Appalachian State University

Department of Economics Working Paper

Number 15-04 | May 2015

Payment and Policy Consequentiality in Contingent Valuation

Peter A. Groothuis
Appalachian State University

Tanga M. Mohr
Appalachian State University

John C. Whitehead
Appalachian State University

Kristan Cockerill
Appalachian State University

Department of Economics
Appalachian State University
Boone, NC 28608
Phone: (828) 262-2148
Fax: (828) 262-6105
www.business.appstate.edu/economics

Payment and Policy Consequentiality in Contingent Valuation

Peter A. Groothuis

Department of Economics

Appalachian State University

Tanga M. Mohr

Department of Economics

Appalachian State University

John C. Whitehead

Department of Economics

Appalachian State University

Kristan Cockerill

Interdisciplinary Studies

Appalachian State University

May 22, 2015

Payment and Policy Consequentiality in Contingent Valuation

Abstract. In stated preference survey research, policy consequentiality exists when the respondent believes that the results of a survey will influence actual policy. Payment consequentiality exists when respondents perceive that there is some non-zero probability that they will have to pay the bid amount. In this study we test for both types of consequentiality using a survey about water conservation measures in western North Carolina. Our analysis finds that both policy and payment consequentiality exist in responses to willingness-to-pay for water conservation measures. Respondents who self-report that they perceive the survey to be consequential are willing to pay positive amounts for the policy. Respondents who do not perceive the survey to be consequential answer with protest no responses and are not responsive to the tax amount in the referendum voting question. In addition as the tax amount increases respondents are less likely to find the survey to be consequential. Understanding the boundaries of consequentiality can contribute to improved survey design to estimate public willingness-to-pay for and acceptance of water conservation programs.

Introduction

Hypothetical bias occurs when there is a divergence between behavioral intentions elicited in a survey setting and actual behavior. Debate continues around the accuracy of the contingent valuation method (CVM) with hypothetical bias being one of the major issues. In 2012, the Journal of Economic Perspectives featured a symposium on CVM. Kling, Phaneuf and Zhou (2012) provided an overview of the method and its development, concluding that when well designed, the CVM can provide important insights. Carson (2012) agreed, arguing that the CVM is "a practical alternative when prices aren't available." In stark contrast, Hausman's (2012) opinion on CVM went from "dubious to hopeless" in the ability of the CVM to accurately measure value. One of Hausman's (2012) issues with contingent valuation is "hypothetical response bias that leads contingent valuation to overstatements of value." Carson, Groves and List (2014), however, suggest that the hypothetical bias critique is overstated due to problems with the inconsequentiality of questions in experimental settings where most of the tests of hypothetical bias have been attempted.

Several meta-analyses compare value estimates from hypothetical and real choices. List and Gallet (2001) and Little and Berrens (2004) find that values based on hypothetical choices are about 3 times higher than those based on real choices in an experimental setting. Murphy et al. (2005), find hypothetical values are about 1.35 times higher than those based on real choices and suggest that hypothetical bias is more likely to occur when students are used as test subjects. Carson and Groves (2007, 2011) and Carson (2012) argue that stated preference surveys will generate accurate statements of willingness-to-pay if the valuation question is incentive compatible (e.g., a referendum vote) and consequential. An incentive compatible question is one where respondents have incentives to truthfully reveal their preferences (e.g., a referendum vote with majority rule). A consequential question is one where the respondent believes that his response has a chance to affect something he cares about. There is mounting empirical evidence from laboratory and field experiments that consequential questions are not prone to hypothetical bias (Landry and List 2007, Vossler and Evans 2009, Vossler and Poe 2011, Vossler, Doyon and Rondeau 2012 and Carson, Groves and List 2014).[1] This leads to what has been called the "knife edge" result: laboratory and field experiment behavior, when the probability of a real outcome is nonzero, is similar to behavior when the probability of a real outcome is one. When the probability of a real outcome is zero in the hypothetical setting, hypothetical and real behavior diverge. This suggests that hypothetical behavior will be similar to real behavior if there is a positive chance that the hypothetical behavior will have real consequences.

While consequentiality theory helps explain why laboratory and field experiments exhibit hypothetical bias for private goods or voluntary contributions, it is not a theory of hypothetical bias for referendum contingent valuation surveys. Consequential surveys are expected to be more accurate but there are no predictions on the direction of any bias for inconsequential surveys. In two CVM applications, Herriges et al. (2010) and Vossler and Watson (2013) ask a follow-up question to determine how consequential respondents consider the survey. They find that respondents who do not believe the survey results are at all consequential are less likely to

[1] Consequentiality may also improve results when the hypothetical question is not incentive compatible. Bulte et al. (2005), using an implicit donation payment vehicle, find that a hypothetical question with a consequential script generates lower willingness-to-pay estimates than the hypothetical question without a consequential script.

support the policy. This is a different sort of “knife edge” result where the lack of perceived consequentiality generates behavior similar to protest no responses (Groothuis and Whitehead 2009).

Interis and Petrolia (2014) further explore the effects of consequentiality in binary and multiple discrete choice experiment questions. In contrast to previous consequentiality studies, Interis and Petrolia (2014) do not find the knife edge result with a binary discrete choice experiment but do with a multiple discrete choice experiment question. Willingness-to-pay is greatest for respondents who believe it is very likely that policy makers will take survey results into consideration and lowest when respondents think that this is unlikely. Vossler, Doyon and Rondeau (2012) also find that willingness-to-pay is a function of the level of consequentiality perceptions. Vossler and Watson (2013) conduct sensitivity analysis of their results by incorporating consequentiality in the empirical willingness-to-pay model. A dummy variable indicating respondents who find the survey to be inconsequential has a negative effect on willingness-to-pay. Deleting respondents who find the survey to be inconsequential increases the theoretical validity of the willingness-to-pay model. Interis and Petrolia (2014) and Vossler and Watson (2013) find evidence to support an important implication of Carson and Groves (2007). That is, because respondents who perceive the survey to be inconsequential may not care about the outcome of the survey, they have little reason to invest in well thought out responses.

According to Carson and Groves (2007) a preference survey question is consequential when a respondent believes their answers will be “potentially influencing to the agency’s [business or government] actions” and the agent cares about the subsequent outcomes. In addition, according to Carson, Grove and List (2014), a survey is consequential if there is a potential the respondent will have to pay the bid. Thus in the literature two types of consequentiality have developed: policy consequentiality and payment consequentiality (Herriges et al., 2010). Policy consequentiality exists when the respondent believes that the results of the survey will influence the policy. Payment consequentiality occurs when respondents perceive that there is some non-zero probability that they will have to pay the bid amount.

In this paper we contribute to the literature in several important ways. First, we provide another test for the effects of perceived consequentiality on willingness-to-pay and differences across bid effects and covariates under different levels of perceived consequentiality. Vossler and Watson (2013) consider the determinants of consequentiality. Herriges et al. (2010), Interis and Petrolia (2013) and Vossler and Watson (2013) consider whether consequentiality perceptions are endogenous. We extend the tests for determinants of consequentiality and endogeneity of consequentiality by considering a joint bivariate probit model of consequentiality and willingness-to-pay. Finally, because no study to date has considered the effect of the bid on consequentiality and bids have been found to effect protest responses (Cunha-e-Sá et al. 2012, Meyerhoff, Bartczak, and Liebe 2012), we include the bid as a determinant in the consequentiality model. We find that both policy and payment consequentiality have implications for the measurement of willingness-to-pay.

Theoretical Model

Strong consequentiality (Carson and Groves 2007) involves both policy consequentiality (the respondent must believe that the results of the survey might influence the policy) and payment consequentiality (the respondent must perceive that there is some probability that they will have to pay). Carson, Groves and List (2014) suggest "a testable implication of [Carson and Grove's (2007)] framework is that the fraction of people who favor a policy action in the population of interest should be invariant to the probability that the survey will influence the decision to provide the public good under the specified terms as long as that probability is positive."

One could model the testable implication of Carson, Groves and List (2014) using a compound lottery such as Cummings and Taylor's (1998): "First, a subjective probability is formed over the likelihood that a majority of survey participants will vote for the policy. This is then combined with the subjective probability that, given the survey referendum passes, the decision makers will actually adopt the policy and people will actually have to pay money in the manner specified in the survey." This compound lottery involves: (1) The probability the referendum passes (either with a majority or specified plurality) and (2) The probability the referendum will be binding given that it passes. We call (1) $P(majority)$ or $P(m)$ and the conditional probability (2) $P(binding|majority)$ or $P(b|m)$. Assuming the decision maker has the power to coerce payment if the referendum is binding, then (1) and (2) form the joint probability: $P(m \cap b) = P(m)P(b|m)$. In a "real" binding referendum $P(b|m) = 1$ so $P(m \cap b) = P(m)$. In other words, the probability the referendum both receives a majority and is binding is just the probability of a majority vote in favor.

Let superscript R denote the real referendum and S denote the survey referendum. In the real referendum: $P(m \cap b) = P(m)^R$. In the survey referendum: $P(m \cap b) = P(m)^S P(b|m)^S$. Carson, Grove and List (2014) are thus suggesting that for $P(b|m)^S > 0$:

$$P(m)^S P(b|m)^S = P(m)^R \quad or \quad P(b|m)^S = \frac{P(m)^R}{P(m)^S}$$

The subjective probability of the survey referendum passing equals the subjective probability of the real referendum passing only when the probability of the survey referendum being binding (if passed) is certain. That is:

$$P(m)^S = P(m)^R \quad iff \quad P(b|m) = 1.$$

Alternatively, if the (subjective or real) probability of the referendum is binding is less than 1 it must be true that the subjective probability of a majority is higher in the survey referendum. That is:

$$P(b|m) < 1 \; \Rightarrow \; P(m)^S > \; P(m)^R.$$

The somewhat counter-intuitive explanation here is that the lower the conditional probability the survey will be binding, the higher the subjective probability it will pass relative to a real referendum.

In a CVM survey, respondents are asked their willingness-to-pay for a change in an environmental good. This value is called the bid in what follows. The compound lottery example also illustrates the link between the bid and respondents' beliefs about the consequentiality of the survey. For example, the law of demand says that as the bid increases the probability of a yes vote decreases. As the probability of yes votes decreases the subjective probability of a majority must also decrease. Therefore, the probability of influencing policy decreases. Finally, according to policy consequentiality, the probability of believing the referendum is consequential decreases. This implies an inverse relationship between the value of the bid and beliefs about the consequentiality of the referendum.

Water Conservation Survey

To test for strong consequentiality we use a survey on water conservation measures in the mountains of western North Carolina. The survey of 51 questions, including demographics, was mailed in May 2013 to a random sample of 3000 Watauga and Ashe County residents. It consisted of a primary mailing, a post card reminder and a second mailing to all non-respondents of the first mailing. In the end, 2413 useable addresses and 591 responses were obtained for a useable response rate of 25 percent.

Table 1 contains a summary of the demographic variables. The average age of respondents was 61 years and average income was $56,000. In the two counties of our sample, 24 percent of respondents have a high school degree or less, 18 percent have some college but no degree, 10 percent have an Associate's Degree, 24 percent have a Bachelor's Degree, and 24 percent have a graduate or professional degree. Comparing our sample to US Census data from the counties, we find that about 23% of Watauga County residents (over age 20) and 35% of Ashe County residents (over age 20) are 60 or older; 38% of Watauga County and 19% of Ashe County residents have a college degree; average household income in Watauga County is about $52,000 and is about $47,000 in Ashe County. Therefore, our survey respondents tend to be older, slightly more educated, and have higher income than the general population in this area. In addition, we find that 50% report having ancestors who lived in this region. Regarding water source, 52% report having their own well, 12% their own spring, 19% a shared well and 17% are on a municipal water supply.

Consider a resident who receives utility from both a consumption good, z, and water supply, q. Then a resident maximizes her utility, $u(q, z)$, subject to a budget constraint $y = pz$ where the price of z is normalized to one. Solving for the indirect utility function yields $v(q, y)$. The willingness-to-pay, WTP, for a more secure water supply, resulting from implementing water conservation measures, is implicitly defined at the payment that equates indirect utility with different water security conditions, $v(q^o, y) = v(q', y - WTP)$, where q^o is the current level of security and q' is the improved security. In our case, the willingness-to-pay question for water conservation measures is a dichotomous choice framework. The variable *for* is a qualitative variable equal to one if the respondents answered "for" to the referendum question:

> *"Suppose that to implement water conservation measures county residents would pay a one-time payment of $A per household in higher county taxes. The money would be used to provide rebates to residents for the purchase of low flow toilets or rain barrels to help save water at home. The money would also be used to re-vegetate creek banks and install permeable pavement where feasible. These measures reduce runoff from storms and help with recharging the groundwater supply. The goal of the program is to provide more water security in the county and to ensure a more stable water supply that can ease stress during droughts. Suppose that this proposal to approve the tax and provide conservation measures will be on the next election ballot. Remember, if the proposal passes you would make a one-time payment of $A in higher taxes and you would have $A less to*

spend on other things. Also remember that if the referendum passes the conservation measures would be implemented and more water would be available in your county during times of drought."

The tax amount variable $A took on the values of $5, $20, $40, $80 or $150. We asked respondents how they would vote on this proposal with three choices for, against or don't know. We find that the frequency of respondents who would be willing to pay falls from 60% willing to pay $5 to 30% willing to pay $150. About 18% of respondents answered "don't know" over all values of $A. One problem that arises when coding dichotomous choice CVM questions is what should be done with "don't know" responses. We follow the conservative approach and code all "don't know" responses as "against" responses (Groothuis and Whitehead 2002, Caudill and Groothuis 2005).

To test for the influence of consequentiality we use a follow up question to our contingent valuation question suggested by Vossler and Watson (2013): "*To what extent do you believe that the indicated votes on the above proposal from you and other survey participants will be taken in to consideration by county policy makers?*" Possible responses ranged from one to five where respondents who stated one believe policy makers will definitely not take the information into account to five where respondents believe policy makers will definitely take the information into account.

In Table 2, we report the percentage of respondents who indicated they would vote for the proposal by both the bid level and the degree of consequentiality. The first column contains responses for those who think the referendum is inconsequential and the degree of consequentiality increases to the right. We find that for the first two columns as the bid increases the percentage of for responses does not follow a clear pattern while in columns 3, 4 and 5 as the bid increases the percentage of for votes falls. Considering the total votes, the percentage of for responses increases with perceived consequentiality until the final option. Of the individuals who answered one to the consequentiality question only 17 percent answered for to the CVM question. Of those who answered two on the consequentiality statement we find 43 percent answered for, and of those who answered three we find 46 percent answered for. The proportion rises to 73 percent for respondents who answered four to the consequentiality question, and falls back to 46 percent for respondents who answered five to the consequentiality question.

Past research suggests that for strong consequentiality a knife edge result occurs when a survey is considered consequential and when the survey is inconsequential (Vossler and Watson 2013). The theory of strong consequentiality suggests that respondents who believe the CVM question results might influence policy face questions that are incentive compatible and will answer the questions as if they are real payments. Following the law of demand, a necessary condition for incentive compatibility is that the probability of voting for the policy decreases as the tax amount increases. We find that for individuals who answered either one or two to the consequentiality question the bid variable does not affect the proportion of for responses suggesting these individuals do not find the CVM question incentive compatible. Our results differ from past research that finds that results differ when comparing those respondents who believe the survey is at least somewhat consequential and inconsequential. Our results find the threshold is at a greater level of perceived consequentiality.

Willingness-to-pay and Consequentiality

To test the influence of consequentiality on willingness-to-pay, we provide several different probit model specifications:

$$P(for = 1) = \Phi(\alpha_0 + \alpha_1 logtax + \boldsymbol{\delta}'\boldsymbol{X} + e),$$

where *for* is equal to 1 if a respondent said they would vote in favor of the referendum, tax is the randomly assigned tax amount, α_0 is a constant, α_1 is the coefficient on the tax variable, $\boldsymbol{X}$ is a vector of explanatory variables with corresponding coefficient vector $\boldsymbol{\delta}$. In the first column of Table 3 we report the results of the basic or naïve model that includes no correction for consequentiality. In this specification, we find that gender, education and the respondent's water source all influence the probability of voting for the water conservation policy. We also find that whether a respondent had an ancestor in the region lowered the likelihood of voting for the water conservation policy. The coefficient on the tax amount is negative and significant. Using the Cameron and James (1987) technique, we estimate the willingness-to-pay for conservation measures and find that it is $12. This model is the traditional model that would be used in a contingent valuation study that does not consider the role of consequentiality.

In the second column, we control for consequentiality using a dummy variable as in Vossler and Watson (2013). If a respondent answered 3, 4, or 5 to the consequentiality question it was coded as one and if they answered 1 or 2 it was coded zero. We find that the sign and significance of all explanatory variables stay the same with a slight decrease in the magnitude on the ancestor coefficient while the coefficient on the consequentiality dummy variable is positive and statistically significant. This suggests that when respondents find the CVM question inconsequential they are more likely to vote against the policy. When respondents find the survey consequential the WTP estimate is $23. When respondents find the survey inconsequential the WTP estimate is \$4 and is not statistically different than zero. Our results suggest that when an individual finds the survey inconsequential they reject the scenario and answer with a protest no.

To further test the influence of consequentiality, we split the sample into two groups based on the consequentiality dummy variable. In column 3 we report the sub-sample who find the CVM question consequential. We find that the coefficient on the log of the tax amount is negative and statistically significant and the magnitude of the coefficient increased relative to the basic model suggesting the tax amount has more influence on the likelihood of voting for the conservation measures. In addition, we find that the WTP estimate climbs to \$27. In the last column we report the results for the respondents who found the survey inconsequential and find that the coefficient on the log of the tax amount is not statistically significant and the WTP estimate is zero. Our results suggest that individuals who believe the CVM question will have no policy implications answer with a protest no.

We next estimate bivariate probit models on both the likelihood of voting for the water conservation measure and the likelihood of respondents finding the survey consequential. To test for strong consequentiality we estimate two bivariate probit models: the first does not include the log of the tax amount variable in the consequentiality equation while the second uses the log of the tax amount. Consider the following bivariate probit model:

$$P(for = 1) = \Phi(\beta_0 + \beta_1 logtax + \boldsymbol{\lambda}'\boldsymbol{X} + \varepsilon_1)$$

$$P(C > 2 = 1) = \Phi(\gamma_0 + \gamma_1 logtax + \boldsymbol{\varphi}'\boldsymbol{X} + \varepsilon_2)$$

$$\rho = corr(\varepsilon_1, \varepsilon_2)$$

where $\varepsilon_1, \varepsilon_2 \sim N(0,0,\rho)$ and $\boldsymbol{\lambda}$ and $\boldsymbol{\varphi}$ are coefficient vectors. The bivariate probit model provides a unique way to test for strong consequentiality. First, the coefficient on the log of the tax amount captures the influence of payment consequentiality. Our theory suggests that as the tax amount rises the perceived level of consequentiality should fall (because the subjective probability of a majority declines). Second, the rho coefficient that measures the correlation between error terms of the two equations tests for policy consequentiality. The rho coefficient captures some unobservable characteristic that correlates the respondents' likelihood of answering for on the CVM question and believing their response is consequential. Our theory makes no predictions on the sign of the rho coefficient. Hausman (2012), however, argues that if respondents suffer from hypothetical bias they will respond for or "yea say" to achieve a warm glow without actually paying the amount biasing WTP upwards. This suggests that the rho coefficient will be negative. Mitchell and Carson (1989), on the other hand, suggest that when respondents do not find a CVM scenario credible they respond with a protest no. Although their work precedes the literature on consequentiality, the protest no literature is consistent with policy inconsequentiality. The protest no literature suggests that the rho coefficient is positive.

In Table 4 we show that in the bivariate probit the rho coefficient is positive and significant in both specifications. These results suggest that there are some unobservable characteristics that both increase the likelihood of voting for the water conservation policy and increases the perception that the survey is consequential. These results support the concept of policy consequentiality where individuals who believe the policy will be informed by the survey are also more likely to vote for the policy. The positive relationship is counter to the Hausman (2012) view of hypothetical bias where individuals respond yes to a survey because they perceive the survey as inconsequential and respond yes to receive a warm glow.

To test for payment consequentiality in the second model, we include the log of the tax amount in the consequentiality specification. Consistent with our theoretical predictions, we find that high bids lead to inconsequential survey results and to a lower likelihood of voting for the policy. The only other variables that determined the level of consequentiality is if a respondent had an ancestor in the county, had attended some college or shared a well. Previous research has shown that residents who are native to an area (thus have ancestors in the area) have different views and preferences for environmental resources and policy measures than newcomers (Riebsame et al 1996; Cockerill and Groothuis 2014). Additionally, in western North Carolina, natives have a greater distrust of the government, which likely influences perceptions of consequentiality (Cockerill and Groothuis 2014).

Conclusions

The literature suggests that when contingent valuation questions are incentive compatible and meaningful respondents will find the survey to be consequential. The literature, however, has had different definitions of consequentiality. Following Herriges et al. (2010), we suggest that strong consequentiality consists of both policy consequentiality and payment consequentiality. Policy consequentiality exists when the respondent believes that the results of the survey will influence the policy. Payment consequentiality occurs when respondents perceive that they will have to pay the tax amount. Using a survey about water conservation measures, we find that both policy and payment consequentiality exist. Respondents who self-report that they perceive the survey to be consequential are willing to pay positive amounts for the policy. Respondents who do not perceive the survey to be consequential answer with protest no responses and are not responsive to the tax amount in the referendum voting question. As the tax amount increases respondents are less likely to find the survey to be consequential.

These results are important for improving both research and policy-making. Our work provides guidance for including consequentiality questions in any CVM work so that it is possible to assess how policy and/or payment consequentiality affect survey responses. Specific to water conservation, our work can contribute to improved policy-making as it provides a higher level of confidence in public survey results about conservation management. As human population continues to grow and climate change drives increased pressure on water resources, better understanding of public perceptions about water issues and management preferences will be valuable. This may be especially true in humid areas that have historically not faced water concerns and hence have not had explicit public discussion or debate about water management options. If CVM can provide reliable data, it may help water managers identify options that are most palatable to their constituents and thereby reduce conflict and controversy as they make potentially controversial decisions.

Table 1. Data Summary

Variable	Mean	Standard deviation	Minimum	Maximum
For vote=1	.45	.50	0	1
Tax Amount	57.25	50.79	5	150
Age	61.70	14.68	18	99
Female=1	0.43	.50	0	1
Some College=1	0.19	.38	0	1
Associates Degree=1	0.10	.29	0	1
Bachelor's Degree=1	0.23	.43	0	1
Graduate Degree=1	0.24	.43	0	1
Income (in $1000s)	56.21	40.67	20	150
Missing Income=1	0.09	.28	0	1
Ancestor=1	0.50	.50	0	1
City Water=1	0.16	.37	0	1
Shared Well=1	0.19	.39	0	1
Spring	0.12	.32	0	1

Sample size = 591

Table 2. Distribution of "For" Responses by Tax Amount and Consequentiality Level

	To what extent do you believe that the indicated votes … will be taken in to consideration by county policy makers?				
Tax Amount	C = 1 Not Taken into Account	C = 2	C = 3	C = 4	C = 5 Definitely Taken into Account
$5	16% (19)[a]	58% (19)	64% (44)	88% (16)	71% (21)
$20	19% (31)	30% (20)	62% (45)	61% (18)	60% (10)
$40	31% (29)	33% (21)	44% (41)	85% (21)	30% (10)
$80	11% (26)	48% (23)	39% (41)	72% (18)	28% (14)
$150	07% (27)	45% (22)	18% (38)	38% (8)	22% (9)
Total	17% (132)	43% (105)	46% (209)	73% (81)	47% (64)
χ^2(df=4)	6.36	4.17	22.75*	9.80*	10.99*

[a]Sample size in parentheses
*significant at the 95% level

Table 3. Probit Determinants of Referendum Votes (For = 1)

Variable	Basic Model	Consequentiality Dummy Model	Consequential Model (C > 2 = 1)	Inconsequential Model (C = 0)
Constant	.557 (.369)[a]	.190 (.383)	.794* (.480)	-.246 (.630)
Log Tax Amount	-.289** (.049)	-.275** (.050)	-.375** (.065)	-.092 (.085)
Age	-.004 (.004)	-.004 (.004)	-.001 (.005)	-.006 (.007)
Female	.337** (.115)	.337** (.116)	.558** (.153)	-.080 (.197)
Some College	.408** (.179)	.354** (.182)	.250 (.230)	.383 (.323)
Associate Degree	.326 (.221)	.318 (.226)	.449 (.296)	.204 (.385)
Bachelor's Degree	.516** (.189)	.491** (.191)	.335 (.242)	.621* (.332)
Graduate Degree	.542** (.196)	.559** (.198)	.305 (.259)	.957** (.322)
Income	.003 (.001)	.002 (.002)	.004* (.002)	.000 (.003)
Missing Income Dum	-.454** (.241)	-.407** (.247)	-.143 (.344)	-.759* (.405)
Ancestor	-.430** (.121)	-.390** (.123)	-.406** (.157)	-.369* (.211)
City Water	.353** (.160)	.350** (.161)	.205 (.202)	.616** (.284)
Shared Well	.338** (.148)	.378** (.150)	.370* (.196)	.470* (.245)
Spring	-.052 (.184)	-.045 (.187)	-.127 (.240)	.114 (.313)
Consequential (C > 2 = 1)		.505** (.118)		
χ^2	121.15**	139.71**	76.19**	50.66**
Sample size	591	591	354	237

[a]Standard error in parentheses.
**significant at the 95% level *significant at the 90% level

Table 4. Bivariate Probit Determinants of Consequentiality and Referendum Votes

	Model 1		Model 2	
Variable	Voting For	Consequentiality	Voting For	Consequentiality
Constant	.497 (.364)[a]	.339 (.323)	.562 (.529)	.687* (.359)
Log Tax Amount	-.267** (.051)	--	-.287** (.051)	-.108** (.048)
Age	-.004 (.004)	-.002 (.004)	-.004 (.004)	-.002 (.004)
Female	.333** (.117)	.042 (.111)	.332** (.117)	.036 (.111)
Some College	.409** (.182)	.348** (.172)	.409** (.182)	.346** (.172)
Associate Degree	.330 (.227)	.113 (.211)	.333 (.227)	.127 (.209)
Bachelor's Degree	.516** (.197)	.202 (.180)	.516** (.198)	.203 (.181)
Graduate Degree	.550** (.201)	.032 (.186)	.549** (.201)	.028 (.185)
Income	.002 (.002)	.002 (.001)	.003 (.002)	.002 (.001)
Missing Income	-.462* (.265)	-.348* (.207)	-.455* (.265)	-.299 (.207)
Ancestor	-.435** (.123)	-.306** (.120)	-.440** (.123)	-.331** (.121)
City Water	.349** (.170)	.049 (.158)	.350** (.171)	.049 (.159)
Shared Well	.339** (.147)	-.146* (.145)	.338** (.147)	-.155* (.145)
Spring	-.049 (.180)	-.023 (.174)	-.049 (.180)	-.026 (.174)
ρ	.300** (.067)		.303** (.067)	
Log likelihood	-718.351		-715.649	
Sample Size	591		591	

[a]Standard error in parentheses.
**significant at the 95% level *significant at the 90% level

References

Bulte, Erwin, Shelby Gerking, John A. List, and Aart de Zeeuw. "The effect of varying the causes of environmental problems on stated WTP values: evidence from a field study." Journal of Environmental Economics and Management 49, no. 2 (2005): 330-342.

Cameron, Trudy Ann, and Michelle D. James. "Efficient estimation methods for 'closed-ended' contingent valuation surveys." Review of Economics and Statistics 69, no. 2 (1987): 269-276.

Carson, Richard T. "Contingent valuation: A practical alternative when prices aren't available," Journal of Economic Perspectives 26, no. 4 (2012): 27-42.

Carson, Richard T., and Theodore Groves. "Incentive and informational properties of preference questions." Environmental Resource Economics 37 (2007): 181-210.

Carson, Richard T., Theodore Groves and John A. List. "Consequentiality: A theoretical and experimental exploration of a single binary choice." Journal of the Association of Environmental and Resource Economists 1, no. 1 (2014): 171-207.

Caudill, Steven B., and Peter A. Groothuis. "Modeling hidden alternatives in random utility models: an application to don't know responses in contingent valuation." Land Economics 81, no. 3 (2005): 445-454.

Cunha-e-Sá, Maria A., Lívia Madureira, Luis C. Nunes and Vladimir Otrachshenko. "Protesting and justifying: a latent class model for contingent valuation with attitudinal data." Environmental and Resource Economics 52, no. 4 (2012): 531-548.

Cockerill, Kristan, and Peter A. Groothuis. "Last settler's syndrome and resource use in Southern Appalachia." Journal of Rural and Community Development 9, no.3 (2014): 319-336.

Cummings, Ronald G., and Laura Osborne Taylor. "Does realism matter in contingent valuation surveys?" Land Economics 74, no. 2 (1998): 203-215.

Groothuis, Peter A., and John C. Whitehead. "Does don't know mean no? Analysis of 'don't know' responses in contingent valuation questions." Applied Economics 34, no. 15 (2002): 1935-1940.

Groothuis, Peter A., and John C. Whitehead. "The provision point mechanism and scenario rejection in contingent valuation." Agricultural & Resource Economics Review 38, no. 2 (2009): 271.

Hausman, Jerry. "Contingent valuation: From dubious to hopeless." Journal of Economic Perspectives 26, no. 4 (2012): 43-56.

Herriges, Joseph, Catherine Kling, Chih-Chen Liu and Justin Tobias. "What are the consequences of consequentiality?" Journal of Environmental Economics and Management 59, no. 1 (2010): 67-81.

Interis, Matthew, and Daniel Petrolia. "The effects of consequentiality in binary-and multinomial-choice surveys." Journal of Agricultural and Resource Economics 39, no. 2 (2014): 201-216.

Kling, Catherine L, Daniel J. Phaneuf and Jinhao Zhao. "From Exxon to BP: Has some number become better than no number?" Journal of Economic Perspectives 26, no. 4 (2012): 3-

26.

Landry, Craig, and John List. "Using ex ante approaches to obtain credible signals for value in contingent markets: Evidence from the field." American Journal of Agricultural Economics 89 (2007): 420-429.

List, John A., and Craig A. Gallet. "What experimental protocol influences disparities between actual and hypothetical stated values?" Environmental and Resource Economics 20, no. 3 (2001): 241-254.

Little, Joseph, and Robert Berrens. "Explaining disparities between actual and hypothetical stated values: Further investigation using meta-analysis." Economics Bulletin 3, no. 6 (2004): 1-13.

Meyerhoff, Jürgen, Anna Bartczak, and Ulf Liebe. "Protester or non-protester: a binary state? On the use (and non-use) of latent class models to analyses protesting in economic valuation." Australian Journal of Agricultural and Resource Economics 56, no. 3 (2012): 438-454.

Mitchell, Robert Cameron and Richard T. Carson. Using Surveys to Value Public Goods: The Contingent Valuation Method. Resources for the Future: Washington DC (1989).

Murphy, James J., P. Geoffrey Allen, Thomas H. Stevens and Darryl Weatherhead. "A meta-analysis of hypothetical bias in stated preference valuation." Environmental and Resource Economics 30, no. 3 (2005): 313-325.

Riebsame, W. E., H. Gosnell and D. M. Theobald. “Land use and landscape change in the Colorado mountains.” Mountain Research and Development 16, no. 4 (1996): 395-405.

Vossler, Christian, and Mary Evans. “Bridging the gap between the field and the lab: Environmental goods, policy maker input, and consequentiality.” Journal of Environmental Economics and Management 58 (2009): 338-345.

Vossler, Christian, and Gregory Poe. “Consequentiality and contingent values: An emerging paradigm.” Chapter 7 in The International Handbook on Non-Market Environmental Valuation, ed. Jeff Bennett. Northhampton, MA: Edward Elgar (2011): 122-141.

Vossler, Christian A., Maurice Doyon and Daniel Rondeau. “Truth in consequentiality: Theory and field evidence on discrete choice experiments.” American Economics Journal: Microeconomics 4, no. 44 (2012): 145-171.

Vossler, Christian A., and Sharon B. Watson. “Understanding the consequences of consequentiality: Testing the validity of stated preferences in the field.” Journal of Economic Behavior and Organization 86 (2013): 137-147.