LNH SNH TF ECTB TAMT TVT OCC AGE &
ENVEM ENNM EDU IN SEX &
/ SKIPLINES=7
set nowarnskip
genr lmtx=log(mtx)
if(vmsla.eq.1) vyes=l
genr lntx=log(ntx)
if(vnhr.eq.1) vynl=l
genr ltamt=log(tamt)
if(tvt.eq.1) vtvt=l
skipif(y eq.1)
skipif(nup.eq.1)
skipif(val.lt.1)
skipif(ltr.eq.1)
if(chi.eq.1) dchi=l
if(osi.eq.1) dosi=l
if(cbnd.eq.1) dcbnd=l
if(own.eq.2) drent=l
if(v.eq.1) dv=1
genr dlmtx=dv*lmtx
genr ddltr=dv*dltr
genr dlyms=dv*llyms
genr dlnup=dv*lnup
genr ddzip=dv*ddzip
genr dchii=dv*dchi
genr dcbnd=dv*dcbbnnd
genr drent=dv*drent
genr dlval=dv*dlval
genr ddenvem=dv*ddenvem
genr dedu=dv*dedu
genr dsex=dv*dsex
genr dage=dv*dage
genr ddocc=dv*ddocc
genr dlin=dv*dlin
genr dosi=dv*dosi
genr dsnh=dv*dsnh
logit vyes lmtx dltr lyms lnup dzip dchi dosi dcbnd drent & lval denvem dedu dsex lage docc lin

logit vyes lmtx dltr lyms lnup dzip dchi dosi dcbnd drent & lval denvem dedu dsex lage docc lin dv dlvmtx ddltr dlyms & dlup ddzip ddchi ddosi ddcbnd ddrent & dlval ddenvem ddedu ddsex dlage ddloc dlin ddshn stop

**bivariate medians for question order subsamples
READ(OPSPda.DAT) ID V ZIP INV LTR YMS YRD NUP CHI HM CL VREG VPRIM & OSI CEAS CBND ED PO RD PR HE OS JU FTM CKF BRT NH OWN VAL MBD NHD & MTX NTX VMSLA VMNRM VNHRN VNHL LNH SNH TF ECTB TAMT TVT OCC AGE & ENVEM ENNM EDU IN SEX & / SKIPLINES=7
set nowarnskip
genr lmtx=log(mtx)
if(vmsla.eq.1) vyes=l
genr lntx=log(ntx)
if(vnhr.eq.1) vynh=l
genr ltamt=log(tamt)
if(tvt.eq.1) vtvt=l

*version 1
skipif(v.ne.1)
logit vyes lmtx / coef=a
genl median=exp(-a:2/a:1)
del skip$

*version 2
skipif(v.ne.2)
logit vyes lmtx / coef=a
genl median=exp(-a:2/a:1)
stop

**full model, pooled sample, for sample differences
READ(OPSP&exp.DAT) ID V ZIP INV LTR YMS YRD NUP CHI HM CL VREG VPRIM & OSI CEAS CBND ED PO RD PR HE OS JU FTM CKF BRT NH OWN VAL MBD NHD & MTX NTX VMSLA VMNRM VNHRN VNHL LNH SNH TF ECTB TAMT TVT OCC AGE & ENVEM ENNM EDU IN SEX & / SKIPLINES=7
set nowarnskip
if(vmsla.eq.1) vyes=l
skipif(mtx.lt.1)
genr lmtx=log(mtx)

skipif(age.lt..1)
skipif(val.lt..1)
if(envem.eq.1) denvem=1
if(ehu.gt.4) dedu=1
if(sex.eq.1) dsex=1
if(osl.lt.3) dosi=1
genr lage=log(age)
if(own.eq.2) drent=1
ngen lval=log(val)
if(zip.lt.4) dzip=1
if(v.eq.3) dexit=1
genr dexitlmt=dexit*lmtx
ngen ddenve=dexit*denvem
ngen ddedu=dexit*dedu

stop
genr ddsex=dexit*dsex  
genr ddosi=dexit*dosi  
genr dlage=dexit*lage  
genr ddrent=dexit*drent  
genr dlval=dexit*lval  
genr ddzip=dexit*dzip  

logit vyes lmtx den vem dedu dsex dosi lage drent lval dzip

logit vyes lmtx den vem dedu dsex dosi lage drent lval dzip &
dexit dexitlmt dden vem ddedu ddsex ddosi dlage ddrent dlval ddzip  
stop
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